



**Dr. S. N. Dwivedi**

Fr. VC & Dir. CIFE (ICAR) Mumbai, Fr. Dir. NIO (CSIR)  
Fr. Addl. Secy., GOI, Fr. Science Advisor & DG MPCST GOMP  
President - Academy of Science Engg. & Technology, Bhopal

## Editorial

Madhya Pradesh is becoming a centre of higher education. Many public, private and deemed universities and education institutions are being established. The students are coming from all parts of India and abroad. They should have opportunities to present their quality research and achievements to the national & international community for better recognition. To meet these objectives, a proactive initiative has been taken by the management and academicians of Radaharaman Group of Institutes (RGI) to bring a High Quality International Journal covering Scientific and Technological advances in different spheres of developmental process for a larger cross section of the scientists, engineers and researchers .In this direction the first edition of this “**International Journal**” covering the broad spectrum of activities in the areas of basic and applied sciences, engineering and technology is published.

Papers have been invited in emerging areas in Science and Technology from various institutions, colleges, R & D Labs and Industries, from India & abroad. This international journal provides a platform vis - a - vis opportunities to publish achievements in frontier areas of innovative and explorative research along with its field level application.

An endeavor has also been made to include high quality professionally relevant papers after its vetting by the enlightened, experienced and knowledgeable editorial board.

We invite feedbacks from our valued readers and well wishers to achieve excellence in our mission to publish a high quality journal to meet international standards.

A handwritten signature in black ink, appearing to read 'S. N. Dwivedi', written in a cursive style.

**Editor-in-Chief**

**Disclaimer:**

The views expressed by the author(s) in the articles published in this Journal are their own. They do not necessarily reflect the views of the Editors, Editorial Board and the Publisher or the organisations they work for

# A Review on Herbal Anti-anaemic Plants

Sharda Singh, Alok Shukla, C. S. Singh, Dr. Papiya Bigoniya  
Radharaman College of Pharmacy, Bhopal  
alokshukla51@rediffmail.com

## Abstract

Anaemia is a common form of nutritional disorder, the principal cause of which is iron deficiency. It is prevalent in both industrialised and developing countries. Infants, children, women of childbearing age, pregnant women and the elderly are considered to be particularly vulnerable to iron deficiency because their intake or absorption is poor. Iron deficiency is the most common single-nutrient deficiency disease in the world, affecting about 15% of the world population, 35% of women and 43% of young children. It occurs when the body's iron stores become depleted and a restricted supply of iron to various tissues becomes apparent. This may result in depletion of haemoglobin and iron-dependent intra-cellular enzymes participating in many metabolic pathways. Therefore, there is the need for proper management of micronutrient deficiencies most especially iron deficiency. The medicinal plants have enormous commercial potential throughout the globe. In worldwide herbal boom, it is estimated that high quality phytomedicinals will provide safe and effective medication. In India, Ayurveda, Siddha, Unani etc. consist of large number of herbal remedies, being used from ancient times and having their potential therapeutic claims. The medicinal plants have the potential to correct anaemia problems. There are so many plants like stem bark of *Sorghum bicolor*, the leaves of *Brillantasia nitens*, *Tectona grandis* and *Allium ascalonicum* are used traditionally for the treatment of anaemia. The present review aims at aetiology and pharmaco-epidemiology of anaemia along with the herbal approach counteracting the disorder.

**Key words-** Anaemia, Herbs, Iron deficiency, Haematotoxicant

## Introduction

Anaemia is a common blood disorder that affects people of all ages, although the people at greater risk are the elderly, young women of child-bearing age and the infants. Anaemia medically stands for lowered haemoglobin level (normal for male: 13.5 - 17.0 gms% & for female: 12.0-15.5 gms%) either with normal or lowered red blood cells depending upon the age and sex. Haemoglobin is basic requirement of the body necessary for transporting oxygen throughout the body. Haemoglobin functions as the moving power stations in the body. So lowered haemoglobin may cause fatigability, unusual tiredness and energy shutdown in all the parts of the body. At the most, 10% of the blood i.e. 350 ml to 400 ml can be donated without any feeling of exhaustion. This condition is not a disease but could develop as a result of various diseases. There are over 400 types of anaemia, many of which are rare but in all cases that is lower than normal number of circulating red blood cells.

Presently, more than half of the world's population experience some forms of anaemia in their life time<sup>1</sup>. It is hard to believe that America, a country with one of the highest standards of living in the world having over 20 million people with the disease of anemia caused by unhealthy diet, and nutritional deficiency with protein and fat intake 30% more than any other country in the world. The great loss in terms of clinical diagnosis and treatment and even depletion in human resources as a result of anaemia could be prevented with adequate knowledge. The incidence of anaemia is higher in the third world than in developed countries due to the presence of many aggravating factors such as poor nutrition, high prevalence of blood parasites example, plasmodium, trypanosomes and

helminthes infestation. It is also known that women are susceptible to anaemia during pregnancy due to high demand from the developing foetus<sup>2, 3</sup>.

Although there are various drugs for the treatment of anaemia, they are not affordable to many poor people especially those in the developing countries such in South East Asia and Africa. In addition, the rural populations in various parts of the world do not have adequate access to high quality drugs for the treatment of anaemia, so they depend heavily on plants and herbal products for the treatment of anaemia. As a result of the fact that anaemia is very common and the incidence is likely to increase in future<sup>1</sup>, there is need to prevent it or seek for more cost-effective and better treatment strategies.

Anaemia is one of the numerous ailments claimed to have been successfully treated with plant materials by traditional medicine practitioners. In China for instance, blood diseases such as malformation of blood circulatory system, anaemia, varicose veins and haemorrhages have been treated with plant materials<sup>4</sup>. The crude extract of *Fagara zanthoxylum* was reported to be effective in the treatment of sickle cell anaemia<sup>5</sup>. It was also reported that the aqueous crude extract of *Telfairia occidentalis* leaves has haematinic activity<sup>6</sup>. It is well established that man consumes a wide variety of local crops and vegetables, which are believed to contribute significantly to the improvement of human health in terms of disease prevention and therapy<sup>7, 8</sup>. There are also claims by traditional medicine practitioners that the stem bark of *Mangifera indica*, *Khaya senegalensis*, *Sorghum bicolor*, *Fagara zandhoxyllum*, leaves of *Telfairia occidentalis*, *Amaranthus hybrids*, *Brillanthisia nitens*, *Tectona grandis*, *Jatropha curcas* having potential to treat anaemia but it appears there is no scientific research and publication to verify these claim.

The antianaemic potential of any promising drug can be evaluated by treating the experimental animal along with the haemotoxicant and assessing the protective effect of drug by estimating different parameters of blood. A range of blood test is employed for accurate diagnosis of disease prognosis and therapy evaluation. This review precisely compiles the details of different blood toxicants inducing anaemia used in experimental pharmacology along with the mechanism of damage. This literature also compiles the details of incidences, causes, symptoms, diagnosis, complications, and general treatment including role of Ayurveda in treatment of anaemia.

**Incidences** - Commonly vulnerable persons are:

- Women- usually have more incidences than males. They suffer commonly during the period of puberty/ menstruation/ pregnancy / breastfeeding.
- Elderly people- commonly suffer more with symptoms than with young due to lack of tolerance, resources, and reduced oxygen carrying capacity of haemoglobin and reduced restoration/re-establishment of blood cells.
- Babies suffer especially when they are born premature and take less food.
- Persons who are devoid of or avoid good nutritious food.
- Persons who suffer with chronic diseases/ailments, especially

stomach ulcers, cancer, septic conditions, infections.

- Persons who are in prolonged treatments with antibiotics, anti-coagulants, Non Steroidal Anti-Inflammatory Drugs (NSAIDs), immunosuppressant and corticosteroids etc.

#### **Causes-**

Anaemia can occur in any one at any time due to

#### **Nutrition -**

Lack of nutrition or poor supply of especially iron, Vit. B12, folic acid and Vit. C or poor absorption may reflect in production of cells to cause insufficiency.

#### **Iron -**

Lack of iron cause iron deficient anaemia. It is most commonly seen in the growing stage of poor children, pregnant/nursing/heavily menstruating women.

#### **Folic acid and vitamin B<sub>12</sub> -**

Causes Megaloblastic anaemia (red blood cells will be seen in bigger size without complete maturation).

#### **Blood loss-**

May be due to acute/chronic reasons either due to physiological or pathological or accidental reasons

#### **Acute-**

Loss of enormous amount of blood from accidents/repeated blood donations/heavy menstruation in short period

#### **Chronic-**

Repeated and recurrent loss of blood either in small or large quantity for example: worms, piles, fissures, menorrhagia, frequent menstruation, gastric erosions causing blood vomiting or bloody stool, cirrhosis of liver, peptic ulcer, intestinal bleeding disorders, etc.

#### **Physiological Changes-**

When physiological requirement is more, body could not cope with the changes due to growth/puberty/menstruation/pregnancy/breastfeeding and so anaemia can occur.

#### **Pathological Diseases-**

Increased destruction of RBC, less nutrient absorption and restarted or suppressed development of blood cells (haemolytic anaemias/sickle cell anaemias/thalassaemia/cancer/tumours/tuberculosis/rheumatic fever/rheumatoid arthritis/AIDS/ kidney disorder) induced anaemia. Insufficient release of essential hormone erythropoietin from kidney in respond to low oxygen in blood (hypoxia) and infections like malaria, sepsis, etc also causes anaemia.

#### **Psychological Changes-**

Emotional upset, deep brooding, depression can cause low vitality and can interfere in the production of blood cells<sup>9</sup>.

#### **Habits-**

May reflect in nutrition absorption i.e. drinking and drugs toxicity **Prolonged use of medicines / toxicity with chemicals** - Antibiotics, anti-coagulants, NSAIDs such as like aspirin, ibuprofen, etc., when taken for a prolonged time may cause small haemorrhages and thus anaemia.

Lead poisoning, mercury poisoning, arsenic poisoning, etc., can cause intestinal bleeding and can also hinder the production of hemoglobin leading to anaemia. Anaemia is also associated with long term intake of corticosteroids and immunosuppressant drugs causes bone marrow depression.

#### **Symptoms-**

Anaemia usually presents a wide range of symptoms<sup>10</sup>. Each and every patient may suffer from different symptoms according to their disease and intensity. The common symptoms are

- Lack of concentration / getting irritated for trivial issues
- Feels exhausted with profound weakness
- Giddiness / fainting / blackouts / headaches
- Short shallow breath with requirement of deep breath often
- Weak rapid pulse and low blood pressure
- Palpitations and breathing difficulty on exertion or climbing stairs
- Chest pain / vague discomfort in chest on exertion
- Pallor of the skin / nails / mucous membranes of mouth
- Smooth glossy tongue with cracks or sore
- Cracks or sore in angle of mouth
- Tinnitus
- Loss of appetite
- Spoon shaped nails / Brittle nails
- Spleen enlargement
- Ankle oedema
- Poor growth

#### **Diagnosis-**

Other than history of complaints (disease history and treatment history) and physical examination of the patient with pulse, blood pressure, colour of the mucous membrane of mouth (especially under the tongue), colour of conjunctiva of eye (especially in lower part) and colour of the nails, analysing the blood count remains fundamental. It can provide lots and lots of information regarding complaints/ disease and plan of treatment. Advanced automatic blood counting machines give accurate, readily readable values for quick diagnosis<sup>11</sup>. The essential tests to diagnose anaemia and to rule out other differential diagnosis are:

- Blood- Total count (Tc), Differential count (Dc), Erythrocyte sedimentation rate (ESR), Percentage of haemoglobin, Red blood cells (RBC) White blood cells (WBC), Packed cell volume (PCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC), Mean corpuscular concentration (MCV), Reticulocytes, Platelets, Serum ferritin, Bleeding time, Clotting time, etc.
- Urine- sugar, albumin, deposits, bile salts and bile pigments
- Stool- ova, cysts and for occult blood
- Barium meal x-rays- to rule out stomach and intestine disorders
- Gastroscopy / Colonoscopy- to rule out stomach and intestine disorders
- Biopsy- in extreme condition, bone marrow biopsy can be done to diagnose / rule out Aplastic anaemia and other bone marrow disorders.
- Whole body CT or MRI to rule out any pathology

### Complications-

Since blood cells / haemoglobin are very vital, if anaemia is not cared for or treated properly with supplements or proper food intake, serious damage will often follow with loss of functions endangering life and sometimes even death can be rewarded. Commonly, anaemia gives angina (chest pain) with shortness of breath and palpitation creating fear for life<sup>12</sup>.

### General treatment-

Whatever may be the cause, the first line of treatment in Allopathy is usually with supplements like iron, folic acid, Vit C and Vit B12 (either in tablet form or injection as per condition or disease of the sufferer, i.e. if intestine absorption is poor, supplements will be given through injections). If it is a critical or emergency condition, then transfusion of blood (i.e. substitution) will be opted as early as possible after analyzing compatibility. Blood can be transferred as a whole or in components as necessary.

Secondly, treatment will be planned after analyzing the cause of the anaemia with all sorts of investigations. Dietary insufficiency will be treated with prolonged prescription of supplements with advice to take good nutritious diet. The response to oral drugs can be seen only after two weeks. In case of bleeding spots (leakage), treatment (sealing / healing either by medicines or surgery) will be opted accordingly (removal of uterus in heavy flow menstruation, spleen in case of tremendous destructions, haemorrhoids in case of recurrent bleeding, etc.). Antibiotics will be prescribed if there is any infection.

Unless otherwise, cause has been corrected, anaemia will never go off and often may worsen with time even with supplements or transfusion.

### AYURVEDIC APPROACH-

Caring for blood count is essential for life since whole life / health relies on it. With clear-cut causes like accidental bleeding, heavy menstruation, pregnancy, poor nutrition, the person can be treated accordingly with the prescribed essential supplements in the form of foods / tablets / tonics / injections and in case of critical condition blood transfusion may be a must. No one can deny this principle. But using supplements (in the form of tablets / tonics / injections) continuously without regular nutritious food to maintain blood counts / haemoglobin is not acceptable. In general, 50% of anaemic patients can be cured with diet alone, 30% may need supplements and medicines and 20% may need blood transfusion and medicines.

Even though well substituted, if the cell activity is not capable of absorbing the same, the substitute will go waste and the cell will continue to be less active or diseased. Homeopathic medicines can tackle the complaint or disease without persistent usage by treating the root cause. Anaemia is an ongoing process of chronic fatigue. Complaints will creep up with time when not attended properly. So it is better to analyze the cause and treat the condition right to the requirement. To distinguish from other ways, Homeopathy can end the endless episode of anaemia by targeting reality. More specific the treatment is, the more effective the treatment will be.

Ayurvedic medicines can boost the nutrition absorption, cells production, control the destruction and can maintain stable levels.

### Ayurvedic medicines commonly used to treat anaemia are-

**Navayasa Churna, Punarnavadi Mandura, Dhatri Lauha, Pradarantaka Lauha, Sarva-Juara-Hara Lauha and Vrihat Yakrdari**

**Lauha-** Dinesh et al., 2007 evaluated the effectiveness of Ayurvedic iron containing preparations in a dose of 250 mg b.d. for 30 days to six groups of iron deficient anemic patients, each group consisting of 20 patients. A control group was given Allopathic preparation - Irex-12, (containing - ferrous fumarate, vitamin C, folic acid and vitamin B12); 1 capsule daily for 30 days for comparison. All hematological and iron parameters were determined before and after completion of treatment. The results showed that there was statistically significant rise in all of them - Hb, PCV, TRBC, MCV, MCH, MCHC and plasma iron, percent saturation and plasma ferritin. Total iron binding capacity decreased significantly. The response of most of Ayurvedic preparations was better than Allopathic preparation and there was no side effect as observed with iron salts. The Hb regeneration rate was 0.10 g/dl/day for Allopathic preparation; while it was above this value for all Ayurvedic preparations except Pradarantaka Lauha which was least effective. Sarva-Juara-Hara Lauha was the drug of choice as Hb regeneration with it was highest 0.16 g/dl/day. Upon analysis of Ayurvedic drugs, these results were found to be consistent and correlated with iron content of the preparation<sup>13</sup>.

### Sootshekhar Rasa and Sitopaladi Churna-

Ayurvedic preparations Sootshekhar Rasa (SR) and Sitopaladi Churna (SC) (250mg+400 mg) taken daily for 90 days not only improved the Hb concentration but sustained the same in the next 180 days. The 90 day study on 119 non pregnant anemic women indicated a maximum gain of 16.0 g/L in Hb concentration. The maximum effect of SR+SC was seen in the moderately anemic women. Out of the three combinations of Sootshekhar Rasa and Sitopaladi Churna (SR 250mg+SC 400 mg, daily) was found to be significantly better than the other two combinations. More importantly, the gain in Hb was sustainable even after stoppage of therapy<sup>14</sup>.

### Rasoushadhis

(Herbomineral formulation; HMF-TE)- Marketed as Efiplus capsule containing Shuddha kasis (a mineral component- ferrous sulphate), powdered herbs of *Cyperus rotundus*, *Piper longum*, *Zingiber officinale* and aqueous extract of *Glycyrrhiza glabra* and specially adding Tamra Bhasma. This formulation was evaluated for its haematonic potential in haloperidol induced anemic rats. The drug was given orally for 15 days to check the haematonic potential of herbomineral formulation. Haemoglobin levels were significantly increased on day 15 of drug treatment. Haematocrit levels were also significantly increased on day 15 of drug treatment. MCV was reduced on day 5 and increased significantly on day 20 of study for HMF-TE double dose group. RBC morphology shows irregular cell walled and hypochromic cell on treatment with haloperidol on 5th day as compared to control and this was corrected with the treatment of herbomineral formulation on day 20 of the study.

The formulation (HMF-TE) exhibited significant haematonic potential by increasing parameters like haematocrit value, hemoglobin concentration, RBC count, MCV, MCH and MCHC<sup>15</sup>.

**Mangifera indica, Telfairia occidentalis and Amaranthus hybridus:** Ogbe et al., 2010 investigated antianaemic potential of *Mangifera indica* stem bark, aqueous leaves extract of *Telfairia occidentalis* and *Amaranthus hybridus* plant extracts on phenyl hydrazine-induced anaemia in rabbits. Anaemia was induced in rabbits with phenyl hydrazine hydrochloride at a dose of 30 mg kg<sup>-1</sup> b.wt by subcutaneous administration. In vivo investigation showed that oral daily dose of 20 mg kg<sup>-1</sup> b.wt of the ethanolic extract of *M. indica* stem bark and aqueous leaves extract of *T. occidentalis* produced a significant antianaemic effect. The aqueous leaves

extract of *A. hybridus* only produced a minimal antianaemic effect, reflected by a significant increase in haemoglobin concentration. This study shows that *M. indica* and *T. occidentalis* extracts have antianaemic potential<sup>16</sup>.

***Allium Ascalonicum:***

The haematological effect of ethanolic extract of *Allium ascalonicum* was evaluated by Owoyele et al., 2004 in male albino rats during a 21 day administration at the doses of 50, 100 and 200 mg/kg b.w, orally. Parameters evaluated include the serum lipids, red and white cell indices. The results showed that the extract administered decreased most of the parameters relating to red cell and increased most of those parameters relating to white cells. It also decreased the total cholesterol (TCH), high density lipoprotein cholesterol (HDL) and low density lipoprotein cholesterol (LDL) with no significant effect on the triglyceride levels<sup>17</sup>.

***Brillantasia Nitens:***

The methanol extract of the leaves of *Brillantasia nitens* was tested for haematinic activity by Akah et al., 2009 in rats using phenylhydrazine (10 mg/kg, p.o.) induced anaemia. The red blood cell count (RBC), haemoglobin concentration (Hb), white blood cell count (WBC) and haematocrit (PCV) were analyzed as indices of anaemia. Oral administration of *B. nitens* extract (400 - 3200 mg/kg/day) to rats previously treated with PHZ increased the Hb, RBC, WBC and PVC within one week. These results lend credence to the traditional use of *B. nitens* leaves in the treatment of anaemia<sup>18</sup>.

***Sorghum Bicolor:*** Oladiji et al., 2007 investigated the effects of oral administration of aqueous extract of *Sorghum bicolor* (L.) Moench stem bark at the doses of 200, 400 and 800 mg/kg body weight on iron sufficient and iron deficient weaning rats. Weaning rats of 21 days old were maintained on iron sufficient and iron deficient diets for 6 weeks before the administration of the aqueous extract of *Sorghum bicolor* stem bark at various doses for 7 days. Proximate analysis of the iron sufficient and iron deficient diets showed that they were similar except in the amount of iron. Extract administration produced significant increase in haemoglobin, packed cell volume and red blood cells in iron sufficient and iron deficient groups. There was also significant increase in the catalase activity of the rat liver and kidney without any significant change in the serum catalase activity. The results revealed that extract administration has restored the anaemic condition in the iron deficient group and thus lend credence to its use in folklore medicine in the management of anaemia<sup>19</sup>.

***Eremomastax speciosa:*** Antimicrobial and antianaemic activities of ethanolic leaf extract of *Eremomastax speciosa* were evaluated. The ethanolic crude extract (500-2000 mg kg<sup>-1</sup>) demonstrated antianaemic property by significantly elevating Red blood cell counts, packed cell volume, Haemoglobin concentration and white blood cell counts of rats. These findings justify the ethnomedical use of this plant.

***Psidium guajava:*** Ethanolic extract of *Psidium guajava* leaf on some haematological indices in rats experimentally infected with *Trypanosoma brucei*. Observations revealed significant decreases in the values for PCV, Hb, RBC counts, MCV, MCHC in infected group relative to the treated as well as the uninfected animals. There was a significant increase in the White Blood Cell (WBC) counts in infected animals when compared with the infected but treated animals. Also significant changes were observed for neutrophil in the infected animals compared to control and infected but treated groups. However, treatment with the ethanolic extract was able to significantly improve the PCV, Hb, RBC, MCV, MCHC and

neutrophil levels relative to the infected but untreated animals. Results demonstrate the anti-anaemic properties of the ethanolic extract of *P. guajava* in rats infected with *T.b. brucei*.

***Tectona grandis:*** Diallo et al., 2008 reported that leaves of *Tectona grandis* significantly increases the concentration of haemoglobin, osmotic resistance of red blood cells and the number of reticulocytes, mainly 7 days after phenylhydrazine administration. Moreover, the extract of *T. grandis* potentiates the increase of the number of reticulocytes. The extract could stimulate erythropoiesis process. Increase in the number of young red blood cells (reticulocytes) explains the strong osmotic resistance of the red blood cells in rats treated with the extract<sup>20</sup>.

***Sorghum bicolor*** (L.) known by variety of name such as great millet and guinea corn in west Africa, kafir corn in South Africa, dura in Sudan, jowar in India and kaoling in china. It is an annual grass characterized by spikelets borne in pairs. Alkaloids and saponins are main phytochemical present in aqueous extract. Jubi formula, a herbal preparation made from three medicinal herbs (*Parquetina nigrescens*, *Sorghum bicolor* and *Harungana madagascariensis*) has been successfully used in the treatment of anaemia in humans and in the treatment of *Trypanosoma brucei brucei*-induced anaemia in rabbits<sup>21</sup>.

**Table 1: Herbs and their parts used in treatment of anaemia**

S. No.	Herb	Part used	Model used	Reference
1.	Khaya Senegalensis	Stem bark	Phenyl hydrazine induced anaemia	21
2.	Sorghum bicolor	Bark	Trypanosoma brucei brucei-induced anaemia in rabbits	19
3.	Snake flower Lamium album	Above ground parts	Phenyl hydrazine induced anaemia, intragastric butadiene induced anaemia	22
4.	Fagara zandhoxylum	Bark	Traditional	5
5.	Magniferra indica	Bark	Phenyl hydrazine induced anaemia	16
6.	Telfairia occidentalis	Leaves	Phenyl hydrazine induced anaemia	16
7.	Amaranthus hybrids	Leaves	Phenyl hydrazine induced anaemia	16
8.	Brillanthisia nitens	Leaves	Phenyl hydrazine induced anaemia	18
9.	Tectona grandis	Leaves	Phenyl hydrazine induced anaemia	20
10.	Jatropha curcas	Bark, leaves	Traditional use	6, 23
11.	Flacourtia flavens	Leaves, root bark	Traditional use	6, 23
12.	Psoraspermum ferbrifugum	Whole herb	Traditional use	6, 23
13.	Combratum dolichopetalum	Whole herb	Traditional use	6, 23
14.	Adenia gummiferra	Root bark	Traditional use	6, 23
15.	Allophylus rubifolius	Root bark, stem bark	Traditional use	24
16.	Bracken-ridgea zanguebarica	Stem bark, root bark	Traditional use	25

**Table 2: Different toxicants used for experimental induction**

S. No.	Toxicant	Dose (mg/kg)	Route	Animal	Schedule	Reference
1.	Phenyl hydrazine	40	I.P.	Albino rats	O.D. for 9 days	22
2.	Butadione	100	I.P.	Albino rats	O.D. for 7 days	22
3.	Cyclophosphamide	0.3	I.P.	Albino rats	O.D. for 7 days	26
4.	Haloperidol	0.2	I.P.	Albino rats	O.D. for 7 days	15

**Mode of action of haemotoxicant used in experimental pharmacology  
Phenylhydrazine:**

The auto-oxidation of phenylhydrazine leads to generation of reactive oxygen species (ROS) and a complex array of phenylhydrazine derived radicals, such as phenylhydrazyl radical, phenyldiazene and benzenediazonium ions. Among reactive oxygen and nitrogen species, superoxide anion (O<sup>-2</sup>), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and nitric oxide (NO) appear most important in involving vascular pathology<sup>27, 28, 29</sup>. It has been demonstrated that the flavonoid (antioxidant), neutralized ROS by directly reacting with (O<sup>-2</sup>), NO and peroxyxynitrite<sup>30, 31, 32</sup>. Therefore, antioxidant may preserve vascular function and protect vascular injuries from ROS and perhaps from other oxidant species, including phenyl hydrazine (PHZ) radicals<sup>33</sup>. Another possible mechanism is that the antioxidant could stimulate erythropoiesis process<sup>20</sup>.

**Phenylbutazone/Butadion:**

Most of the hematologic effects of NSAIDs including phenylbutazone (agranulocytosis, red cell aplasia, aplastic anemia, hemolytic anemia, thrombocytopenia) are thought to result from an immune reaction and are, therefore, drug specific. Drugs that bind strongly to proteins, such as non-steroidal anti-inflammatory drugs, can act as haptens and elicit antibody production and other immune responses.

Nonimmune hematologic effects of non-steroidal anti-inflammatory drugs include inhibition of platelet aggregation and hemolysis. Reversible inhibition of platelet cyclooxygenase occurs for all NSAIDs except acetylsalicylic acid (ASA), which irreversibly acetylates the cyclooxygenase for the lifetime of the platelet. Hemolysis can occur owing to the ability of non-steroidal anti-inflammatory drugs to oxidize hemoglobin to methemoglobin or sulfhemoglobin.

**Cyclophosphamide:**

Cyclophosphamide is inactive, until metabolized in liver by P450 mixed junction oxidase to 4-hydroxycyclophosphamide, which (reversibly) forms aldophosphamide. Aldophosphamide is conveyed to other tissue, where it is converted to phosphoramidate mustard, the actual cytotoxic molecule and acrolein which is responsible for bone marrow depression and haemorrhage cystitis<sup>12</sup>.

**Haloperidol:**

Haloperidol is a butyrophenone and phenothiazine-derived neuroleptics. Haloperidol is a typical antipsychotic drug used to manage anxiety in patients. Haloperidol causes bone marrow depression and blood dyscrasias inducing anemia. Acute akathisia is a common and disturbing side effect of classic antipsychotic medication. Some evidence suggests a role for iron deficiency in chronic and tardive akathisia. Butyrophenone class of drugs is having serum iron and serum protein level lowering effect indirectly responsible for iron deficiency anemia<sup>11</sup>.

**CONCLUSION**

The highest prevalence of anemia exists in the developing world where its causes are multifactorial. With limited resources and complex socioeconomics in the developing world, combating anemia is a global public health challenge. Different studies indicate high prevalence of anemia in adolescent boys and girls. Adolescent health is the most important indicator of development of a nation. Hence, urgent attention is needed in this area. Evidence suggests that preventive supplementation coupled with nutrition education may be a more effective strategy associated with better compliance and improvement in nutrition status. However, anaemia-free population is practically possible when the

consequences of anaemia and its preventive and curative measures are popularised among the common public especially the rural population. This extensively cited and well documented review will definitely help the researcher in invention of suitable antianaemic drug, experimental study protocol preparation and cross referencing the published methods.

**REFERENCES**

- [1] Duff, S. Types of Anaemia. [www.innvista.com](http://www.innvista.com). Assessed on 01 Jan 2011.
- [2] Orna, N. U. Iron deficiency anaemia. *Clinical Pharmacology of Herbal Medicines* 7 (1991) 12-16.
- [3] Ong, H. C. Anaemia in pregnancy in an Aborigine population. *Medical Journal of Malaysia* 28: (1973) 22-28.
- [4] Richard, H. *Chinese Herbal Medicine: Ancient art and modern Science*. Shocker Brook, New York (1978) pp. 49-52.
- [5] Sofowora, A. *African Medicinal plants: Proceeding of a conference*. University of Ife Press, Ife Nigeria (1979) pp. 3.
- [6] Dina, O. A., Adedapo, A. A., Oyinloye, O. P., Saba, A. B. Effect of *T. Occidentalis* extract on experimentally induced anaemia in domestic rabbits. *African Journal of Biomedical Research* 3: (2006) 181-183.
- [7] Breazile, J. E. *Textbook of Veterinary Physiology*. 1st ed. Lea and Fabiger, Philadelphia (1971) pp. 205-210.
- [8] Burkill, H. M. *The Useful Plants of West Tropical Africa*. 2nd ed. Royal Botanical Garden (1985) pp. 28.
- [9] Robbins and Cotran. *Pathologic Basis of Disease*, 7th ed. W. B. Saunders, Philadelphia (2007) pp. 619-645.
- [10] Rang, H. P., Dale, M. M., Ritter, J. M., Flower, R. J. *Rang and Dale's Pharmacology* 6th ed. Churchill Livingstone, Philadelphia (2007) pp. 331-355.
- [11] Tripathi, K. D. *Essentials of Medical Pharmacology*, 4th ed. Jaypee Brothers medical publishers, New Delhi (1999) pp. 545-575.
- [12] Brunton, L. L., Lazo, J. S., Parker, K. L. *Goodman and Gillman's The Pharmacological basis of Therapeutics*, 11th ed. McGraw-Hill, USA (2006) pp. 1433-1488 and 1322-1328.
- [13] Sharma, D. C., Chandiramani, D., Riya, M., Sharma, P. Scientific evaluation of some ayurvedic preparations for correction of iron deficiency and anemia. *Indian Journal of Clinical Biochemistry* 22: (2007) 123-128
- [14] Prakash, V. B., Prakash, S., Sharma, R., Pal, S. K. Sustainable effect of ayurvedic formulations in the treatment of nutritional anemia in adolescent students *The Journal of Alternative and Complementary Medicine*. 16: (2010) 205-211.
- [15] Trivedi, A., Mishra, S. H. Evaluation of haematinic potential of a herbomineral formulation (HMF-TE) in haloperidol induced anaemia. *Pharmacognosy research* 1: (2009) 192-196.
- [16] Ogbe, R. J., Adoga, G. I., Abu, A. H. Antianaemic potentials of some plant extracts on phenyl hydrazine-induced anaemia in rabbits. *Journal of Medicinal Plants Research* 4: (2010) 680-684.
- [17] Owoyelea, B. V., Alabi, O. T., Adebayoa, Soladoyea, a. O.,

- Abioyeb, A. I. R., Jimohb, S. A. Haematological evaluation of ethanolic extract of *Allium ascalonicum* in male albino rats. *Fitoterapia* 75: (2004) 322-326.
- [18] Akah, P. A., Okolo, E. C., Ezike, A. C. The haematinic activity of the methanol leaf extract of *Brillantasia nitens* Lindau (Acanthaceae) in rats. *African Journal of Biotechnology*. 8: (2009) 2389-2393.
- [19] Oladiji, A. T., Jacob, T. O., Yakubu, M. T. Anti-anaemic potentials of aqueous extract of *Sorghum bicolor* (L.) moench stem bark in rats. *Journal of Ethnopharmacology* 111: (2007) 651-656.
- [20] Diallo, A., Gbeassor, M., Vovor, A., Gadegbeku, K. E., Aklikokou, K., Amegnona Agbonon, A., Abena, a. A., De Souza, C., Akpagana, K. Effect of *Tectona grandis* on phenylhydrazine-induced anaemia in rats. *Fitoterapia* 79: (2008) 332-336.
- [21] Sanni, F.S., Ibrahim, S., Esievo, K.A.N., Sanni, S. Effect of oral administration of aqueous extract of *Khaya senegalensis* stem bark on phenylhydrazine induced anaemia in rats. *Pakistan Journal of Biological Sciences* 8: (2005) 255-258.
- [22] Petukhova, N. M., Buryakina, A. V., Avenirova, E. L., Buurakova, M. A., Drozhzhina, E. V. Study of biological activity an oil extract of the snakeflower *Lamium Album*. *Pharmaceutical Chemistry Journal* 42: (2008) 354-356.
- [23] Alada, A. R. A. The hematological effect of *Telfelia occidentalis* diet preparation. *African Journal of Biomedical Research* 3: (2000) 185-186.
- [24] Chhabra, S. C., Mahunna, R. L. A., Mshiu, E. N. Plants used in traditional medicine in estern Tanzania. V. Angiosperms (Passifloraceae to Sapindaceae). *Journal of Ethnopharmacology* 33: (1991) 143-157.
- [25] Omolo, O. J., Chhabra, S. C., Nyagah, G. Determination of iron content in different parts of herbs used traditionally for anaemia treatment in East Asia. *Journal of Ethnopharmacology* 58: (1997) 97-102.
- [26] Pawar, R. S., Jain, A. P., Kashaw, A., Singhai, A. Effect of *Asteracantha longifolia* on haematological parameters in rats. *Indian Journal of Pharmacology* 38: (2006) 285-286.
- [27] Ardanaz, N., Pagano P. J. Hydrogen peroxide as a paracrine vascular mediator: regulation and signaling leading to dysfunction. *Experimental Biology and Medicine* 23: (2006) 237-251.
- [28] Cai, H. NAD (P) H oxidase-dependent self-propagation of hydrogen peroxide and vascular disease. *Circulation Research* 96: (2005) 818-822.
- [29] Forstermann, U., Munzel, T. Endothelial nitric oxide synthase in vascular disease: from marvel to menace. *Circulation* 113: (2006) 1708-1714.
- [30] Hanasaki, Y., Ogawa, S., Fukui, S., The correlation between active oxygens scavenging and antioxidative effects of flavonoids. *Free Radical Biology and Medicine* 16: (1994) 845-850.
- [31] Korkina, L.G., Afanas'ev, I. B. Antioxidant and chelating properties of flavonoids. *Advance Pharmacology* 38: (1997), 151-163.
- [32] Vanacker, S. A., Tromp, M.N., Haenen, G. R., Van der Vijgh, W. J., Bast, A. Flavonoids as scavengers of nitric oxide radical. *Biochemical and Biophysical Research Communication* 214: (1995) 755-759.
- [33] Luangaram, S., Kukongviriyapan. U., Pakdeechote. P., Kukongviriyapan, V., Pannangpetch, P. Protective effects of quercetin against phenylhydrazine- induced vascular dysfunction and oxidative stress in rats. *Food and Chemical Toxicology* 45: (2007) 448-455.



# A systematic and holistic approach to assess the rate of Total Productive Maintenance in the reduction of losses in an Oxygen Plant

Mahima Singh<sup>1</sup>, Mohammad Younus<sup>2</sup>, Dr PK Lahiri<sup>3</sup>

Department of Mechanical Engineering, RIRT,(RGI)Bhopal, India.

<sup>1</sup>shri\_mahima@yahoo.com,<sup>2</sup>m.younus76@yahoo.com,<sup>3</sup>pronabkul@gmail.com

## Abstract

This paper deals with an endeavour to eliminate losses in the oxygen plant by the application of Total Productive Maintenance technique. TPM technique is applied to the heat exchanger of an air compressor, where the losses were maximum i.e. at the region of heat rejection. Jishu-Hozen (Autonomous Maintenance) and Kobetsu Kaizen (continuous improvement) has been used for the investigation. Analysis to find the root cause of failure was carried out on the basis of Plan-Do-Check .

**Keywords** - TPM (Total Productive Maintenance), automated production, auto maintenance, deterioration, proactive, Total quality Management (TQM), Heat Exchanger, air compressor, strategies, stochastic, quantum.

## I. About TPM

Plant production equipment has become highly sophisticated. Roots produce and 24 hours automated production is a reality. But only the operation has been automated; maintenance still heavily depends on human input. The automated technologically advanced equipment however requires skills beyond the competence of the average maintenance supervision or work. To use the equipment effectively, there is need of an appropriate maintenance system. Total Productive Maintenance (TPM) is a new way of looking at maintenance spectrum (Fig.1). Auto-maintenance ensures appropriate and effects efforts are expend since the machine is wholly in the domain of one person or team. TPM is a critical adjunct to lean manufacturing. If machine uptime is untenable vis-a-vis downtime not reducible and if process capability is not sustained, the process must keep extra stocks to buffer against this uncertainty and flow through the process will be interrupted.

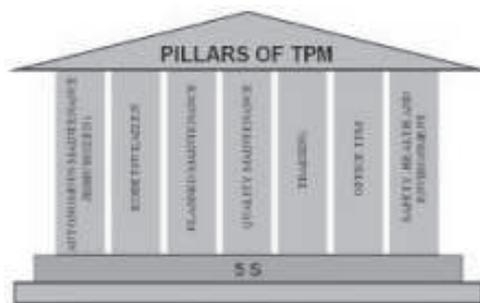


Fig. 1 The pillars of TPM

One way to think to TPM is that of "deterioration prevention" and maintenance reduction", not fixing the machines in particular. For this reason many people refer to TPM as "Total Productive Manufacturing" or Total Process Management" Total productive maintenance (TPM) is a well designed maintenance program, which involve newly defined concept for maintaining plant and equipment. TPM is a proactive approach that essentially aims to prevent any kind of slack before occurrence. Its motto is zero error zero work-related accident by way of making it non damaging vis-a-vis zero loss.

It may be said that TPM is a systematic approach to clarifying integrated plants maintenance vis-a-vis productive objectives, making strategic decisions and checking progress towards the objectives. TPM are the objectives for the organization as a whole not for parts of it. Strategic decisions are those which affect or are intended to affect the organization as a whole over long period of time. It can further be explained that TPM would generally encompass a process which has a continues dynamic characteristics having stochastic representation of heterogeneous sets of endogenous and exogenous variables taken together on a fairly wide time horizon, are generally non linear in nature and either of implicit or explicit type possessing specific characteristics. These are analysed and synthesized on a holistic plane ,defining the entire spectrum of shop floor activities. At the start, the system appears to be icebergal and slowly get exposed as the time moves on.

The TPM program closely resembles popular Total Quality Management (TQM) program. TPM technique is thus used more effectively by way of improving the overall performance and the plant TPM is a system fully involving all employees from the top management to the production line workers.

TPM is a means and creating a safe and perceptive work environment in which all employees target the elimination of all kinds of waste generated due to equipment failure frequently and breakdown of defective products which includes rejecting and reworking. Thus TPM approach leads to higher employees morale and greater organizational practicability with enhanced productivity and commitment by way of sustained professional involvement.

## II. A Description of the Oxygen Plant Observed:

The present paper deals with the concept of an introduction analysis and implementation approach vis-a-vis TPM at an industry under investigation. They are adopting the air separation technology of manufacturing air products (Fig.2) and filling the cylinders and supplying to different plants in India.

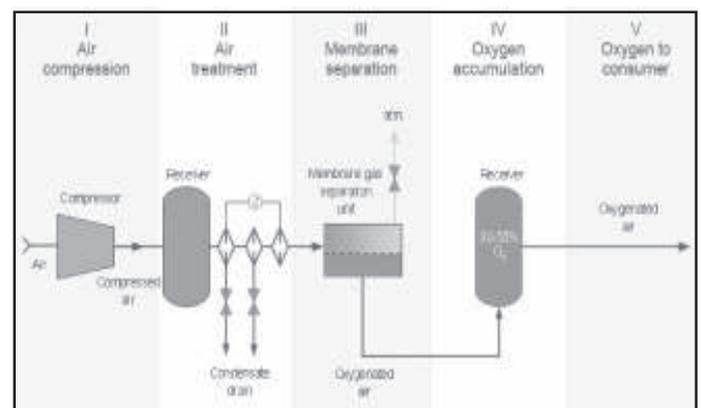


Fig. 2 Process diagram

In the production process of oxygen gas there are five basic steps/process involved: -

- (1) Compression of atmospheric air
- (2) Purification of air
- (3) Cooling of air.
- (4) Separation of liquid air into O<sub>2</sub>
- (5) Compression withdrawal and filling of O<sub>2</sub>.

**Normal problems that occur in an oxygen plant: -**

- a. The plant operation should be such that it is neither too cold nor too warm. If the cold box is too cold, the nitrogen will condense into liquid oxygen and oxygen purifier will fail.
- b. If the plant is too warm oxygen will evaporate with the nitrogen and the quantity of oxygen reduced will go down substantially.
- c. With the plant working continuously for a few months, it tends to accumulate carbon-di-oxide and moisture in its internal part. These are to be removed once in about four months time period.
- d. Before starting plant, it is generally defrosted and blown out. That the cooling/ starting is done which will take about 7 to 8 hours. When the plant is stopped for short intervals, the plant need not be defrosted, but all the cold line valves are to be closed to prevent outside moisture for entering the cold box.
- e. The moisture and the carbon dioxide in the air will be removed in the molecular sieve vessels connected in the system. If they are not removed before the entry to cold box, they will form Ice and Dry Ice which will choke the heat exchanger, tubes and other equipment.

The equipment-wise (in use) losses are given in Table 1. This table is the summary of the losses which were occurring very frequently in the industry from last two years.

Table 1

Equipment-wise distribution of losses (In hours) Period/month Nov'09

S. No.	Component	Electrical Delay	Electrical Delay	Operational Delay	Others	Total
1	Heat exchanger of Air Compressor	9.580	1.164	0	0	10.744
2	Chiller component, battery, heater MCC	0.012	0	0	0	0.012
3	Oxygen compressor	0.440	0	0	0	0.014
4	Bullet Area, pump house meeting room	0	0	0	0	0
	Total	9.592	1.164	0	0	10.760

Thus, it was decided to study the section where the losses were maximum i.e. at the heat exchanger of air compressor. The use of heat exchanger was kept in mind as elaborated.

**III. IMPLEMENTATION OF TPM**

TPM starts with "5S". The systematic process of housekeeping was involved to achieve a serene environment at the work place, so that the employees are committed to practice it as the problems cannot be clearly tackled when the work place is unorganized. Cleaning and organizing the workplace helps the team to discover by way of identifying problems.

*Sorting*

Thorough scanning of all the instructions on the Heat Exchanger was performed and suggestions were made to make them simple and pin-pointed.

*Straightening*

The entire molecular sieves are arranged according to the number and size. These sieves were properly labelled according to the specifications. Tube bundles of heat exchangers were arranged according to the specifications.

*Sweeping or systematic cleaning*

It was made a matter of primary concern that the workplace and all the equipments be very clean, tidy and organized. The moisture and carbon dioxide in the air were the main focus.

*Standardizing*

An attempt was made to standardize the procedures in the plant.

*Self discipline*

Serious measures were also taken to educate and motivate workers to follow the set instructions religiously.

**IV. OVERALL PLANT EFFICIENCY**

It is a function of three factors namely Management losses, Scheduled downtime loss and OEE (overall equipment efficiency). Management losses include losses due to want of tools, want of raw materials, want of trays, want of skilled manpower etc. Scheduled downtime includes any Jishu Hozen activity, preventive maintenance activity or meetings.

*Overall Equipment Efficiency (OEE)*

The basic measure associated with TPM is the OEE. This OEE highlights the actual "Hidden Capacity" in an organization. OEE is not an exclusive measure of how well the maintenance department works. The design and installation of equipment as well as how it is operated upon and maintained do affect the OEE. It measures both efficiency and effectiveness of the equipment. It incorporates two basic indicators of equipment performance and reliability. Thus OEE is a function of the two factors mentioned below.

- a. Availability or Uptime (A).
- b. Performance efficiency (PE) i.e. actual vs. design capacity

Thus

$$OEE = A \times PE$$

Availability is proportion of time the machine is actually available for production out of the time it should have been available. It excludes planned and unplanned downtime, tool change, tool service, job change

etc. Availability losses include equipment failures and changeovers indicating situations when the line is not running although it is expected to run.

$$A = (\text{Utilized time}) / (\text{Loading time})$$

Utilized time = Loading time - Mechanical Failure loss hour.

Loading time = (Calendar hour - Plant Shut down hour - Breakdown hours) x Power failure hour.

Performance Efficiency can be expressed as: Performance Efficiency (PE) = Total oxygen generation / utilized hr. x plant capacity.

**V. RESULT & CONCLUSION**

The data were collected before and after the implementation of TPM. The performance related parameters were observed on weekly basis for a period of four weeks. During this period, operational delay, breakdown time and mechanical failure time were noted in minutes. The oxygen cylinders produced/filled during this period were also listed. With the help of the formulae described above, the availability, performance efficiency and overall equipment efficiency were calculated. They are then plotted to analyse the effect of TPM in the plant (Fig. 2 & 3).

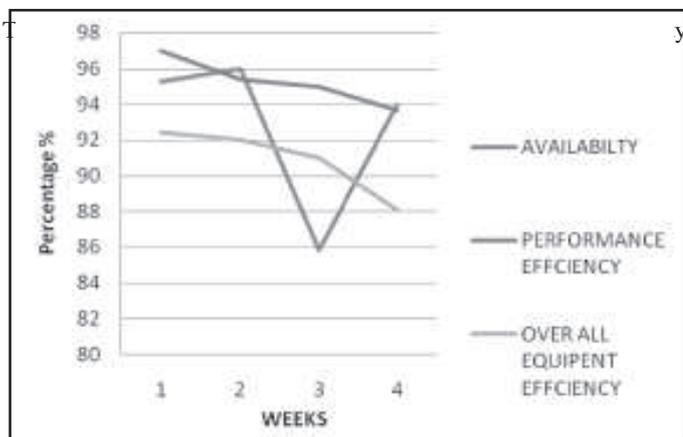


Fig. 3 Before the application of TPM

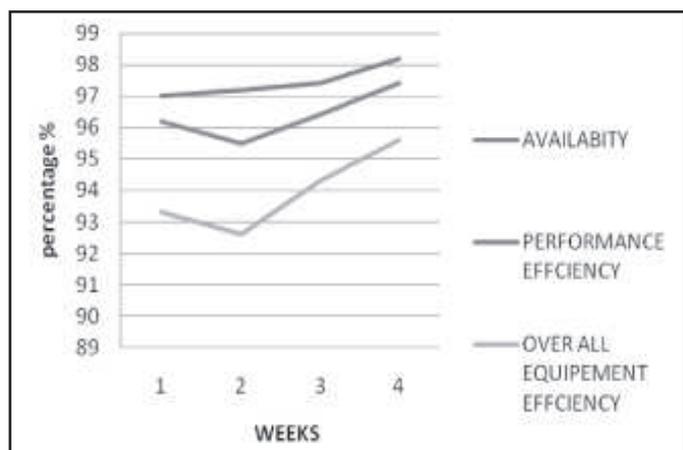


Fig. 4 After the application of TPM

and performance efficiency are reported in the Table 2.

Table 2

Plant Performance Efficiency after Investigation

No. Attributes	Before TPM	After TPM	% Improvement
1 Overall Equipment efficiency	90.82%	95.35%	4.53%
2 Plant Availability	93.23%	96.6%	3.37%
3 Performance Efficiency	97.42%	98.71%	1.29%

It can be observed from above table that there is substantial increase in the performance efficiency, availability, and overall equipment efficiency in the oxygen plant. The percentage enhancement is 1.29%, 3.37% and 4.53% in the performance efficiency, plant availability and overall equipment efficiency respectively.

Benefits from TPM implementation

The team spirits among the employees has increased and a thorough structured approach was laid down. The team had been able to eliminate the problems of the shop floor. Increased efficiency of equipment in a production process has motivated the management and the workers to implement TPM on all the equipments on the shop floor.

Following points are quite important for the successful implementation of TPM on the shop floor.

1. Management support in terms of time, money, and manpower and commitment of all employees are important.
2. Continuous monitoring and motivation of the employees.
3. Implementation of TPM would be more effective if carried out done in a very systematic manner.
4. All the procedures including cleaning and inspection done by the workers performing the routine tasks.
5. Cleaning and inspection of records if maintained properly and analysed regularly show continuous improvement.

As can be seen from the implementation of TPM, that it has significantly reduced the yield loss and reduced the downtime of equipment. It should be acknowledged that a TPM implementation is not a short-term fix program. It is a continuous journey based on changing the work area by way of making it improvement centric.

Today, with the enhanced quantum and neck to neck competition in industry which is at an all time high, TPM may be the only thing that stands between success and total failure for the companies. It can be adapted to work not only in industrial plants, but also in construction, building maintenance, transportation logistic management and in a variety of other situations/applications. Employees must be educated properly and convinced that TPM is not just another "Program of the month" of rather the management is totally committed effective implementation of the program for sustained growth.

**Acknowledgement:**

The authors thank Shri R.R. Saxena, Group Chairman RGI & the management for the support and help provided in the preparation of this paper.

**Reference**

1. Barber P.R, Eastman's Kodak Press Central Method Lowers Repair variability and Retains Quality Industrial Engineering journal, USA.
2. Bhabury B, Application of Productive Maintenance: A Case Study, All India Scenario, Institute of Engineers Pune .
3. Bod Francis TPM Success through people, Engine power Train, Land Rover, U.K. JIPM Journal 1992.
4. Buffa S.E & Tauber T.H.W. Production Inventory System planning and control. Richard, D. Irwin INC Illinois USA pp 103.104 1997.
5. Dey B.R. Quality circle proceedings at the total personal manager conference on a Human Resource Approach to the Management of Industrial Relation, Tata Management Centre, Pune.
6. Duag T.Martin. TPM experience of Du point Fibres. USA, JIPM Journal , 1992
7. Edmood, S.Buff and Nilliam H Taubert, Production Inventory System.

# An improving Monoalphabetic method of Encryption/Decryption using Diffie-Hellman key exchange

Santosh Soni

Asst. Prof. Dept. of CSE  
PCST, Bhopal  
Mob.: 9425409391

Pawan Meena

Dept. of CSE  
PCST, Bhopal  
Mob.:9300711151  
pavan1914@gmail.com

## Abstract

To exchange important information through the internet, an authenticated key exchange is required. In this paper, shows the possibility of exploiting the features of Genetic Algorithm with monoalphabetic methods in a linear way, to generate Key values of the given text and then applying conversion, transposition with the features of Cryptography.

In monoalphabetic substitution ciphers the plaintext letters are enciphered differently depending upon their placement in the text. As the name monoalphabetic suggests this is achieved by using Symmetric-key algorithms is used Diffie-Hellman key exchange[3]. In Diffie-Hellman key exchange algorithm is based on mathematical principles. This algorithm is based on random number and exchange the key between Alice & Bob. And generate Symmetric-key. This same key is used for Encryption/ Decryption.

**Key words** : Encryption, Decryption, Diffie-Hellman key exchange, Mono Substitution.

## 1. Introduction

The use of internet increasing rapidly so demand for effective network security is also increasing exponentially day by day. In the field Businesses have an obligation to protect sensitive data from loss or hackers. Not only we see security needs; we have to understand where the computer is vulnerable and how to protect it. In the present scenario, a user needs to be connected anyhow, anywhere, anytime to the networks and securities.

## 2. Definition of cryptography

The word cryptography [1] comes from the Greek word "cryptos", which means hidden and "graphein", which means writing. We have always been a need for exchanging information secretly. Cryptography, the science of encrypting and decrypting information can be traced back all the way to year 2000 BC in Egypt. Here it was first used with the help of the standard hieroglyphics in order to communicate secretly. Julius Caesar [6] (100-44 BC) used a simple substitution cipher which has been named after him today. During the first and the second war the demand for secrecy increased dramatically and all kinds of new cryptographic techniques evolved. Today's society has evolved, and the need for more sophisticated methods for protecting data has increased. As the world becomes more connected, the demand for information and electronic services is growing, and with the increased demand comes increased dependency on electronic systems. Exchanging sensitive information over the Internet, such as credit card numbers is common practice. Now information society, cryptography is one of the main tools for privacy, trust, access control, electronic payments, corporate security, authentication and many other fields. The use of cryptography is not something used only by governments and highly skilled Specialists it is available for everyone. In This paper we will present knowledge about Cryptography. It will focus on new approach on text encryption and decryption and describe their functions and flaws.

## 3. Communication introduction

Let's consider two parties that want to communicate secretly, Alice and Bob. If Alice wants to send something to John, some information, we call that information a plaintext. After encrypting the plaintext a cipher text is produced. Bob knows the encryption method since he is the intended receiver and since he must use the same method together with his secret key to decrypt the cipher text and reveal the plaintext.

## 4. Purpose of my work

The main objective of my work is to protect information leakage what so ever manner it may be, the use of appropriate technology to provide a high level of confidentiality, integrity, non reputability and authenticity to information that is exchanges over networks.

- **Confidentiality**: - data is protected by hiding information using encryption technique.
- **Integrity**: - Ensures that a message remains unchanged from the time it is created and opened by recipient.
- **Authentication**: - it verifies the identity of user in the system and continues to verify their identity in case someone tries to break into the system.

## 5. Type of encryption method

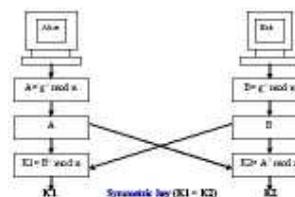
### 5.1 Monoalphabetic method

In Monoalphabetic method ciphers the plaintext letters are enciphered differently depending upon their placement in the text[6]. As the name monoalphabetic suggests this is achieved by using same key. To implementation of monoalphabetic method the Diffie-Hellman key exchange is used. The Diffie-Hellman key exchange is generating the Symmetric key (based on random variables) and that key is used for Encryption/ Decryption.

### 5.2 Diffie-Hellman key exchange

Diffie-Hellman key exchange is a specific method of exchanging keys. It is one of the earliest practical examples of Key exchange implemented within the field of cryptography[3]. The Diffie-Hellman key exchange method allows two parties that have no prior knowledge of each other to jointly establish a shared secret key over an insecure communications channel. This key can then be used to encrypt subsequent communications using a symmetric key cipher[4]. It is a type of key exchange.

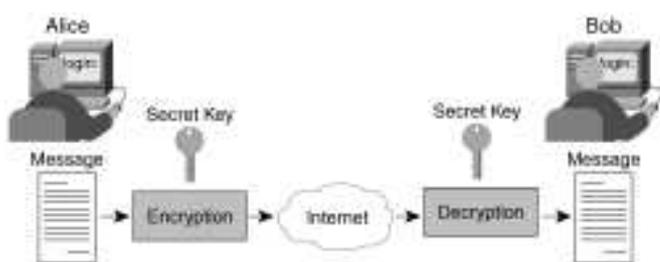
Diffie-Hellman establishes a shared secret that can be used for secret communications by exchanging data over a public network. Here is an explanation which includes the encryption's mathematics:



The simplest, and original, implementation of the protocol uses the multiplicative group of integers modulo  $p$ , where  $p$  is prime and  $g$  is primitive root mod  $p$ . Here is an example of the protocol[3].

1. Alice and Bob agree to use a prime number  $p=23$  and base  $g=5$ .
2. Alice chooses a secret integer  $a=6$ , then sends Bob  $A = g^a \text{ mod } p$ 
  - o  $A = 5^6 \text{ mod } 23$
  - o  $A = 8$
3. Bob chooses a secret integer  $b=15$ , then sends Alice  $B = g^b \text{ mod } p$ 
  - o  $B = 5^{15} \text{ mod } 23$
  - o  $B = 19$
4. Alice computes  $s = B^a \text{ mod } p$ 
  - o  $s = 19^6 \text{ mod } 23$
  - o  $s = 2$
5. Bob computes  $s = A^b \text{ mod } p$ 
  - o  $s = 8^{15} \text{ mod } 23$
  - o  $s = 2$

Both Alice and Bob have arrived at the same value or same key. This same key is use to improve monoalphabetic method for Encrypt/ Decrypt the message.



### A. Encryption / Decryption Process

Take the example text "Welcome". Take the symmetric key  $k=2$  (using Diffie-Hellman key exchange based on random number). This value is use to encrypt / decrypt the message. In monoalphabetic method only one key is use for encryption / decryption the message. Using Diffie-Hellman key exchange the problem of monoalphabetic is improved because the key is symmetric key but it change based on different message[2].

**Plaintext:** - welcome

**Chiphertext:** - ygneqog

### B. Key Term logy [5]

- Cipher An algorithm for performing encryption (and the reverse, decryption) - a series of well-defined steps that can be followed as a procedure. Works at the level of individual letters, or small groups of letters.
- Cipher text A text in the encrypted form produced by some cryptosystem. The convention is for cipher texts to contain no white space or punctuation.

- Cryptanalysis The analysis and deciphering of cryptographic writings or systems.
- Cryptography?. The process or skill of? communicating in or deciphering Secret writings or ciphers
- Cryptosystem The package of all processes, formulae, and instructions for encoding and decoding messages using cryptography.
- Decryption Any procedure used in cryptography to convert cipher text (encrypted data) into plaintext.
- Diagram Sequence of two consecutive characters.
- Encryption The process of putting text into encoded form.
- Key length The size of the key - how many values comprise the key?
- Mono-alphabetic Using one alphabet - refers to a cryptosystem where each alphabetic character is mapped to a unique alphabetic character.
- Plaintext A message before encryption or after decryption, i.e., in its usual form which anyone can read, as opposed to its Encrypted form. as well as the number of solutions that can be investigated at one time, i.e., per generation

### 6. Conclusion

The Proposed methodology will give the new area of research on monoalphabetic method based on symmetric key generated by Diffie-Hellman key exchange generate same key based on random variables. This new methodology for text encrypts and decrypt using key exchange algorithm is definitely an effective method while compared with other cryptography systems.

### References

- [1] William Stallings, "Cryptography and Network Security: Principles and Practice", 2/3e Prentice hall, 1999.
- [2] Jeetendra Kumar Ambulkar, 'Poly substitution method for encryption and decryption' (IJCSSE) Vol. 02, No. 05, 2010, 1810-1812.
- [3] Wikipedia, "Diffie-Hellman\_key\_exchange", ' http://en.wikipedia.org/wiki/Diffie% E2% 80% 93 Hellman\_key\_exchange' modified 29 December 2010.
- [4] Atul Kahate, "Cryptography and network security"second edition TMH, reprints 2010.
- [5] Majdi Al-qdah & Lin Yi Hui, "Simple Encryption/Decryption Application" International Journal of Computer Science and Security, Volume (1) : Issue (1)
- [6] R. Venkateswaran & Dr. V. Sundaram, "Information Security: Text Encryption and Decryption with poly substitution method and combining the features of Cryptography", International Journal of Computer Applications (0975 - 8887) Volume 3 - No.7, June 2010.

# Application of Data Mining In E-Commerce

**Dr. Ravindra Mangal**  
Head, Department of Physics  
Govt Doongar College Bikaner (RAJ)

**Akash Saxena**  
Asst. Prof. & Head (CSE)  
St. Wilfred'S P.G. College Jaipur

## Abstract

Data mining has matured as a field of basic and applied research in computer science in general and e-commerce in particular. This paper surveyed some of approaches where data mining has been applied in electronic commerce. And this paper focused on data mining in the context of e-commerce, not surveying the algorithms in data mining.

**Keywords:** Data mining, Global World, E-Commerce

## I. Introduction

Data mining tools aid the discovery of patterns in data and ecommerce provides a perfect workbench for data mining It is ideal because many of the ingredients required for successful data mining are easily satisfied[1]: data records are plentiful, electronic collection provides reliable data, insight can easily be turned into action, and return on investment can be measured. To really take advantage of this domain, however, data mining must be integrated into the e-commerce systems with the appropriate data transformation bridges from the transaction processing system to the data warehouse and vice-versa. An integrated solution can also provide users with a uniform user interface and seamless access to metadata The plan behind this article is to explore a semi-automated data mining system that can be used to create and maintain web based content through interactive mining operations in a hierarchical arrangement. We will prototype an Online Department Store which mainly sells books and software, etc[2]. This e-commerce system integrates interactive mining operations. In this e-commerce system, the data mining algorithms for supplier hunting, and sales statistics, promotional campaigns and e-mail marketing have been encapsulated into Microsoft SQL Server stored procedures. Such an SQL implementation of data mining algorithm has several advantages . The first advantage of SQL based mining algorithms is fast and easy development since they are declaratively specified as set of SQL queries. The Boolean association rule framework can be easily augmented with nontrivial extensions to handle complex mining tasks. Secondly, one can make use of the database indexing and query processing capabilities thereby leveraging on more portable, scalable, and concurrent. The mining results will be stored back into the relational database.

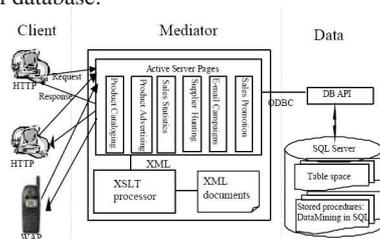


Fig1:Three Tier architecture For the Online Department store integrating data mining Functionalities

## II. E-Commerce

Electronic commerce or e-commerce refers to a wide range of online business activities for products and services. It also pertains to "any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact. E-commerce is usually associated with buying and selling over the Internet, or conducting any transaction involving the transfer of ownership or rights

to use goods or services through a computer-mediated network. E-commerce technologies make it possible for merchants to know much more about consumers and use this information more effectively than ever before[3,4]. Online merchants can use this information to develop new information asymmetries, enhance their ability to brand products, charge premium prices for high quality service and segment the market into an endless number of subgroups, each receiving a different price. It has various features like Ubiquity, Global reach, Universal Standards, Interactivity, Information density and Richness and Personalization.

## III. Data Mining

Data mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. Most companies already collect and refine massive quantities of data. Data mining techniques can be implemented rapidly on existing software and hardware platforms to enhance the value of existing information resources, and can be integrated with new products and systems as they are brought on-line[5].

The most commonly used techniques in data mining are:

- Artificial neural networks: Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- Genetic algorithms: Optimization techniques that use process such as genetic combination, mutation, and natural selection in a design based on the concepts of evolution.
- Nearest neighbor method: A technique that classifies each record in a dataset based on a combination of the classes of the k record(s) most similar to it in a historical dataset (where  $k \geq 1$ ). Sometimes called the k-nearest neighbor technique.
- Rule induction: The extraction of useful if-then rules from data based on statistical significance.

## IV Encapsulation of Datamining and Commerce

Data mining tools aid the discovery of patterns in data and ecommerce provides a perfect workbench for data mining, it is ideal because for successful data mining various things are required i.e. data records are plentiful, electronic collection provides reliable data, insight can easily be turned into action, and return on investment can be measured. Data mining integrated into the e-commerce systems with the appropriate data transformation bridges from the transaction processing system to the data warehouse and vice-versa. An integrated solution can also provide users with a uniform user interface and seamless access to metadata. The plan behind this article is to explore a semi-automated data mining system that can be used to create and maintain web based content through interactive mining operations in a hierarchical arrangement. We will prototype an Online Department Store which mainly sells books and software, etc. This e-commerce system integrates interactive mining operations. In this e-commerce system, the data mining algorithms for supplier hunting, and sales statistics, promotional campaigns and e-mail

marketing have been encapsulated into Microsoft SQL Server stored procedures. Such an SQL implementation of data mining algorithm has several advantages. The first advantage of SQL-based mining algorithms is fast and easy development since they are declaratively specified as set of SQL queries. The Boolean association rule framework can be easily augmented with nontrivial extensions to handle complex mining tasks. Secondly, one can make use of the database indexing and query processing capabilities thereby leveraging on more portable, scalable, and concurrent. The mining results will be stored back into the relational database. Supply chain management, Video on demand, Remote banking, Procurement and purchasing, Online marketing and advertisement, Home shopping, Auctions are the various applications of E-Commerce and they also use data mining for extract useful information [6].

Various applications of e-commerce are continually affecting trends and prospects for Business over the Internet, including e-banking, e-tailing and online publishing/online retailing. A more developed and mature e-banking environment plays an important role in e-commerce by encouraging a shift from traditional modes of payment (i.e., cash, checks or any form of paper-based legal tender) to electronic alternatives (such as e-payment systems. In most developing countries, the payment schemes available for online transactions are the following:

### **1. Traditional Payment Methods**

- **Cash-on-delivery.** Many online transactions only involve submitting purchase

orders online. Payment is by cash upon the delivery of the physical goods.

- **Bank payments.** After ordering goods online, payment is made by depositing

Cash into the bank account of the company from which the goods were ordered.

Delivery is likewise done the conventional way.

### **2. Electronic Payment Methods**

- **Innovations affecting consumers,** include credit and debit cards, automatedteller machines (ATMs), stored value cards, and e-banking.

- **Innovations enabling online commerce** are e-cash, e-checks, smart cards, and encrypted credit cards. These payment methods are not too popular in developing countries. They are employed by a few large companies in specific secured channels on a transaction basis.

- **Innovations affecting companies** pertain to payment mechanisms that banks provide their clients, including inter-bank transfers through automated clearing houses allowing payment by direct deposit.

### **V Conclusion**

E-commerce generally refers to commercial transactions between businesses or between business and consumers that take place wholly or partially over the internet or other electronic communication networks. Web e-commerce applications are Supply chain management, Video on demand, Remote banking, Procurement and purchasing, online marketing and advertisement, Home shopping, Auctions, electronic payment system etc are needs some data mining tools for extract the frequent uses information. In this paper specify the needs of data mining in electronic payment system.

### **References**

- [1]. Role of Data Mining in E-Payment systems Sabyasachi Pattanaik, Partha Pratim Ghosh FM University, Balasore

(IJCSIS) International Journal of Computer Science and Information Security, Vol. 7, No. 2, February 2010.

- [2]. AN E-COMMERCE SYSTEM INTEGRATING DATA MINING FUNCTIONALITIES Frank Wang, Na Helian, Yau Jim Yip Department of Computing London Metropolitan University 166-220 Holloway Road, London N7 8DB, United Kingdom
- [3]. Department of Computing London Metropolitan University 166-220 Holloway Road, London N7 8DB, United Kingdom CSE 634-Datamining Concepts and Techniques Professor Anita Wasilewska Presented By Sushma Devendrappa Swathi Kothapalli.
- [4]. E-Commerce and E-business by Zorayda Ruth Andam
- [5]. The 7th Balkan Conference on Operational Research .BACOR 05. Constanta, May 2005, Romania
- [6]. Data Mining in Electronic Commerce David L. Banks, Institute of Statistics and Decision Sciences, Duke University; banks@stat.duke.edu Yasmin H. Said, School of Computational Sciences, George Mason University

# Blackhole Attack Detection in Adhoc Network

Harsh Kumar Singh  
MANIT, Bhopal  
harshku4@gmail.com

Prof. Anurag Jain  
HOD, RITS, Bhopal  
anurag.akjain@gmail.com

Murli Dhar Vishwakarma  
RITS, Bhopal  
mtechrits@gmail.com

## Abstract

The wireless ad-hoc network typically works in an entrusted environment along with little physical security; they are subjected to a number of unique security attacks. One of the most popular and serious attack in ad-hoc network is "blackhole attack". In blackhole attack a malicious node falsely advertises good path (e.g., shortest path or most stable path) to the destination node during the path-finding process (in on-demand routing protocols) or in the route update messages (in table driven routing protocols). The intention of the malicious node could be to hinder the path finding process or to intercept all data packets being sent to the destination node concerned.

This paper proposed a method of detection that is based on transmission time and neighbor number of nodes to detect and locate blackhole attack on Ad-hoc On Demand and Distance Vector (AODV) routing protocol. The proposed Black hole attack is one of many possible attacks in MANET. Black hole attack can occur when the malicious node on the path directly attacks the data traffic and intentionally drops, delay or alter the data traffic passing through it. This attack can be easily lessen by setting the promiscuous mode of each node and to see if the next node on the path forward the data traffic as expected.

In this type, use an anomaly detection scheme. It uses dynamic training method in which the training data is updated at regular time intervals. Multidimensional feature vector is defined to express state of the network at each node. Each dimension is counted on every time slot. It uses destination sequence number to detect attack. The feature vector include Number of sent out RREQ messages, number of received RREP messages, the average of difference of destination sequence number in each time slot between sequence number of RREP message and the one held in the list. They calculate mean vector by calculating some mathematical calculation. They compare distance between the mean vector and input data sample. If distance is greater than some threshold value then there is an attack. The updated data set to be used for next detection. Repeating this for time interval T anomaly detection is performed.

**Keyword:** - Black whole attack, Ad-hoc On Demand and Distance Vector (AODV), Ad hoc network

## Introduction

Black hole attack is one of many possible attacks in MANET. In this attack, a malicious node sends a forged Route Reply (RREP) packet to a source node that initiates the route discovery in order to make believe to be a destination node. By comparing the destination sequence number contained in RREP packets when a source node received multiple RREP, it judges the greatest one as the most recent routing information and selects the route contained in that RREP packet. In case the sequence numbers are equal it selects the route with the smallest hop count. If the attacker spoofed the identity to be the destination node and sends RREP with destination sequence number higher than the real destination node to the source node, the data traffic will flow toward the attacker. Therefore, source and destination nodes became unable to communicate with each other. In [14], the authors investigated the effect of blackhole attack when movement velocity and a number connection toward the fatality node are changed, and proposed the detection technique at the destination

node. However, we can effectively avoid the attack for example by selecting the bypass route during route reconstruction which achieved by detecting the attack at the source node rather than at the destination node. Thus, taking into account the detection at the source node is obligatory.

Regarding the detection of blackhole attack at the source node, [6, 7] have proposed methods in which still they are using the same training data to define the normal state. However, in MANET where the network state changes frequently, the pre-defined normal state may not precisely reflect the present network state. Therefore, using this normal state may degrade the detection accuracy. In this paper, we use a reactive routing protocol known as Ad hoc On-demand Distance Vector (AODV) routing [11] for analysis of the effect of the blackhole attack when the destination sequence numbers are changed via simulation. Then, we select features in order to define I normal state from the attribute of blackhole attack. Finally, we present a new training method for high accuracy detection by updating the training data in every given time intervals and adaptively defining the normal state according to the changing network environment.

## IDS APPROACHES FOR MANET

To protect against the blackhole attack, five methods have been proposed. In [2], the method requires the intermediate node to send a RREP packet with next hop information. When a source node receives the RREP packet from a transitional node, it sends a Further Request to the next hop to verify that it has a route to the intermediate node who sends back the RREP packet, and that it has a route to the destination. When the next hop receives Further Request, it sends Further Reply which includes check result to source node. Based on information in Further Reply, the source node judges the validity of the route. In [9], the method requires the intermediate node to send Route Confirmation Request (CREQ) to next hop node toward the destination. Then, next hop node receives CREQ, and look up its cache for a route the destination. If it has one, it sends Route Confirmation Reply (CREP) to source node with its route information. The source judges whether the path in RREP is valid by comparing the information with CREP. In these methods, the operation is added to routing protocol. This operation can increase the routing overhead resulting in performance degradation of MANET which is bandwidth-constrained. In [13], source node verifies the authenticity of node that initiates RREP by finding more than one route to the destination. The source node waits for RREP packet to arrive from more than two nodes. In ad hoc networks, the outmoded paths in most of the time have some shared hops or nodes. When source node receives RREPs, if routes to destination shared hops, source node can recognize the safe route to destination. But, this method can cause the routing delay. Since a node has to wait for RREP packet to arrive from more than two nodes. Therefore, a method that can prevent the attack without increasing the routing overhead and the routing delay is required. Huang et al. [6] propose a method in which the packet flow is observed at each node. In this method, they define a total of 141 features with traffic related and topology related, and suggest incongruity detection means with interrelation between features. In [7], Huang et al. construct an Extended Finite State Automaton (EFSA) according to the specification of AODV routing protocol; modelize normal state; and detect attacks with both

specification based detection and anomaly detection. In specification based detection, they simply detect attacks as unexpected packet from condition defined by EFSA. Also, in anomaly detection, they define normal state and compare it with condition of EFSA and amount of statistic of transition, and then detect attacks as a deviation from those states. From the distinctiveness of the blackhole attack, we need to take a destination sequence number into account. In [6], feature related to the destination sequence number has not been taken into account as the feature to define the normal state. In [7], the threshold is used and the feature is defined as the number of time that the destination sequence number is greater than the threshold. However, since a destination sequence number changed depending on the network environment, up to a threshold it may be difficult to successfully show favoritism between the normal state and the state where blackhole attack took place. And hence cause squalor in detection accuracy. Except the destination sequence number issue, the above mentioned approaches use static training data to define the normal state. However, we note that the MANET topology can be changed easily, and the difference in network state becomes larger by time. Further-more, these methods cannot be applied to a network while the training has been done in another network. As a result, these methods are considered difficult in a MANET environment. To solve this problem, normal state needs to be defined using the data reflecting the trend of current situation and this leads to the idea of updating the training process within a time interval. By so doing, attack detection can be adaptively conducted even in a changing network environment.

**DETECTING BLACKHOLE PROVOKE TRAIT SELECTION**

To express state of the network at each node, multidimensional feature vector is defined. Each dimension is counted up on every time slot. In order to detect this attack, the destination sequence number is taken into account. In normal state, each node's sequence number changes depending on its traffic conditions. When the number of connections increases the destination sequence number tends to rise, when there are few connections it tends to be increased monotonically. However, when the attack took place, regardless of the environment the sequence number is increased largely. Also, usually the number of sent out RREQ and the number of received RREP is almost the same. From these reasons we use the following features to express the state of the network. Number of sent out RREQ messages Number of received RREP messages .The average of difference of Dst Seq in each time slot between the sequence number of RREP message and the one held in the list Here, the average of the difference between the Dst Seq in RREQ message and the one held in the list are calculated as follows. When sending or forwarding a RREQ message, each node records the destination IP address and the Dst Seq in its list. When a RREP message is received, the node looks over the list to see if there is a same destination IP address. If it does exist, the difference of Dst Seq is calculated, and this operation is executed for every received RREP message. The average of this difference is finally calculated for each time slot as the feature.

**Discrimination Module of Anomaly Detection**

For the traffic that flow across each node, the network state in time slot  $i$  is expressed by 3-dimension vector  $x_i = (x_{i1}, x_{i2}, x_{i3})$ . Here, the groups of normal states are considered to be gathered close in feature space. In contrast, the abnormal state is considered to be the cattering

data that deviates from the cluster of normal state. According to this, the distribution of network state

From now, we calculate the Mean vector  $\bar{x}^D$  from Equation (1) using

training data set  $D$  of  $N$  time slots.

$$\bar{x}^D = \frac{1}{n} \sum_{i=1}^n x_i \tag{1}$$

Next, we calculate the distance from input data sample  $x$  to the mean vector  $\bar{x}^D$  from Equation (2).

$$d(x) = \|x - \bar{x}^D\|^2 \tag{2}$$

When the distance is larger than the threshold  $T_h$  (which means it is out of range as normal traffic), it will be judged as an attack (Equation (3)).

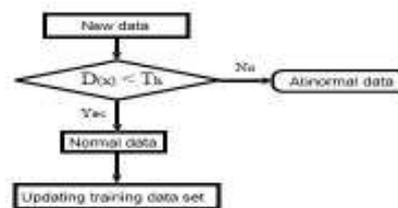
$$\begin{cases} d(x) > T_h & : \text{attack} \\ d(x) \leq T_h & : \text{normal} \end{cases} \tag{3}$$

Here, the projection distance with maximum value is extracted as  $T_h$  from the learning data set (Equation (4)):

$$T_h = d(x_I), \text{ where } I = \arg \max_{i \in D} d(x_i) \tag{4}$$

Let  $\Delta T_0$  be the first time interval for a node participating in MANET. By using data collected in this time interval, the initial mean vector is calculated, then the calculated mean vector will be used to detect the attack in the next period time interval  $\Delta T$ . If the state in  $\Delta T$

is judged as normal, then the analogous data set will be used as learning data set. Otherwise, it will be treated as data including attack and it will be consequently discarded. This way, we keep on learning the normal state of network.



Learning flow chart of proposed method

By doing this, we update the training data set to be used for the next detection. Then, the mean vector which is calculated from this training data set is used for detection of the next data. By repeating this for every time interval  $\Delta T$  we can perform anomaly detection which can adapt to MANET environments.

**Conclusion**

The various authors have given various proposals for detection and prevention of black hole attack in MANET but every proposal has some precincts and their respected solutions. The approaches leads to black hole node detection but no one is reliable procedure since all mobile nodes cooperate together to scrutinize and detect possible multiple black

hole nodes. Future work includes intend to develop simulations to analyze the performance of the proposed solutions and compare their performances.

### REFERENCE

- [1] Akanksha Saini, Harish Kumar, "Comparison between various black hole detection technique in MANET," in National Conference on Computational Instrumentation, CSIO 19-20 March 2010.
- [2] H. Deng, W. Li, and D. P. Agrawal, "Routing security in ad hoc networks," *IEEE Communications Magazine*, vol. 40, no. 10, pp. 70-75, Oct. 2002.
- [3] Y. C. Hu, A. Perrig, and D. B. Johnson, "Ariadne: A secure on-demand routing protocol for ad hoc networks," in Eighth Annual International Conference on Mobile Computing and Networking (MobiCom 2002), pp. 12-23, Sept. 2002.
- [4] Y. C. Hu, D. B. Johnson, and A. Perrig, "SEAD: Secure efficient distance vector routing for mobile wireless ad hoc networks," in The 4th IEEE Workshop on Mobile Computing Systems & Applications, pp. 3-13, June 2002.
- [5] Y. C. Hu and A. Perrig, "A survey of secure wireless ad hoc routing," *IEEE Security & Privacy Magazine*, vol. 2, no. 3, pp. 28-39, May/June 2004.
- [6] Y. A. Huang, W. Fan, W. Lee, and P. S. Yu, "Cross feature analysis for detecting ad-hoc routing anomalies," in The 23rd International Conference on Distributed Computing Systems (ICDCS'03), pp. 478-487, May 2003.
- [7] Y. A. Huang and W. Lee, "Attack analysis and detection for ad hoc routing protocols," in The 7th International Symposium on Recent Advances in Intrusion Detection (RAID'04), pp. 125-145, French Riviera, Sept. 2004.
- [8] D. B. Johnson, D. A. Maltz, and Y. C. Hu, The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR), IETF Internet Draft, draft-ietf-manet-dsr-10, July 2004.
- [9] S. Lee, B. Han, and M. Shin, "Robust routing in wireless ad hoc networks," in ICPP Workshops, pp.73, 2002.
- [10] C. E. Perkins, E. M. Royer, S. R. Das, and M. K. Marina, "Performance comparison of two on-demand routing protocols for ad hoc networks," *IEEE Personal Communications*, pp. 16-28, Feb. 2001.
- [11] C. E. Perkins, E. M. B. Royer, and S. R. Das, Ad hoc On-Demand Distance Vector (AODV) routing, RFC 3561, July 2003.
- [12] K. Sanzgiri, D. LaFlamme, B. Dahill, B. N. Levine, C. Shields, and E. M. B. Royer, "Authenticated routing for ad hoc networks," *IEEE Journal on Selected Areas in Communications*, vol. 23, no. 3, pp. 598-610, Mar. 2005.
- [13] M. A. Shurman, S. M. Yoo, and S. Park, "Black hole attack in wireless ad hoc networks," in ACM 42nd Southeast Conference (ACMSE'04), pp. 96-97, Apr. 2004.
- [14] W. Wang, Y. Lu, and B. K. Bhargava, "On vulnerability and protection of ad hoc on-demand distance vector protocol," in The 10th International Conference on Telecommunications (ICT'03), vol. 1, pp. 375-382, French Polynesia, Feb. 2003.
- [15] M. G. Zapata, Secure Ad Hoc on-demand Distance Vector (SAODV) Routing, IETF Internet Draft, draft-guerrero-manet-saodv-03, Mar. 2005.
- [16] Satoshi Kurosawa, Hidehisa Nakayama, Nei Kato, Abbas Jamalipour, and Yoshiaki Nemoto, "Detecting Blackhole Attack on AODV-based Mobile Ad Hoc Networks by Dynamic Learning Method", *International Journal of Network Security*, Vol.5, Issue 3, pp: 338-346, 2007



# Conservation of Aquatic Biodiversity in Upper Reaches of Himalayan Region

**Ashu Awasthi**

Zoology, M.V.M., Bhopal (M.P.) India

ashu\_awasthi3@yahoo.com

**Rani Dhanze**

Fisheries, COVAS, CSKHP

Krishi Vishawavidyalaya, Palampur

## Abstract

In Western Himalayas, Himachal Pradesh is located between 30022 to 33012 North latitude and 75047 to 79047 East longitudes. It has varied type of water resources like glacier fed rivers, snow fed tributaries, natural lakes, man made reservoirs and many other seasonal water bodies. Beas is one of important river of Himachal Pradesh which originates at an elevation of 14,308 feet (4361m) in the Rohtang glacier at Beas Kund (Lahul-Spiti). River Beas, along with its tributaries comprises a stretch of 923 Kms. including 297 Kms. main river & 623 Kms. of its tributaries. Study of some tributaries of river Beas has been done by Dhanze & Dhanze (2002); Chauhan (2002). Recent reviews indicates that land degradation, forest loss, biodiversity and habitat degradation, scarcity and pollution of fresh water are increasing hence this limnobiological study of three tributaries of Beas drainage system is an integrated approach to assess the water quality of tributaries of River Beas in Palampur (Distt.Kangra). The investigations consist of the analysis of important water quality parameters. Samples were collected between 9am - 10am from site I(Poon), site II(Awa) & site III(Mole) fortnightly subjected for analysis in the laboratory by Following the Standard Methods for Examination of Water & Waste Water (APHA, 1985) at Department of Fisheries, COVAS, CSK-Himachal Pradesh Agricultural University, Palampur. The investigations were made to know the ecological condition of the tributaries of River Beas so that the conservation action plan and sustainable productivity can be ensuring on long term basis.

**Keywords:** Ecological degradation, forest loss, biodiversity, phytoplankton, conservation

## Introduction:

In aquatic ecosystems the phytoplankton constitutes a vital link in the food chain. The planktons are essential organisms to understand the basic nature and economy of the fresh water bodies. Changes in season, influence the physio-chemical condition of aquatic bodies which in turn influence the phytoplankton dynamics ( Sarkar & Sen, 1975; Moitra & Mukharjee, 1972; Bhoumik, 1993). Though a plenty of work has been done on the seasonal variation of plankton by a number of Indian workers (Ganapati, 1942; George, 1961; Saha et al., 1971; Khan & Saddique, 1974; Kohli et al., 1982; Sarkar et al., 1985; Bhoumik, 1987, and Wishard et al., 1988). Hitherto, nothing about planktons from these tributaries of river Beas in Palampur of Himachal Pradesh is known till date. Himachal Pradesh is a hill state in Western Himalayas, located between 30022 to 33012 North latitude and 75047 to 7904 East longitudes. It has varied type of water resources like glacier fed rivers, snow fed tributaries, natural lakes, man made reservoirs and many other seasonal water bodies. Beas is one of important river of Himachal Pradesh which originates at an elevation of 14,308 feet (4361m) in the Rohtang glacier at Beas Kund (Lahul-Spiti). River Beas along with its tributaries comprises a stretch of 923 Kms. including 297 Kms. main river & 623 Kms. of its tributaries. Study of some tributaries of river Beas has been done by Dhanze & Dhanze (2002); Chauhan (2002). Recent reviews indicates that land degradation, forest loss, biodiversity and habitat degradation, scarcity and pollution of fresh water are increasing hence this limnobiological study of three tributaries of Beas drainage system is

an integrated approach to assess the water quality of River Beas. The investigations have been made to know the ecological condition of tributaries of River Beas. This is a beginning towards the better understanding of an important place of conservation recreation.



Study Site I  
Poon Tributary

Study Site II  
Awa Tributary

Study Site III  
Mole Tributary

## Material and Methods:

The present investigations consist of the analysis of important water quality parameters which include Water temperature, Air temp., D.O., Conductivity, Free CO<sub>2</sub>, Alkalinity, Chloride, Magnesium hardness, Calcium hardness, Water velocity, Silicates and TDS. Samples were collected between 9am -10am from site I, site II & site III (Poon, Awa, Mole) fortnightly subjected for analysis in the laboratory by Following the Standard Methods for Examination of Water & Waste Water (APHA, 1985). pH measured by using electronic pH analyzer, D.O., FreeCO<sub>2</sub>, Carbonates, Calcium, Magnesium and chloride measured by titration calorimetric methods and TDS by water analyzer Kit at Department of Fisheries, COVAS, CSK-Himachal Pradesh Agricultural University, Palampur.

## Results & Discussions:

The productivity of a water body largely governed by physical and chemical parameters viz. water current, temperature, TDS, Free CO<sub>2</sub>, DO, Silicates, Magnesium, Calcium and Total hardness, Chloride and Conductivity. All these parameters were observed for post monsoon and winter (Aug., Sept. and Nov.). Air temperature varied from 13°C to 29°C in all three sites; out of which minima was observed at site III & maxima at site II. Temperature is one of the important & changing environmental factors directly influences some aquatic reactions in aquatic ecosystem and thus it is an important physical parameter which regulates the self purification capacity of river and connected water bodies like reservoirs. Minimum water temperature was recorded 11°C at site III in November and maximum 24°C at site I & II during August which shows that temperature was high when day length was longer. The air temperature always found to be 20°C-40°C higher than that of water temperature. Hydrogen ion concentration (acidic) and hydroxyl ion concentration (alkaline) results from ionization of water. Change in hydrogen ion concentration brings change in hydroxyl ion concentration and vice versa. In pure water both hydrogen & hydroxyl ion are in equal concentration hence pure water is neither acidic nor basic. For natural water pH value ranges 4 to 9 depending upon the concentration of carbonates, bicarbonates and hydroxyl ion. Hence pH is used in the alkalinity and

CO<sub>2</sub> measurement and in acid base equilibrium. pH was found maximum at site I & II i.e., 8 and minimum was recorded at site III i.e., 6. Alkalinity was also recorded maximum at site I it clearly indicates that as the pH value increases the alkalinity also increases. TDS is the measure of the amount of all kinds of solids (suspended, dissolved, volatile etc.) the concentration of TDS content usually ranges from 20mg/l to 100mg/l. In fresh water total dissolved solids are mainly composed of carbonates, bicarbonates, chlorides, nitrate, sulphate, phosphate, Ca, Mg, Na, Fe & Mn. As a rule hardness of water increases with increase in level of TDS. It is clear from the table I, II & III that the minimum TDS (32.1µmhos) was observed at site III and maximum (42µmhos) was observed at site I & II. Value of TDS was more in winter season than rainy season as the dissolved solids becomes more concentrated in winter due to evaporation and non-replacement of water. Conductivity is the measure of capacity of a substance to conduct the electric current and is reciprocal to resistance & is rapid method to measure TDS and is related to dissolve solids. Bhatt et al (1999) stated that higher the value of TDS higher will be the value of Conductivity. Minimum conductivity was recorded at site III and maximum at site I i.e., 20.8 & 27.36 µmhos. It clearly indicates that more ions are present in water of site I than site II & III. Alkalinity in natural water is formed due to dissolution of CO<sub>2</sub> in water or HCO<sub>3</sub> produced by the action of ground water on lime stone or chalk; measured value may also include contribution from borates, silicates, phosphates and other bases. The maximum alkalinity was observed at site I (36mg/l in Aug.) and minimum at site III (14mg/l in Aug). It gives indication that site I is more productive than rest of two sites. The alkalinity was maxim during rainy season (August) due to deposition of allachthonus material from adjacent areas. Alkalinity is directly proportional to pH. Dissolved Oxygen is a single limnological parameter speaks about the health of tropic status and productivity of a biotic system, it was maximum at site I(7.7mg/l), medium at site II(6.8mg/l) & minimum at site III(6.4mg/l). This indicates that why Mahseer is well flourishing at site I and II in comparison to site III. Free CO<sub>2</sub> is necessary to retain Ca in solution form of calcium bicarbonate. CO<sub>2</sub> is not appreciably toxic to fish; most species can survive for several days in water containing 60mg/l, provided DO should be in plenty. Maximum CO<sub>2</sub> was recorded at site I i.e. 8.1mg/l and minimum was recorded at site II & III (3.92 & 4mg/l). It indicates that free CO<sub>2</sub> helps in photosynthesis in plants because the algae & aquatic plants were more at site I in comparison to II and III site. CO<sub>2</sub> is inversely proportional to temperature. Cl<sup>-</sup> conc. beyond certain limit may cause osmoregulatory problems to aquatic organisms especially in fishes. Further its high concentration causes cardio vascular problem to organisms and gives bitter taste of water. Maxima of Cl<sup>-</sup> was recorded at site I(9.3mg/l) and minima at site III(4.2mg/l) but the water of site I doesn't gives bitter taste as the Cl<sup>-</sup> ion is dominated by Ca & Mg. Maximum (14.2mg/l) hardness was reported at site I and minimum (10mg/l) at site III. It also indicates that Ca & Mg both were also recorded max. in site I and II. Calcium is very important factor influencing metabolism & growth. Ca conc. up to 1800mg/l have been found not to impair any physiological reaction in man. Ca conc. in all three sites was in limit. Principle source of Mg in natural water is various kinds of rocks, sewage and industrial waste. The maxima recorded at site II & Minimum at I & III (2.77, 1.4 & 1.6mg/l.)

**Table 1 Various Limnological Parameters Recorded at Site I**

S. No.	Parameter	August		September		November		Min	Max	Mean
		I	II	I	II	I	II			
1	Water Temperature	24	22	24.5	24	15	14	14	24	20.5
2	Dissolved Oxygen	7.6	7.7	7.92	7.2	6.8	6.17	6.8	7.92	7.2
3	Air Temperature	28	24	27	27	16	16	16	28	23
4	pH	7	7	7	7	8	8	7	8	7.3
5	Conductivity	23.52	26.19	27.36	25.48	26.65	26.39	23.53	27.36	25.9
6	Free CO <sub>2</sub>	6.40	8	6	7	5.8	6.1	5.8	8.1	6.66
7	Alkalinity	36	24.6	24	26	29.1	29.0	24.3	36	28.2
8	Chloride	8.0	9.3	9	8	8.7	8.5	8.0	9.3	8.6
9	Magnesium	2.09	2.05	1.4	2.09	2.54	2.76	1.4	2.052	2.15
10	Calcium	3.78	3.36	4.2	3.36	2.81	2.74	2.81	4.2	3.37
11	Total Hardness	12.40	11.8	10	12	13.29	14.12	10	14.12	12.26
12	Silica	0.220	0.020	0.031	0.026	0.110	0.021	0.020	0.220	0.071
13	Total Dissolved Solids	36.2	40.3	42.1	39.2	41	40.6	36.2	42.1	39.9

**Table 2 Various Limnological Parameters Recorded at Site II**

S. No.	Parameter	August		September		November		Min	Max	Mean
		I	II	I	II	I	II			
1	Water Temperature	24	24	23	23	12	13	12	24	19.83
2	Dissolved Oxygen	6.8	6.24	6.8	6.4	6.2	5.9	5.9	6.8	6.39
3	Air Temperature	29	27	27	27	15	16	15	29	23.5
4	pH	7	7	7	7	7	8	7	8	7.16
5	Conductivity	27.3	22.75	22.1	23.4	24.8	24.9	22.1	27.3	24.3
6	Free CO <sub>2</sub>	3.29	6	4	4.2	4.6	5.1	3.92	6	4.03
7	Alkalinity	24	24	20	18	23	24	18	24	22.1
8	Chloride	8.2	7.1	8.0	5.8	7.1	8.4	5.8	8.4	7.4
9	Magnesium	2.77	2.10	2.05	2.30	2.55	2.62	2.05	2.77	2.39
10	Calcium	2.60	2.52	3.36	2.52	2.82	3.20	2.52	3.36	2.83
11	Total Hardness	14.0	11.2	11.8	12	13.2	14.0	11.2	14	12.7
12	Silica	0.61	0.02	0.040	0.023	0.034	0.03	0.02	0.61	0.055
13	Total Dissolved Solids	42	35	34	36	38.02	38.4	34	42	37.2

**Table 3 Various Limnological Parameters Recorded at Site III**

S. No.	Parameter	August		September		November		Min	Max	Mean
		I	II	I	II	I	II			
1	Water Temperature	22	23	23	22	11	13	11	23	19
2	Dissolved Oxygen	5	6.4	6	6.2	5.0	6.3	5	6.4	5.8
3	Air Temperature	26	27	27	27	13.0	16	13	27	22.6
4	pH	6	6	6	6	7	7	6	7	6.3
5	Conductivity	20.8	22.1	21.58	21.45	23.4	24.7	20.8	24.7	22.3
6	Free CO <sub>2</sub>	4	4.2	6.2	5.1	6.0	5.8	4	6.2	5.2
7	Alkalinity	14	18	20	21	24	23	14	24	20
8	Chloride	5.6	5.2	4.2	5.1	7.8	9.0	4.2	9.0	4.98
9	Magnesium	1.74	2.30	1.61	1.8	2.32	2.45	1.6	2.45	2.03
10	Calcium	2.8	2.52	3.36	2.62	3.56	3.21	2.52	3.56	3.01
11	Total Hardness	10.8	12	10	10.3	13.11	13.30	10	13.30	11.58
12	Silica	0.062	0.051	0.060	0.046	0.063	0.053	0.046	0.063	0.14
13	Total Dissolved Solids	32.1	34.0	33.2	33.0	36.0	38.12	38.12	32.1	34.4

Table - 4: Phytoplankton Recorded at Site I

S. No.	Name of Plankton	Phytoplankton					
		August		September		November	
		I	II	I	II	I	II
1.	<b>Family: Chlorophyceae</b>						
	Crucigenia	1	-	-	-	-	1
	Coelastrum	1	-	-	-	-	2
	Dictyosphaerium	1	-	-	-	1	-
	Oedogonium	23	-	-	-	-	5
	Pediastrum	1	10	38	19	23	30
	Spirogyra	73	2427	230	321	240	263
	Scenedesmus	1	-	3	5	4	1
	Staurastrum	1	1	-	-	-	-
	Ulothrix	32	3281	840	1003	6	603
	Xanthidium	2	2	9	4	19	8
	Zygenema	51	20	21	26	-	21
	Oocystis	-	3	-	4	-	2
	Tetraspora	-	1	1	-	-	-
	Volvox	-	1	-	-	-	-
	Mesotaenium	-	-	36	26	11	8
	TOTAL	187	5746	1178	1408	304	944
2.	<b>Family: Cyanophyceae</b>						
	Anabaena	3	33	11	13	15	10
	Anacystis	2	-	-	1	1	-
	Nodularia	3	-	-	-	-	-
	Phormidium	9	-	32	23	17	21
	Synchcystis	1	-	-	-	-	1
	Spirulina	4	-	-	-	2	-
	Tetradun	1	-	-	1	1	1
	Gomphosphaeria	-	6	20	13	16	22
	TOTAL	23	39	63	51	53	55
3.	<b>Family: Bacillariophyceae</b>						
	Coscinodiscus	2	-	-	-	-	1
	Diatom	30	6	6	5	-	7
	Fragellaria	25	1	1	8	10	6
	Navicula	31	73	183	110	78	82
	Synedra	91	65	238	130	141	120
	Gomphosphaeria	-	8	31	15	10	16
	Cyclotella	-	6	-	7	4	1
	Nitzschia	-	-	7	-	-	-
	Cymbella	-	-	2	4	-	-
	Pinnularia	-	-	7	-	-	-
	TOTAL	179	159	475	279	243	233
<b>ZOOPLANKTON</b>							
4.	<b>Family : Ciliata</b>						
	Protozoa	-	8	15	18	8	10
	TOTAL		8	15	18	8	10
5.	<b>Family: Crustacea</b>						
	Nauplius	-	43	49	40	31	48
	Cladocera	1	13	20	17	37	40
	Copepod	3	39	46	30	18	16
	TOTAL	4	95	115	87	86	104
6.	<b>Family: Rotifera</b>						
	Keratella	1	6	3	6	2	5
	Brachionus	3	11	13	12	10	16
	Epiphane	1	-	-	-	-	1
	Ascomorpha	1	-	-	-	-	1
	TOTAL	6	17	16	18	12	23
	<b>TOTAL ORGANISMS</b>	<b>399</b>	<b>6064</b>	<b>1862</b>	<b>1861</b>	<b>705</b>	<b>1369</b>

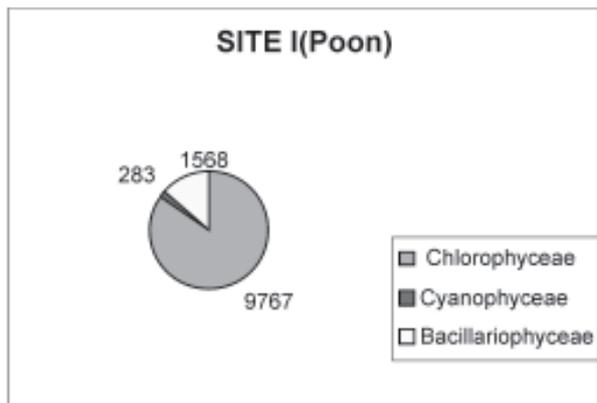
Table-5: Phytoplankton Recorded at Site-II

S. No.	Name of Plankton	Phytoplankton					
		August		September		November	
		I	II	I	II	I	II
1.	<b>Family: Chlorophyceae</b>						
	Oedogonium	1	2	10	5	7	11
	Spirogyra	6	-	4	10	6	4
	Scenedesmus	1	-	-	1	1	-
	Staurastum	-	-	-	-	-	-
	Ulothrix	8	-	19	20	16	13
	Xanthidium	-	3	3	-	-	2
	Zygenema	1	1	5	8	4	1
	Ankistrodesmus	-	-	1	-	1	3
	Actinastrum	5	8	3	-	4	-
	Mougotia	4	4	2	-	-	2
	Volvox	-	-	2	1	2	1
	TOTAL	26	18	49	45	41	37
2.	<b>Family: Cyanophyceae</b>						
	Anabaena	5	15	15	17	20	-
	Nodularia	2	-	2	1	1	2
	Phormidium	1	-	-	-	1	1
	Synchoystis	-	-	-	-	-	1
	Spirulina	-	-	-	-	-	1
	Tatradun	-	-	-	-	-	1
	Oscillatoria	17	3	3	5	2	6
	Microcystis	2	-	-	-	2	-
	Chlamydomonas	-	1	-	-	-	1
	Crocococcus	-	-	1	-	2	1
	Gomphosphaeria	-	-	7	2	4	1
	TOTAL	27	19	28	25	32	15
3.	<b>Family: Bacillariophyceae</b>						
	Diatom	3	21	21	15	19	14
	Fragellaria	17	-	1	2	8	12
	Navicula	109	82	83	90	86	71
	Synedra	70	78	91	51	63	71
	Cymbella	3	-	-	1	-	-
	Gomphonema	3	-	1	-	1	-
	Cyclotella	2	-	-	-	-	-
	Surirella	-	3	-	1	-	-
	TOTAL	207	184	197	160	177	168
<b>ZOOPLANKTON</b>							
4.	<b>Family : Ciliata</b>						
	Protozoa	-	-	33	10	13	32
	Vorticella	-	-	-	1	1	1
	TOTAL			33	11	14	17
5.	<b>Family: Crustacea</b>						
	Cladocera		37	39	31	33	38
	Copepod	-	-	3	2	1	4
	TOTAL	-	37	42	33	34	42
6.	<b>Family; Rotifera</b>						
	Keratella	-	-	-	-	-	1
	Brachionus	-	11	12	8	3	7
	Epiphane	2	2	-	1	1	-
	TOTAL	2	11	12	9	4	8
	<b>TOTAL ORGANISMS</b>	<b>251</b>	<b>263</b>	<b>366</b>	<b>288</b>	<b>308</b>	<b>304</b>

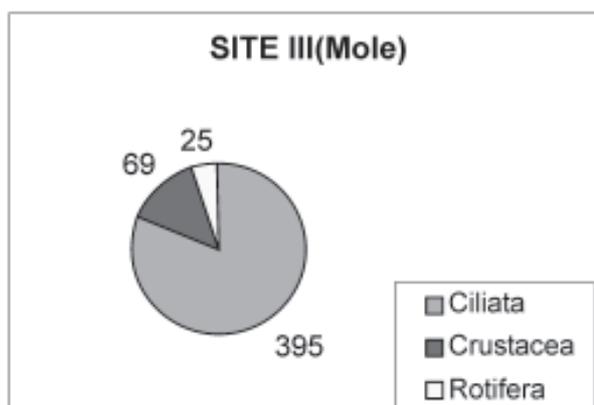
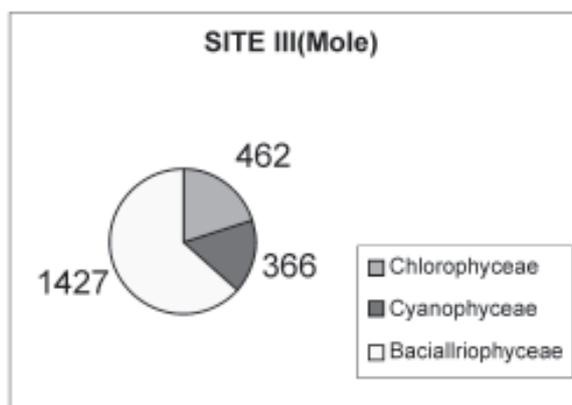
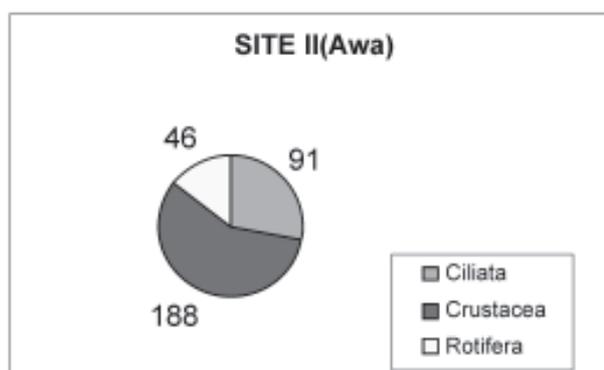
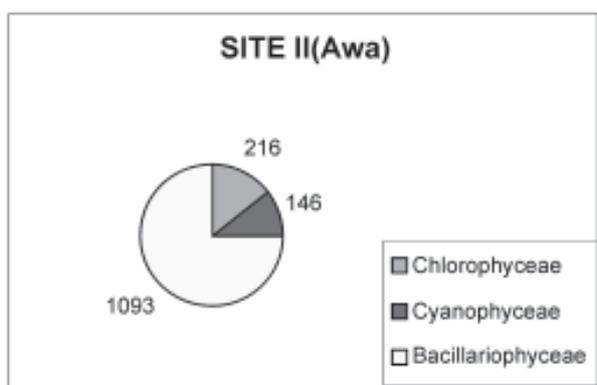
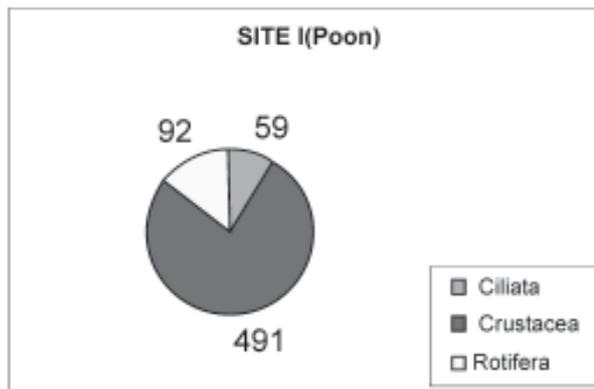
Table 6 Plankton Recorded at Site III

S. No.	Name of Plankton	Phytoplankton					
		August		September		November	
<b>1.</b>	<b>Family ; Chlorophyceae</b>						
	Crucigenia	-	-	-	-	1	-
	Dictyospherium	-	-	-	1	-	1
	Oedogonium	6	38	33	20	31	26
	Padiastrum	2	-	3	1	4	-
	Spirogyra	23	46	49	31	27	34
	Scenedesmus	-	-	1	2	1	-
	Staurastrum	-	1	4	-	-	1
	Ulothrix	15	2	6	13	10	4
	Ankistrodesmus	1	-	-	2	-	1
	Volvox	1	-	2	-	1	-
	Actinastrum	2	1	3	-	2	3
	Tatrasterum	-	1	1	3	1	-
	TOTAL	50	89	102	73	78	70
<b>2.</b>	<b>Family; Cyanophyceae</b>						
	Anabaena	14	82	54	61	43	57
	Anacystis	-	-	-	1	2	-
	Nodularia	-	1	3	1	-	1
	Phormidium	-	-	-	-	-	1
	Tetradon	-	-	-	-	3	-
	Oscillatoria	1	5	9	4	8	3
	Arthrospira	12	-	-	-	-	-
	TOTAL	27	88	66	67	56	62
<b>3.</b>	<b>Family: Bacillariophyceae</b>						
	Diatom	8	9	11	4	6	8
	Fragellaria	7	-	3	-	1	-
	Synedra	35	319	209	201	316	235
	Gomphonema	6	-	4	8	7	2
	Nitzchia	-	5	1	10	3	5
	Surirella	-	3	-	1	-	-
	TOTAL	56	336	228	224	333	250
<b>ZOOPLANKTON</b>							
<b>4.</b>	<b>Family: Ciliata</b>						
	Vorticella	-	1	-	-	-	-
	Protozoa	42	90	71	74	66	51
	TOTAL	42	91	71	74	66	51
<b>5.</b>	<b>Family: Crustacea</b>						
	Nauplius	8	1	2	6	3	2
	Cladocera	6	12	9	4	-	2
	Copepod	1	3	4	2	1	3
	TOTAL	15	16	15	12	4	7
<b>6.</b>	<b>Family: Rotifera</b>						
	Epiphanes	-	7	-	1	2	3
	Keratella	-	-	1	-	1	-
	Brachionus	1	1	2	1	1	4
	TOTAL	1	8	3	2	4	7
	<b>TOTAL ORGANISMS</b>	<b>191</b>	<b>628</b>	<b>485</b>	<b>452</b>	<b>541</b>	<b>447</b>

Phytoplankton Recorded at All Three Sites are as



Zooplanktons recorded at all the sites are as



From the table 4, 5 and 6 it can be observed that the phytoplankton population from family Chlorophyceae was recorded maximum at Poon tributary in all the seasons i.e. 9767 where at site II (Awa) were recorded 216 and at site II (Mole) were recorded 462 respectively.

Organisms from the family Cyanophyceae were recorded maximum at site III (Mole) viz. 366 and 283 and 146 at site I and site II. From the Family Bacillariophyceae maximum organisms were recorded at site I

i.e. 1568 and minimum were recorded at site II i.e. 1093 where as at site III were recorded 1427.

The Zooplanktons from the family Ciliata were recorded maximum at site III (395 and minimum at site I (59) and 91 were recorded at site II.

491,188 and 69 Crustaceans were recorded at site I, site II and site III respectively. Similarly 92, 46 and 25 Rotifers were recorded at site I, site II and site III.

All these observation shows that plenty of food is available in these three tributaries of River Beas i.e. Poon, Awa and Mole namely.

### Recommendations:

On the basis of present study, some recommendations emerged which are given below for the conservation of the native fishes like *Tor putitora*, *Puntius ticto* and *Garra gotyla* in their own natural habitat and their development for culture and sport fisheries in rivers.

- As plenty of natural food in the form of phyto and zooplankton is available in the site I and Site II, so the fingerlings of *Tor putitora* can be stocked from outside so that the production of these sites can be enhanced.
- During Monsoon season a large number of fingerlings of *Tor putitora* and *Puntius ticto* enters in the paddy fields through the small channels from the main river tributary (Poon).The local people having the land near this tributary may be suggested to adopt the Paddy cum Fish (*Tor putitora*) Culture in their fields as no one in this region is using this technique till this date and all are engaged in the paddy production alone. This will help to uplift the socio-economic status of the local farmers by increasing their income.
- In natural waters *Tor-putitora* fingerlings of size 60mm to 100mm are available in rivers. These may be collected and stocked in Sanctuaries to become brooders. This will help in conservation of *Tor-putitora* in natural habitat.
- Cage/Pen culture may be adopted for the rearing of fry to fingerlings of *Tor putitora*. After 100 mm size fingerlings may be released. This will give more survival results.
- Development of sport fishery will enhance tourism, provide employment to local people and hence increase local and national income.
- The awareness programmes regarding the importance of fish diversity should be organized.
- Likewise site II (Awa), the sanctuaries should also be declared in the site I for the conservation of fish diversity of this site.

### References:

- [1] APHA (1985): Standard methods for examination of water & waste water, APHA, AWWA, WPCF New York, p.p.1268.
- [2] Bhat L.R. Lacoul, H.D. Lekhak and P.K. Jha (1999): Physico-chemical characteristics and phytoplankton of Tauda Lake. *Poll, Res*18 (4):253to258.
- [3] Bhoumik, M.L. Sarkar, U.K and Pandey, B.K. (1993): Plankton abundance and composition in sewage feed fish ponds. *J. Inl. Fish Soc. India* 25(1):23-29.
- [4] Bhoumik, M.L. (1987): Fluctuation in plankton population and some hydrobiological factors of the Kalyani Lake, *Environ. & Ecol.*5:46-52.
- [5] Chauhan R. (2002): Physico-chemical regime of high altitude river ecosystem, Cold water fishes, Genetic resources and their

conservation, NATCON publication-7:231-234.

- [6] Dhanze J.R. & Rani Dhanze (2002): Limnology of Mahseer water in sub - temperate zone of Himachal Pradesh, Cold water fishes, Genetic resources and their conservation, NATCON publication-7:145-150.
- [7] Ganapati, S.W. (1942): An ecological study of a garden pond containing abundant zooplankton. *Proc. Ind. Soc.* 17(3): 41-58.
- [8] George, M.G (1961) Diurnal variation in two shallow ponds in Delhi, India. *Hydrobiologia*, 304:29-38.
- [9] Khan, A. & A.Q. Saddique(1974): Seasonal Changes in the plankton population of a fresh water fish pond at Aligarh.*Indian.J.Fish* 21(2): 463-478.
- [10] Kohli, M.P.S., Thakur, N.K. and Munnell S.K. (1982): Seasonal Changes in plankton population of some fresh water at Patna.*J.Inl.Fish.Soc.India.*3:79-102.
- [11] Michael,R.G.(1969): Seasonal trends in physico-chemical factors and plankton in fresh water fish pond and their role in fish culture.*Hydrobiologia*33(1) 144-160.
- [12] Saha,G.N. Sehgal, K.L. Mitra, E. and Nandi, A.C.(1971): Studies on the seasonal diurnal variation in physico-chemical and biological condition of a perennial fresh water pond. *J. Int.Fish.Soc.India*3:79-102.
- [13] Sarkar A.K. & Sen, P.(1975): Occurrence of plankton in fresh water ponds. *Indian Biol.*7:71-75.
- [14] Sarkar, S. K., Singh B.N. and Choudhary A. (1985): Composition and variation I the abundance of zooplankton in the Hoogly astuary, West Bengal, *Proc.Ind.Acad.Sci.*95:125-134.
- [15] Wishard ,S.K. and S.N. Malhotra(1988): Periodocity and abundance of plankton in Gulariya reservoir relation to certain physico-chemical conditions. *J. Inl. Fish. Soc. India* 20(1): 42-49.



# Convulsion of Bhopal Industrial Disaster

## Review of toxicants present in the drinking water of the tragedy survivors

Gitanjali Pathak

Department of Biotechnology,  
St. Xavier's College, Mumbai- 400001, India

### Abstract

Bhopal became a global symbol of the world's worst industrial disaster on December 3rd, 1984. It resulted in mortality of 3000- 3500 human lives and devastating over 200 000 people. Investigations conducted by several organizations for the past 20 years, on the water quality around the former Union Carbide India Ltd. site, have concluded that the drinking water of the calamity survivors is highly contaminated with high concentrations of heavy metals and pesticides. Survivors continue to experience high prevalence of health problems, which could be due to the consumption of contaminated drinking water. This has grasped the attention of world media and various scientists. Consequently, a toxicological profile of heavy metals and pesticide is addressed upon as an attempt to understand the abnormalities and devise effectual therapeutics and diagnostics. Although Bhopal tragedy has placed a conspicuous highlight on the lack of knowledge about industrial chemicals and their effects, it has opened new lines of scientific learning about the impact and interaction of chemicals on human lives and development of possible remedial measures.

**Keywords:** Disaster, human lives, Calamity, Survivors, contaminations, high concentration, heavy metals, pesticides, toxicological profile, therapeutics, diagnostics, remedy, convention.

### INTRODUCTION

With a quivering chill in the spine one recalls the tormenting night of December 3rd 1984 in the City of Lakes. The cataclysm resulting from the leakage of methyl isocyanate (MIC) and 21 other identified and 9 unidentified gaseous compounds (Sriramachari 2004) from the pesticide factory of Union Carbide India Ltd (UCIL), in which thousands of animals and human beings died, will never be forgotten.

The tragedy took place in the midnight hours of December 2-3, 1984 in Bhopal, India due to leakage of water, which entered tank containing forty tons of highly toxic methyl isocyanate. The resulting reaction increased the temperature inside the tank to more than 200°C, raising the pressure to a level it was not designed to withstand and eventually releasing a large volume of toxic gases (Acquilla et al. 2005).

The anomalous mortality and morbidity due to the disaster initiated global scientific attention and a gamut of multi-systemic studies were conducted by trans-institutional collaborations and many research disciplinarians. Significant number of studies were conducted on varied aspects, but the published work has generally pointed towards Methyl Isocyanate as a causative agent of the potential toxic effects delineating symptomatology and clinical morbidity in the survivors (Varma, and Guest 1993).

In depth molecular studies revealed pulmonary, ophthalmic, reproductive, immunologic, neurological, and hematologic toxicity among the survivors. Investigations conducted so far have also raised questions that for how long the gas victims would continue to suffer from multi system disorders and whether their forthcoming generations would also be affected by these abnormalities (Mishra et al. 2009).

Consequently, to understand the persistence of the ill-effects observed in the suffering population of Bhopal, it is important to examine other

aspects which hold the potential to comprehend the extent and severity of the long term effects associated with the disaster.

Today, more than 500,000 registered survivors of the tragedy (Mishra et al. 2009) still suffer from ailments caused directly by exposure to MIC or by the subsequent pollution caused by the UCIL plant site. Even though the UCIL, dismantled the key production units before the disaster as the factory was in the process of closing down, a complete chemical waste disposal was never conducted (Eckerman 2005).

Twenty-six years later, the Carbide survivors live in agony as unsheltered chemicals which have been stored on-site for decades continuously leach into soil and groundwater. The contamination of soil and groundwater in the surrounding areas may be a source of many health problems among residents within these communities. The influence of chemicals on human health, results in widespread interactions and studying each of these responses will require extensive research studies on different states of health of survivors. Many of the effects were not observed earlier and have started surfacing over a period of years. The escalating numbers of birth defects in children including cleft palates, webbed feet and hands, twisted limbs, brain damage and heart problems have caught the attention of various organizations and world media (Briggs Oct 31, 2009).

### 1. WATER CONTAMINATION

Union Carbide India Ltd. was shut down more than 25 years ago after a fatal gas leak, however the unethical measures of chemical disposal by Union Carbide during its tenure of pesticide production has led to chemical stockpiles and is continuing to poison people around the plant. (Johnson et al. 2009)

The production of Sevin- carbaryl pesticide involved use of other chemicals like chlorine, phosgene, monomethylamine and naphthol.

Chemical	Concentration (µg/L)
Chloride	214000
Sodium	96200
Calcium	16800
Magnesium	1680
Sulphate	1600
Nitrate	4160
Potassium	120
Carbaryl	127
COD	7200

A complete chemical waste disposal was never conducted by Union carbide or its successor Dow Chemicals. The legal responsibility of the chemical disposal has been debated for decades. However, toxic chemicals are still lying at the pesticide factory site and skulking their way into the groundwater.

The presence of DDT and HCH in the drinking water supply of the city was probably first observed in 1990 (Dikshith et al. 1990). The concern over water contamination around the disaster site was investigated by National Environmental Engineering Research Institute (NEERI), in

1990. The assessment study investigated the pollution due to the Solar Evaporation Pond (SEP) on the former UCIL plant site. The SEP was used to dump waste water emerging from the Sevin production process at the UCIL plant. The study included the investigation of climatic, geological (stone formations) and hydrogeological (surface waters, groundwater flow) settings of the area on which the SEP is located. In the reports of NEERI (1990), it is stated that the flow of groundwater is in a north- easterly direction and thus, chemicals leaching into the ground from UCIL plant site are expected to be transported in this direction. The chemical profile of SEP reported by NEERI is given in Table 1. It can be observed that the levels of Chloride, Sodium and Calcium are the highest and traces of carbaryl pesticide are also present. Greenpeace, a US based voluntary organization also conducted a number of studies in order to identify the chemical pollutants present on the UCIL plant site and the surrounding area. The first Greenpeace investigation was conducted in 1999 (Labunska et al. 1999) and focuses primarily on the contamination of soil and drinking water. Elevated levels of mercury, chromium, copper, nickel and organochlorines such as hexachloroethane, hexachlorobutadiene (HCB), hexachlorocyclohexane isomers (HCH), DDT and numerous chlorinated benzenes were reported. Table 2(a) summarises some of the chemicals that were found in the survey.

The second report published in 2002 (Stringer et al. 2002) focuses on the solar evaporation pond (SEP) and on the chemical stockpiles that were at that time still stored in buildings on the plant site. In total, twelve stockpile samples from six locations on the plant site and four soil samples from the SEP were taken. From twelve stockpile samples, eleven contained carbaryl at concentrations in part per billion (ppb) range. HCH isomers were present in ten samples, varying by tens of ppb. In five samples, HCB was detected. It was quantified in three samples where its concentration ranged between 580 to 5800 ppb. The authors also found a wide range of organic compounds to be present in the stockpile samples.

Media	Chemicals	Heavy metals
Groundwater	Dichloromethane, Chloroform	Nickel
Soil	Chloroform, HCH isomers, VOCs	Nickel, Mercury, Chromium
Vegetables	Chloroform	Nickel, Mercury, Chromium
Breast Milk	Chloroform, HCH isomers, VOCs	Nickel, Mercury, Lead

Among these chemicals were groups of chlorinated compounds such as chlorobenzenes, chlorocyclohexanes and chlorocyclohexenes. Other organochlorines were DDT, chlorinated naphthalenes, chlorinated toluenes and chlorinated biphenyls as summarized in Table 2 (b).

Media	Chemicals	Heavy Metals
Water	VOC, Dichlorobenzenes, Trichlorobenzenes, Chloroform, Carbon tetrachloride, Tri- Tetra and Hexachloroethene	Not analysed
Soil samples near UCIL factory site	Chlorinated benzenes, Naphthalene and its derivatives, Phenanthrene and its derivatives, HCH isomers, DDT, Hexachlorobutadiene (HCB)	Mercury, Chromium, Copper, Nickel
Solar Evaporation Pond Soil Samples	1,4-dichlorobenzene	Mercury

Media	Chemical Groups	Single chemical complex
Chemical Stockpiles	Chlorobenzenes, Chlorocyclohexanes, Chlorocyclohexenes, Chlorinated Naphthalenes, Chlorinated toluenes, Chlorinated biphenyls	DDT, HCB, Carbaryl
Solar Evaporation Soil Samples	Aliphatic hydrocarbons, Chlorobenzenes, Phthalate esters, benzenes	

The last report published by Greenpeace (Labunska, and Santillo 2004) on Bhopal is a short technical note discussing results from analysis of a few water samples that have been collected south of the UCIL plant site. Elevated levels of chloroform and 1,2,4-trichlorobenzene were found.

(Chander 2001) reviewed the issues of water contaminations and its possible effects on the surviving population. A year later Shrishti, an Indian voluntary organization provided an assessment of water, soil, vegetable and breast milk sample analysis with the objective to investigate how chemical contaminants are transferred from the environment into humans. The study was conducted among the communities that are located in the vicinity of the UCIL plant site. (Shristi 2002) reported that heavy metals and organochlorine compounds were present in all of the investigated media, i.e. soil, groundwater, vegetables and breast milk. Table 3 shows a selection of chemicals and heavy metals found in the four media at the sampling sites. According to the authors, there are no other chemical industries present in a radius of 3-5 km from UCIL which have used the same compounds as have been used by UCIL. The results from the Shristi (2002) clearly indicate that the UCIL plant site is still a source of chemical contaminants and that the chemicals are mobile in the underground.

The most recent study with respect to water contamination around Union Carbide India Ltd. factory was conducted by Centre for Science and Environment (CSE) (Johnson et al. 2009), a non-governmental organization based in New Delhi. Centre for Science and Environment (2009) gives an account of three different pesticides which were produced at UCIL. **Carbaryl** (trade name Sevin), **Aldicarb** (trade name Temik), and a formulation of Carbaryl and gamma-hexachlorocyclohexane (?-HCH) sold under the trade name **Sevidol**. Carbaryl and Aldicarb fall under carbamate group of insecticides; both are moderately persistent, highly toxic; highly water soluble and mobile in soils.

Organochlorine compounds	Carbamates	Chlorinated benzene compounds	Heavy metals
hexachlorobenzene (HCB)	Carbaryl	1,2 dichlorobenzene (1,2 DCB)	Lead
α, β, γ and δ isomers of HCH	Aldicarb	1,3 dichlorobenzene (1,3 DCB)	Cadmium
		1,4 dichlorobenzene (1,4 DCB)	Chromium
		1,2,3 trichlorobenzene (1,2,3 TCB)	Mercury
			Arsenic

The report also states that heavy metal like mercury was used as a sealant in the Sevin plant and chromium was used as a coolant in the cooling plant of the UCIL factory. CSE in 2009 (Johnson et al. 2009) studied the chemistry of the processes used for producing various pesticides in UCIL and based on the study, they selected four groups of chemicals for testing in soil and water samples, which have been summarized in Table 4. The total pesticide concentration in the waste samples was as high as 9867 ppm. The concentration of pesticides found in all water samples varied from 1.1 to 59.3 times, when compared to the mandatory water standard in India fixed by the Bureau of Indian Standards (IS:14543). The average concentration in all groundwater samples was 0.006 ppm

which is 12 times the standard. The report concludes that carbamate pesticides, as a general group, are considered to be moderately-persistent in the environment. But finding carbamates in groundwater, 25 years since the plant shut down, clearly means that the UCIL plant is acting as a continuous source of groundwater contamination. As a result - communities living around the pesticide plant and surrounding areas are being continuously affected on a daily basis to complex mixtures of hazardous chemicals. Though less acute, than the exposure which took place as a result of the 1984 MIC release, long-term chronic exposure to mixtures of toxic synthetic chemicals and heavy metals is likely to have serious consequences for the health and survival of the local population.

### 2. TOXIC EFFECTS OF HEAVY METALS & PESTICIDE FOUND IN BHOPAL TRAGEDY

In all the investigations, the occurrence of toxic chemicals such as organochlorine compounds, heavy metals-nickel, mercury, chromium, lead, copper and various pesticide residues-DDT, HCB and carbaryl is evident in the groundwater. Of all these compounds, chloroform, carbon tetrachloride and the dichloro- and trichlorobenzenes were found to be present at the highest concentrations and presence of chloroform, HCH isomers and VOCs in breast milk of women survivors could thus be identified as target chemicals. The toxicokinetics and identifying symptoms of toxic effects of few of the contaminants are listed below.

#### 2.1 Pathophysiology and Symptomology of Heavy Metal Toxicity Mercury

Mercury is an ubiquitous environmental toxin that causes a wide range of adverse health effects in humans. Three forms of mercury exist: elemental, inorganic and organic. Each of them has its own profile of toxicity. Exposure to mercury typically occurs by inhalation or ingestion (Guzzi, and La Porta 2008). Mercury can cross the placental membrane and accumulate in fetal tissues. Inorganic forms of mercury induce a complex called metallothionein (Yoshida et al. 2002), builds up mainly in the kidney. Organic mercury compounds, being lipid soluble, accumulate in adipose tissue and the brain. Elimination is primarily through the urine and the feces, with small amounts in breath, sweat, and saliva (Counter, and Buchanan 2004). Mercury is an accumulative poison. Mercury toxicity presents in many ways, depending on the type of exposure (e.g., inhalation, topical, ingestion, aspiration) and on the chemical form of the metal. Symptoms may start rapidly after acute exposure of mercury vapor and can retain 75% of the mercury inhaled. The individual may develop dyspnea, chest tightness, chills, fever, weakness, and GI (Graeme et al. 1998). Central nervous system defects and erethism as well as arrhythmias, cardiomyopathies, and kidney damage have been associated with mercury exposure. Other clinical signs include inflammation of mouth and gums (gingivitis), tremors, loosening of teeth, jerky gait, personality change, depression, irritability, and nervousness (Axel Weiner, and Nylander 1993; Crespo-López et al. 2009).

#### Nickel

Nickel is a metallic element that is naturally present in the earth's crust. Due to unique physical and chemical properties, metallic nickel and its compounds are widely used in modern industry. Since nickel has not been recognized as an essential element in humans it is not clear how nickel compounds are metabolized. It is known that exposure to nickel compounds can have adverse effects on human health (Denkhaus, and Salnikow 2002). The toxicokinetics of nickel compounds depends on their solubility in water and biological fluids. Nickel sulfate and nickel chloride are highly soluble in water. Absorption is higher when soluble forms of nickel are present in drinking water. Once absorbed, nickel is transported with the plasma, in a form bound to serum albumin, amino acids, polypeptides, and other small organic molecules. The half-life of nickel in nickel platers (exposed primarily to nickel sulfate) was found to be 20-34 h in plasma and 17-39 h in urine (Shi 1994). Nickel is able to cross the placenta, if present in small soluble percentages. High nickel content in serum and tissue may interfere with both copper and zinc metabolism. It also readily crosses the cell membrane via calcium channels and competes with calcium for specific receptors. Nickel carbonyl can cross-link amino acids to DNA and lead to formation of reactive oxygen species (Kasprzak, Sunderman, and Salnikow 2003). Nickel carbonyl can also suppress natural killer cell activity and production of some interferons (Chen et al. 2003).

Nickel is found at elevated levels in the kidneys, liver, brain and adipose tissue (Shi 1994). Nickel and nickel compounds are skin sensitizers, leading to irritation, eczema and allergic contact dermatitis. Skin sensitization reactions can progress to erythema, some eruption, and in more extreme cases to pustules and ulcers (Zirwas, and Molenda 2009). Exposure to certain nickel compounds is associated with development of cancer. Nickel particulate (e.g., elemental and subsulfide) has been associated with nasal and lung cancer after workplace exposures. Chromosomal aberrations have been noted in lymphocytes in occupationally exposed individuals.

#### Lead

Lead has been used since ancient times, and some of its toxic effects have been recognized for several centuries. Lead is a ubiquitous environmental and industrial pollutant that has been detected in almost all phases of environmental and biological systems (Johnson 1998). Lead is readily absorbed through the digestive tract. Absorption becomes less efficient with age. This absorption is enhanced by diets deficient in iron, zinc, and calcium. Once absorbed, lead is distributed throughout the body tissues via the blood. Almost all of the lead in the blood is found in red blood cells (Fraga 2005). There are two primary sites in the red blood cell where lead forms complexes: the membrane and the hemoglobin. Lead interferes with the biosynthesis of heme in at least two steps in the multistep process. Heme proteins are important to the structure and function of hemoglobin in red blood cells. Lead binds with 8-aminolevulinic acid dehydratase and depresses its activity (Dorea, and Donangelo 2006). This biochemical block explains the occurrence of anemia found in chronic lead poisoning. The concentration of zinc protoporphyrin also can be used as a diagnostic tool for lead poisoning (Ahamed, and Siddiqui 2007).

Lead can cross the placenta and has been shown to accumulate in the developing child. Prolonged exposure to lead (44 weeks) in young children can lead to the accumulation of lead in the growth plates at the end of the long bones (Dorea, and Donangelo 2006). The primary targets for toxicity are the nervous system, the blood, and the kidneys. Reproductive effects can also occur and include male infertility, abortion,

and neonatal morbidity and mortality(Grandjean 1978). Lead may damage sperm and parts of the reproductive tract. Symptoms of acute exposure in young children include anorexia, vomiting, and irritability. In cases of very high levels of exposure, symptoms may also include slurred speech, peripheral neuropathy, and paralysis(Hsu, and Guo 2002; Johnson 1998).

#### Chromium

Chromium may cause adverse health effects following inhalation, ingestion, or dermal exposure. The toxicity of chromium is mainly caused by hexavalent compounds as a result of a higher cellular uptake of chromium(VI) compounds than chromium(III)(Tandon et al. 1978). Absorption of chromium(III) compounds is via passive diffusion and phagocytosis. Hexavalent chromium is unstable in the body and is reduced intracellularly (by many substances including ascorbate and glutathione) providing very reactive pentavalent chromium and trivalent chromium. Both of these intermediates can alter DNA(O'Brien, Ceryak, and Patierno 2003).

Dermal exposure to chromium compounds can cause irritant dermatitis and skin ulcerations (chrome holes). Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Inhalation of chromium(VI) compounds is also associated with lung cancer and these compounds are classified as human carcinogens(Gad 1989).

### **2.2 Pathophysiology and Toxic-Effects of Pesticides produced at Carbide India**

#### Carbaryl

Carbaryl, a wide -spectrum carbamate insecticide is used to control a wide variety of pests, including moths, beetles, cockroaches, ants, ticks, and mosquitoes. Carbaryl binds and inhibits acetylcholinesterase, the enzyme responsible for metabolizing the neurotransmitter acetylcholine and terminating its action at cholinergic synapses. Exposure to carbaryl results in synaptic accumulation of acetylcholine in both the central and peripheral nervous systems and hyperstimulation of muscarinic and nicotinic receptors leading to 'cholinergic crisis'(Yang, and Deng 2007).

The acute effects of exposure are due to cholinergic overstimulation and may include the SLUDGE syndrome (salivation, lacrimation, urination, diarrhea, gastrointestinal cramping, and emesis), respiratory depression, bronchospasms, increased bronchial secretions,

pulmonary edema, blurred vision, miosis, headache, tremors, muscle fasciculations, mental confusion, coma, and death (due to respiratory failure)(Mount, and Oehme 1981; Rosman et al. 2009). Several cases of persistent neurophysiological or neurobehavioral effects have been reported following acute high-dose exposure to carbaryl(Cranmer 1986; Gunasekara et al. 2008).

#### Dichlorodiphenyltrichloroethane (DDT)

DDT metabolism proceeds at a very slow rate. Liver microsomal P450 and other microsomal enzymes initially dechlorinate DDT to 1,1-dichloro-2,2- bis(p-chlorophenyl)ethylene (DDE) and reduce to 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD). The conversion of DDD to bis(p-chlorophenyl)acetic acid (DDA) involves the formation of an acyl chloride intermediate by hydroxylation followed by hydrolysis to yield the final product(Jaga, and Dharmani 2003). DDA is the main form in which DDT is excreted. Most excretion takes place through bile with 2% in urine and less than 1% in feces. The nervous system is the main

site of toxicity for DDT. Effects are observed on both the central nervous system (CNS) and peripherally. In particular, sodium channels are altered such that once activated they close slowly, prolonging the depolarization of the nerve by interfering with the active transport of Na<sup>+</sup> ions out of the axon. Potassium channels are also affected. DDT specifically affects Na<sup>+</sup>, K<sup>+</sup> - adenosine triphosphatases (ATPases), which inhibit repolarization of neurons(Nigam et al. 1988). The membrane remains partially depolarized and is extremely sensitive to complete depolarization by very small stimuli. DDT also inhibits calmodulin that is necessary for Ca<sup>2+</sup> transport essential for the subsequent release of neurotransmitters(Kurihara 2000). Most human exposures are from ingesting very large amounts of DDT. The nervous system appears to be one of the primary target systems for DDT toxicity in humans after acute, high exposures. Symptoms range from nausea, fatigue, and vomiting to tremor and convulsions in severe poisoning (Beard 2006; Snedeker 2001).

#### Hexachlorobenzene (HCB)

Hexachlorobenzene is an organochlorine fungicide, is slightly absorbed in the gastrointestinal tract but readily distributed in the body, preferentially to fatty tissues. It also readily passes the placenta. Hexachlorobenzene is metabolized slowly by the liver to pentachlorophenol, pentachlorobenzene, tetrachlorobenzene, and some unidentified compounds(Aylward et al. 2010; Reed, Buchner, and Tchounwou 2007). In humans, hexachlorobenzene is mainly excreted in the urine as its metabolites, pentachlorophenol and pentachlorothiophenol. Hexachlorobenzene affects porphyrin synthesis and consequently the proteins involved in the metabolism and transport of oxygen. Its main target organ is the liver(Booth, and McDowell 1975).

Children born from mothers exposed to hexachlorobenzene during pregnancy showed acute illnesses and rashes. Infants nursing from exposed mothers showed porphyria cutanea tarda, poor growth, arthritis, and enlarged thyroids(Axelsson 1986). Porphyria cutanea tarda causes red-colored urine, skin sores, changes in skin color, arthritis, and problems of the liver, nervous system, and stomach(Gunn et al. 2010).

### **FUTURE OUTLOOK**

Bhopal has rightly been called "The Hiroshima of Chemical Industry" (Lewis 1999) - it is indisputably the world's worst industrial disaster. The Bhopal disaster has placed a glaring spotlight on the lack of knowledge about many industrial chemicals and their effects on human health. The impact of toxicity of chemical mixtures is very difficult to assess because each component displays its own toxicity and components may interact to produce enhanced or diminished effects. This fatal interaction of synthetic toxins and human lives has generated global scientific interest and various muti-systemic studies have been conducted on exposed and affected individuals by agencies such as ICMR, TISS Bombay, ITRC, IMCB and other scientists who have conducted independent research. Their studies indicate long-term effects like neurological disorders, pulmonary fibrosis, bronchial asthma, chronic obstructive pulmonary disease, emphysema, recurrent chest infections, keratopathy and corneal opacities due to methyl isocyanate exposure in Bhopal tragedy victims.

However, more than a quarter century has passed and the suffering of the Carbide survivors has been transmitted to their successive generations. Therefore, international consensus is required with strategic planning involving components like drinking water, surrounding soil and other elements which are in direct interaction with the survivors.

The reports accounting water contamination near the Union Carbide plant site have been published repeatedly from the year 1990 to 2009 by several

organizations and individual scientists. Accordingly, to understand and uncover the unique abnormalities in the survivors and to devise effective therapeutics and diagnostics, a complete epidemiological survey needs to be conducted. The author strongly suggests that scientific assessment of the concentration and toxicity of chemicals and chemical waste within the Union Carbide factory premises be studied in detail.

While the Bhopal disaster is extremely appalling, it has opened new lines of scientific learning on the impact and interaction of chemicals on human lives, and is thus assisting in the treatment of long term effects resulting from such high magnitude industrial catastrophes.

### Acknowledgements

The author has made a careful attempt to include all available reports and citations on water contaminations near the Union Carbide India Ltd., however, exclusions if any, are regretted. The author is thankful to Dr. P.K.Lahiri, Dr.(Ms.) Vivien Amonkar and Dr. Puneet Gandhi for their guidance and support in the preparation of the manuscript.

### References:

- [1] Acquilla, S., R. Bertell, V. R. Dhara, and G. Tognoni. 2005. "Aftermath of the world's worst chemical disaster: Bhopal, December 1984." *Journal of Loss Prevention in the Process Industries* 18(4-6): 268-73.
- [2] Ahamed, M. and M. K. J. Siddiqui. 2007. "Low level lead exposure and oxidative stress: Current opinions." *Clinica Chimica Acta* 383(1-2): 57-64.
- [3] Axel Weiner, J. and M. Nylander. 1993. "The relationship between mercury concentration in human organs and different predictor variables." *The Science of The Total Environment* 138(1-3): 101-15.
- [4] Axelson, O. 1986. "A review of porphyria and cancer and the missing link with human exposure to hexachlorobenzene." *IARC Sci Publ*(77): 585-9.
- [5] Aylward, L. L., S. M. Hays, M. Gagne, A. Nong, and K. Krishnan. 2010. "Biomonitoring equivalents for hexachlorobenzene." *Regul Toxicol Pharmacol* 58(1): 25-32.
- [6] Beard, J. 2006. "DDT and human health." *Science of The Total Environment* 355(1-3): 78-89.
- [7] Booth, N. H. and J. R. McDowell. 1975. "Toxicity of hexachlorobenzene and associated residues in edible animal tissues." *J Am Vet Med Assoc* 166(6): 591-5.
- [8] Briggs, B. Oct 31, 2009. "Horrendous legacy." *The Age*. Australia.
- [9] Chander, J. 2001. "Water contamination: a legacy of the union carbide disaster in Bhopal, India." *Int J Occup Environ Health* 7(1): 72-3.
- [10] Chen, C.-Y., Y.-F. Wang, W.-R. Huang, and Y.-T. Huang. 2003. "Nickel induces oxidative stress and genotoxicity in human lymphocytes." *Toxicology and Applied Pharmacology* 189(3): 153-59.
- [11] Counter, S. A. and L. H. Buchanan. 2004. "Mercury exposure in children: a review." *Toxicology and Applied Pharmacology* 198(2): 209-30.
- [12] Cranmer, M. F. 1986. "Carbaryl. A toxicological review and risk analysis." *Neurotoxicology* 7(1): 247-328.
- [13] Crespo-López, M. E., G. L. Macêdo, S. I. D. Pereira, G. P. F. Arrifano, D. L. W. Picanço-Diniz, J. L. M. d. Nascimento, and A. M. Herculano. 2009. "Mercury and human genotoxicity: Critical considerations and possible molecular mechanisms." *Pharmacological Research* 60(4): 212-20.
- [14] Denkhaus, E. and K. Salnikow. 2002. "Nickel essentiality, toxicity, and carcinogenicity." *Critical Reviews in Oncology/Hematology* 42(1): 35-56.
- [15] Dikshith, T. S. S., R. B. Raizada, S. N. Kumar, M. K. Srivastava, S. K. Kulshrestha, and U. N. Adholia. 1990. "Residues of DDT and HCH in major sources of drinking water in Bhopal, India." *Bulletin of Environmental Contamination and Toxicology* 45(3): 389-93.
- [16] Dorea, J. G. and C. M. Donangelo. 2006. "Early (in utero and infant) exposure to mercury and lead." *Clinical Nutrition* 25(3): 369-76.
- [17] Eckerman, I. 2005. *The Bhopal Saga - Causes and Consequences of the World's Largest Industrial Disaster*. Hyderabad: Universities Press.
- [18] Fraga, C. G. 2005. "Relevance, essentiality and toxicity of trace elements in human health." *Molecular Aspects of Medicine* 26(4-5): 235-44.
- [19] Gad, S. C. 1989. "Acute and chronic systemic chromium toxicity." *Science of The Total Environment* 86(1-2): 149-57.
- [20] Graeme, M. D., A. Kimberlie, M. D. Pollack Jr, and C. V. Facep. 1998. "Heavy Metal Toxicity, Part I: Arsenic and Mercury." *The Journal of Emergency Medicine* 16(1): 45-56.
- [21] Grandjean, P. 1978. "Widening perspectives of lead toxicity : A review of health effects of lead exposure in adults." *Environmental Research* 17(2): 303-21.
- [22] Gunasekara, A. S., A. L. Rubin, K. S. Goh, F. C. Spurlock, and R. S. Tjeerdema. 2008. "Environmental fate and toxicology of carbaryl." *Rev Environ Contam Toxicol* 196: 95-121.
- [23] Gunn, G. B., K. E. Anderson, A. J. Patel, J. Gallegos, C. K. Hallberg, G. Sood, S. S. Hatch, and G. Sanguineti. 2010. "Severe radiation therapy-related soft tissue toxicity in a patient with porphyria cutanea tarda: a literature review." *Head Neck* 32(8): 1112-7.
- [24] Guzzi, G. and C. A. M. La Porta. 2008. "Molecular mechanisms triggered by mercury." *Toxicology* 244(1): 1-12.
- [25] Hsu, P.-C. and Y. L. Guo. 2002. "Antioxidant nutrients and lead toxicity." *Toxicology* 180(1): 33-44.
- [26] Jaga, K. and C. Dharmani. 2003. "Global surveillance of DDT and DDE levels in human tissues." *Int J Occup Med Environ Health* 16(1): 7-20.
- [27] Johnson, F. M. 1998. "The genetic effects of environmental lead." *Mutation Research/Reviews in Mutation Research* 410(2): 123-40.
- [28] Johnson, S., R. Sahu, N. Jadon, and C. Duca. 2009. "Contamination of soil and water inside and outside the Union Carbide India Limited, Bhopal." New Delhi: CENTRE FOR SCIENCE AND ENVIRONMENT.

- [29] Kasprzak, K. S., F. W. Sunderman, and K. Salnikow. 2003. "Nickel carcinogenesis." *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis* 533(1-2): 67-97.
- [30] Kurihara, N. 2000. "[Chlorinated hydrocarbon insecticides(DDT, methoxychlor, HCH etc.).]" *Nippon Rinsho* 58(12): 2417-21.
- [31] Labunska, I. and D. Santillo. 2004. "High levels of chlorinated organic compounds, including tetrachloromethane, in water from well adjacent to former Union Carbide India Ltd (UCIL) pesticide plant, Bhopal (India)." *Green peace Organization*.
- [32] Labunska, I., A. Stephenson, K. Brigden, R. Stringer, D. Santillo, and P.A. Johnston. 1999. "The Bhopal Legacy: toxic contaminants at the former Union Carbide factory site, Bhopal, India. ." *Greenpeace Research Laboratories*.
- [33] Lewis, S. 1999. "Beyond the Chemical Century." E. L. Jones: Environmental Health Fund , Strategic Counsel on Corporate Accountability.
- [34] Mishra, P. K., R. M. Samarth, N. Pathak, S. K. Jain, S. Banerjee, and K. K. Maudar. 2009. "Bhopal Gas Tragedy: review of clinical and experimental findings after 25 years." *Int J Occup Med Environ Health* 22(3): 193-202.
- [35] Mount, M. E. and F. W. Oehme. 1981. "Carbaryl: a literature review." *Residue Rev* 80: 1-64.
- [36] Nigam, S. K., A. B. Karnik, B. C. Lakkad, K. N. Thakore, and B. H. Joshi. 1988. "Experimental and human surveillance on BHC and DDT insecticides commonly used in India." *Ann N Y Acad Sci* 534: 694-705.
- [37] O'Brien, T. J., S. Ceryak, and S. R. Patierno. 2003. "Complexities of chromium carcinogenesis: role of cellular response, repair and recovery mechanisms." *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis* 533(1-2): 3-36.
- [38] Reed, L., V. Buchner, and P. B. Tchounwou. 2007. "Environmental toxicology and health effects associated with hexachlorobenzene exposure." *Rev Environ Health* 22(3): 213-43.
- [39] Rosman, Y., I. Makarovsky, Y. Bentur, S. Shrot, T. Dushnistky, and A. Krivoy. 2009. "Carbamate poisoning: treatment recommendations in the setting of a mass casualties event." *Am J Emerg Med* 27(9): 1117-24.
- [40] Shi, Z. 1994. "Nickel carbonyl: toxicity and human health." *Science of The Total Environment* 148(2-3): 293-98.
- [41] Shristi. 2002. "Toxic Present - Toxic Future: A Report on Human and Environmental Chemical Contamination around the Bhopal disaster site."
- [42] Snedeker, S. M. 2001. "Pesticides and breast cancer risk: a review of DDT, DDE, and dieldrin." *Environ Health Perspect* 109 Suppl 1: 35-47.
- [43] Sriramachari, S. 2004 "The Bhopal gas tragedy: An environmental disaster." *CURRENT SCIENCE* 86(7): 16.
- [44] Stringer, R., I. Labunska, K. Brigden, and D. Santillo. 2002. "Chemical Stockpiles at Union Carbide India Limited in Bhopal: an investigation." *Green Peace Laboratories*.
- [45] Tandon, S. K., D. K. Saxena, J. S. Gaur, and S. V. Chandra. 1978. "Comparative toxicity of trivalent and hexavalent chromium : Alterations in blood and liver." *Environmental Research* 15(1): 90-99.
- [46] Varma, D. R. and I. Guest. 1993. "The Bhopal accident and methyl isocyanate toxicity." *J Toxicol Environ Health* 40(4): 513-29.
- [47] Yang, C.-C. and J.-F. Deng. 2007. "Intermediate Syndrome Following Organophosphate Insecticide Poisoning." *Journal of the Chinese Medical Association* 70(11): 467-72.
- [48] Yoshida, M., M. Satoh, A. Shimada, E. Yamamoto, A. Yasutake, and C. Tohyama. 2002. "Maternal-to-fetus transfer of mercury in metallothionein-null pregnant mice after exposure to mercury vapor." *Toxicology* 175(1-3): 215-22.
- [49] Zirwas, M. J. and M. A. Molenda. 2009. "Dietary nickel as a cause of systemic contact dermatitis." *J Clin Aesthet Dermatol* 2(6): 39-43.

# Culturally Compatible Human Resource Strategies

**Geetika Krishna**

Asstt. Prof., REC, Bhopal

**Pushkar Pachori**

Asstt. Prof., RIRT, Bhopal

## Abstract

Human Resource strategies can be powerful tools for signaling to cultural changes and reinforcing those changes once they are made. The potential of HR strategies and programs for shaping organizational culture can not be overestimated. HRM among other things, we believe that the globalization and the advancement of technology influences how organization should react and adjust to the changing times and economy.

**Key words:** Globally oriented culture, culturally compatible human resource, Global HR strategies, Global standardization and local autonomy, Culture diverse Human Resource.

## CULTURE

"Culture is the customs and civilization of a particular people or group"

## Introduction

"It is the capability of different cultures to live together harmoniously."

When an organization goes global and sets up its operations in some other country, it faces a totally different culture of that particular location. This local culture is their in the attitudes, work styles, demands and perceptions of the local human resource. A globalizing organization thus has to make its home culture compatible with the local culture in order to survive in the local market. The new transnational environment requires a plethora of individuals who can work internationally - who are ultimately flexible, accommodating, and adaptable to different cultures and varying ways of doing things. Those organizations who effectively pursue

Culturally compatible HR strategies actually achieve success in long-run.

Studies on the success or failure of individuals in an international setting have indicated that American expatriates experience a failure rate of 30 to 40 percent as compared to many Europeans and Japanese, whose failure rate has been estimated as low as six percent (Tung 1988). It appears that some countries or cultures are more effective at producing successful global professionals than other countries.

## Organizational Structures for Global Business

There are 4 main organizational structures for global business:

- 1) **Domestic exporter** - heavy centralized activities in one country (financing, sales, marketing, human resources, strategic management) while sales are dispersed using agency agreements, and subsidiaries that are reliant on the home company.

**HR Strategy:** Domestic exporters just have to rely on the sales staff of local area; therefore they adjust the HR policies regarding the pay scales, skills required and evaluation for sales personnel only.

- 2) **Multinational firm** - control and management of finances out of central home base, while production, sales and marketing operations are in other countries. Products are made to fit local markets i.e. financial firms, General Motors etc

**HR Strategy:** Multinational firms have to set their HR

strategies for the employees of all departments according to the culture of respective firms. Here the budget of the firms is being set in home base while the pay scales as well as incentive plans & benefits are the core discretions of national firms.

- 3) **Franchisers** - product is created, designed and financed in home country, but for product-specific reasons, there is a heavy reliance on foreign personnel for production, marketing, and human resources. i.e. McDonald's, KFC

**HR Strategy:** Franchisers are just like multinational firms with the only difference that multinationals create the whole separate set up for all national campuses while the franchisers follow the strict policies and strategies of HR being pre-set by the home base. However franchises may carry out specific HR plans as per the local cultural adjustments but within a restricted provision of base.

- 4) **Transnational firms** - have no national home base, have several regional home bases, and optimize supply and demand constraints locally, central core for decision making, but dispersed power and financial power to the divisions. i.e. Citicorp, Sony, Ford

**HR Strategy:** Transnational firms retain the freedom of decision-making in determining its own HR strategies. Such strategies follow the cultural adjustments in the best interest of company. Such HR strategies are fully coated with local cultural essence that gives the firm a new home environment.



Fig. Organizational Evolutionary Development Curve

## Culturally Compatibility Human Resource Strategies



Human resources or, as some would call it, human capital, is becoming the most important asset for most organizations in the world. As the New Economy pervades in the world's communities and organizations, it becomes necessary to study and pay close attention to the impact of Globalization and Technology in shaping today's strategy for managing culturally diverse human resources.

Globalization has resulted in significant implications for HR functions as they attempt to develop global HR strategies and design programs and processes to manage a global workforce. The key to success is to balance global standardization and local autonomy.

The challenge for Human Resource leaders is really to understand the role of Human Resource Management in an organization competing in a global business environment and effectively define the critical issues and responses necessary in implementing a strategic Human Resource Program.

- Studies on the success or failure of individuals in an international setting have indicated that American expatriates experience a failure rate of 30 to 40 percent as compared to many Europeans and Japanese, whose failure rate has been estimated as low as six percent (Tung 1988). It appears that some countries or cultures are more effective at producing successful global professionals than other countries.
- Moore (2003) argues that there are 10 countries that produce the largest number of "good" global managers: Canada, the Netherlands, Switzerland, Belgium, Ireland, Sweden, Denmark, Singapore, Australia, and Finland. According to Moore, what these 10 countries have in common is their size. While they are not dominant powers in their geographic regions, they are considered significant players on the international stage. These middle-economy countries face the everyday reality that they are not the most important culture in their region and thus they find themselves constantly negotiating between their own culture and identity and that of surrounding dominant cultures. In order to be successful, individuals growing up in mid-sized countries learn to embrace multiple ways of looking at the world. They grow up with a duality (or plurality) that obliges them to work effectively with their neighbors. It is this ability to be "all things to all people" that helps such individuals to be successful in a global context. "When working on global teams or in other countries, the ability to think outside your own culture and see an issue through the eyes of another is critical to success" (Moore 2003)
- In the field of psychology considerable work has been conducted on people's sensitivity to intercultural issues and their ability to adapt to other cultures and different ways of doing things. Some organizations have moved to personality testing to better ascertain the likelihood of success of individuals working in an international environment.

#### GLOBALLY ORIENTED CULTURE

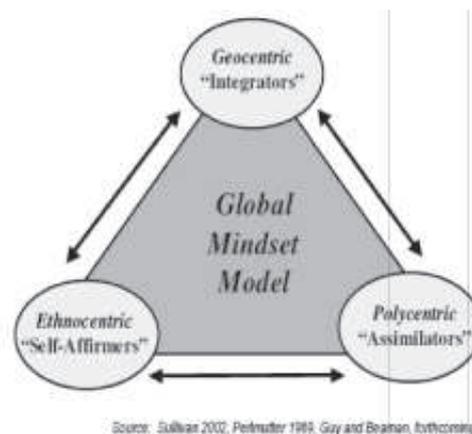
- Much has been written on the influence of culture and global orientation on business. These "deeply ingrained assumptions, generalizations, or ... images that influence how we understand the world and how we take action."
- An ethnocentric mindset is one that basically holds one's own values, beliefs, and culture are intrinsically superior to those of others. Ethnocentric individuals interpret the world through

the eyes of their own culture, not recognizing, even devaluing, cultures that are different from their own. "If it works here, it'll work anywhere," exemplifies the ethnocentric individual. Ethnocentric can play an important role in preserving standards and uniformity across the global corporation.

- A polycentric mindset is one that adapts and assimilates to the values, attitudes and beliefs of another culture. Because they are highly attuned to the conditions and expectations of other cultures, polycentric individuals can play the role of empathetic "advisors," effective at bridging the gap and transferring knowledge between the local environment and corporate. The danger with the polycentric mindset is the tendency to "go native", sometimes to the detriment of the organization's objectives.

A geocentric mindset is one that believes there are certain cultural universals and commonalities in the world and that no culture is superior or inferior to another. "The geocentric mindset accepts the premise that bright people [do] bright things around the world" (Sullivan 2001). Also called "cosmopolitans," these types of individuals focus on "finding commonalities and spreading universal ideas and juggling the requirements of diverse places" (Kanter 1995).

#### GLOBALIZATION vs. CULTURAL IDENTITY



It is fair to say that the impact of globalization in the cultural sphere has, most generally, been viewed in a pessimistic light. Typically, it has been associated with the destruction of cultural identities, victims of the accelerating encroachment of a homogenized, westernized, consumer culture. This view, the constituency for which extends from (some) academics to anti-globalization activists (Shepard and Hayduk 2002), tends to interpret globalization as a seamless extension of - indeed, as a euphemism for - western cultural imperialism.

Into this world of manifold, discrete, but to various degrees vulnerable, cultural identities there suddenly burst (apparently around the middle of the 1980s) the corrosive power of globalization. Globalization, so the story goes, has swept like a flood tide through the world's diverse cultures, destroying stable localities, displacing peoples, bringing a market-driven, 'branded' homogenization of cultural experience, thus obliterating the differences between locality-defined cultures which had constituted our identities.

#### WEST VICTIMIZING EASTERN CULTURE

Though globalization has been judged as involving a general process of

loss of cultural diversity,

some of course did better, some worse out of this process. Whilst those cultures in the mainstream of the flow of capitalism - those in the West and, specifically, the United States - saw a sort of standardized version of their cultures exported worldwide, it were the cultures of the developing world that have been most threatened. Thus the economic vulnerability of these non-western cultures is assumed to be matched by a cultural vulnerability.

### **GLOBALIZATION PROLIFERATES CULTURE**

Cultural identity is at risk everywhere with the depredations of globalization, but the developing world is particularly at risk. But another, quite contradictory, story can be told: that globalization, far from destroying it, has been perhaps the most significant force in creating and proliferating cultural identity. To take just one example, Manuel Castells devoted an entire volume of his celebrated analysis of 'The Information Age' to the proposition that: 'Our world and our lives are being shaped by the conflicting trends of globalization and identity.' For Castells, the primary opposition to the power of globalization lies in 'the widespread surge of powerful expressions of collective identity that challenge globalization on behalf of cultural singularity and people's control over their lives and environment' (1997: 2). Far from being the fragile flower that globalization tramples, identity is seen here as the up surging power of local culture that offers resistance to the centrifugal force of capitalist globalization. The impact of globalization thus becomes, more plausibly, a matter of the interplay of an institutional-technological impetus towards globality with counterpoised localizing forces. The drive towards globality combines logic of capitalist expansion with the rapid development of deteriorates media and communications technologies. But this drive is opposed by various processes and practices expressing different orders of 'locality'.

### **GLOBAL-LOCAL CULTURAL STRATEGY OF HR**

In a global-local strategy, cultural differences amongst employees can be seen as a strategic advantage for cross-border learning capabilities and the flexibility of the company.

This policy can be summarized as follows:

"As much global integration possible, as much local adaptation as absolutely necessary."

Hewlett-Packard manager illustrated the direction in one sentence:

"We want one solution for the world rather than 54 country solutions. We optimize at the company rather than the country level."

IBM, on the other hand, values a regional differentiation in their human resource policy. They believe in making exceptions, in flexibility in the area of deployment even as far as differentiated standardization:

"This is the span needed to bridge the political and cultural gaps, especially between westernized corporate cultures and Asian country cultures"

### **CROSS-CULTURAL DIFFERENCES AND HR**

A growing body of research has emerged over the past decade looking at cross-cultural differences in negotiation style [Fisher 1980; Tung 1984]. These studies conclude that people of different cultures use significantly different negotiation approaches. These different approaches include:  
communication styles used  
Persuasion strategies employed  
Protocols followed.

### **CROSS - CULTURAL CONFLICTS:**

Negotiation studies all point to possible differences in the way conflict is viewed and managed, little attention has been paid to differences in reacting to cross-cultural conflicts in negotiations. Yet, the handling of conflict is critical to any effective cross-cultural negotiations.

When two parties negotiate in a joint project, buyer/seller relationship or any other business context, conflict inevitably arises [Habib 1987]. It may arise because of differences in the perceptions of the decision making environment, or preferences for particular actions, behavioral styles and/or goals between the parties [Fisher 1974]. How the parties respond to conflict also depends on a number of factors, including the nature of the conflict, the cultural orientation of the individuals, and the affiliation of the parties. It is clear that how the parties perceive, respond to, and choose to resolve conflicts is critical to the success of any long-term business relationship. Individuals from different cultures are known to adopt different conflict resolution strategies. Ting-Toomey [1988] proposed that members of collective cultures perceive and manage conflict differently from those in individualistic cultures.

### **INTRA- VERSUS INTER-CULTURAL NEGOTIATION STRATEGY**

There is no consensus on whether decision makers extend their domestic negotiation styles to negotiating with cross-cultural partners. Managers may assume different negotiation styles with parties of another culture to seek greater cooperation [Graham 1985].

When dealing with members of a foreign culture, a manager may try to adopt behavioral patterns similar to the other party. The negotiators who appear similar may be more attractive to the other party and, thereby, enhance the bargaining outcomes (see review by Evans [1963]; Rubin and Brown [1975], and Francis [1991]). A business deal is a business deal, and profit maximization knows no cultural boundaries.

### **DEVELOPMENTAL MODEL OF INTERCULTURAL SENSITIVITY**

Milton Bennett's Model of Intercultural Sensitivity provides a useful roadmap for understanding the acquisition and maturity of individual cultural awareness, and global orientation. Bennett (1993) postulates a development progression that that all individuals go through as they develop into geocentric or cosmopolitans (see Figure 13). As individuals mature globally, they move from the "ethnocentric" stages of denial, defense, and minimization to the "ethno relative" stages of acceptance, adaptation, and integration. Other empirical work has demonstrated that the more international experiences individuals have, the less ethnocentric they become (Guy and Beaman, forthcoming). Hence, associates who have reached the ethno relative stages of their individual development - those with geocentric mindsets - are vital for the new chaordic, Transnational HR organization to function effectively.

### **COLLECTIVISM/INDIVIDUALISM**

The differences between the Chinese and North American culture are well documented.

#### **COLLECTIVISM:**

The Chinese culture is collective and of "high context."

Collectivism emphasizes group harmony and interdependence.

ETHNOCENTRIC STAGES	ETHNORELATIVE STAGES
<b>I. DENIAL</b> A. Isolation B. Separation	<b>IV. ACCEPTANCE</b> A. Respect for Behavioral Difference B. Respect for Value Difference
<b>II. DEFENSE</b> A. Denigration B. Superiority C. Reversal	<b>V. ADAPTATION</b> A. Empathy B. Pluralism
<b>III. MINIMIZATION</b> A. Physical Universalism B. Transcendent Universalism	<b>VI. INTEGRATION</b> A. Contextual Evaluation B. Constructive Marginality

Source: Bennett 1993

Chinese negotiators dislike taking the initiative and normally pay more attention to maintaining a harmonious relationship

When successive efforts within the inner circle fail, the conflict is likely to be met with resolute force by the authorities

PRC executives were also found to be more dichotomizing (i.e., inclination to classify the world into extremes-black or white, evil or good

In their decisions, more likely to consult their superiors

motivation for favoring certain norms over others is also driven by cultural factors

Societal norms are known to reward those who subscribe to them and punish those who deviate

**HR Strategies:**

- In two-person, buyer-seller simulations, it is more effective to use competitive (domineering) strategies to negotiate with Chinese.
- Avoid open conflict, and when a conflict emerges, it must be resolved in inner circles before it becomes serious enough to justify public involvement.
- Avoid potential conflicts and smooth over issues.
- use delaying tactics
- use more obliging and avoiding conflict resolution styles
- maintain relations as key motivators in their negotiation strategy

**Individualism:**

- The North American culture is individualistic and of "low context"
- Individualism emphasizes individual rights and independence.
- American negotiators tend to be authoritative, autocratic and in a hurry to make a deal
- American executives are less dichotomizing
- less decisive
- American executives emphasize personal motivations (Self-Esteem, Position In Company) or situational explanations as key motivators

**HR Strategies:**

- In two-person, buyer-seller simulations, it is more effective to

use problem-solving integrative strategies to negotiate with Americans

- Use less obliging and avoiding conflict resolution styles
- Show more concern for goal achievement
- Individuals are responsible for all decisions by themselves.
- Turning to superiors for instruction on ordinary conflicts, particularly task-related conflicts could signal incompetence at one's level of responsibility
- Here, a case study on conflict resolution concerning Chinese and Canadian culture would more elaborately describe it.

**Case Study : German Industrial Enterprises**

- A few years ago it was typical to give one's subsidiaries a free rein and send managers overseas from headquarters only. But today a great deal depends on overcoming this one-way street and in looking for and employing the best-suited managers, regardless of their origins. What contributions can human resource management make towards a company's global orientation - an area in which local scope and latitude are traditionally very high.
- This is a study on German industrial enterprises named

"DEVELOPING GLOBAL HUMAN RESOURCE STRATEGIES" by Hans-Erich Mueller. It shows that in recent years German industrial enterprises have re-aligned the management of their executive staff. Cornerstones of this quiet revolution are a policy of worldwide parity of executives in evaluation, remuneration and development, greater participation of those with line responsibility from product areas and regions in strategic development, as well as a re-alignment of human resource instruments. Worldwide standards in human resource policy are key factors in the competition for qualified managers. Not only companies, but also executives need to adjust.

"Do you have worldwide HR policies, that is, policies that apply to all employees regardless of location?"

This is one of the central questions underlying interviews with HRM executives of the twelve largest German manufacturers, which took place between the summer and fall of 2000. This includes the largest German companies excluding trade, banking and insurance, as well as energy suppliers according to the Business Week Global 1000, 12 July 1999

**GLOBAL INTEGRATION :**

The same worldwide standards for senior management in evaluation, compensation and development are the milestones en route towards a global human resource strategy, which has only caught on in recent years at German companies like BASF, Bayer, DaimlerChrysler, Henkel, Lufthansa, SAP, Schering, Siemens, and Volkswagen. Henkel sees itself as a leader in human resource policy, both within and beyond its own areas of business, one which brings about more equality of treatment and fairness, so that qualified executives can commit themselves to the company and participate in its success.

Deutsche Telekom and Preussag (the former steel manufacturer-turned tourism giant), who have recently become more international in their orientation, are just now in the process of preparing themselves for a cross-border, integrated human resource policy. The autonomy of the newly purchased overseas companies has been substantial so far. Bertelsmann, where deployment has traditionally been decentralized,

has just begun a more integrated policy for senior management. Lufthansa in the Star Alliance network, too, participated recently for the first time in creating a sound foundation for a global executive management scheme.

### FOUR ALTERNATIVES FOR A CROSS BORDER STRATEGY

Local Adaptation:

International Strategy:

Appropriate when there is little foreign business - knowledge transfer from the center of headquarters.

Coordination costs are low.

Multinational Strategy:

Affiliates are autonomous and local adapted.

- Cross-border advantages of standardization and learning are low.
- Coordination-costs are lowest.

[1] Global Strategy:

- Advantages of standardization of policies and practices.
- Strong centralism.
- Lack of local responsiveness causes disadvantages.
- National segmented markets, cultures, policies set barriers
- Coordination costs are high.

[2] Transnational Strategy:

- Uses advantages form globalization, localization and cross-border learning simultaneously.
- Coordination costs are highest

Companies successful across borders with corporate headquarters in Germany have pursued a more globally integrated human resource strategy

### Conclusion:

In recent years, many of the largest German companies have completed the change towards a transnational strategy for senior management: Worldwide guidelines with enough flexibility to adjust to local situations, a global "as far as possible" with local responsiveness and interpretation of criteria, as well as a network of systems development contributing to global integration (see fig). The drivers of this transformation are adjusted company strategies and structures, the lack of qualified senior executives for global competition and the fact that managers have staff in many countries. Additional impetus has come about by a change in the expectations of executive managers and their desire for equality of treatment.

The consequences: changes in the expectations placed on senior management - broader and greater international experience and the dissolution of traditional centers of power, which the headquarters had offered previously.

Managing top executives: towards a transnational strategy



### Cultural Misalignment

In many cases cultural misalignments are a byproduct of major organizational change initiatives, such as total quality management, employee involvement or reengineering. Each of these initiatives typically requires some cultural adjustment to be effective, even though they all seem to have similar goals, such as treating employees as critical assets, focusing on customer satisfaction and delegating authority broadly. Even when the optimal culture for supporting these initiatives has been identified and agreed to, the difficulties associated with making adjustments to the current culture must still be dealt with.

### Implementing Global HR Strategies

"Top-level managers in many of today's leading corporations are losing control of their companies. The problem is not that they have misjudged the demands created by an increasingly complex environment and an accelerating rate of environmental change, nor even that they have failed to develop strategies appropriate to the new challenges. The problem is that their companies are incapable of carrying out the sophisticated strategies they have developed. Over the past 20 years, strategic thinking has far outdistanced organizational capabilities.

"Today, people create national competitiveness, not, as suggested by classical economic theory, mere access to advantageous factors of production. Yet, human systems are also one of the major constraints in implementing global strategies. Not surprisingly therefore, human resource management has become "an important focus of top management attention, particularly in multinational enterprises.

The clear issue is that strategy (the what) is internationalizing faster than implementation (the how) and much faster than individual managers and executives themselves (the who). "The challenges [therefore] are not the 'whats' of what-to-do, which are typically well-known. They are the 'hows' of managing human resources in a global firm.

How prepared are executives to manage transnational companies? How capable are firms' human resource systems of recruiting, developing, retaining, and using globally competent managers and executives? A recent survey of major U.S. corporations found only six percent reporting foreign assignments to be essential for senior executive careers, with forty-nine percent believing foreign assignments to be completely immaterial.

Which firms are leading in developing globally competent managers and executives, and which remain in the majority and lag behind? That majority, according to a recent survey of 1500 CEOs, will result in a lack of sufficient senior American managers prepared to run transnational businesses, forcing U.S. firms to confront the highest executive turn-

over in history.

By contrast, it describes the approaches of some of the world's leading firms that distinguish them from the majority. There is no question that the world business is going global; the question raised in this article is how to create human systems capable of implementing transnational business strategies. Based on their research, the authors support the conclusion of the recent 21st Century Report that of executives who perceive their international operations as shelves for second-rate managers are unsuited for the CEO Job in the year 2000, or indeed any managerial job today.

**Cross - Cultural Competent HR**

- Transnational managers must learn about many foreign cultures' perspectives, tastes, trends, technologies, and approaches to conducting business.
- Unlike their predecessors, they do not focus on becoming an expert on one particular culture.
- Transnational managers must be skillful at working with people from many cultures simultaneously. They no longer have the luxury of dealing with each country's issues on a separate, and therefore sequential, basis.
- Similar to prior expatriates, transnational managers must be able to adapt to living in other cultures. Yet, unlike their predecessors, transnational managers need cross-cultural skills on a daily basis, throughout their career, not just during foreign assignments, but also on regular multi country business trips and in daily interaction with foreign colleagues and clients worldwide.
- Transnational managers interact with foreign colleagues as equals, rather than from within clearly defined hierarchies of structural or cultural dominance and subordination. Thus, not only do the variety and frequency of cross-cultural interaction increase with globalization, but also the very nature of cross-cultural interaction changes.

Table 1  
Transnationally Competent Managers

Transnational Skills	Transnationally Competent Managers	Traditional International Managers
Global Perspective	Understand worldwide business environment from a global perspective	Focus on a single foreign country and on managing relationships between headquarters and that country
Local Responsiveness	Learn about many cultures	Become an expert on one culture
Synergistic Learning	Work with and learn from people from many cultures simultaneously	Work with and coach people in each foreign culture separately or sequentially
Transition and Adaptation	Create a culturally synergistic organizational environment	Integrate foreigners into the headquarters' national organizational culture
Cross-cultural Interaction	Adapt to living in many foreign cultures	Adapt to living in a foreign culture
Collaboration	Use cross-cultural interaction skills on a daily basis throughout one's career	Use cross-cultural interaction skills primarily on foreign assignments
Foreign Experience	Interact with foreign colleagues as equals	Interact within clearly defined hierarchies of structural and cultural dominance
	Transposition for career and organization development	Expatriation or organization priority to get the job done

**Effective HR Strategies in Globalization**

Recruiting, Developing & Retaining Qualified Managers

Qualified managers have become a bottleneck factor in international competition. Cross border

and interdisciplinary experience is expected and not always available. In addition, loyalty to the company has depreciated. Headhunters are poaching the best people. How do companies with international experience handle this problem? Corporate itself is addressing the subject, human resource instruments for executives are realigned creating a winning employee value proposition.

**Incorporating Global Knowledge**

Executives should see themselves as drivers of a common corporate culture. They travel more, send e-mails around the world, participate in tele-conferencing, familiarize themselves with business magazines and business schools and, in short, are part of knowledgeable and mobile elite. This is reason enough for former barriers to disappear, allowing questions about comparisons and equity to emerge. The new media make the flow of information and communication around the world possible. But how and to what extent this new media can be employed in the development of an integrated global executive strategy also depends on the individual strategy and corporate culture. Company networks and very decentralized structures seem to hinder global standardization, whereas a growing international business Responsibility frees a substantial and powerful drive. Finally, the degree of integrating business areas and the regions will differ.

**Realigning Performance & Compensation Systems**

An improved integrated human resource management is the answer to changes in the company's strategies due to increased globalization. The starting point includes basic values and guidelines being worked out and formulated by international teams and the appropriate tools. The goal is to increase the global standardization of appraisal and compensation systems for executives and at the same time to incorporate local qualities.

**Conclusion**

By keenly analyzing the Human resource Management of company, we the group members agree that company is carrying out satisfactory culturally compatible strategies for its HR. Although it is not promoting the "cultural identity" agenda that aggressively but even then it is facing much less cultural conflicts among its HR. It may be due to the reason that it has divided itself in just two markets: Europe & Asia. The European market almost holds the same culture and three of its Asian market countries are Islamic. We came through very unusual facts about managing any company's HR. We believe that managing a competitive and culturally compatible HR in a competitive global market is a tough job. And company is so far quite successful in hiring and retaining exceptionally talented HR worldwide.

Human resource management, among other things, we believe that the globalization and the advancement of technology influences how organizations should react and adjust to the changing times and economy. Every company will have to find its own route - and this will depend on the situation and will be different for executive management and specialized staff. The decisive turnaround within today's human resource policy appears to be in the replacement of both local autonomy and the home country preference. We will not seek to deny the obvious power of globalized capitalism to distribute and promote its cultural goods in every corner. Nor will we take up the argument now very commonly made by critics of the cultural imperialism thesis that a deeper cultural impact cannot be easily inferred from the presence of such goods. What we will

try to comment is something more specific: that cultural identity, properly understood, is much more the product of globalization.

### Recommendations

HRM can just recommend global companies within the sphere of our knowledge, exposure and literature survey. WE recommend that:-

- A worldwide audit of IHR (International Human Resource) programs and plans should be conducted at least every three years as a matter of course. While guidelines and an approval process help management navigate through obvious change, subtle changes within the company, local market practice, legislation, and employee demographics can erode programs' effectiveness over time. Multinational pools are particularly subject to degrading without continuous corporate sponsorship and should also be re-evaluated periodically.
- Each organization must decide whether it has the right people in the right places to make the changes, whether these people have been adequately trained, given the necessary resources and focused on the right objectives, and whether they believe they will be rewarded for their contributions. HR strategy must be consistent with the needs of the organization, and its component strategies must provide alignment with the organization's objectives.

Human resource strategies can be powerful tools for signaling cultural change and reinforcing those changes once they are made. Who is hired and retained, how people are paid, and what behaviors are deemed desirable all send strong messages about the desired culture. The potential of HR strategies and programs for shaping organizational culture cannot be overestimated. For HR strategy to realize its full potential, the organization must first determine what its culture is and what it should be. Then the organization can create a plan for aligning culture with its mission and environmental or contextual realities by managing the culture from what it is to what it should be.

### References

- [1] Adler, Nancy J. 1983. Cross-cultural management research: The ostrich and the trend. *Academy of Management Review*, 8(2): 226-32.
- [2] Robert Doktor. 1986. From the Atlantic to the Pacific Century: Cross-cultural management reviewed. *Journal of Management*, 12(2): 295-318.
- [3] Aghion, P., & Blanchard, O. 1996. on insider privatization. *European Economic Review*, 40: 759-766.
- [4] Edstrom & J.R. Galbraith "Transfer of Managers as a Coordination and Control Strategy in Multinational Firms." *Administrative Science Quarterly*, 22, 1977, 248-263
- [5] Arnold, D. J. & Quelch, J. A. 1998. New strategies in emerging economies. *Sloan Management Review*, 40(1): 7-20.
- [6] Aulakh, P. S., Kotabe, M., & Teegen, H. 2000. Export strategies and performance of firms from emerging economies: Evidence from Brazil, Chile, Mexico. *Academy of Management Journal* 43: 342-361.
- [7] Barberis, N., Boycko, M., Shleifer, A., & Tsukanova, N. 1996. How does privatization work: Evidence from the Russian shops. *Journal of Political Economy*, 104: 764-790.
- [8] Beamish, Paul & Jiping Zhang. 1991. Hybrid-Skylake case. In Paul Beamish, Peter Killing, Donald Lecraw & H. Crookell, *International management: Text and cases*, 232-48. Homewood Ill.: Irwin.
- [9] Blodgett, Linda Longfellow. 1991. Partner contributions as predictors of equity share in international joint ventures. *Journal of International Business Studies*, 22(1): 63-78.
- [10] Chan, Wing-tsit. 1986. The individual in Chinese religions. In Charles A. Moore, ditor, *The Chinese mind*. Honolulu, Hawaii: University of Hawaii Press.



# Effect of dietary iron supplementation on the absorption of zinc, copper and manganese of a freshwater aquarium fish, *Carassius auratus* (Linnaeus, 1758)

Arabinda Das, Dr. Chandra Prakash (Senior Scientist, Aquaculture), Arun Sharma  
Thongam Ibemcha Chanu and Nilesh Pawar

Aquaculture Division, Central Institute of Fisheries Education, Versova, Andheri (W), Mumbai - 400061

## Abstract

The present study aimed to clarify the effect of dietary iron on the absorption of dietary zinc, copper and manganese in common goldfish, *Carassius auratus* (Linnaeus, 1758). Eight different diets with graded levels of dietary iron (as  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ) ranging from 34.27 to 537.14 mg  $\text{kg}^{-1}$  were prepared and fed to triplicate groups of *C. auratus* fry in aquariums for 75 days. The trace element analysis was carried out using atomic absorption spectrophotometer. Results showed significantly low muscle zinc, hepatic copper and whole-body manganese in experimental groups of fishes fed experimental diets with high dietary iron, thus indicating their utilization in iron absorption. No significant effect of dietary iron on whole-body and hepatic zinc, muscle and whole-body copper, and muscle and hepatic manganese were found. The study would help to establish the mineral interactions of iron with zinc, copper and manganese in fish. These interactions should be carefully considered before commercial diet formulation.

**Keywords:** Iron, Zinc, Copper, Manganese, Experimental diets, *Carassius auratus*

## 1. Introduction

The role of trace elements in biological systems has been described in several animals, but the knowledge in fish is limited to iron (Fe), zinc (Zn), copper (Cu), manganese (Mn) and selenium (Se) as components of body fluids, cofactors in enzymatic reactions, structural units of non-enzymatic macromolecules, etc (Watanabe et al. 1997). Investigations in fish are comparatively complicated as both dietary intake and waterborne mineral uptake have to be considered in determining the mineral budgets. Fresh water usually contains very less soluble minerals. Freshwater fish suffer from hydration across the gills due to the steady loss of salt to the hypotonic environment and therefore, drink little or no water, and have to compensate for their urinary salt losses by pumping salt from the water across the gills into the plasma. Therefore, freshwater fish are more demanding on an adequate supply of dietary mineral than marine fish (Cowey, 1979). Although fish can absorb soluble trace elements across the gill membrane and intestinal mucosa, diet is considered to be the major source of these elements (NRC, 1993). Thus, fish in soft water require additional supplementation in diet and therefore, in estimating requirements for commercial feed preparation of freshwater fish, interaction of iron with other minerals with waterborne elements has to be considered.

As a component of the enzyme caeruloplasmin (ferroxidase), copper is involved in iron absorption and metabolism (Lall, 2002). It is therefore involved in haemoglobin synthesis and red blood cell production and maintenance. Albert and Tacon (1987) reported that dietary copper availability and absorption is reduced in the presence of iron. The copper content significantly elevated in guppy (*P. reticulata*) fed the iron-deficient diet (Shim and Ong, 1992). But the relationship between iron and copper shows no significant correlation between dietary iron and hepatic copper concentration in Atlantic salmon (Andersen et al. 1997). Manganese is essential for regeneration of red blood cells (Albert and Tacon, 1987). Dietary supplementation with iron significantly reduced whole-body manganese in Atlantic salmon (Andersen et al. 1996). It is assumed that iron and manganese compete for the same binding site for absorption

(Hurley and Keen, 1987). There is no effect of dietary iron on whole-body zinc of Atlantic salmon as reported by Andersen et al. (1996). Therefore, the present study was conducted to clarify the effect of dietary iron on the absorption of dietary zinc, copper and manganese in a freshwater aquarium fish, *C. auratus*.

## 2. Materials and methods

### 2.1 Experimental diets

Purified ingredients supplemented with ferrous sulphate heptahydrate,  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  (Qualigens Fine Chemicals, India) as the source of iron were used to formulate eight different experimental diets (Table 1).  $\text{FeSO}_4$  replaced cellulose to achieve the desired levels of iron in the diets. The supplemental levels of iron in the diets were 0 mg  $\text{kg}^{-1}$  ( $T_1$ ), 20 mg  $\text{kg}^{-1}$  ( $T_2$ ), 40 mg  $\text{kg}^{-1}$  ( $T_3$ ), 60 mg  $\text{kg}^{-1}$  ( $T_4$ ), 80 mg  $\text{kg}^{-1}$  ( $T_5$ ), 100 mg  $\text{kg}^{-1}$  ( $T_6$ ), 250 mg  $\text{kg}^{-1}$  ( $T_7$ ) and 500 mg  $\text{kg}^{-1}$  ( $T_8$ ).

Initially gelatin crystals were mixed in warm distilled water in a plastic container and then all ingredients were mixed with the gelatin jelly. Oil was added to the dry mixture, and dough was prepared with the required amount of distilled water. The dough was cooked in a pressure cooker for half an hour, cooled and then vitamin and mineral mixtures were added.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  was dissolved in water and mixed with the dough. Pellets were prepared using a hand pelletizer, air dried for 30 min followed by oven drying at 52°C for 12 hours. The dried pellets were packed in zip lock polythene bags and then stored in an air sealed container for further use. Proximate analysis of eight different diets was done by standard methods (AOAC, 1995).

### 2.2 Assay of Fe, Zn, Cu and Mn concentrations in different diets

The nitric acid (65% w/v) and hydrochloric acid (30% w/v) were supra pure reagents (Merck), high-purity water was produced with a Milli-Q system (Millipore, MA, USA). Calibration was obtained with external standards. The standard solutions were prepared by diluting a 1000 mg  $\text{L}^{-1}$  multi element solution (ICP Multi element standard IV, Merck, Darmstadt, FRG) with deionized water. Glasswares were cleaned by soaking with the contact over night in a 10% (w/v) sulphuric acid solution and then rinsed with deionized water.

0.5 g of sample (ingredients/diets) was digested with 8 ml of  $\text{HNO}_3$  and 1 ml of HCl in a microwave reaction system (Multiwave 3000, Perkin Elmer). The temperature was set at 190°C and pressure at 25 bar @ 0.4 bar/s for 20 minutes. The concentrations of iron, zinc, copper and manganese in the diets were determined by using atomic absorption spectrophotometer (AAAnalyst 800, Perkin Elmer). All the parameters were set according to the manufacturer's instructions. Hollow-cathode lamps were operated at lamps current 30 mA to obtain a clear lean blue flame (oxidizing condition). The details are given in the Table 2.

### 2.3 Experimental fish and management

300 nos. of healthy fishes (*C. auratus*) with an average weight of  $2.961 \pm 0.0259$  g (mean  $\pm$  SE) were collected from the hatchery unit of the institute and were acclimatized in 500 L FRP tanks under aerated conditions on T1 diet at the rate of 3% of body weight twice a day for 7 days before the commencement of the experiment.

240 nos. of fishes were randomly distributed in 8 groups and each group was maintained in triplicate set containing 10 nos. of fishes. Fishes were provided with adequate aeration and fed with eight different experimental diets at the rate of 3% of body weight twice a day in rectangular glass aquariums (45 × 22 × 30 cm, 30 L capacity) for a period of 75 days. The aquariums were cleaned manually once in a week to prevent algal growth and 50% siphoning was done at a day interval in order to remove the faecal matter.

#### 2.4 Physico-chemical parameters of water

The ground water was passed through a Reverse Osmosis Water Treatment Unit prior to use for rearing of *C. auratus*. The concentration of Fe, Zn, Cu and Mn in the source water was measured by using atomic absorption spectrophotometer (AAAnalyst 800, Perkin Elmer). 250 ml of water sample was evaporated to reduce the volume approximately up to 25 ml in a chromic acid washed and dried conical flask. The content was then digested by adding 2 ml of HNO<sub>3</sub> and 1 ml of HCl (Suprapur, Merck) and make up the volume up to 50 ml in a volumetric flask. Analysis was done according to the instrumental conditions (Table 2). Physico-chemical parameters of rearing water viz. temperature, pH, DO, free CO<sub>2</sub>, total alkalinity, total hardness, NH<sub>4</sub><sup>+</sup>-N, NO<sub>2</sub><sup>-</sup>-N, NO<sub>3</sub><sup>-</sup>-N, and PO<sub>4</sub><sup>-</sup>-P (APHA, 2005) were recorded during the experimental period.

#### 2.5 Assay of Fe, Zn, Cu and Mn concentrations in different tissues

Four numbers of anaesthetized fishes (50 µl clove oil L<sup>-1</sup>) from each aquarium were dissected immediately under ice cold condition, muscle tissues were collected and liver tissue was pooled together for trace mineral analysis. For estimation of whole-body iron concentrations, the whole fish was cut into small pieces and homogenized using mortar and pestle. For the estimation of these elements concentration, 0.5 g of sample was digested by 5 ml of supra pure HNO<sub>3</sub> and 1 ml of supra pure HCl. The digested samples were analysed according to the instrumental conditions given in the Table 2.

#### 2.6 Statistical analysis

All the data were expressed as arithmetic mean ± SE. The data were statistically analyzed using one-way Analysis of Variance (ANOVA) via SPSS version 16.0 for Windows and Duncan's multiple range test was used to determine the significant differences between the means (P<0.05). Comparisons were made at the 5% probability level (P<0.05).

### 3. Results

#### 3.1 Proximate composition of experimental diets

The proximate composition (% on dry matter basis) of different experimental diets in terms of moisture, crude protein, ether extract and ash are given in Table 3.

#### 3.2 Fe, Zn, Cu and Mn concentrations of experimental diets

The iron concentrations of casein, gelatin, starch soluble, dextrin and cellulose were found 13.79±0.184, 2.21±0.07, 61.29±0.367, 74.23±0.52 and 85.49±1.42 mg kg<sup>-1</sup> respectively. Fe, Zn, Cu and Mn concentrations of experimental diets were presented in the Table 4.

#### 3.3 Physico-chemical parameters of water

The physico-chemical parameters of water were recorded during experimental period. The average values of all aquariums were found in normal range. The concentration of Fe, Zn, Cu and Mn (mean ± SE) in the source water was found 0.034±0.001, 0.010±0.000, 0.001±0.000 and 0.003±0.000 mg L<sup>-1</sup> respectively.

#### 3.4 Muscle Fe, Zn, Cu and Mn concentrations

There was significant difference (P<0.05) of iron and zinc concentration in the muscle among different experimental groups, but no significant difference was observed in the concentration of muscle copper and manganese. The muscle iron concentration increased concomitantly with the increased level of dietary iron supplementation, whereas, the muscle zinc concentration decreased with the increase of muscle iron concentration (Fig.1).

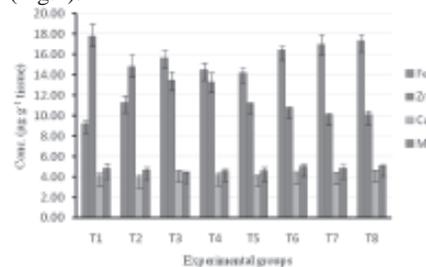


Fig. 1. Muscle Fe, Zn, Cu, and Mn concentration (mean ± SE) of *C. auratus* fed different experimental diets

#### 3.5 Whole-body Fe, Zn, Cu and Mn concentrations

Significant differences (P<0.05) of whole-body iron and manganese concentration were observed among the experimental groups, but whole-body zinc and copper concentration among different groups of fishes fed with different experimental diets were found insignificant. The whole-body manganese concentration got decreased with the increase of the whole-body iron concentration (Fig. 2).

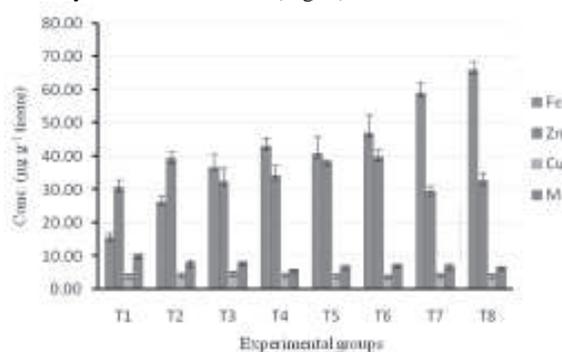


Fig. 2. Whole-body Fe, Zn, Cu and Mn concentration (mean ± SE) of *C. auratus* fed different experimental diets

#### 3.6 Hepatic Fe, Zn, Cu and Mn concentrations

The concentration of iron and copper in liver among the groups of fishes was significant (P<0.05), no significant difference was found in the concentration of zinc and manganese among different experimental groups. The copper concentration in the liver of T8 group of fishes reduced significantly (Fig. 3).

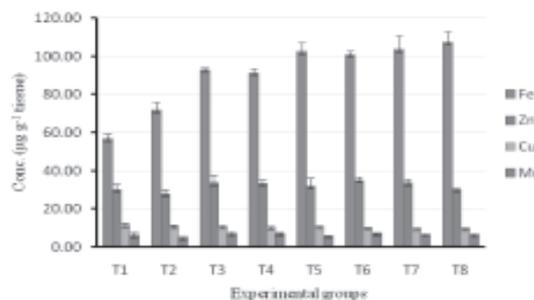


Fig. 3. Hepatic Fe, Zn, Cu and Mn concentration (mean ± SE) of *C. auratus* fed different experimental diets

## 4. Discussion

### 4.1 The experimental diets

The preparation of iron-free basal diet is one of the major obstacles in nutritional studies of fish. It is very difficult to obtain iron-free ingredients for experimental diets (Lall, 1989), but it is possible to incorporate minimum iron in basal diet by estimating the iron content of ingredients to be used in the purified diet preparation. Based on the analysis of ingredients, the experimental diets were formulated to contain a minimum amount of iron. As cellulose and dextrin contain high concentration of iron compare to other ingredients; the protein requirement of juvenile goldfish is 29% (Lochmann and Phillips, 1994) and the carbohydrate digestibility is high (70%) in goldfish (Pannevis, 1993), this was accomplished by supplying 35% crude protein as casein and gelatin, reducing the amount of dextrin with starch soluble and including a minimum amount of cellulose (Table 1). Shiau and Su (2003) reported that the effectiveness of ferric citrate as iron source is half of the ferrous sulfate in meeting the iron requirement of Atlantic salmon. Ferrous iron (Fe+2) is absorbed more efficiently than ferric iron (Fe+3) at a neutral pH (Guillaume, et al. 2001). Hence, it was assumed that FeSO<sub>4</sub>.7H<sub>2</sub>O added to diets will also be readily available to *C. auratus*. The excess dietary calcium reduces the absorption of the trace elements zinc, iron and manganese as reported by Lall (1979); the iron-free mineral mixture was prepared as per the requirement of freshwater aquarium fish.

### 4.2 The source of water

Fish have the ability to absorb trace elements such as Fe, Zn, Cu and Mn from water across the gill surfaces. This is one of the major drawbacks in studies related to dietary trace elements in fish, because the amount of dissolved elements fish absorb is difficult to predict and thus, the interactions among water borne trace elements in fish is also difficult to predict. Therefore, the water source which contains very less dissolved trace elements was used for this study to reduce the interactions among waterborne trace elements and to increase the effectiveness of dietary minerals interaction. Ground water was passed through a Reverse Osmosis Water Treatment Unit which comprises a sand filter, a coarse filter (20 µm), a reverse osmosis membrane filter, an activated charcoal filter, a sterilizer and a fine filter (5 µm) in series. The unit was used to reduce the total dissolved solids present in ground water. The source water contains very less quantity of trace elements. The experiment started when the water temperature was around 25°C which is the most favourable temperature for goldfish and ended within the optimal range. The decrease level of DO due to gradual increase in temperature and body size was adjusted time to time by adjusting air flow to the sponge filter.

### 4.3 The absorption of trace elements

In this experiment, there was an antagonistic relationship between dietary iron and muscle zinc. Dietary iron supplementation significantly reduced muscle zinc, but no significant effect of dietary iron on muscle copper and manganese was observed. High dietary iron may depress the absorption of muscle zinc. An antagonistic relationship was also found between dietary iron and whole-body manganese. High dietary iron may reduce the absorption of manganese or manganese may be utilized for regeneration of red blood cells. This is in accordance with those obtained by Andersen et al. (1996) in Atlantic salmon. Further, the reduction in whole-body manganese may be due to the competition between iron and manganese for the same binding site for absorption. However, there was no significant effect on whole-body zinc and copper among the experimental groups. Andersen et al. (1996) also reported that there is no effect of dietary iron on whole-body zinc in Atlantic salmon.

Albert and Tacon (1987) reported that dietary copper absorption is reduced in the presence of iron. However, Andersen et al. (1997) reported that there is no significant correlation between dietary iron and hepatic copper concentration in Atlantic salmon (Andersen et al. 1997). In this experiment, dietary iron supplement were also found to reduce hepatic copper. This indicates the involvement of hepatic copper in iron absorption and metabolism. Thus, this is in accordance with the freshwater aquarium fish, guppy as reported by Shim and Ong (1992). No effects of dietary iron on hepatic zinc and manganese were found in the present experiment.

Therefore, it can be concluded as iron interact with zinc, copper and manganese and affect their bioavailability or these elements have role on the absorption and metabolism of iron, thus, inclusion of these trace elements in commercial diet should be based on their interaction of that particular species.

### Acknowledgements

The authors are thankful to Dr. Dilip Kumar, Director, Central Institute of Fisheries Education (CIFE), Mumbai for providing all the infrastructure facilities needed for the conduct of the work. Authors are also thankful to Dr. Virendra Kumar Tiwari, Senior Scientist, CIFE, Mumbai and Mr. Suresh Babu P.P., Scientist, CIFE Centre, Kakinada for their timely help, guidance and valuable suggestions.

### References

- Albert G. J. and Tacon A. G. J., 1987. The Nutrition and Feeding of Farmed Fish and Shrimp-A Training Manual. Food and Agriculture Organization of the United Nations.
- Andersen F., Lorentzen, M., Waagbo R. and Maage A., 1997. Bioavailability and interactions with other micronutrients of three dietary iron sources in Atlantic salmon, *Salmo salar* L. smolts. *Aquacult. Nutr.*, 3: 239-246.
- Andersen F., Maage A. and Julshamn K., 1996. An estimation of dietary iron requirement of Atlantic Salmon (*Salmo salar*). *Aquaculture Nutrition*, 2: 41- 47.
- AOAC, 1995. Official methods for analysis, Vol 1, 16th Ed. (Ed. Cunniff, P. A.) AOAC international, Artington. USA.
- APHA-AWWA-WEF, 2005. Standard Methods for the Examination of Water and Waste Water, 20th edn. (ed. Clesceri, L.S., Greenberg, A. E. and Eaton, A. D.). American Public Health Association, American Water Works Association, Water Environment Federation, Washington DC.
- Cowey C.B., 1979. Protein and amino acid requirements of finfish. In: *Finfish nutrition and fishfeed technology*, (ed J.E. Halver and K. Tiews) *Schr. Bundesforschungsanst. Fisch. Hamb.*, (14/15) Vol. 1:pp3-16
- Guillaume J., Kaushik S., Bergot P. And Metailler R., 2001. Carotenoids and pigmentation, In: *Nutrition and Feeding of Fish and Crustaceans*. Praxis publishing, UK. pp. 183-196.
- Hurley L. S and Keen C. L, 1987. Manganese. In: *Trace Element in Human and Animal Nutrition* (Eds. Mertz., W.) 5th edn. Vol.1. Academic Press Inc., New York, pp. 185-223.
- Lall S. P., 1979. Minerals in finfish nutrition. In: *Finfish nutrition and fishfeed technology*, (Eds. Halver, J. E. and Tiews, K.), *Schr. Bundesforschungsanst. Fisch. Hamb.*, (14/15) Vol. 1:75-87
- Lall S. P., 1989. The minerals. In: *Fish Nutrition* (Ed. Halver, J. E.), Academic Press, New York, pp. 219- 257.

Lall S. P., 2002. The minerals. In: Fish Nutrition (Eds. Halver, J. E. and Hardy, R. W.), Academic Press, New York, pp. 260- 308.

Lochmann R. T. and Phillips H., 1994. Dietary protein requirement of juvenile golden shiners (*Notemigonus crysoleucas*) and goldfish (*Carassius auratus*) in aquaria. *Aquaculture*, 128: 277-285.

NRC (National Research Council), 1993. Nutrition Requirements of Fish. National Academic Press, Washington, DC. Pp-16-21.

Pannevis M. C., 1993. Nutrition of ornamental fish. In: (Eds. Burger, I.H.), The Waltham Book of Companion Animal Nutrition. Pergamon

Press, Oxford, pp. 85-96.

Shiau S. Y. and Su L. W., 2003. Ferric Citrate is Half as Effective as Ferrous Sulfate in Meeting the Iron Requirement of Juvenile Tilapia, *Oreochromis niloticus* X *O. aureus*. , *J. Nutr.*, 133: 483-488.

Shim K. F. and Ong S. I., 1992. Iron requirement of the guppy (*Poecilia reticulata* Peters). *J. Aquar. Aquat. Sci.*, 6: 33-40.

Watanabe T., Kiron V. and Satoh S., 1997. Trace minerals in fish nutrition. *Aquaculture*, 151 : 185-207.

**Table 1:** Composition of different experimental diets (% dry matter)

Ingredients	Percentage of inclusion							
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>
Casein (vitamin-free)	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Gelatin	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Dextrin white	15.70	15.70	15.70	15.70	15.70	15.70	15.70	15.70
Starch soluble	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Cellulose	1.50	1.49	1.48	1.47	1.46	1.45	1.375	1.25
CMC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BHT	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sunflower oil	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Cod liver oil	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
DL-Methionin	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
L-Tryptophan	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vitamin mixture <sup>1</sup>	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Iron-free mineral mix <sup>2</sup>	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
FeSO <sub>4</sub> ·7H <sub>2</sub> O	0.00	0.01	0.02	0.03	0.04	0.05	0.125	0.25

<sup>1</sup>Vitamin mixture (IU or mg kg<sup>-1</sup> diet)

Thiamine hydrochloride-20 mg; Riboflavin-30 mg; Calcium D-pantothenate-50 mg; Niacin-160 mg; Vit B<sub>6</sub>-20 mg; Vit B<sub>12</sub>-0.05 mg; Vit C-450 mg; Folic acid - 6 mg; Inositol -1000 mg; Biotin - 2.5 mg; Choline chloride 3000 mg; Vit A-6000 IU; Vit D-800 IU; Vit E-75 IU; Vit K-10 mg

<sup>2</sup>Iron-free mineral mix (mg or g kg<sup>-1</sup> diet)

CaCO<sub>3</sub>-5.8 g; CaHPO<sub>4</sub>·2H<sub>2</sub>O-12 g; KH<sub>2</sub>PO<sub>4</sub>-12.9; MgSO<sub>4</sub>·7H<sub>2</sub>O-5.5 g; NaCl-3 g; ZnSO<sub>4</sub>·7H<sub>2</sub>O-400 mg; MnSO<sub>4</sub>·H<sub>2</sub>O-352 mg; CuSO<sub>4</sub>·5H<sub>2</sub>O-30 mg; KI-6 mg; NaMoO<sub>4</sub>·2H<sub>2</sub>O-8 mg; CoCl<sub>2</sub>·6H<sub>2</sub>O-2 mg; Na<sub>2</sub>SeO<sub>3</sub>-2 mg

**Table 2:** Instrumental conditions for the AAS measurement

Elements	Wave length (nm)	Slit width (nm)	Characteristic check (mg L <sup>-1</sup> )	conc.	Linear Range (mg L <sup>-1</sup> )
Fe	248.3	0.2	6.0		6.0
Zn	213.9	0.7	1.0		1.0
Cu	324.8	0.7	4.0		5.0
Mn	279.5	0.2	2.5		2.0

**Table 3:** Proximate composition of experimental diets (% on dry matter basis)

Treatment	Moisture	Crude protein	Ether extract	Ash
T <sub>1</sub>	7.952	35.23	6.93	5.44
T <sub>2</sub>	7.977	35.00	7.29	5.39
T <sub>3</sub>	8.024	35.47	6.80	5.53
T <sub>4</sub>	8.015	34.77	7.22	5.37
T <sub>5</sub>	8.133	34.53	7.27	5.49
T <sub>6</sub>	7.869	35.23	7.22	5.02
T <sub>7</sub>	7.927	34.77	7.00	5.62
T <sub>8</sub>	7.989	35.47	7.07	5.65

Data expressed as arithmetic mean (n = 3).

**Table 4:** Fe, Zn, Cu and Mn concentration of different experimental diets

Treatments	Trace elements (mg kg <sup>-1</sup> )			
	Fe	Zn	Cu	Mn
T1	34.27a ± 1.09	109.05 ± 0.75	8.88 ± 0.44	113.55 ± 1.63
T2	59.75b ± 1.19	110.35 ± 1.69	8.39 ± 0.30	112.93 ± 2.17
T3	80.72c ± 1.03	107.58 ± 1.07	8.51 ± 0.67	113.68 ± 1.71
T4	95.54d ± 1.69	108.10 ± 1.15	8.40 ± 0.55	110.15 ± .84
T5	119.04e ± 1.36	109.02 ± 0.84	8.42 ± 0.63	113.68 ± 0.73
T6	139.06f ± 1.79	109.20 ± 1.71	8.85 ± 0.30	114.58 ± 0.79
T7	285.84g ± 1.35	109.68 ± 1.23	8.71 ± 0.28	115.92 ± 1.33
T8	537.14h ± 1.78	109.58 ± 0.55	8.86 ± 0.19	114.88 ± 1.49

Mean values with different superscript within a column for a parameter vary significantly (P<0.05), Data expressed as mean ± SE (n = 4).



# Effect of Methanolic Extract of *Achyranthes Aspera* Linn. on Indomethacin induced gastric ulcer in rats

Bisen V., Tiwari N., Sahay H., Lodhi A., Das AK., Bigoniya P., Verma NK\*

Dept. of Pharmacology, Radharaman College of Pharmacy, Bhopal-462044, M.P., India

E mail: neeleshosho@gmail.com, Phone: 08989011742

## Abstract

Plants have been one of the important sources of medicines since the beginning of human civilization. There is a growing demand for plant based medicines, health products, pharmaceuticals, food supplements, cosmetics etc. *Achyranthes aspera* Linn. (*A. aspera*) is used as an emmenagogue, antiarthritic, purgative, diuretic, antimalarial, oestrogenic, cardiogenic, antileprotic, antispasmodic, antibacterial and antiviral agent. It is reported to contain alkaloids, flavanoids, saponins, steroids and terpenoids. The study was aimed at evaluating the antiulcer activity of methanolic extract of leaf of *A. aspera* (MEAA). The anti-ulcer assessment was performed using the nonsteroidal anti-inflammatory drug (indomethacin) - as ulcer inducer. The effects of the MEAA on gastric content volume, pH, free acidity, total acidity and ulcer index were evaluated. The percentage of ulcer inhibition was significantly higher in the groups treated with the MEAA (400 and 600 mg/kg). MEAA and standard drug reduced the volume of gastric juice and total acidity whereas, gastric pH was increased significantly. In conclusion, the results of this study showed significant antiulcer activity of MEAA may be due to presence of phyto-constituents like flavanoids, saponins and tannins.

**Keywords:** *Achyranthes aspera*, antiulcer, gastroprotective, indomethacin,

## 1. Introduction:

Gastric hyperacidity and gastroduodenal ulcer is a very common global problem today. It is now generally agreed that gastric lesions develop, when the delicate balance between some gastroprotective and aggressive factors is lost (1, 2). Major aggressive factors are acid, pepsin, *Helicobacter pylori* and bile salts. Defensive factors mainly involve mucus-bicarbonate secretion and prostaglandins (3). Hypersecretion of gastric acid is a pathological condition, which occurs due to uncontrolled secretion of hydrochloric acid from the parietal cells of the gastric mucosa through the proton pumping H<sup>+</sup>K<sup>+</sup> ATPase (4). Even the normal rate of acid secretion may cause ulceration in the breached mucosa when some gastroprotective factors are lost.

The modern approach to control gastric ulceration is to inhibit gastric acid secretion, to promote gastroprotection, to block apoptosis and to stimulate epithelial cell proliferation for effective healing (5). Most of the antisecretory drugs such as proton pump inhibitors (omeprazole, lansoprazole, etc.) and histamine H<sub>2</sub>-receptor blocker (ranitidine, famotidine, etc.) are extensively used to control increased acid secretion and acid related disorders caused by stress, NSAID's and *H. pylori*, but there are reports of adverse effects and relapse in the long run (6,7). On the contrary most of the herbal drugs reduces the offensive factors and proved to be safe, clinically effective, better patient tolerance, relatively less expensive and globally competitive (8). Plant extracts, however, are some of the most attractive sources of new drugs and have been shown to produce promising results in the treatment of gastric ulcers.

Number of drugs including proton pump inhibitors, prostaglandins analogs, histamine receptor antagonists and cytoprotective agents are available for the treatment of peptic ulcer. But most of these drugs produce several adverse reactions including toxicities and even may alter biochemical mechanisms of the body upon chronic usage (9). Hence,

herbal medicines are generally used in such cases when drugs are to be used for chronic periods. Several natural drugs have been reported to possess anti-ulcerogenic activity by virtue of their predominant effect on mucosal defensive factors (10, 11).

*Achyranthes aspera* Linn. family; Amaranthaceae locally known as Apang, is an annual, biennial, lower portion perennial erect under shrub or rather stiff herb growing up to 0.3 to 1.0 m in height. It grows throughout the world in tropical and warmer regions. In Unani and Ayurvedic system of medicine, leaves and fruits are used as remedy for piles, renal dropsy, pneumonia, cough, kidney stones, skin eruption, snake bite, gonorrhoea and dysentery etc. The plant has antibacterial, antitumor, anti-inflammatory, anti-fertility, abortifacient activity and increases pituitary and uterine weights in ovariectomised rats and reproductive toxicity in male rats (12).

The *A. aspera* has been extensively studied for various pharmacological properties but antiulcer activity of the plant has not been reported so far. The study therefore seeks to access methanolic extract of the leaves of *A. aspera* for antiulcer activity in experimental animal model.

## 2. Materials and Methods:

### 2.1 Drugs and chemicals

Ethanol and Diethyl ether (Loba Chemie Pvt. Ltd. Mumbai), indomethacin and omeprazole (Sigma Chemical Co., St. Louis, MO, USA) were used in this study. All the dosage form and reagents were prepared immediately before use and all the reagents used were of analytical grade.

### 2.2 Plant Material:

The leaves of plant *Achyranthes aspera* were collected from fields of Bhopal in the month of Nov. 2009 (fig 1). It was identified and authenticated by Dr. Madhuri Modhak, Department of Botany, M.V.M. College, Bhopal. A voucher specimen (mvm- H/Am- 01) has been deposited at the herbarium of the same institute.



**Fig 1: Leaves and flower of *Achyranthes aspera***

### 2.3 Extract preparation:

The leaves were shade dried at room temperature and pulverized. The methanolic extract of leaves of *A. aspera* (MEAA) was prepared by using methanol in a Soxhlet apparatus after defatting with petroleum ether (80%). The yield of the methanolic extract was 16.7% (w/w). In each experiment, the extract was diluted with water to obtain desired concentration.

#### 2.4 Phytochemical screening

A preliminary phytochemical screening of MEAA was conducted to determine the presence or absence of alkaloids, tannins, phenols, saponins, carbohydrates, steroids and glycosides according to the methods described by Kokate et al. (13).

#### 2.5 Animals

Albino mice were used for acute toxicity study. Adult male albino rats of Wistar strain weighing about 120-150 g were used for the study. The animals were obtained from Animal house of Radharaman College of Pharmacy, Bhopal (M.P.). The animal room was well ventilated with a 12 h light/dark cycle throughout the experimental period. They were maintained in clean, sterile, polypropylene cages and fed with commercial pelleted rat chow (M/S Hindustan Lever Limited, Bangalore, India) and water ad libitum. All animals were deprived of food for 18 h before subjecting to ulcerogens and were allocated to different experimental groups. The study was approved by the institutional animal ethical committee (IAEC/RCP/2010-11), which follows the guidelines of CPCSEA (Committee for the Purpose of Control and Supervision of Experimental on Animals), which complies with international norms of INSA.

#### 2.6 Acute Toxicity Studies

The LD50 of A. Aspera was estimated by following up-and-down stair case method. A total six albino mice were selected for each experiment. Animals were observed hourly for 6 hour and again after 24 hour. The parameters for motor activity and gross effect were determined after administration of A. Aspera extract orally at a dose level of 5 g/kg body weight.

#### 2.7 Anti-Ulcer Activity

##### 2.7.1 Indomethacin induced ulcer

The albino rats of either sex weighing between 180-200 gm were divided into 5 groups of 6 animals each and fasted for 24 hrs with water ad libitum prior to experiment. The animals of group 1 were pretreated with vehicle and the animals of group 2 were treated with standard i.e. omeprazole 10 mg/kg p.o. Similarly the animals of group 3, 4 and 5 were pre-treated orally with methanolic extract 200, 400 mg/kg and 600 mg/kg respectively. Indomethacin (100 mg/kg p.o.) was administered to the animals of group 2-5, 60 minutes after the respective treatments. The animals were then sacrificed by cervical dislocation after 6 hrs. The stomach was taken out and cut open along the greater curvature of stomach (14, 15).

##### 2.7.2 Estimation of pH, Gastric volume, Total and Free acidity

The pH of the gastric juice was recorded by digital pH meter. The gastric juice was collected and its volume was measured. The gastric juice was centrifuged and the clear supernatant was analysed for total and the free acidity using the method of Hawk et al (16). Briefly, 1 ml of supernatant liquid was pipette out and diluted to 10 ml with distilled water. The solution was titrated against 0.01N sodium hydroxide using Topfer's reagent as indicator (17). The end point was titrated when the solution turned orange in colour. The volume of NaOH was noted, which corresponded to free acidity and the solution was further titrated until it regained its pink colour. The total volume of NaOH was noted, which corresponded to the total acidity.

##### 2.7.3 Measurement of ulcerative index

The stomach was opened and washed with running tap water, placed on

a flat glass plate to measure the ulcerated area. Standardization was made with a 10×10 cm square glass plate. The opened stomach was laid on the glass plate and the mucous was exposed, allowing the counting of injuries per square mm. The ulcer index was determined by using the formula

$$\text{Ulcer Index} = 10/X$$

Where, X = Total mucosa area/ Total ulcerated area

#### 2.7.4 Assessment of ulcer grading and percentage inhibition

The number of ulcers per stomach were noted and severity of the ulcers were observed microscopically and scoring was done as described before (18); 0 for normal coloured stomach, 0.5 for red colouration, 1 for spot ulcer, 1.5 for hemorrhagic streaks, 2 for ulcer between > 3 but < 5mm and 3 for ulcer > 5mm. Mean ulcer score for each animal is

$$\text{Percentinhibition} = \frac{\text{Ulcerareaofcontrol} - \text{ulcerareaofreated}}{\text{Ulcerareaofcontrol}} \times 100$$

expressed as ulcer index. The percentage protection was calculated.

The percentage healing was calculated as:

#### 2.7.5 Morphological examination

The stomach was opened and washed with running tap water, placed on a flat glass plate to view the morphological alteration induced by different treatment and photograph were taken using digital camera (10 mega pixel 5X zoom).

#### 2.7.6 Statistical analysis

The results are presented as mean±SEM. The data were also analyzed by ANOVA (one-way analysis of variance) using SPSS package. The statistical analysis was performed using Dunnett's multiple comparison tests for all parameters. The values were considered significant at the levels of P is less than 0.05.

### 3. RESULTS:

#### 3.1. Phytochemical analysis

The phytochemical screening tests were positive for alkaloids, carbohydrates, glycosides, flavanoids, steroids, and tannins.

#### 3.2. Acute Toxicity studies

The parameters for motor activity and other gross effects were normal in all groups determined after administration of A. aspera. From these observations it is concluded that the extract is quite safe even at the higher doses and has no acute toxicity.

#### 3.3 Effect of MEAA on Gastric volume and gastric pH

Volume of gastric content was increased significantly in the MEAA treated groups at the doses of 400 and 600 mg/kg (0.54±0.01 and 0.44±0.03) compared with control group (2.32±0.05). A. aspera treated animals significantly increased the gastric pH at the doses of 400 and 600 mg/kg (4.41±0.13 and 5.06±0.08 respectively) as compared with the reduction of control group (1.55±0.01) as shown in table 1.

Table 1: Effect of MEAA on indomethacin-induced gastric ulcer in rats

Treatment	Gastric Vol. (ml/100 g)	pH	Free Acidity (Meq/100 g)	Total Acidity (Meq/100 g)	Ulcer Index	% Inhibition
Indomethacin	-- --	1.95 ± 0.13	77.33 ± 0.52	95.03 ± 1.12	32.83 ± 0.85	
Omeprazole	0.32	8.13	11.32	19.83	07.11	79
MEAA (200mg/kg)	0.77 ± 0.01*	3.55 ± 0.01*	36.55 ± 0.09*	42.76 ± 0.71*	15.51 ± 0.76*	53
MEAA (400mg/kg)	0.54 ± 0.01**	4.41 ± 0.13**	17.55 ± 0.41**	31.42 ± 0.42**	10.95 ± 0.44**	64
MEAA (600mg/kg)	0.44 ± 0.03**	5.08 ± 0.08**	15.48 ± 0.38**	25.71 ± 1.0**	10.21 ± 0.26**	68

Data are expressed as the mean±SEM; n = 6 in each group. \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001 when compared to indomethacin treated group (one-way ANOVA followed by Dunnett's test).

3.4 Effect of MEAA on Total and Free acidity

The anti-ulcer property of *A. aspera* in pylorus ligation model is evident from its significant reduction in free acidity, at the doses of 400 and 600 mg/kg (17.55± 0.41, and 15.40± 0.38 respectively) as compared with the control group (77.33±0.52), total acidity significantly reduced at the doses of 400 and 600 mg/kg (31.42±0.42 and 25.71±1.0 respectively) as compared with the control group (95.03±1.12), as shown in table 1.

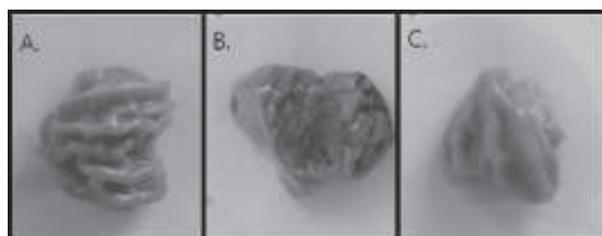
3.5 Effect of MEAA on ulcer index

Ulcer index was significantly reduced in MEAA treated groups at the doses of 400 and 600 mg/kg (10.95±0.44 and 10.21±0.26 respectively) as compared with the control group (32.83±0.85) as shown in table 1.

Pretreatment with test extracts reduced the ulceration in a dose dependant manner. The extent of gastroprotective effect of the test extracts is 53%, 64% and 69% at 200, 400 mg/kg and 600 mg/kg doses respectively, which is comparable to that of standard omeprazole. The test extracts at the doses mentioned above has shown significant protection even to that of standard omeprazole. The results are compiled in table 1.

3.6 Morphological examination

In the microscopic observation of indomethacin-induced rat, damaged mucosal epithelium, glands and inflammatory exudates, were found in ulcerated wall of the stomach. Protections against these morphological changes were observed by apparent epithelializations, glandular organization, regeneration of mucosa and reduced size of ulcer crater in MEAA pretreated rats (Fig 2: A-C).



4. DISCUSSION:

In the present study we have assessed the protective effects of *A. aspera* on gastric ulcer models, to ascertain ulcer healing and antisecretory property of *A. aspera*, which is a widely used plant in herbal medicinal practice. NSAID'S like indomethacin inhibits COX-1 thereby inhibits the prostaglandin synthesis, consequently lipooxygenase pathway is enhanced liberating leukotrienes and these leukotrienes are reported to have a role in ulcerogenesis. In addition there is some evidence that NSAIDs may induce ulcer by causing the back diffusion of H<sup>+</sup> ion in to mucosal cells (19). Therefore the gastroprotective effect of the test extract may be due to its ability to inhibit the synthesis of prostaglandins/ leukotrienes. Hence, it may be inferred that MEAA affords effective protection to gastric mucosa may be by increasing gastric mucin content and increased the pH and decreased the free and total acidity in rats, which in turn reduces the activity of pepsin and prevent mucolysis. This in turn protects the stomach from all the above mentioned challenges. Medical treatment of peptic ulcer is dependent on correcting the imbalance between the offensive and defensive factors.

The preliminary phytochemical screening of MEAA revealed the presence of tannins, alkaloids, flavanoids, and saponins. *A. aspera* showed potent antiulcer effect comparable to omeprazole may be due to synergistic effect of different secondary metabolites. Previous studies proved that anthocyanins possess significant antioxidant, anti-ulcer and ulcer healing activity in experimental ulcer models (20, 21). Additionally, saponins, tannins and volatile oil of some plants are also known to possess antiulcer activity (22, 23, 24). Though, we have not studied the active principles responsible for the anti-ulcer activity of MEAA it is likely that presence of tannins, saponins or flavanoids along with other bioactive compounds in this plant may be responsible for the ulcer preventing action.

The test extracts acts on both the parameters of equation viz; healing and anti-secretary which govern the treatment of peptic ulcer and thus can be useful clinically. However further studies are needed to assess its safety profile before it is used clinically.

Acknowledgements:

We are thankful to Dr. Mrs Papiya Bigoniya, the Principal and Mr R. R. Saxena, the Chairman, RGI Bhopal for their constant support and providing all the facilities to carry out this research work.

References:

- [1] Tripathi, K.D. Essentials of Medical Pharmacology, 4th ed. Jaypee Brothers medical publishers, New Delhi (1999) pp. 628.
- [2] Goel, R.K., Bhattacharya, S.K.. Gastroduodenal mucosal defense and mucosal protective agents. Indian J. Exp. Biol 29:(1991) 701-714.
- [3] Hoogerwerf, W.A., Pasricha, P.J. Agents used for the control of gastric acidity and treatment of peptic ulcers and gastrooesopahgeal reflux diseases. In: Hardman, J.G, Limbrid, L.E., Goodman, C.S., Gilman, B.T. (Eds.), Goodman and Gilman's: The Pharmacological Basis of Therapeutics, 10th ed. McGraw-Hill, New York (2001) pp. 1005-1019.
- [4] Sachs, G, Shin, J.M., Briring, C., Wallmark, B., Hersey, S. The pharmacology of the gastric acid pump: the H<sup>+</sup>K<sup>+</sup>-ATPase. Annual Review of Pharmacology and Toxicology 35:(1995) 277-305.

- [5] Bandhopadhyay, U., Biswas, K., Chatterjee, R., Kumar Ganguly, I.C.C., Bhattacharya, K., Banerjee, R. Gastroprotective effect of Neem (*Azadiracta indica*) bark extract: possible involvement of H+K+ATPase inhibition and scavenging of hydroxyl radical. *Life Science* 71:(2002) 2845-2865.
- [6] Martelli, A., Mattlioli, F., Mereto, E., Brambilla, C.G., Sini, D., Bergamaschi, R., Brabilla, G. Evaluation of omeprazole genotoxicity in a battery of in vitro and in vivo assays. *Toxicology* 30:(1998) 19-41.
- [7] Wolfe, M.M., Sachs, G. Acid suppression: optimizing therapy for gastroduodenal ulcer healing, gastroesophageal disease and stress-related erosive syndrome. *Gastroenterology* 118:(2000) S9-S31.
- [8] Goel, R.K., Sairam, K. Antiulcer drugs from indigenous sources with emphasis on *Musa sapientum*, *Tamrabhasna*, *Asparagus racemosus* and *Zingiber officinale*. *Indian Journal of Pharmacology* 34:(2002) 100-110.
- [9] Ariyphisi, I., Toshiharu, A., Sugimura, F., Abe, M., Matsuo, Y., Honda, T. Recurrence during maintenance therapy with histamine H2 receptors antagonist in cases of gastric ulcers. *Nikon University Journal Medical* 28:(1986) 69-74.
- [10] Sairam, K., Rao, C.V., Goel, R.K. Effect of *Centella asiatica* Linn. on physical and chemical factors induced gastric ulceration and secretion. *Indian J. Exp. Biol.* 39:(2001) 137.
- [11] Sairam, K., Rao, C.V., Goel, R.K. Effect of *Convolvulus pluricaulis* Choisy on gastric ulceration and secretion in rats. *Indian J. Exp. Biol.* 39:(2001) 350.
- [12] Barua C.C., Talukdar A., begum S.A., Lahon L.C., Sharma D.K., Pathak D.C., Borah P. Antinociceptive activity of methanolic extract of leaves of *A.aspera* Linn. In animal models of nociception. *Indian J Exp Boil.* 48:(2010) 817-821.
- [13] Kokate, C.K., Purohit, C.K., Gokhale, S.B. Phytochemical tests. In: *Pharmacognosy*. Nirali Prakashan, Pune, India (1996) pp. 510-512.
- [14] Mc Cofferty, D.M., Granger, D.N., Wallace, J.L. Indomethacin induced gastric injury and leukocyte adherence in arthritic versus healthy rats. *Gastroenterology* 109:(1995)1173-1180.
- [15] Datta, G.K., Sairam, K., Priyambada, S., Debnath, P.K., Goel, R.K.. Antiulcerogenic activity of satavari mandw. An Ayurvedic herbo medical preparation. *Indian J Exp. Biol.* 40:(2002)1173-77.
- [16] Hawk, A. *Hawk's Physiological Chemistry*, 14 Ed. McGraw-Hill, Book Co. (1965) pp. 483-485.
- [17] Une, H.D., Sarveiya, V.P., Pal, S.C., Kasture, V.S., Kasture, S.B. Nootropic & anxiolytic activity of Saponins of *A. aspera* leaves. *Pharmacology Biochemistry and Behavior* 69:(2001) 439-44.
- [18] Kulkarni, S.K. *Handbook of experimental Pharmacology*, Vallabh Prakashan, New Delhi (2002) pp.148.
- [19] Davenport. H.W. Gastric mucosal haemorrhage in dose-effect of acid, aspirin and alcohol. *Gastroenterol.* 56:(1969) 439-49.
- [20] Cristoni, A., Magistretti, M.J. Antiulcer and healing activity of *Vaccinium myrtillus* anthocyanosides. *Farmaco Prat* 42:(1987) 29-43.
- [21] Tsuda, T. The role of anthocyanins as an antioxidant under oxidative stress in rats. *Biofactors* 13:(2000) 133-139.
- [22] Aguwa, C.N., Nwako, S.O. Preliminary studies on the root extracts of *Naulea latifolia* smith, for antiulcer properties. *Nigerian Journal of Pharmaceutical Science* 4:(1998) 16-23.
- [23] Hiruma-Lima, A., Gracioso, J.S., Nunes, D.S., Souza Brito, A.R.M. Effects of an essential oil from the bark of *Croton cajucara* Benth. On experimental gastric ulcer models in rats and mice. *Journal of Pharmacy and Pharmacology* 51:(1999) 341-346.
- [24] Al-Rehaily, A.J., Al-Howiriny, T.A., Al-Sohaibani, M.O., Rafatullah, S. Gastroprotective effects of 'Amla' *Emblica officinalis* on in vivo test models in rats. *Phytomedicine* 9:(2002) 515-522.

# Evaluation Performance Of Classification Algorithms

**Bharti Dongre**

b\_d167@yahoo.co.in

M.Tech (CSE) TIT,Bhopal

**Sini Shibu**

sinijoseph@hotmail.com

Assistant Professor,CSE

Deptt.,TIT,Bhopal

## Abstract

The field of intrusion detection has received increasing attention in recent years. One reason is the explosive growth of the Internet and the large number of networked systems that exist in all types of organizations. Intrusion detection techniques using data mining have attracted more and more interests in recent years. As an important application area of data mining, they aim to meliorate the great burden of analyzing huge volumes of audit data and realizing performance optimization of detection rules. A lot of classification algorithm have been evaluated over KDD (knowledge discovery and data mining). This paper evaluates performance of feature selection algorithm, different classification algorithm like naive bayes, random tree, random forest, combination of classifier using bagging, boosting, stacking and results of the same when used for network based IDS. The classification task requires a lot of computation in model generation. The time required for model generation can be reduced by removing redundant attributes and/or by using parallel approach.

## Keywords:

*DataMining, KDDcup99 dataset, WEKA*

## 1.Introduction

Intrusion detection is defined [1] as the process of intelligently monitoring the events occurring in a computer system or network, analyzing them for signs of violations of the security policy. The primary aim to intrusion detection system is to (IDS) protect the availability,

confidentiality and integrity of critical networked information system.

## Types of Intrusion Detection Systems

Current IDSs fall into two categories:

- Network-based Intrusion Detection Systems (NIDSs)
- Host-based Intrusion Detection Systems (HIDSs).

These systems can be classified based on which events they monitor, how they collect information and how they deduce from the information that an intrusion has occurred. IDSs that scrutinize[2] data circulating on the network are called Network IDSs (NIDSs), while IDSs

that reside on the host and collect logs of operating system-related events are called Host IDSs (HIDSs). IDSs[3] may also vary according to the technique by which they detect intrusions.

Three types of Intrusion Detection techniques[4] exist based on the method of inspecting the traffic:

Signature based IDS.

Statistical anomaly based IDS.

Hybrid IDS

## 2. CLASSIFIERS

### 2.1Network Intrusion Detection Using Naive Bayes

The framework builds the patterns of the network services over data sets labeled by the services. With the built patterns, the framework detects

attacks in the datasets[5] using the naive Bayes Classifier algorithm[6]. Authors carry out their experiment on 10% of the KDD'99 dataset[7], which contains 65,525 connections. For their experiments, they choose the naïve Bayes Classifier in WEKA Compared to the neural network based approach our approach achieve higher detection rate, less time consuming and has low cost factor. However, it generates somewhat more false positives. As a naive Bayesian network is a restricted network that has only two layers and assumes complete independence between the information nodes. This poses a limitation to this research work.

### 2.2 Random Tree

All of the effects of the different [8] variables are not necessarily found in a single tree. For example, at a given node there may be more than one significant variable on which to split, but obviously only one of these can be used as a splitter at a time. This is why multiple trees are usually interactively explored or sampled using the random tree creation. Random tree considers k attributes at each node. Random tree in itself is a weak classifier. Random tree is generally used to generate so many decision trees all of which collectively participate in classification task by schemes like bagging, boosting etc. to yield better results.

### 2.3 Bagging

To introduce bagging, suppose that several training datasets of the same size are chosen at random from the problem domain. Imagine using a particular machine learning technique to build a decision tree for each dataset. You might expect these trees to be practically identical and to make the same prediction for each new test instance[9]. Surprisingly, this assumption is usually quite wrong, particularly, if the training datasets are fairly small. This is a rather disturbing fact. The reason for it is that decision tree induction is an unstable process: slight changes to the training data may easily result in a different attribute being chosen at a particular node, with significant ramifications for the structure of the subtree beneath that node. This automatically implies that there are test instances for which some of the decision trees produce correct predictions and others do not. Returning to the preceding expert's analogy, consider the experts to be the individual decision trees. We can combine the trees by having them vote on each test instance. If one class receives more votes than any other, it is taken as the correct one. Generally, the more the merrier: predictions made by voting become more reliable as more votes are taken into account. Decisions rarely deteriorate if new training sets are discovered, trees are built for them, and their predictions participate in the vote as well. In particular, the combined classifier will seldom be less accurate than a decision tree constructed from just one of the datasets. Improvement is not guaranteed, however. It can be shown theoretically that pathological situation exists in which the combined decisions are worse.

The effect of combining multiple hypotheses can be viewed through a theoretical device known as the bias-variance decomposition. Suppose that we could have an infinite number of independent training sets of the same size and use them to make an infinite number of classifiers. A test instance is processed by all classifiers, and a single answer is determined by majority vote. In this idealized situation, errors will still occur because no learning scheme is perfect: the error rate will depend on how well the

machine learning method matches the

Problem at hand, and there is also the effect of noise in the data, which cannot possibly be learned. Suppose the expected error rate were evaluated by averaging the error of the combined classifier over an infinite number of independently chosen test examples. The error rate for a particular learning algorithm is called its bias for the learning problem and measures how well the learning method matches the problem. Bias measures the "persistent" error of a learning algorithm that can't be eliminated even by taking an infinite number of training sets into account. Of course, it cannot be calculated exactly in practical situations; it can only be approximated.

### 2.3 C4.5

C4.5 is an algorithm used to generate a decision tree developed by Ross Quinlan[10]. C4.5 is an extension of Quinlan's earlier ID3 algorithm. ID3 algorithm uses information gain to decide the splitting attribute. Given a collection S of c outcomes, Entropy is defined as,

$$Entropy(s) = -p(I) \log_2 p(I)$$

Where P (I) is the proportion of S belonging to class I.

The information gain of example set S on attribute A is defined as

$$Gain(S, A) = Entropy(s) - \frac{|S_v|}{|S|} Entropy(S_v)$$

Where, Sv =subset of S for which attribute A has value v. The attribute value that maximizes the information gain is chosen as the splitting attribute. Information Gain used in ID3 algorithm always tends to select attributes that have a large number of values since the gain of such an attribute would be maximal. To overcome this drawback Quinlan suggested the use of Gain Ratio as a measure to select the splitting attribute instead of Information Gain.

The gain ratio of example set S on attribute A is defined as,

Where,

$$GainRatto(S, A) = \frac{Gain(S, A)}{Splitnfo(S, A)}$$

Where S1, S2....Sm are the partitions induced by attribute A in S.

The training data is a set S = s1,s2,... of already classified samples. Each sample si = x1,x2,... is a vector where x1,x2,... represent attributes or features of the sample. The training data is augmented with a vector C = c1,c2,... where c1,c2,... represent the class to which each sample belongs. At each node of the tree, C4.5 chooses one attribute of the data that most effectively splits its set of samples into subsets enriched in one class or the other. Its criterion is the normalized information gain (difference in entropy) that results from choosing an attribute for splitting the data. The attribute with the highest normalized information gain is chosen to make the decision. The C4.5 algorithm then recurses on the smaller sub lists.

## 3 Parallel Computing Works

### 3.1 High Performance Data Mining for Network Intrusion Detection

Computer intrusion detection is an approach to detect suspected intrusions as soon as possible to reduce the damage to the system and take appropriate actions using the audit data generated by the computers. There are two basic approaches, anomaly detection and misuse detection. Anomaly detection is to define correct behavior of the system, and then to detect abnormal behaviors. Misuse detection is to characterize known intrusion patterns and generate explicit rules to describe them. Then, it monitors for those patterns to indicate an occurrence of intrusion. However, these algorithms are computationally expensive and the audit data are usually too huge to be processed manually or find valuable information heuristically. The author [11] used a high performance data mining technique to discover underlying hidden knowledge embedded in large volumes of data. They have developed a parallel data mining model for intrusion detection using a parallel back propagation neural network. They have evaluated the performance of the developed model in terms of speedup, prediction rate, and false alarm rate.

### 3.2 Cluster Computing for Neural Network based Anomaly Detection

Network intrusion-detection systems are now being identified as a mandatory component in multilayered security architecture. Intrusion detection systems have traditionally been based on the characterization of a user and tracking of activity of the user to see if it matches that characterization. Artificial neural networks provide a feasible approach to model complex engineering systems such as intrusion detection.

To characterize the behavior of users have been well studied in the recent past, without considering the enormous time they take to get modeled. In this paper the author[12] present an implementation of a parallel version of the Back Propagation training algorithm for Feed-forward neural networks that are used for detecting intruders based on the MPI standard on Linux PC clusters. The experiments show a considerable increase in speedup during training and testing of the neural network, which in turn increases the speed of detecting intruders. The parallel neural network training algorithm for classifying large volumes of training data, speeds up the training process without the requirement for any special hardware. Since the data is distributed over all the nodes of the cluster, this method can also bring down the space requirements on a single computer to manageable limits. Thus, the eventual goal of detecting intruders at a near real-time situation and at a faster pace is achieved.

### 3.3 A Taxonomy of Parallel Techniques for Intrusion Detection

Intrusion detection systems (IDS) have become a key component in ensuring the safety of systems and networks. These systems enforce a security policy by inspecting arriving packets for known signatures (patterns). This process actually involves several tasks that collectively incur a significant delay. As network line speeds continue to increase, it is crucial that efficient scalable approaches, such as parallelization, are developed for IDS. In this paper author [13] has developed a framework which may be used to classify various approaches to parallelizing intrusion detection systems. Parallelization of IDS can occur at three general levels: node (entire system), component (specific task), and sub-component (function within a specific task). The author categorize existing and proposed parallel solutions using proposed framework, discuss the advantages and disadvantages of each, and provide empirical evaluation of one form of parallelism.

### 3.4 Parallel Computing for the Longest Common Subsequences in Network Intrusion Detection System

The longest common subsequence problem has been applied to network instruction detection system, Bioinformatics and E-commerce, etc. This paper [14] proposes an extended longest common subsequence problem

called (K, l)-LCS problem, designs a parallel algorithm to solve (K, l)-LCS problem on SMP machine by the divide and conquer strategy and the tournament bee, and then presents a parallel algorithm for solving (K, l)-LCS problem on SMF clusters by applying the k-selection technique based on mesh-connected network. The theoretical analysis and experiments on Dawning-U) o parallel computer show that the parallel algorithm obtains a linear speedup and has a very good scalability.

**3.5 A Parallel Architecture for Stateful Intrusion Detection in High Traffic Networks**

In a scenario where network bandwidth and traffic are continuously growing, network appliances that have to monitor and analyze all flowing packets are reaching their limits. These issues are critical especially for Network Intrusion Detection Systems (NIDS) that need to trace and reassemble every connection, and to examine every packet flowing on the monitored link(s), to guarantee high security levels. Any NIDS based on a single component cannot scale over certain thresholds, even if it has some parts built in hardware. Hence, parallel architectures appear as the most valuable alternative for the future. This paper [15] proposes a parallel NIDS architecture that is able to provide with fully reliable analysis, high performance and scalability.

**4 RESULTS AND DISCUSSION**

Classifiers used for the experiments are naive bayes, J48, random tree, random forest and their combinations using bagging, boosting and stacking. 218542 connections are used for training set and 63473 connections are used for testing set. To conduct experiments WEKA is used which contains implementation of various machine learning algorithms used for data mining. RunWEKA.ini file is edited to assign 1.5 GB of memory to WEKA in order to handle large volume of data.

Different classifier algorithms perform differently for different classifiers. This section evaluates the performance of classifiers, classifier combinations using bagging boosting and stacking for different classes.

**Experiments performed on data set 0**

**Naivebayes**

=== Run information ===

Scheme: weka.classifiers.bayes.NaiveBayes

Instances: 218542

== Summary ==

Correctly Classified Instances	61623
	97.0854 %
Incorrectly Classified Instances	1850
	2.9146 %
Kappa statistic	0.8773
Mean absolute error	0.015
Root mean squared error	0.1074
Relative absolute error	9.398 %
Root relative squared error	41.7536 %
-----	
Total Number of Instances	63473
-----	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
0.992	0.002	1	0.992	0.996	0.993	dos
1	0.004	0.012	1	0.024	0.999	u2r
0.005	0	0.273	0.005	0.011	0.97	r2l
0.874	0.006	0.67	0.874	0.758	0.996	probe
0.964	0.021	0.835	0.964	0.894	0.997	normal
Weighted Avg:						0.971 0.004 0.966 0.971 0.966 0.993

=== Confusion Matrix ===

a	b	c	d	e	<-- classified as
54771	3	0	259	160	a = dos
0	3	0	0	0	b = u2r
1	23	6	14	1056	c = r2l
3	99	0	707	0	d = probe
16	124	16	76	6136	e = normal

**Random tree**

=== Run information ===

Scheme: weka.classifiers.trees.RandomTree -K 0 -M 1.0 -S 1

Relation: IP\_PACKETS

Instances: 218542

=== Evaluation on test set ===

=== Summary ===

Correctly Classified Instances	62054	97.7644 %
Incorrectly Classified Instances	1419	2.2356 %
Kappa statistic	0.9048	
Mean absolute error	0.0089	
Root mean squared error	0.0945	
Relative absolute error	5.6047 %	
Root relative squared error	36.7307 %	
Total Number of Instances	63473	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
0.996	0.001	1	0.996	0.998	0.997	dos
0.667	0	0.222	0.667	0.333	0.833	u2r
0.003	0	0.6	0.003	0.005	0.504	r2l
0.985	0.002	0.875	0.985	0.927	0.992	probe
0.988	0.023	0.83	0.988	0.902	0.983	normal
Weighted Avg:						0.978 0.003 0.974 0.978 0.97 0.987

=== Confusion Matrix ===

a	b	c	d	e	<-- classified as
54961	0	0	0	232	a = dos
0	2	1	0	0	b = u2r
0	5	3	45	1047	c = r2l
4	0	0	797	8	d = probe
5	2	1	69	6291	e = normal

**CONCLUSION**

Reduced model redundancy using feature selection algorithm without affecting performance. Reduced error due to variance by using classifier combinations thus increasing the performance of classification. Developed parallel Naive Bayes algorithm to speed up model generation.

**REFERENCES**

[1]. Norbik Bashah, Idris Bharanidharan Shanmugam, and Abdul Manan Ahmed, " Hybrid Intelligent Intrusion Detection System", World Academy of Science, Engineering and Technology 11, pp 23-26, 2005.

[2]. [http://en.wikipedia.org/wiki/Intrusion-detection\\_system](http://en.wikipedia.org/wiki/Intrusion-detection_system)

[3]. D.E.Denning, "An Intrusion Detection Model", IEEE Transactions on Software Engineering, SE-13, pp. 222-232, 1987.

[4]. [http://en.wikipedia.org/wiki/Intrusion\\_detection\\_system](http://en.wikipedia.org/wiki/Intrusion_detection_system)

[5]. Hao-ran deng, Yun-hong wang. An artificial-neural-network-based multiple classifiers intrusion detection system. International Conference on Wavelet Analysis and Pattern Recognition 2007, Beijing, China.

[6]. Mrutyunjaya Panda<sup>1</sup> and Manas Ranjan Patra<sup>2</sup>. Network Intrusion Detection Using Naive Bayes. IJCSNS International Journal of Computer Science and Network Security, VOL.7 No.12, December 2007. [http://paper.ijcsns.org/07\\_book/200712/20071238.pdf](http://paper.ijcsns.org/07_book/200712/20071238.pdf)

[7]. The KDD Archive. KDD99 cup dataset, 1999. <http://kdd.ics.uci.edu/databases/kddcup99/kddcup99.html>.

[8]. WEKA'S help section.

[9]. <http://www2.cs.cmu.edu/afs/cs/project/jair/pub/volume11/opitz99ahtml/node3.html> and [node4.html](http://www2.cs.cmu.edu/afs/cs/project/jair/pub/volume11/opitz99ahtml/node4.html).

[10]. [http://en.wikipedia.org/wiki/C4.5\\_algorithm](http://en.wikipedia.org/wiki/C4.5_algorithm).

[11]. Kenji Yamanishi, Jun ichi Takeuchi, Graham J. Williams, and Peter Milne. Online unsupervised outlier detection using finite mixtures with discounting learning algorithms. In Knowledge Discovery and Data Mining, pages 320-324, 2000. <http://portal.acm.org/citation.cfm?id=982727>

[12]. Mrutyunjaya Panda<sup>1</sup> and Manas Ranjan Patra<sup>2</sup>. Network Intrusion Detection Using Naive Bayes. IJCSNS International Journal of Computer Science and Network Security, VOL.7 No.12, December 2007. [http://paper.ijcsns.org/07\\_book/200712/20071238.pdf](http://paper.ijcsns.org/07_book/200712/20071238.pdf)

[13]. Daniela chiopu<sup>1</sup>, Irina Tudor<sup>1</sup>. Analyzing Information Security Issues Using Data Mining Techniques. The 3rd International

Conference on Virtual Learning, ICVL 2008. [http://www.cniiv.ro/2008/disc/icvl/documente/pdf/met/ICVL\\_models ndMethodologies\\_paper14.pdf](http://www.cniiv.ro/2008/disc/icvl/documente/pdf/met/ICVL_models ndMethodologies_paper14.pdf)

[14]. Cheng Zhong, Guo-Ling Chen, Jia-Hua He .Parallel computing for the longest common subsequences in NIDS , International Conference on Machine Learning and Cybernetics 2004 [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=1382234](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1382234)

[15]. Luca Foschini, Ashish V. Thapliyal, Lorenzo Cavallaro, A Parallel Architecture for Stateful, High-Speed Intrusion Detection. <http://www.springerlink.com/index/31043r2496566848.pdf>

# Improved Clustering Approach with Validation Measures

Khushboo Saxena  
A.P., TIT Bhopal

Gaurav Saxena  
A.P SSSIST Bhopal

Surendra Mishra  
A.P SSSIST Bhopal

Pankaj Kawadkar  
A.P. NIIST Bhopal

## Abstract

Fuzzy C means is a well-known and widely used partitional clustering method. One of the most popular clustering technique is K-means clustering but it suffers from two major shortcomings, right value of clusters (k) are initially unknown and effective selections of initial seed are also difficult. In this article an new idea is generated which overcomes initial seed problem and also the validation of cluster problem.

*Keywords-K-means, Initial seed, Validation, fuzzy clustering, Efficiency*

## I. INTRODUCTION

CLUSTER analysis provides insight into the data by dividing the objects into groups (clusters) of objects, such that objects in a cluster are more similar to each other than to objects in other clusters. Clustering is a common technique for statistical data analysis, which is used in many fields, including machine learning, data mining, pattern recognition, image analysis and bioinformatics. Many Clustering algorithms have been developed for finding useful patterns in datasets, in which Fuzzy C-means is the simplest and easiest to implement. Fuzzy C-means is the most celebrated and widely used clustering technique. Despite of its popularity for general clustering K-means suffers from three major shortcomings:[1] it scales poorly computationally, the number of clusters K has to be supplied by the user and the performance of K-means depends on the initial guess of partition. Many of the variants of K-means how to self generate the clusters without providing the number of clusters is not much explored at present, which is a major drawback of K-means clustering Algorithm.

This paper proposed a framework that eliminates the drawback of K-means clustering algorithm. Validation of clustering is also a challenging task [which improve the efficiency of clustering so this algorithm will also find the generated clusters are valid or not[3].

$$\mu_j(x_i) = \frac{1}{\sum_{i=1}^n \left[ \frac{d_{ji}^2}{\sum_{j=1}^p d_{ji}^2} \right]^{\frac{1}{m-1}}}$$

## II. PREVIOUS WORK

A lot of algorithms have been developed that suit specific domains. K-means clustering algorithm is a simple and fast approach to classify the data sets. Initially we have large number of seeds. After those samples are assigned to each cluster based on its distance from the seed (centroid).The centroid is computed for each set and the data points are reassigned. The algorithm runs until it converges or until desired number of cluster is obtained.

Several variations and improvements of original K-means algorithm have been done means algorithm of Macqueen is widely used for its simplicity; Forgy algorithm shows convergence to a local minimum. Here convergence depends on the initial clustering and no guarantee for optimal clustering. Fuzzy logic is based on human reason of approximation. Fuzzy logic is used in problems where the results can be approximate rather than exact. Hence, the principles of fuzzy logic suit well to clustering problems. Clustering problems measure some kind of closeness between similar objects. Fuzzy logic has been widely used in various fields to provide flexibility to classical algorithm. Fuzzy C-means is the earlier well known approach to classify the data using fuzzy. Fuzzy C-means clustering involves two processes: the calculation of cluster centers and the assignment of points to these centers using a form of Euclidian distance. This process is repeated until the cluster centers stabilize. The algorithm is similar to K-means clustering in many ways but incorporates

fuzzy set's concepts of partial membership and forms overlapping clusters to support it. It assigns membership value to the data items for the clusters within a range of 0 to 1[2]. The algorithm needs a fuzzification parameter m in the range [1, n] which determines the degree of fuzziness in the clusters. When m reaches the value of 1 the algorithm works like a crisp partitioning algorithm and for larger values of m the overlapping of clusters is tend to be more. The algorithm calculates the membership value  $\mu$  as:

Where  $\mu_j(x_i)$ : is the membership of xi in jth cluster

$d_{ji}$ : is the distance of xi in  $C_j$

p: is the number of specified cluster

m: fuzzification parameter

And new cluster centers are calculated with the fuzzy membership values as:

The main restriction is that the sum of membership values of a data point xi in all the clusters must be one and this tends to give high membership values for the outlier points, so the algorithm has difficulty in handling outlier points. Secondly, the membership of a data point in a cluster depends directly on its membership values in other cluster centers and this sometimes happens to produce unrealistic results[6].

In fuzzy C-means method a point will have partial membership in all the clusters. The third limitation of the algorithm is that due to the influence (partial membership) of all the data members, the cluster centers tend to move towards the center of all the data points. The fourth constraint of the algorithm is its inability to calculate the membership value if the distance of a data point is zero[7].

Fuzzy C-means algorithm is a most popular fuzzy clustering algorithm. Many approaches have been proposed to improve the performance of the algorithm.

1. C-means with Modified Distance Function: Frank Klawonn and Annette Keller have proposed a modified C-means algorithm with new distance function which is based on dot product instead of the conventional Euclidean distance. This method aims at identifying clusters with new shapes. With this modified C-means membership function, the fuzzy clustering algorithm can form clusters into their natural shapes.
2. Modified C-means for MRI Segmentation: Lei Jiang and Wenhui Yang presented a new approach for robust

segmentation of Magnetic Resonance images (MRI) that have been corrupted by intensity in homogeneities and noise. The algorithm is formulated by modifying the objective function of the standard fuzzy C means (FCM) method to compensate for intensity in homogeneities[9].

3. Adaptive Fuzzy Clustering The adaptive fuzzy clustering algorithm is a modified version of the C-means clustering and it is proposed by Krisnapuram and Keller[4]. The adaptive fuzzy clustering algorithm is efficient in handling data with outlier points. In comparison with C-means algorithm, it gives only very low membership for outlier points .Since the sum of distances of points in all the clusters involves in membership calculation, this method tends to produce very less membership values when the number of clusters and points increases and this is the main limitation of it[5].
4. In reformed fuzzy C-means a neighbourhood influence parameter  $\gamma$  at each pixel is calculated. The probabilistic constraint is removed by equating sum of membership function in a cluster to n.

$$\sum_{j=1}^c (u_{jk}) = n$$

Fuzzy K-means improves the basic K-means version with fuzzy. This method is divided into steps. In this method K-means is performed at the first step and fuzzy maximum likelihood is estimated at the second step. EM is an iterative algorithm that is used in problems where data is incomplete or missing. It is widely used in computer vision, speech processing and pattern recognition. The Expectation Maximization algorithm is the most frequently used technique for estimating class conditional probability density functions (PDF) in both univariate and multivariate cases. EM starts with an initial estimate for the missing variables and iterates to find the maximum likelihood (ML) for these variables. Maximum likelihood methods estimate the parameters by values that maximize the sample's probability for an event. EM algorithm is an iterative technique with four major steps. The first step is initializing the hidden variables. The second step estimates the unobserved variables with respect to known variables[8]. In the third step we compute the maximum likelihood for unobserved data and then finally check for the stop condition. The frequent references to log-likelihoods in connection with maximum likelihood estimation are a computational short-cut, rather than a theoretical necessity. This is because maximum likelihood estimates involve the multiplication of many small probabilities which, because of rounding errors, may get truncated to zero. Let  $X=(x_1, \dots, x_n)$  be a random vector and  $\{f_x(x) : \theta \in \Theta\}$  a statistical model parameterized by  $\theta = (\theta_1, \dots, \theta_k)$ , the parameter vector in the parameter space  $\Theta$ . The likelihood function is a map L:  $\Theta \rightarrow R$  given by

$L(x) = \prod_{i=1}^n f(x_i | \theta)$ . The likelihood function is a map L:  $\Theta \rightarrow R$  given by

$$L(x) = \prod_{i=1}^n f(x_i | \theta)$$

In other words, the likelihood function is functionally the same in form as a probability density function. However, the emphasis is changed from the x to the  $\theta$ . The pdf is a function of the x's while holding the parameters  $\theta$ 's constant; L is a function of the parameters  $\theta$ 's, while holding the x's constant. When there is no confusion,  $L(x)$  is abbreviated to be  $L(\theta)$ .

The parameter vector  $\hat{\theta}$  such that  $L(\hat{\theta}) \geq L(\theta)$  for all  $\theta$  is called a maximum likelihood estimate, or MLE, of  $\theta$ .

Many of the density functions are exponential in nature; it is therefore easier to compute the MLE of a likelihood function L by finding the maximum of the natural log of L, known as the log-likelihood function:

$$l(x) = \ln(L(x))$$

### III. RELATIONSHIP BETWEEN FUZZY CMEANS CLUSTERING AND VALIDATION

The aim of maximum likelihood estimation is to find the values for parameters that maximize the probability of obtaining a particular set of data. For example if the parameters of a probability distribution are known it is a relatively simple task to determine the probability of obtaining a sample with particular characteristics. It is common to have a sample values obtained from a population whose parameters are unknown. The sample could have come from many different probabilities

distributions: maximum likelihood methods find the parameters that maximize the probability of drawing that sample.

The frequent references to log-likelihoods in connection with maximum likelihood estimation are a computational short-cut rather than a theoretical necessity. This is because maximum likelihood estimates involve the multiplication of many small probabilities which because of rounding errors may get truncated to zero. If logarithms are used the multiplications become additions and the truncation problem is reduced.

Let  $X = (X_1, \dots, X_n)$  be a random vector and  $\{f_X(x) : \theta \in \Theta\}$  a statistical model parameterized by  $\theta = (\theta_1, \dots, \theta_k)$ , the parameter vector in the parameter space  $\Theta$ . The likelihood function is a map

L:  $\Theta \rightarrow R$  given by:

$$L(x) = \prod_{i=1}^n f(x_i | \theta)$$

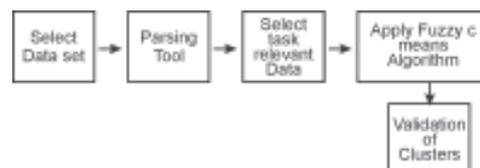
In other words, the likelihood function is functionally the same in form as a probability density function. However, the emphasis is changed from the x to the  $\theta$ . The pdf is a function of the x's while holding the parameters  $\theta$ 's constant, L is a function of the parameters  $\theta$ 's, while holding the x's constant[7].

When there is no confusion,  $L(x)$  is abbreviated to be  $L(\theta)$ . The parameter vector  $\hat{\theta}$  such that  $L(\hat{\theta}) \geq L(\theta)$  for all  $\theta$  is called a maximum likelihood estimate or MLE of  $\theta$ .

Many of the density functions are exponential in nature, it is therefore easier to compute the MLE of a likelihood function L by finding the maximum of the natural log of L, known as the log-likelihood function:

$l(x) = \ln(L(\theta, x))$  and minimizes the sum of square error after that find the generated clusters are valid or not using log likelihood function. After that test to efficiency and performance of this proposed algorithm apply on web log data[6].

### IV. PROPOSED ARCHITECTURE



Select data set: It is the process of retrieving data files. These access log files contain information in CERN (Common Log Format).

Parsing Tool and Select task relevant Data: K-mean algorithm work on only numerical data so mapping is performed on web pages. And assign every web page to unique numerical value. After that select useful data.

Apply Proposed Algorithm: After this proposed clustering algorithms are performed. This clustering algorithm is applied on Data set of the bases of feature vector and fuzzy parameter. Proposed algorithm is completed in two stages: in the first stage fuzzy parameter is generated from the feature vector and according to that fuzzy parameter, number of cluster and their centroid is generated in the second stage according to the clusters similarity they merge into a one cluster.

Validation of Clusters: cluster validation phase is performed which will find the number of generated clusters are valid or not.

### V. CONCLUSION AND FUTURE SCOPE

This paper overcomes the major drawbacks viz. right number of cluster and initial seed (center point) problem. Proposed efficient clustering algorithm is based on two specific factors, fuzzy parameter which initially selects the random value from the feature vector and decides the number of cluster. Second is, specific factor which merge the clusters according to the similarity.

The area of future research includes that finds the right number of attribute in any cluster. Fuzzy clustering algorithm have sum of membership of a data point in all the clusters must be equal to one and this tends to give high membership values for the outliers so, Another extension would be removed the probabilistic constraint by equating sum of membership function in a cluster to n.

### REFERENCES

- [1]. A Modified Fuzzy K-means Clustering using Expectation Maximization Sara Nasser, Rawan Alkhaldi, Gregory Vert Department of Computer Science and Engineering, 171, University of Nevada Reno, Reno NV 89557, USA.
- [2]. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber Intelligent Database Systems Research Lab, School of Computing Science Simon Fraser University, Canada.
- [3]. On Clustering Validation Techniques: MARIA HALKIDI,, YANNIS BATISTAKIS, MICHALIS VAZIRGIANNIS Department of Informatics, Athens University of Economics & Business, Patision 76, 10434, Athens, Greece (Hellas).
- [4]. An efficient algorithm to scale up k-medoid based algorithm for large databases, Maria camila N.Barioni,HumbertoL.Razente,Agma J.M. Traina, Caetano Traina Jr. Computer Sciene department-ICMC/USP, Caixa postal 668-13560-970-sao carlos-sp-Brazil.
- [5]. Lei Jiang and Wenhui Yang, "A Modified Fuzzy C-Means Algorithm.for Segmentation of Magnetic Resonance Images" Proc. VIIth Digital Image Computing: Techniques and Applications, pp. 225-231, 10-12 Dec. 2003, Sydney.
- [6]. Ji He,Man Lan, Chew-Lim Tan, Sam-Yuan Sung, Hwee-Boon Low, "Initialization of Cluster refinement algorithms: a review and comparative study", Proceeding of International Joint Conference on Neural Networks.Budapest, 2004.
- [7]. E. Forgy. Cluster analysis of multivariate data: efficiency vs. interpretability of classifications. In WNAR meetings, Univ of Calif Riverside, number 768, 1965.
- [8]. K-Means Clustering Versus Validation Measures: A Data-Distribution Perspective Hui Xiong, Senior Member, IEEE, Junjie Wu, and Jian Chen, Fellow, IEEE
- [9]. A Modified Fuzzy C-Means Algorithm for Natural Data Exploration: Binu Thomas, Raju G., and Sonam Wangmo



# Internal Quality Assessment Systems

**Dr. C. K. Buttan**

HOD-Deptt. Of Commerce & Mgmt.  
SAIFIA College, Bhopal  
drckbpeace@yahoo.com

**Atul Loomba**

Asstt. Prof., MBA  
RITS, Bhopal  
atulloomba121@yahoo.co.in

## Abstract

It is not surprising, at the dawn of the 21st century, that quality of education is becoming more important. Thus providing quality education is an important tool to remaining competitive in the education industry. Despite struggling with complex change in the world, some HEIs have taken proactive steps to provide the best for their diverse student population. Competitive pressures have forced HEIs to adopt quality education assurance system, which contribute low and mutual recognition of academic and professional qualification at the domestic and world level, as also employment and job security at the community level and for the community's competitive at the world level.

The model presented here describes systematic ways to plan and manage change. However the apparent simplicity of the model belies the complexities associated with the change process. Each HEI is different, which call for a different approach to change initiatives depending on the climate and culture. The diagnostic tools help to guide thinking, but are not substitute for the degree of strategic thinking, influencing, and problem solving required in each unique situation.

**Key words:** *Intelligence Quotient, Emotional Quotient, Organizational Diagnosis Elements,*

## 1) Introduction

The higher education system in India grew rapidly after independence.

Year	Universities	Colleges
1980	132	4738
2005	348	17625

The system of higher education in India a highly fragmented one that is far more difficult to manage than any other system of higher education in world. However, other than a handful few institutions of national important providing high quality higher education, the system is failing to produce wealth creators and creative, intellectual leaders who are much needed in all society. India's higher education sector has failed to map the future demand for various skills and it has not kept pace with industry's growth. Since higher education in India is an important part of modern Indian society and is intertwined in the political and social systems of the society, this sector is in need of change, development and improvement.

Country	Enrollment of Student
India	500-600
USA & Europe	3000-4000
China	8000-9000

Physiological side: '**Emotion**' is a complex state of human mind, involving bodily changes of widespread character such as breathing, pounding heart, flushed face, sweating palms, pulse rate, gland secretions, etc.

Psychological side, a state of excitement or perturbation marked by strong

feelings. The '**feelings**', are what one experiences as the result of having emotions.

Happiness, fear, anger, affection, shame, disgust, surprise, lust, sadness, elation, love, frustration, anxiety, failure, achievement etc.

**Anger:** fury, outrage, resentment, annoyance, hostility.

**Love:** acceptance, friendliness, trust, kindness, infatuation.

**Shame:** guilt, remorse, humiliation, regret.

**Fear:** anxiety, nervousness, apprehension, terror.

**Enjoyment:** happiness, joy, relief, contentment, pleasure.

**Sadness:** Grief, sorrow, cheerlessness, gloom.

**Surprise:** Shock, astonishment, amazement

## 2) Review of Literature

The literature of educational quality has development along a distinct path. The definition offered by Gordon and parting ton characterizes the general approach the educational quality as:" the success with which an institution provides educational environments that enable students effectively to achieve worthwhile learning goals, including appropriate academic standards".

The license Raj continues to flourish in higher education sector in India causing confusion and uncertainty in the regulatory environment. Conflicts between multiple regulatory authorities are the standard norms. Major weaknesses are perceived to be bureaucracy, lack of de-regulation or related policies, and lack of autonomy with respect to admissions, course curriculum, among others.

Prestigious institutions are not able to accommodate all aspirants when compared to International Universities.

Affordability is the major concern for private education. In addition, factors such as limited in take of students, quotas for various categories, restriction in attracting NRI / Foreign students, large and continuous up gradation of laboratories, equipments, infrastructure, lack of public transport etc, puts considerable pressure on the institutions.

This will attract large scale foreign investments into India and also to an extent reverse brain drain. However, the government will have to create a level playing field for all institutions and also ensure that other factors are considered. Their entry should also increase the capacity in Research areas and so on, rather than focus on undergraduate programs.

Imbalance in the expertise level within institutions at times results in Pay structure Variation especially when certain departments have to be rewarded more for research orientation and also due to environmental demands like preference for particular courses depending upon the IT boom and other related reasons.

Within institutions, most of the projects happen on individual basis at the department level rather than involving multi disciplinary aspects which improper the quality and quantity of the projects. While there is a lot institutions themselves can do to improve the quality of education imparted by them.

Emotional Intelligence is "the capacity for recognizing our own feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in our relationships. Emotional intelligence describes abilities distinct from, but complementary to, academic intelligence."

### **The Indian Perspective**

Emotional intelligence is the ability of an individual to appropriately and successfully respond to a vast variety of emotional inputs being elicited from inner self and immediate environment. Emotional intelligence constitutes three psychological dimensions such as emotional competency, emotional maturity and emotional sensitivity, which motivate an individual to recognize truthfully, interpret honestly and handle tactfully the dynamics of human behavior".

### **CHARACTERISTICS OF HIGH EI PERSON-**

A time to wait and a time to watch,

A time to be aggressive and a time to be passive,

A time to be together and a time to be alone,

A time to fight and a time to love,

A time to work and a time to play,

A time to cry and a time to laugh,

A time to confront and a time to withdraw,

A time to speak and a time to be silent,

A time to be patient and a time to decide.

### **Characteristics of a low EI Person**

"If only I had a different job ... .."

"If only I had finished graduation ... .."

"If only I had been handsome/beautiful ..."

"If only my spouse had stopped drinking ..."

"If only I had been born rich and famous..."

"If only I had good contacts..."

"If only I had better friends ..."

"If only I had married someone else ..."

### **TWO VIEW POINTS ABOUT EI**

**Traditionalists say that emotions:** Distract us increase our Vulnerability  
Cloud our judgment Inhibit free flow of data must be controlled Distract us increase our Vulnerability  
Cloud our judgment Inhibit free flow of data Must be controlled

**High performers say that emotions:** Motivate us increase our

Confidence Speed our analysis build trust provide vital feedback Must be managed

### **SOME MYTHS/FACTS ABOUT EI**

Being EI does not mean a weak, submissive or defensive personality. Being highly EI does not mean being extra nice, polite or sugar coating your language. The females are not superior to males in expressing / experiences emotions as most of us tend to believe incorrectly. In fact, the research shows that males are equally emotional when compared to

females. There is no direct evidence to prove that EQ is dependent upon heredity. However, the environment does seem to influence the EQ.

Advocating EQ does not mean that we are promoting low scorers or average IQ people. Having average EQ is not bad or undesirable

Having high EQ is always welcome. We are not negating the IQ. In fact a combination of high EQ and high IQ would be a most ideal personality. It would be a win situation.

You can develop your EQ by upgrading your emotional skills. The popular thinking that EQ is entirely inherited is incorrect. Emotional Intelligence is not fixed at birth. There is no emotional intelligence genes as such that we know of today. It is something one has learned.

You can upgrade your emotional skills at any stage of your life. In fact, age and maturity are positively correlated with the EI. Same is not true about IQ which is more or less static.

Though some critics may argue that emotional traits can not be measured accurately the psychologists have shown that EI can be measured by using standardized scientific tools.

### **3) Objective**

- 4) Process consultation with individuals and groups, team building, and inter-group workshops to build trust and openness among participants, increase interpersonal competence, manage conflict more constructively and facilitate problem- solving.
- 5) Action research programs to diagnose organizational or group problems, identify possible solutions, implement changes, and evaluate the outcome.
- 6) Goal setting and planning activities to focus on issues, identify demands from the organization's environment, clarify organizational directions, and increase member commitment to improved organizational effectiveness.
- 7) Continuous diagnosis is necessary in any planned change effort. Diagnostic activities are those designed to provide an accurate account to things as they really are. The diagnosis identifies strength, opportunities and problem areas.
- 8) Emotional Competency
- 9) Emotional Maturity
- 10) Emotional Sensitivity

### **11) Hypothesis**

1. Assess the potential for action.
2. Get the "whole system" in the room.
3. Focus on the future.
4. Structure tasks that people can do for themselves.

### **I. EMOTIONAL COMPETENCY**

Tackling Emotional Upsets

High Self-esteem

Handling Egoism

Handling Inferiority Complex

### **II. EMOTIONAL MATURITY**

Self-Awareness  
 Developing Others  
 Delaying Gratification  
 Adaptability and Flexibility

**III. EMOTIONAL SENSITIVITY**

Understanding Threshold of  
 Emotional Arousal  
 Empathy  
 Improving Inter-personal Relations  
 Communicability of Emotions

**5) Research Methodology**

Some 25 years ago came the birth of another discipline, called organizational development, the goal of which was to focus on the gap that exists between where a group or organization is and where they would like to be. This paper tries to address the role that organization development can play as an approach for sustainable excellence in higher educational institutions. The first section of the paper addresses the status of higher education in India, exploring the challenges faced by higher education institutions, and suggestions that can improve the quality of higher education. The second section suggests the use of Six box model as a diagnostic tool for an educational institution. It illustrates how planned and focused organization development interventions can help in understanding of the system and guide the change process in today's unsettled higher education environment.

The Empirical Research

Benefits of EI-in higher education

CLUSTER I: EXTREMELY HIGH

Artist, Insurance, Advertisement, Social Work

CLUSTER II: HIGH

Teaching, Legal, Tourism, Politics, Business/ Entrepreneurship, Police

CLUSTER III: AVERAGE

Judiciary, Administration, Information Technology, Medicine, Banking, Engineering, Accountancy, Nursing etc.

**6) Result and Discussion**

Organizational Development (OD) is defined as a long range effort to improve an organization's ability to cope with change and to improve its problem-solving and renewal processes through effective management of organization culture. It is an approach to effective planned change that is used in the private sector and more recently; in public, nonprofit and independent (volunteer) organizations.

Description of OD Activities and Concepts

1. Diagnostic Activities
2. Team Building Activities
3. Inter Group Activities
4. Survey Feed Back Activities
5. Education Training Activities
6. Structural Activities
7. Process Consultation
8. Caching And Counseling Activities

**Organizational Diagnosis Elements**

Elements	Formal systems	Informal Systems
Purposes	Goal Clarity vision mission statements	Goal Agreement
Structure	Functional organizational Chart	How work is actually done or not done?
Relationships	Who should cooperate with whom? & what? Which technologies should be used for coordination?	How effective is coordination? Quality of relationships conflict management techniques
Rewards	Formal Reward System	Informal Reward System
Helpful Mechanisms	Policy manuals, Badger system, management information system, planning and control system.	What system actually used for and are they subverted?
Leadership	What and how do top people manage? What systems are in use?	What are actual norms and behaviors of the management system? What is the leadership style and is appropriate for the maturity level of faculty?

9. Life Career Planning Activities

10. Open Systems Planning

**Suggestions**

I. Redesign regulatory and accreditation environment to ensure efficient functioning of private sector with high quality.

- a) Evolve appropriate pedagogy & curriculum to absorb the emerging trends in the Higher Education and leverage online learning and to create virtual university.
- a. Ensure that Industry and User Agencies open their facilities for training and research to Higher Education.
- b. Encourage Independent Agencies like FICCI\*, CII\*\* to promote strategy of self regulation for private sector and to ensure disseminations of accurate information to society.
- c. Encourage tax incentives in creating capacities in research across the country and encourage industry with similar benefits to collaborate with institutions.
- d. Upgrade technical institutions to university level.
- e. Encourage institutions to have centre of relevance in Excellence in Key areas of technology.
- f. Promote healthy organization climate and culture within the educational institutions which in turn favours quality education and encourages sustainable excellence.

\* FICCI - Federation of Indian Chamber of Commerce and Industries.

\*\* CII - Confederation of Indian Industries.

**APPLYING EI IN ORGANISATIONS**

**Customer Service:** Learning how to help your customers feel heard, understood, helped, served, respected, valued and important.

**Hiring:** Selecting employees with relatively high Emotional Intelligence, i.e. emotionally sensitive, aware, optimistic, resilient, positive and responsible.

**Turnover:** Enabling turnover reduction through helping employees feel appreciated, recognized, supported, challenged, rewarded and respected.

**Training:** Raising EQ at all levels of the business through Emotional Literacy and EQ awareness workshops.

**Corporate Culture:** Creating an environment where employees feel safe, trusted, special, needed, included, important, cooperative, focused, productive, motivated, respected and valued.

**Productivity:** Developing intrinsic motivation. Increasing employee commitment, cooperation and cohesion. Reducing lost time spent on conflicts, turf-battles, defensiveness and insecurity.

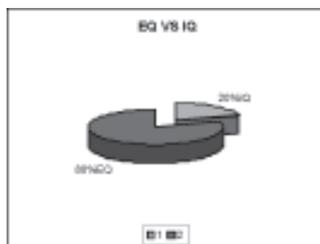
**Goal Setting:** Setting goals based on feelings. For example, stating the goal that we want customers to feel satisfied, appreciated, etc. and setting similar goals for employees, and then getting feedback on feelings and measuring and tracking performance.

**Emotional Support:** Mitigating negative emotions like fear, worry, anxiety, and stress.

**Leadership:** A leader with high EQ is emotionally aware. This means that he or she is aware of his own feelings and is not limited to logic, intellect and reasons when making decisions and managing people.

**Intelligence Quotient (IQ) v/s Emotional Quotient (EQ)**

The research shows that IQ can help you to be successful to the extent of 20 percent only in life. The rest of 80 percent success depends on your EQ



**Benefits of EI-----In higher education**

- After EQ training, discipline referrals to the principals dropped by 95%.
- Social and emotional skills create higher achievement.
- Increased social and emotional skills reduce discipline problems.
- After 30 social-emotional lessons, hostility decreased and pro-social behavior increased.
- EQ training increases focus, learning, collaboration, improves classroom relationships, and decreases both negative feelings and violence.
- People who have poor abilities at reading body language are less academically successful.

- Children with highly developed social skills perform better academically than peers who lack these skills.
- Students who are anxious or depressed earn lower grades/lower achievement scores, and are more likely to repeat a grade.
- Low levels of empathy are associated with poor school achievement.
- Students who believe their teachers support and care about them are more engaged with their work; they value their work more, and have higher academic goals.
- Children who are able to delay gratification are more popular, earn better grades.
- Teachers can help students lessen their frustrations, prevent behavioral problems, and accelerate learning by providing students with information and skills to make appropriate choices.

**7) CONCLUSION:**

As today's leader take their organizations through uncharted waters again and again, they have recognized the need for a clear strategy for managing both the change itself, and the human side of change, which is referred to as transition. Often, phrases such as 'change is inevitable', 'change is constant', and 'the only thing contain is change itself' are commonly heard when commiserating about the pace of modern life". Organizational issues in educational settings are equally complex, so it is essential that the elements for sound decision making are present, a sound change management strategy, an appropriate change model, and an environment that invites debate and challenge.

Using a holistic OD diagnostic tool like the six box model, a consultant (internal or external) can make a better diagnosis that will help HEIs in their planning and decision making. It helps to direct organizational change by identifying.

- The strengths, weaknesses, opportunities and threats (SWOT) of the institution as a whole.
- The future needs of the institution.
- The gap between the two and the required action plan.
- The culture of the institution (current and required).
- The strength and weaknesses in the current competencies of the key staff in the institution.
- The future competencies needed by the HEI, and the gap between the two.

The model presented here describes systematic ways to plan and manage change. However the apparent simplicity of the model belies the complexities associated with the change process. Each HEI is different, which call for a different approach to change initiatives depending on the climate and culture. The diagnostic tools help to guide thinking, but are not substitute for the degree of strategic thinking, influencing, and problem solving required in each unique situation.

It is not surprising, at the dawn of the 21st century, that quality of education is becoming more important. Thus providing quality education is an important tool to remaining competitive in the education industry. Despite struggling with complex change in the world, some HEIs have taken proactive steps to provide the best for their diverse student

population. Competitive pressures have forced HEIs to adopt quality education assurance system, which contribute low and mutual recognition of academic and professional qualification at the domestic and world level, as also employment and job security at the community level and for the community's competitive at the world level.

Indian who deals with variety of Emotions in their daily lives seems to zipper up their motive side as sooner they enter their work place. This is prompted by the mistaken notion work is serious business and display of emotion ought to be regarded with extreme suspicion.

Emotional Quotient (EQ) is the most important determinant of the extent of professional and personal success in life. It is interesting to note that so many people with high IQ fail whereas those with less intellectual endowment are extremely successful. Even in certain renowned establishments where people are trained to be smart, the most valued and productive managers are those who have a high emotional intelligence level, and not necessarily those with the highest IQ.

While doing internal quality assessment of HEI and their contribution, we must analyze the present standard of abridgement - between IQ and EQ. EQ is used interchangeably with emotional intelligence that "knows what feels good". EQ or IQ include qualities such as self awareness, ability to manage moods, motivation, empathy and social skills like Cooperation and Leadership which again a need - for HEI "staidly standard".

Applying EI makes you feel comfortable within your own skin and with people around you. You can also understand what makes you incompatible with certain people or jobs and learn ways to deal with the emotional difficulties ease. You can also understand the specific feelings that cause you stress and learn ways to become more at peace.

### References

- [1] Beer, M., Eisentar, R.A., & Spector, B(1990), why change programs don't produce change.
- [2] Altbach, P.G., The dilemma of change in Indian higher education.
- [3] Clark J.V. and Krone, C.G. "Towards an Overview of organizational Development in the Early Seventies,"
- [4] Harrison, R. Choosing the depth of organizational interventions.



# Localization in WSN

**Jitendra Saxena**

CSE, MANIT, Bhopal  
Jsaxena2007@rediffmail.com

**Swati Dongre**

CSE, RIRT, Bhopal  
dswati31@gmail.com

**Chetan Agrawal**

CSE, RITS, Bhopal  
chetan.agrawal12@gmail.com

## Abstract

Wireless sensor networks found their way into a broad variety of applications including industrial automation, medical applications, highway monitoring, habitat monitoring, military applications, environmental applications, and at the bottom commercial applications like personal health diagnosis, automated grocery checkout, remote controlled heating and lighting, etc. Except commercial applications most of them require thousands of nodes deployed for sensing and controlling. Recent advances in internet, communications, information technologies, and sensor design made these applications possible and the design of cheap low power nodes using MEMS help envision all Potential applications. All these applications require knowing the locations of nodes, thus demanding a Localization algorithm that is less complex in terms of computations, communication overhead and increasing the overall lifetime of the network with low life-cycle costs. In this paper we give details of a simple mathematical technique, classical multidimensional scaling and how it solves the localization problem. It is simple for it does not have iterations or loops. This so called MDS-MAP algorithm is able to find the relative positions of nodes and with few anchor nodes available derives or maps the relative coordinates to absolute coordinates. When using a complex localization algorithm highly sophisticated nodes must be deployed and this increases the overall cost of deployment of the network.

**Keywords:** *Wireless sensor networks localization, localization algorithm, and localization technique*

## 1. INTRODUCTION

A Wireless Sensor Network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, vibration, pressure, sound, motion or pollution. Wireless sensor networks are densely deployed in sensing fields. They have very limited communication range and sensing range. Sensor node has very limited battery

power and they are prone to failure. Wireless sensor nodes can be deployed in such a location where human being is impossible to reach physically. So, if a sensor node loses its battery power it becomes useless, hence the topology of wireless sensor networks changes frequently. Sensor nodes have very limited processing power and memory. Wireless sensor networks are randomly deployed. The sensor nodes can be thrown in the sensing field. Basic features of sensor networks are:

- Self-organizing capabilities
- Short-range broadcast communication and multi hop routing
- Dense deployment and cooperative effort of sensor nodes
- Frequently changing topology due to fading and node failures
- Limitations in energy, transmit power, memory, and computing power from the airplane

### 1.1 CHARACTERISTICS OF WIRELESS SENSOR NETWORK

THE UNIQUE AND IMPORTANT CHARACTERISTICS OF WSN INCLUDES:

- ABILITY TO WITHSTAND HARSH ENVIRONMENTAL CONDITIONS MOBILITY OF NODES
- DYNAMIC NETWORK TOPOLOGY
- HETEROGENEITY OF NODES
- LARGE SCALE OF DEPLOYMENT

### 1.2 ISSUES IN WIRELESS SENSOR NETWORK

THE DIFFERENT TYPES OF CONSTRAINTS IN WSN ARE:

- LIMITED POWER THEY CAN HARVEST OR STORE
- LIMITED AMOUNT OF COMPUTATIONAL AND MEMORY RESOURCES
- LESS AMOUNT OF NETWORK BANDWIDTH

## 2. WHAT IS LOCALIZATION

The process of finding location of the nodes is called localization. In this process we try to find out the approximate location of the sensor node with high accuracy. The process of localization collects information about the longitude, latitude and altitude of the sensor node. Localization can be classified in two ways:

- a. Local/Relative
- b. Global/Absolute

### 2.1 Why localization

If we get some information from the sensor network and we don't know the location from where information is being generated, this information is useless. If we got information from the sensor network that there is fire, the next question will be "where". If we know the location information we can make arrangements in time at that particular location within time. Most of routing protocols use flooding technique for routing of packets. If we know the location of each and every sensor node, a selective forwarding can be used to route packets. Selective forwarding reduces the network load and increases the network lifetime by saving power of individual node. Sensor data must be registered to its physical location to permit deployment of energy-efficient routing schemes, source localization algorithms, and distributed compression techniques.

### 2.2 Problems in wireless sensor localization

GPS receiver is used for localization. But, the sensor network is very dense in nodes and using GPS receiver is not economically good. So GPS receiver cannot be fitted in each and every sensor node because it increased the cost of sensor network and also it increases size of nodes. GPS receiver based techniques cannot be used for indoor localization. GPS receiver techniques require satellite communication, so it needs more battery power. So finally GPS receiver based techniques are not suitable for sensor networks economically.

### 3. localization algorithm

Sensor network needs an independent localization algorithm because it is not possible to provide location information at the time of deployment. Some sensor network When a sensor node moves from one point to another point it needs localization. Sensors are deployed randomly in the sensing field. Location prediction of individual node is not possible at the time of deployment. New sensor nodes are also added to already deployed sensor network. So newly deployed sensor nodes need localization. Sensor nodes are usually node designed specifically to do localization. So sensor network needs individual localization algorithm. networks have moving sensors, their location changes with respect to time.

#### Distance measurements in localization

Different distance measurement techniques are used in localization. Accuracy of every localization algorithm depends on the accuracy in distance measurements. To localize a sensor node in k dimension plane we require distance from k+1 already localized nodes. These are the basic measurement techniques

- a. RSS( Received Signal Strength)
- b. TOA(Time of Arrival)
- c. AOA(Angle of Arrival)

#### RSS (Received Signal Strength)

Distance measurements in wireless network can be done using RSS technique. There is a relation between transmission power and received power. There is a power loss in the environment in wireless network. The actual power transmitted cannot reach to the receiver due to fading and other environment factors. If the transmitted power at a unit distance  $d_0$  is  $P_0$  then received power  $P_r$  at a distance  $d$  is given by  $P_r = P_0 (d/d_0)^{-n}$ . This formula says that received power is always promotional to distance raise to power  $n$ , where  $n$  is path loss exponent. So, at the time of transmission transmitter know the transmitted power and receiver measures the received power. After calculating transmitted power and received power we can calculate the actual distance. The distance measurement techniques rely of large scale fading. RSS is a basic measurement technique. RSS cannot give accurate result there is always error because of environment

conditions change. The accuracy of distance measurement using RSS is also depends on the accuracy of the receiver. There is always error due to multipath fading, scattering, shadowing etc.

#### TOA (Time of Arrival)

TOA is another technique for distance measurement in wireless environment. It requires to calculate time elapsed in transmission of signal and signal receive. Lets transmitter transmits signal at time  $T_1$  and  $T_2$  is the time when receiver receives signal. So time taken by signal to travel distance between transmitter and receiver is  $\Delta T = T_2 - T_1$ . Lets speed of the signal is  $S$  and the distance is  $D$ , then  $D = \Delta T * S$ . Such type of techniques need clock synchronization of transmitter and receiver. The accuracy of this technique also depends on the time measuring precision. TOA technique can be accomplished using two different signals like wireless signal and ultrasound waves. These two signals have different propagation speed. Both the signals are transmitted. The time difference of arrival is used to calculate the distance between sensor node and base station.

#### AOA (Angle of arrival)

In the localization process angle of arrival is also used. Angle of arrival is used in the contribution of RSS. If there is a base station from which a sensor node is receiving signal, distance is calculated using RSS and if we can calculate the angle of the line joining the sensor node and base station and a reference line we can calculate location of sensor node. Angle of arrival is a technique to determine the direction of signal incident on a antenna array. AOA use time difference of arrival (TDOA) for measuring direction of signal. Phase difference of different signals incident on different element of antenna array is used to calculate direction. It is just like reverse beam forming.

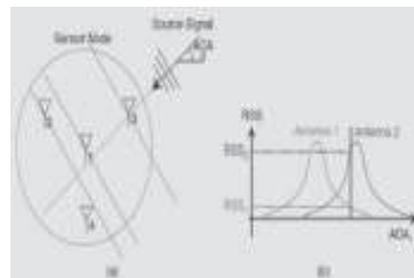


Fig:-1 Angle of arrival

Lets the angle of the line with reference line is  $\theta$  and the distance between sensor node and base station is  $d$  having location  $(x, y)$  then, Location of the sensor node is calculated as follows,

$$X' = d \cos \theta$$

And

$$Y' = d \sin \theta$$

Angle of arrival can be calculated using directional antenna.

A rotating directional antenna can be used for localization. The rotation directional antenna rotates at a constant speed. Every sensor node receive signal from the directional antenna. Different sensor nodes at different location receives signal at different time. This time difference is used to decide angle. Directional antenna array can be used to cover whole area. If the beam width of directional antenna is  $\Delta \theta$ , there is  $360/\Delta \theta$  directional antenna needed to cover whole area.

#### Techniques for localization

There are different localization techniques available. Different localization algorithm uses different measurement techniques. The accuracy and scalability is based on the measurement techniques used. The basic techniques used for localization are:

- a. Triangulation
- b. Scene analysis
- c. Proximity

### Triangulation

In the triangulation method the location of an object is calculated using triangle geometry. To localize an object we need to know the distance from three already localized objects. Let's the distance from there already known objects is  $d_1$ ,  $d_2$ , and  $d_3$ . The location of these objects is  $(x_1, y_1)$ ,  $(x_2, y_2)$  and  $(x_3, y_3)$ .

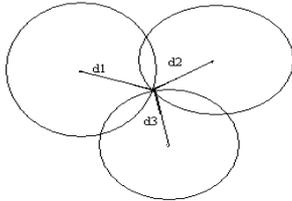


Fig 2 Triangulation

Let the location of the sensor node is  $(x, y)$ . There we will get three equations.

$$d_1 = \{(x_1 - x)^2 + (y_1 - y)^2\}^{1/2}$$

$$d_2 = \{(x_2 - x)^2 + (y_2 - y)^2\}^{1/2}$$

$$d_3 = \{(x_3 - x)^2 + (y_3 - y)^2\}^{1/2}$$

Calculating these three equations we can get the location of the node  $(x, y)$ .

### Scene analysis

In this technique the surrounding environment is observed to infer the location of the object. The changes in the surrounding environment are compared with the already available database and location is determined. There are two types of scene analysis technique

- a) Static scene analysis: observations are matched with the already available database to calculate location.
- b) Differential scene analysis: Two different scenes are analysed and the difference is used to calculate location.

### Proximity

This technique is used for localization when object is near to a known object. The observed changes at this location like pressure temperature etc. are used for localization.

### References

- [1] Bachrach.J and Taylor.C (2005), "Handbook of Sensor Networks", chapter Localization in Sensor Networks.Wiley.
- [2] I. Akyildiz, W. Su, Y. Sankara subramaniam, and E. Cayirci, "A survey on sensor networks," IEEE Communication Magazine, vol. 40, pp. 102-116, Aug. 2002.
- [3] Azzedine Boukerch, Horacio A.B.F., Edurado F.Nakamura, Antonio A.F.Loureiro (2007), "Localization systems for Wireless Sensor etworks", University of Ottawa, IEEE wireless communications.

- [4] Florian Wickelmaier, "An Introduction to MDS", Sound quality research unit, Aalborg University, Denmark, May 2003.
- [5] I. Borg and P. Groenen, Modern multidimensional scaling theory and applications, Springer, 1997.
- [6] A. Savarese, Robust positioning algorithms for distributed ad hoc wireless sensor networks, Master's Thesis, 2002.
- [7] L. Doherty, K. S. J. Pister and L. El Ghaoui, "Convex position estimation in wireless sensor networks," IEEE INFOCOM, vol. 3, pp. 1655-1663, April 2001.



# Recommendation System Using Item Based and User Based Collaboration Filtering

**Niket Bhargava**

Asst. Prof. Dept. of CSE  
BIST, Bhopal  
9826948781

**Smrity Gupta**

Dept. of CSE  
BIST, Bhopal

## Abstract

Recommender systems attempt to highlight items that a target user is likely to find interesting. Recommender systems apply knowledge discovery techniques to the problem of making personalized recommendations for information, products or services during a live interaction. Collaborative Filtering, the most successful recommender system technology to date, helps people make choices based on the opinions of other people. Existing collaborative filtering methods, mainly user-based and item-based methods, predict new ratings by aggregating rating information from either similar users or items. Collaborative Filtering (CF) allows the preferences of multiple users to be pooled to make recommendations regarding unseen products. We consider in this paper the problem of online and interactive CF: given the current ratings associated with a user, what queries (new ratings) would most improve the quality of the recommendations made? Recommender systems apply data analysis techniques to the problem of helping users find the items they would like to purchase at E-Commerce sites by producing a predicted likeliness score or a list of top-N recommended items for a given user. We apply Clustering algorithms for finding nearest similar item. To finding nearest item for this we use C++ language. We apply improved K-mean algorithms method on preprocessed data. Finally we proposed a method that can increase accuracy as respect to user based system.

**Keywords:** *Recommender Systems, Collaborative Filtering Recommendation algorithm, K-mean algorithm.*

## INTRODUCTION

Collaborative filtering aims at predicting the user interest Collaborative filtering aims at predicting the user interest for a given item based on a collection of user profiles. Research started with memory-based approaches to collaborative filtering, that can be divided in user-based approaches and item-based approaches[1]. Given an unknown test rating (of a test item by a test user) to be estimated, memory-based collaborative filtering first measures similarities between test user and other users (user-based), or, between test item and other items (itembased). The final rating is estimated by fusing predictions from three sources: predictions based on ratings of the same item by other users, predictions based on different item ratings made by the same user, and, third, ratings predicted based on data from other but similar users rating other but similar items. Existing user-based and item-based approaches correspond to the two simple cases of our framework. The complete model is however more robust to data sparsity, because the different types of ratings are used in concert, while additional ratings from similar users towards similar items are employed as a background model to smooth the predictions. Experiments demonstrate that the proposed methods are indeed more robust at the same time providing better quality than the best available user-based algorithms. Collaborative Filtering (CF) has attracted considerable attention over the past decade due to the ease of online data accumulation and the pressing need in many applications to make suggestions or recommendations to users about items, services or information. When ever other users have viewed a product of interest and offered ratings of that product, then the existing ratings can be used to predict the rating of a subject for them who have not seen the product. Specifically, if users

with similar "interests" to the subject (as determined using ratings by the subject on other products) have rated the product in a particular way (e.g., positively), one might predict that the subject would rate the product in the same way (e.g., recommend the product). In this way, CF allows the preferences of multiple users to be pooled in a principled way in order to make recommendations.

## Related Work:

In this section it is briefly explained the work related to the work;

## Collaboration Filtering:

Collaborative Filtering systems can produce personal recommendations by computing the similarity[2] between your preference and the one of other people .One of the most promising such technologies is collaborative filtering [Shardanand et al., 1995]. Collaborative Filtering works by building a database of preferences for items by users. A new user, Neo, is matched against the database to discover neighbors, which are other users who have historically had similar taste to Neo. Items that the neighbors like are then recommended to Neo, as he will probably also like them. Collaborative Filtering has been very successful in both research and practice, and in both information filtering applications and E-commerce applications[3]. However, there remain. Important research questions in overcoming two fundamental challenges for Collaborative Filtering recommender systems.

The first challenge is to improve the scalability of the Collaborative Filtering algorithms. These algorithms are able to search tens of thousands of potential neighbors in real-time, but the demands of modern systems are to search tens of millions of potential neighbors. Further, existing algorithms have performance problems with individual users for whom the site has large amounts of information. For instance, if a site is using browsing patterns as indications of content preference, it may have thousands of data points for its most frequent visitors. These "long user rows" slow down the number of neighbors that can be searched per second, further reducing scalability[5].The second challenge is to improve the quality of the recommendations for the users. Users need recommendations they can trust to help them find items they will like. Users will "vote with their feet" by refusing to use recommender systems that are not consistently accurate for them. In some ways these two challenges are in conflict, since the less time an algorithm spends searching for neighbors, the more scalable it will be, and the worse its quality. For this reason, it is important to treat the two challenges simultaneously so the solutions discovered are both useful and practical. In this paper we address these issues of recommender systems by applying different approach Item-Based algorithms. The bottleneck in conventional Collaborative Filtering algorithms is the search for neighbors among a large .user population of potential neighbors [Herlocker et al., 1999][6]. Item-based algorithms avoid this bottleneck by exploring relationships between items first, rather than the relationships between users. Recommendations for users are computed by finding items that are similar to other items the user has liked. Because the relationships between items are relatively static, item-based algorithms may be able to provide the same quality as the user-based algorithms with less online computation. Collaborative-Filtering-enabled Web sites that recommend books, CDs,

movies, and so on, have become very popular on the Internet. Such sites recommend items to a user on the basis of the opinions of other users with similar taste. objects that are being clustered. These points represent initial group centroids. Assign each object to the group that has the closest centroids. When all objects have been assigned, recalculate the positions of the K centroids. Repeat Steps 2 and 3 until the centroids no longer move[4]. This produces a separation of the objects into groups from

**Proposed Algorithm: Start: Clustering algo** (Iteration, Counting, Destination, Center, and Check\_result).

**Step1:** Initialize: Iteration=0;Counter=0;a by Two dimension Array; Center of the object, new center of the new object; Final Center of the resultant Object;

**Step2:** X position and Y position is defined;

**Step3:** Initialize Graphics Mode.

**Step4:** Now insert Threshold Value and insert no of objects

**Step5:** loop1: until value not equal to 0;

Draw the Circle according to the Object value: show the cluster;

**Step6:** loop2 If Circle is <=3 then don't Change the iteration;

**Step 7:** loop3 An Iteration =3|| iteration=2; Else if circle>=3 Then iteration++; Or Iteration=iteration+1;

)\*(a [loop][1]-center).Compute the square root of x and Y result; End loop.

**Step8:** Rescanning the object and results Loop1: Compare the threshold value with Cluster destination Increment the Cluster Loop2: Set the Cluster position: Now again Calculate X and Y direction Values Go to Step 5[7].

**Step9:** Again compute the square root of x and Y result If Square Root<threshold value the Max value=new Square root Circle radius =Max value; Print: all Clusters:

**Step10:**Merge the object with all cluster Loop1 start Initialize value1[8].Loop2 start Initialize value 2; Calculate X and Y direction Value Go to step5; New Square root of x and y Value New center=new square root;

**Step11:**If object<previous result Cluster<previous Cluster Then PRINT New result PRINT destination Matrix PRINT evolution Matrix; PRINT new comparing Result and final clusters Again PRINT "Iteration and Final Comparing Values (Errors).

**Result Analysis and Comparison**

In this it is proposed a prediction which shows that improved clustering algorithm shows better result than other basic approaches.

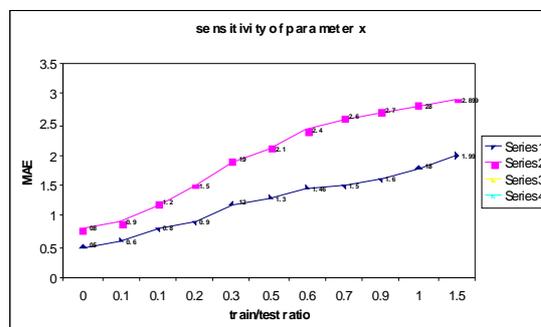
**Experimental Setup:**

We experimented with the MovieLens1, EachMovie2, and ook-crossing3 data sets. While we report only the Movie Lens results (out of space considerations), the model behaves consistently across the three data sets[9]. The Movie Lens data set contains 100,000 ratings (1-5 scales) from 943 users on 1682 movies (items), where each user has rated at least 20 items. To test on different number of training users, we selected the users in the data set at random into a training user set (100, 200, 300, training users, respectively) and the remaining users into a test user set.

**Table 1.1: Expected Values**

Neighborhood	MAE	MAE
0	0.5	0.8
0.1	0.6	0.9
0.1	0.8	1.2
0.2	0.9	1.5
0.3	1.0	1.9
0.5	2.0	2.1
0.6	2.5	2.4
0.8	2.9	2.6

**Comparison graph 1.2: Sensitivity of parameter x versus mean absolute**



**Series 1:** shows improved clustering line chart.

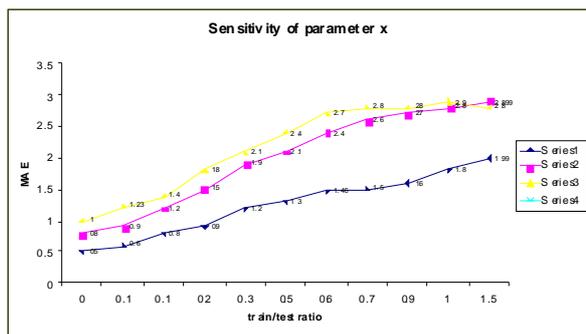
**Series 2:** shows previous clustering line chart

Two conclusions have been drawn from the result. First proposed item based algorithm provide better quality than previous one. Second the old clustering based algorithm perform better with very sparse data set, but as more data are added than the quality goes down[10].

**Table.1.2 Proposed Algorithms**

Neighborhood	MAE	MAE	MAE
0	0.8	1	0.5
0.1	0.9	1.23	0.6
0.1	1.2	1.4	0.8
0.2	1.5	1.8	0.9
0.3	1.9	2.1	1.0
0.5	2.1	2.4	2.0
0.6	2.4	2.7	2.5
0.8	2.6	2.8	2.9

Comparison graph 13: Sensitivity of mean absolute error versus parameter



Series1: shows improved clustering line Chart.

Series 2: shows previous clustering line

Series 3: shows user based line chart

In this section we present our experimental results of applying item-based collaborative filtering techniques for generating predictions. Our results are mainly divided into two parts-quality results and performance results[11]. In assessing the quality of recommendations, we first determined the sensitivity of some parameters before running the main experiment.

**Performance Results**

Having clearly established the superior quality of item-based algorithms over the user-based ones, we focus on the scalability challenges item-based similarity is more static and allows us to pre compute the nearest items. These methods although save the time require an  $O(n^2)$  space for  $n$  times[12].

**Conclusion**

In this work it is proposed that an active approach to CF, based on a probabilistic model of user preference data. The framework is quite general, considering the value of queries that could most improve the quality of the recommendations made, based on the model's redictions. It is shown that offline pre-computation of bounds on value of information, and of prototypes in query space, can be used to dramatically reduce the required online computation. Also have derived detailed bounds for a particular model, and empirically demonstrated the value of the active approach using this model. In each iteration algorithm generated the clusters and tested the accuracy of the Clusters. This improved algorithm showed how much error is reduced, by previous one. This is the benefit of the my algorithms which showed error and calculated it. After calculating again testing Filtering process started. This result was computed on Few Data which were predefined in the form of array. The result can vary if changed the data from the Database.

**REFERENCES:**

[1]. J. D. M. Rennie and N. Srebro. Fast maximum margin matrix factorization for collaborative prediction. In Proc. of ICML, 2005.  
 [2]. Herlocker, J., Konstan, J.A., Terveen, L., Riedl, J., 2004. Evaluating collaborative filtering recommender systems. ACM Transactions on Information Systems (TOIS) 22 (1).

[3]. Craig Boutilier. A POMDP formulation of referenceelicitation problems. In Proceedings of the EighteenthNational Conference on Artificial Intelligence, pages 239-246, Edmonton, 2002.  
 [4]. AMENTO, B., TERVEEN, L., HILL, W., HIX, D.,and SCHULMAN, R. 2003. Experiments in Social Data Mining. To appear in ACM Transactions on Information Systems.  
 [5]. Huang, Z., Chen, H., Zeng, D., 2004. Applying associative retrieval techniques to alleviate the sparsity problem in collaborative filtering. ACM Transactions on Information Systems 22 (1).  
 [6]. BAEZA-YATES, R., RIBIEO-NETO, B. 1999. ACM Press / Addison Wesley, New York. BAILEY, B. P., GURAK, L. J., KONSTAN, J. A. 2001. An Examination of Trust Production in Computer-Mediated Exchange. In Proceedings of the 7th Conference on Human Factors and the Web, July 2001.  
 [7]. BALABANOVIC, M., SHOHAM, Y. 1997. Fab: Content-Based, Collaborative Recommendation. Communications of the ACM 40, 66-72. 7)BASU, C., HIRSH, H., COHEN, W. W. 1998. Recommendation as Classification: Using Social and Content-Based Information in Recommendation. In Proceedings of the Fifteenth National Conference on Artificial Intelligence (AAAI-98), RICH, C. and MOSTOW, J., Eds.AAAI Press, Menlo Park, CA. 714-720.  
 [8]. BILLSUS, D., PAZZANI, M. J. 1998. Learning collaborative information filters. In Proceedings of the Fifteenth National Conference on Artificial Intelligence (AAAI-98), RICH, C. and MOSTOW, J., Eds. AAAI Press, Menlo Park, CA. 46-53.  
 [9]. BREESE, J. S., HECKERMAN, D., KADIE, C. 1998. Empirical analysis of predictive algorithms for collaborative filtering. In Proceedings of the Fourteenth Conference on Uncertainty in Artificial Intelligence (UAI-98), COOPER, G. F. and MORAL, S., Eds. Morgan Kaufmann, San Francisco. 43-52.  
 [10]. CANNY, J. 2002. Collaborative Filtering with Privacy via Factor Analysis. In Proceedings of the 25th Annual International ACM SIGIR Conference on Research and Development in Information retrieval, ACM Press, New York, NY. 238-245.  
 [11]. CLAYPOOL, M., BROWN, D., LE, P.,and WASEDA, M. 2001. Inferring User Interest. IEEE Internet Computing 5, 32-39. CLEVERDON, C., KEAN, M. 1968. Factors Determining the Performance of Indexing Systems.  
 [12]. COSLEY, D., LAM, S. K., ALBERT, I., KONSTAN, J. A.,and RIEDL, J. 2003. Is Seeing Believing? How Recommender Interfaces Affect ith the same item-name via the node-link structure. If P is nonempty, call insert tree(P, N) recursively.



# Stability Improvement Based on Power System Stabilizer and Static VAR Compensator

Rajneesh Karn  
Prof. EX, REC, Bhopal

Vishwajeet Verma  
Asstt.Prof. EX, REC, Bhopal

## Abstract

This paper presents a new simple method of transient stability improvement applied on two machines power system. Phasor simulation has been used, checked and found much faster than standard detailed solution. In this method, the network differential equations were replaced by a set of algebraic equations at a fixed frequency which dramatically reduced the simulation time. A power system stabilizer (PSS) is used over various operating conditions with and without 3-ph faults. A design of a static VAR controller (SVC), using a fixed and variable capacitor was tested. Moreover, the paper contributes to the improvement of transient stability of two machines system by using PSS and SVC control. The system response was simulated and evaluated during single and three phase faults applied to the terminals. Digital simulation results, due to single and three-phase faults under different loading conditions were performed to demonstrate the robustness and effectiveness of the developed controller in terms of fast response and less settling time.

**Keywords:** Transient stability, PSS, SVC

## Introduction

The stability problem of power system became very important following the famous power black-outs in several locations in Europe and the US, where planning, operations and control procedures of large interconnected power systems had to be revised. An understanding of system stability, therefore, requires a large knowledge both of the mathematical modelling of the problems and of the numerical techniques. In most cases, the model consists of a set of nonlinear algebraic or differential equations depending upon the type of studies to be performed [1]. Damping of generator oscillations were investigated using a Proportional Integrated Derivative (PID) Static VAR Controller [2,3]. The PID Controller is a simple and most widely used for control schemes in industrial process control. It is well known that for a controllable and observable linear system, the response can be arbitrarily improved by power system stabilizer feedback [4]. However, since these controls are obtained from small signal machine equations, the improvement is local in nature. Under large disturbance conditions, machine operation departs considerably from the equilibrium and consequently controls are inadequate in providing machine stabilization under these circumstances [5, 6].

The purpose of this paper is to develop and phasor simulation of power system stabilizer and static VAR compensator applied to two machines power system for the improvement of transient stability. The robustness of the proposed static VAR controller will be demonstrated by computer phasor simulation of a power system following a large disturbance causing variations in the operating condition.

## POWER SYSTEM MODEL

The example described in this section illustrates modelling of a simple transmission system containing two hydraulic power plants. Static VAR compensator (SVC) and power system stabilizers (PSS) are used to improve transient stability and power system oscillations damping. Despite the simple structure of the illustrated power system in the example below, the phasor simulation method can be used to simulate more complex power grids. A single line diagram represents a simple 500 kV transmission system is shown in Fig. 1.

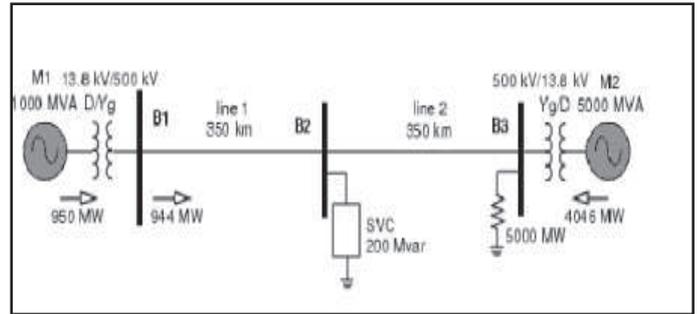


Fig. 1: Single line diagram of power system.

A 1000 MW hydraulic generation plant (M1) is connected to a load centre through a long 500 kV, 700 km transmission line. A 5000 MW of resistive load is modelled as the load centre. The remote 1000 MVA plant and a local generation of 5000 MVA (plant M2) feed the load.

A load flow has been performed on this system with plant M1 generating 950 MW so that plant M2 produces 4046 MW. The line carries 944 MW which is close to its surge impedance loading (SIL = 977 MW). To maintain system stability after faults, the transmission line is shunt compensated at its centre by a 200 MVar Static VAR Compensator (SVC). The SVC does not have a power oscillation damping (POD) unit. The two machines are equipped with a hydraulic turbine and governor (HTG), excitation system, and power system stabilizer (PSS).

The symmetrical data of the two machines are as follows:

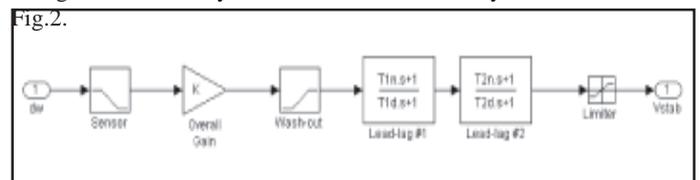
$$x_d = 1.305, \quad x_d' = 0.296, \quad x_d'' = 0.252, \quad x_q = 0.474, \quad x_q' = 0.243, \quad x_q'' = 0.18$$

$$T_d' = 1.01 \text{sec.}, \quad T_d'' = 0.05 \text{sec.}, \quad T_q'' = 0.1 \text{sec.}, \quad H = 3.7$$

## POWER SYSTEM STABILIZER

The generic Power System Stabilizer (PSS) block is used in the model to add damping to the rotor oscillations of the synchronous machine by controlling its excitation current. Any disturbances that occur in power systems due to can result in inducing electromechanical oscillations of the electrical generators. Such oscillating swings must be effectively damped to maintain the system stability and reduce the risk of outage. The output signal of the PSS is used as an additional input ( $V_{stab}$ ) to the excitation system block. The PSS input signal can be either the machine speed deviation, ( $\Delta\omega$ ), or its acceleration power,  $P_a = P_m - P_e$  (difference between the mechanical power and the electrical power).

The generic Power System Stabilizer nonlinear system is modelled in



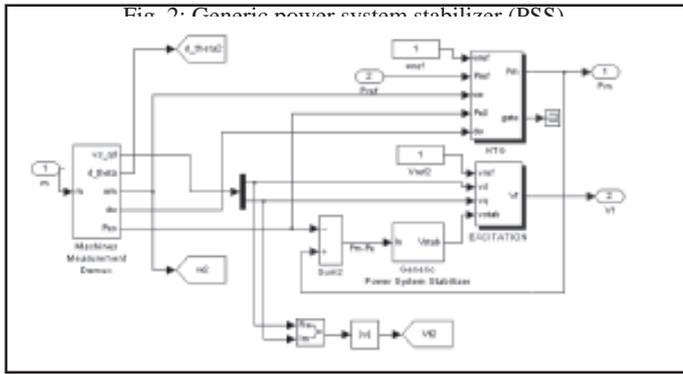


Fig. 3: Simulink of HTG and excitation of synchronous machine.

To ensure a robust damping, a moderate phase advance has to be provided by the PSS at the frequencies of interest in order to compensate for the inherent lag between the field excitation and the electrical torque induced by the PSS action. The model consists of a low-pass filter, a general gain, a washout high-pass filter, a phase-compensation system, and an output limiter. The general gain (K) determines the amount of damping produced by the stabilizer. The washout high-pass filter eliminates low frequencies that are present in the signal and allows the PSS to respond only to speed changes. The phase-compensation system is represented by a cascade of the two first-order lead-lag transfer functions used to compensate the phase lag between the excitation voltage and the electrical torque of the synchronous machine. Fig. 3 shows the simulink of hydraulic turbine and governor (HTG), excitation system, and power system stabilizer (PSS) of synchronous machine.

PSS data sheet are as follows:

Sensor time constant=0.015 sec.

Gain =2.5

Lead-lag time constant=60\*e-31

Wash-out time constant=1.

**STATIC VAR COMPENSATOR (SVC)**

The SVC (Phasor Type) block is a phasor model that has to be used with the phasor simulation method. It can be used in three-phase power system together with synchronous generator generators, motors, and dynamic loads to perform transient stability studies and observe impact of SVC on electromechanical oscillation and transmission capacity. All power electronic components are represented by simple transfer functions that yield to a correct representation at the system's fundamental frequency.

**A. SVC V-I Characteristic**

The SVC can be operated in two different modes:

- a). In voltage regulation mode (the voltage is regulated within limits as explained below).
- b). In VAR control mode (the SVC susceptance is kept constant)

As long as the SVC susceptance B stays within the maximum and minimum susceptance values imposed by the total reactive power of capacitor banks (B<sub>cmax</sub>) and reactor banks (B<sub>lmax</sub>), the voltage is regulated at the reference voltage V<sub>ref</sub>. However, a voltage droop is normally used (between 1% and 4% at maximum reactive power output), and the V-I characteristic has the slope shape as shown in Fig. 4.

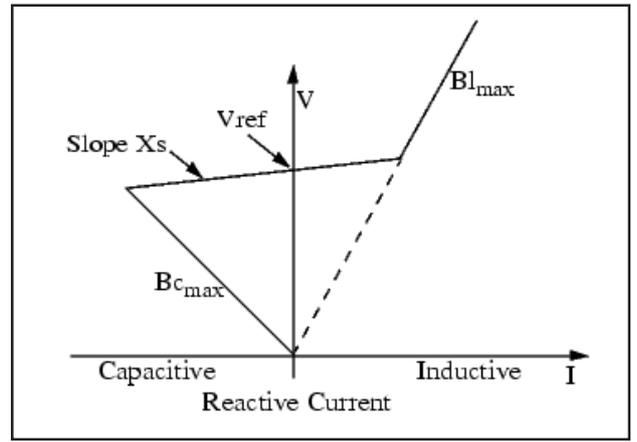


Fig. 4. SVC V-I Characteristic.

The V-I characteristic is described by the following three equations:

$$V = V_{ref} + X_s \cdot I \quad \text{SVC is in regulation} (-B_{cmax} < B < B_{lmax})$$

$$V = \frac{I}{B_{cmax}} \quad \text{SVC is fully capacitive} (B = B_{cmax})$$

$$V = \frac{I}{B_{lmax}} \quad \text{SVC is fully inductive} (B = B_{lmax})$$

Where:

V: Positive sequence voltage (p.u.)

I: Reactive current (p.u./Pbase) (I > 0

Indicates an inductive current)

X<sub>s</sub>: Slope or droop reactance (p.u./Pbase)

B<sub>cmax</sub>: Maximum capacitive susceptance (p.u./Pbase) with all TSCs in service, no TSR or TCR

B<sub>lmax</sub>: Maximum inductive susceptance (p.u./Pbase) with all TSRs in service or TCRs at full conduction, no TSC

**B. SVC Dynamic Response**

When the SVC is operating in voltage regulation mode, its response speed to a change of system voltage depends on the voltage regulator gains (proportional gain K<sub>p</sub> and integral gain K<sub>i</sub>), the droop reactance X<sub>s</sub>, and the system strength (short-circuit level).

For an integral-type voltage regulator (K<sub>p</sub>=0), if the voltage measurement time constant T<sub>m</sub> and the average time delay T<sub>d</sub> due to valve firing are neglected, the closed-loop system consisting of the SVC and the power system can be approximated by a first-order system having the following closed-loop time constant:

$$T_c = \frac{1}{K_i \cdot (X_s + X_n)}$$

Where:

T<sub>c</sub> Closed loop time constant

K<sub>i</sub> Proportional gain of the voltage regulator (p.u.\_B/p.u.\_V/s)

X<sub>s</sub> Slope reactance p.u./Pbase

X<sub>n</sub> Equivalent power system reactance (p.u./Pbase)

The equation indicates that faster response speed is obtained when either, the regulator gain is increased or the system short-circuit level is decreased (higher  $X_n$  values), when compared with time delays due to voltage measurement and valve firing, that results in an oscillatory response and eventually instability with too-weak system or too-large regulator gain.

The SVC data sheet is as follows:

Normal voltage = 500KV

Reactive power = 200MVar

Reference voltage = 1.009 pu

$X = 0.03$  pu

Open loop time constant = 0.1 sec.

Time constant of voltage measured = 0.008

Thyristor valving time delay = 0.004 sec.

**DIGITAL SIMULATION RESULTS**

The load flow solution of the above system is calculated and the results are given in table 1.

Two type of fault are disturbance to the power system, firstly, is a single line fault and secondary, is three phase fault as follow:

**A. Single-Phase Fault**

Figure 5: shows the power system response due to 0.01 Sec. single phase fault with PSS and no SVC. Fig.6 shows the power system response due to 0.01 Sec. single phase fault with and without PSS and no SVC. Also, the rotor speed responses due to 0.01 sec. with both PSS and SVC at 1-phase fault shown in Fig. 7.

Table 1: Load Flow solution of power system under study.

	$I_a = I_b = I_c$	$V_{ab} = V_{bc} = V_{ca}$	P	Q	Torque	$V_{ref}$	$P_m$
1	0.95p $\mu$	1 p $\mu$	0.95p $\mu$	0.203 p $\mu$	0.953 p $\mu$	1.44p $\mu$	0.953 p $\mu$
MCH 2	0.812p $\mu$	1 p $\mu$	0.809p $\mu$	0.77p $\mu$	0.811 p $\mu$	1.40p $\mu$	0.811p $\mu$

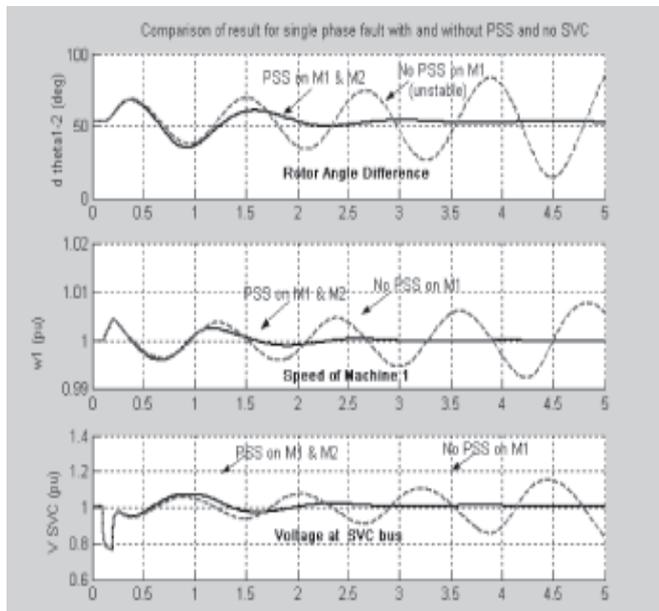


Fig. 5: Power system response due to single phase fault with PSS and no SVC.

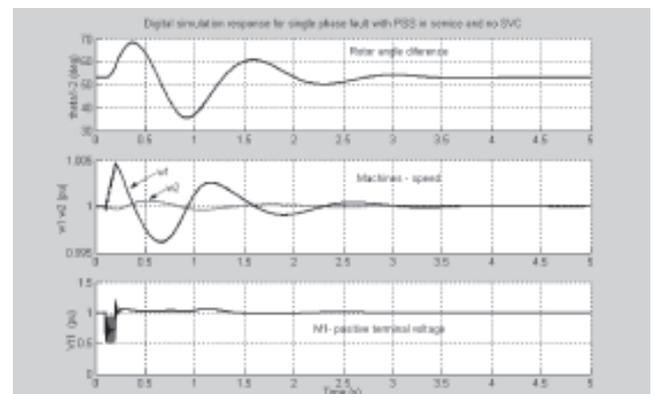


Fig.6: Power system response due to single phase fault with and without PSS and no SVC

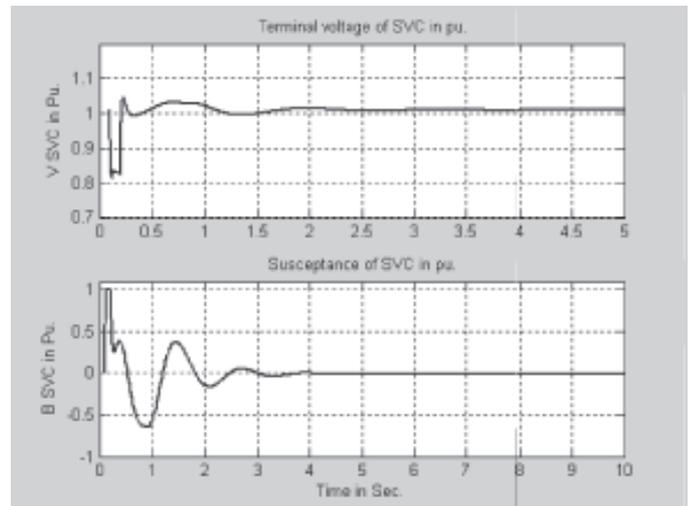


Fig.7: Rotor speed response to 0.01 sec with PSS and SVC at 1-hase fault

Fig.8 displays the terminal voltage and susceptance of SVC in pu at 1-phase fault. Moreover, Fig. 9 shows the rotor angle difference in degree with PSS and SVC at 1-phase fault. The terminal voltage in pu. Of machine 1,2 with PSS and SVC at 1-phase fault is depicted in Fig.10.

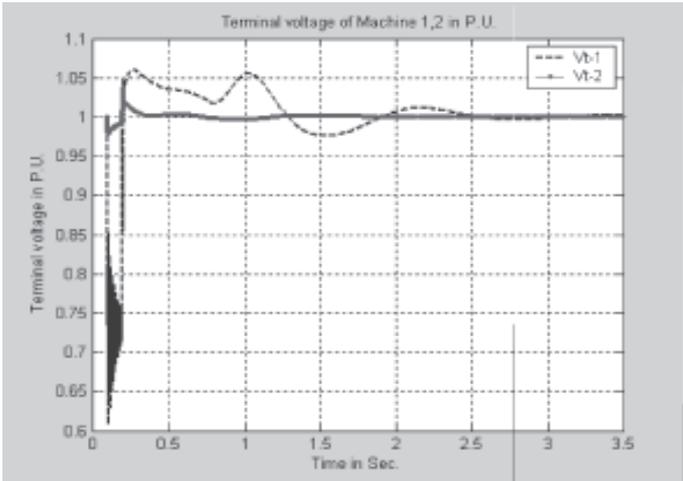


Fig. 8: Terminal voltage and susceptance of SVC in pu at 1-phase fault.

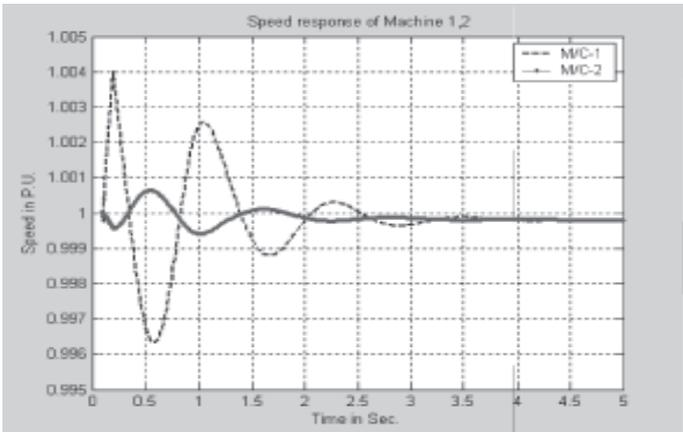


Fig. 9: Rotor angle difference in degree with PSS & SVC at 1-phase fault.

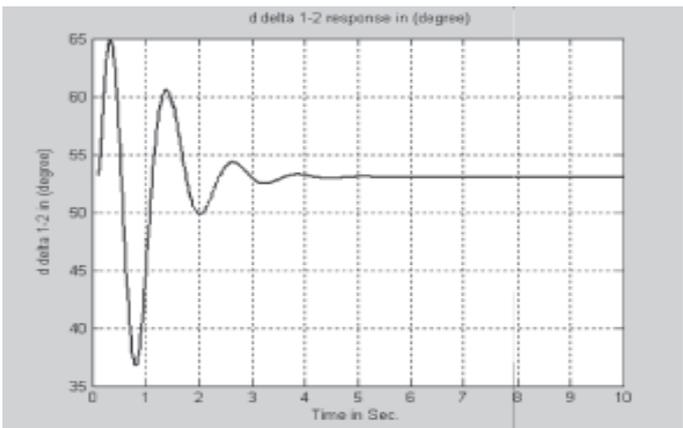


Fig. 10: Terminal voltage in pu. Of machines 1&2 with PSS & SVC at 1-phase fault.

**B. Three-Phase Fault**

a) Fixed capacitor of SVC (3-phase fault):

Figure 11 shows the rotor speed responses in pu. Due to 3-phase fault with PSS and fixed capacitor of SVC.

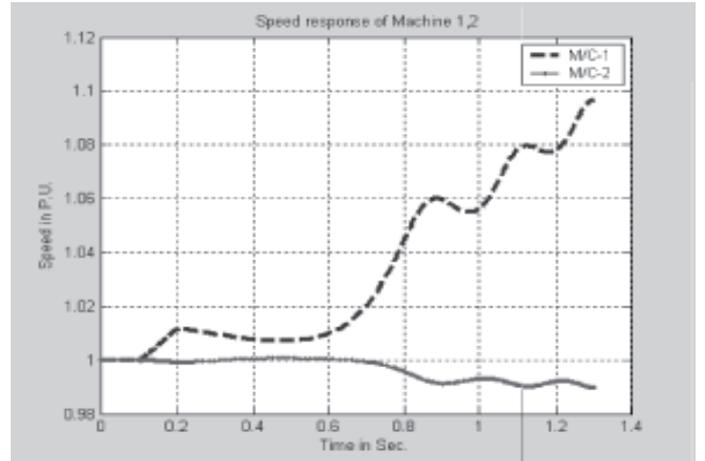


Fig. 11: Rotor speed response at 3-phase with PSS & fixed capacitor of SVC in pu.

The following Fig. 12 depicted the terminal voltage and susceptance responses in pu. Of SVC with PSS due to 3-phase fault with fixed capacitor of SVC.

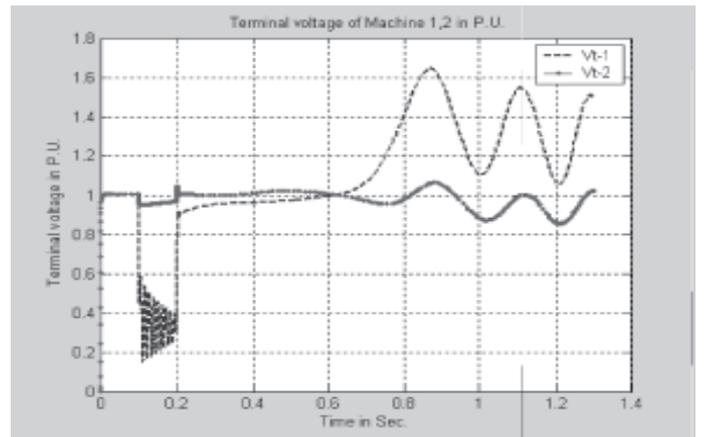


Fig. 12: Terminal voltage response in pu. Of two-machine at 3-phase fault

b) Variable capacitor of SVC (3-phase fault)

The terminal voltage and susceptance responses of SVC in pu due to 3-phase fault with PSS and variable capacitor of SVC shown in Fig. 13.

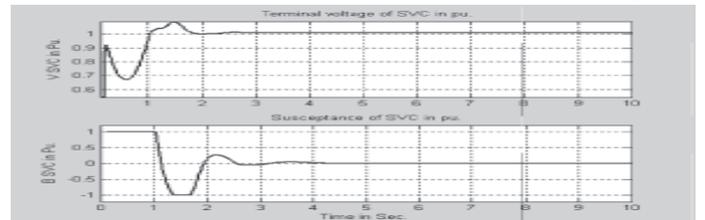


Fig. 13: Terminal voltage and susceptance of SVC in pu due to 3-phase fault with variable capacitor of SVC.

Fig. 14 displays the terminal voltage response in pu. of two-machine due to 3-phase fault with PSS and variable capacitor of SVC. Moreover, the power system responses due to 3-phase fault with and without PSS and SVC is depicted in Fig. 15. Fig.

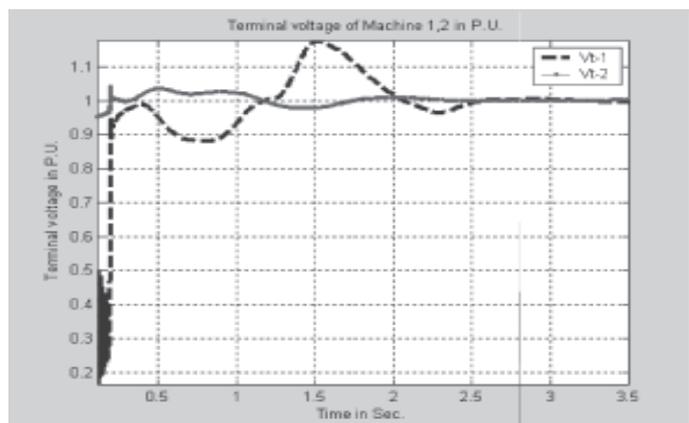


Fig. 14: Terminal voltage response in pu. of two-machine due to 3-phase fault with PSS and variable capacitor of SVC.

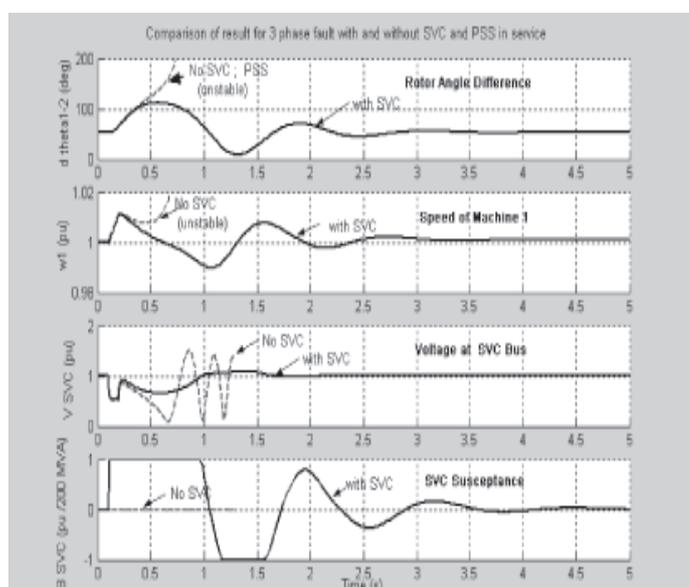


Fig. 15: Power system response due to 3-phase fault with and without PSS and SVC.

**CONCLUSION**

In this paper, the transient stability problem of two machines power system is solved by using phasor simulation. From the above results, the phasor simulation of static VAR control and power system stabilizer are superior in stabilizing the system dynamic response and preserving the system transient stability in case of three-phase fault and sudden jump in electrical loads. The stability region is valid for different fault types and locations. Damping of synchronous machine oscillations is investigated by using fixed and variable capacitor of static VAR compensator. In case of using PSS with fixed capacitor SVC, the system performance goes to unstable due to three-phase fault. Digital simulation result depicted the powerful of SVC with PSS in terms of fast response and small settling time in

case of single or three phase faults.

**References :**

- [1] M. Power, General report for WG 39, Power System Operation and Control, Cigre, Session 2000, Paris. 27 Aug-1 Sep 2000.
- [2] G. A. Mahmoud, "Transient stability assessment of multi-machine power systems using Catastrophe theory", Bulletin of the faculty of Engineering, Assiut University, Vol. 22, No.1, January 1994.
- [3] Ali M. Yousef "Transient stability Enhancement of multi-machine using Global deviation PSS" " Journal of Engineering sciences, Faculty of Engineering, Assiut University, Vol. 32-No.2 April 2004 pp. 665-677.
- [4] Bose A. "Application of direct methods to transient stability analysis of power System", IEEE Trans., on PAS, PAS-103, 1984, pp. 1629-1636.
- [5] Labib M. Daloub, Naser Shtawa, "Designn of Robust Control Stabilizer for Multi-Machine Power system", World Engineering Conference 2007, 5-9 August 2007, Penang, Malaysia.
- [7] Labib M. Daloub, Ali M. Yousef, Mustafa El Rezaghi, "Power System Stabilizer Designn based on Robust Control for Multi-Machine Power system", Al-Azhar Engineering 9th International Conference, Vol. 2, No. 4, April, 12-14, 2007, Cairo, Egypt.
- [8] "MATLAB Math Library User's Guide", by the Math Works. Inc.



# Statistical Bayesian Intelligence Technique for Spam Filtering

**Monti Babulal Pal**  
Sri VITS, Indore  
montipal1@gmail.com

**Nilesh Patidar**  
RITS, Bhopal  
patidarnilesh1@gmail.com

## Abstract

This paper describes how Bayesian mathematics can be applied to the spam problem, resulting in an adaptive, 'statistical intelligence' technique that is much harder to circumvent by spammers. It also explains why the Bayesian approach is the best way to tackle spam once and for all, as it overcomes the obstacles faced by more static technologies such as blacklist checking, databases of known spam and keyword checking. Spam is an ever-increasing problem. The number of spam mails is increasing daily. Techniques currently used by anti-spam software are static, meaning that it is fairly easy to evade by tweaking the message a little. To effectively combat spam, an adaptive new technique is needed. This method must be familiar with spammers' tactics as they change over time. It must also be able to adapt to the particular organization that it is protecting from spam.

**Keywords:** - *statistical intelligence, spam, blacklist, Bayesian approach.*

## 1. Introduction

Every day we receive many times more spam than legitimate correspondences while checking mail. On average, we probably get ten spams for every appropriate e-mail. The problem with Spam is that it tends to swamp desirable e-mail. Junk E-Mail courses through the Internet, clogging our computers and diverting attention from mail we really want. Spammers waste the time of a million people. In future, Spam would like OS crashes, viruses, and popup, become one of those plagues that only afflict people who don't bother to use the right software.

The problem of unsolicited e-mail has been increasing for years. Spam encompasses all the e-mail that we do not want and that is only very loosely directed at us. Unethical e-mail senders bear little or no cost for mass distribution of messages; yet normal e-mail users are forced to spend time and effort purging fraudulent and otherwise unwanted mail from their mailboxes. Bayesian filters are advantageous because they take the whole context of a message into consideration[1]. Unlike other filtering techniques that look for spam-identifying words in subject lines and headers, a Bayesian filter uses the entire context of an e-mail when it looks for words or character strings that will identify the e-mail as spam. A Bayesian filter is constantly self-adapting. Bayesian filters are adaptable in that the filter can train itself to identify new patterns of spam. The Bayesian technique learns the email habits of the company and understands that. It let each user define spam so that the filter is highly personalized[1]. Bayesian filters also automatically update and are self-correcting as they process new information and add it to the database.

## 2. What is Spam?

Spam is somewhat broader than the category "unsolicited commercial automated e-mail"; Spam encompasses all the e-mail that we do not want and that is only very loosely directed at us.

### 2.1. How Spam Creates Problem?

The problem of unsolicited e-mail has been increasing for years. Spam encompasses all the e-mail that we do not want and that is very loosely directed at us. Normal e-mail users are forced to spend time and effort

purging fraudulent mail from their mailboxes. The problem with spam is that it tends to swamp desirable e-mail.

## 2.2 Looking at filtering Algorithm:

### 2.2.1. Basic structured text filters

The e-mail client has the capability to sort incoming e-mail based on simple strings found in specific header fields, the header in general, and/or in the body. Its capability is very simple and does not even include regular expression matching. Almost all e-mail clients have this much filtering capability.

### 2.2.2. White List Filter

The "white list plus automated verification" approach. There are several tools that implement a white list with verification: TDMA is a popular multi-platform open source tool; Choice Mail is a commercial tool for Windows.

A white list filter connects to an MTA and passes mail only from explicitly approved recipients on to the inbox. Other messages generate a special challenge response to the sender. The white list filter's response contains some kind of unique code that identifies the original message, such as a hash or sequential ID. This challenge message contains instructions for the sender to reply in order to be added to the white list (the response message must contain the code generated by the white list filter.

### 2.2.3. Distributed adaptive blacklists

Spam is delivered to a large number of recipients. And as a matter of practice, there is little if any customization of spam messages to individual recipients. Each recipient of a spam, however, in the absence of prior filtering, must press his own "Delete" button to get rid of the message. Distributed blacklist filters let one user's Delete button warns millions of other users as to the spamminess of the message.

Tools such as Razor and Pyzor operate around servers that store digests of known spam. When a message is received by an MTA, a distributed blacklist filter is called to determine whether the message is a known spam. These tools use clever statistical techniques for creating digests, so that spam with minor or automated mutations In addition, maintainers of distributed blacklist servers frequently create "honey-pot" addresses specifically for the purpose of attracting spam (but never for any legitimate correspondences)[14].

### 2.2.4. Rule-based rankings

The most popular tool for rule-based Spam filtering, by a good margin, is Spam Assassin. Spam Assassin (and similar tools) evaluates a large number of patterns mostly regular expressions against a candidate message. Some matched patterns add to a message score, while others subtract from it[2]. If a message's score exceeds a certain threshold, it is filtered as spam; otherwise it is considered legitimate[13].

### 2.2.5. Bayesian word distribution filters

The general idea is that some words occur more frequently in known spam, and other words occur more frequently in legitimate messages. Using well-known mathematics, it is possible to generate a "spam-

indicative probability" for each word.

It can generate a filter automatically from corpora of categorized messages rather than requiring human effort in rule development.

It can be customized to individual users' characteristic spam and legitimate messages.

**2.2.6. Bayesian trigram filters**

Bayesian techniques built on a word model work rather well. One disadvantage of the word model is that the number of "words" in e-mail is virtually unbounded. The number of "word-like" character sequences possible is nearly unlimited, and new text keeps producing new sequences. This fact is particularly true of e-mails, which contain random strings in Message-IDs, content separators, UU and base64 encodings, and so on. There are various ways to throw out words from the model[11]. It uses trigrams for probability model rather than "words". Trigram is smaller unit of words.

Among all the techniques described above we have chosen Bayesian approach for i2.3 Algorithm for Bayesian probability model of Spam and No spam words: When user logs in the administrator checks all new mails for Spam and set the status as Spam, non-Spam, Blacklist for Blacklisted sender and White list for white listed sender. The sender will be checked against sender XML file which maintains the status of user (Blacklisted, White listed, No status)[3]. If sender is blacklisted or white listed then no check for Spam is applied. If sender is with No status then used the following algorithm for checking against Spam.

The authors have used Graham's Bayesian statistical based approach. Steps of statistical filtering:

Started with corpus of Spam and No spam tokens mapping each token to the probability that an email containing it is a Spam, contained in Probability XML file.

Scanned the entire text, including subject header of each message. Currently considered alphanumeric characters, exclamation mark and dollar signs to be part of tokens, and everything else to be a token separator.

When a new email arrives, extracted all the tokens and found at most fifteen with probabilities p1...p15 furthest (in either direction) from 0.5. The factor used for extracting 15 interesting words was calculated as follows:

- a. For words having probability greater than 0.5 in probability XML -Factor = Token probability -0 .5
- b. For words having probability less than 0.5 in probability XML - Factor = 0.5 - Token probability
- c. One question that arises in practice is what probability to assign to a token we've never seen, i.e. one that doesn't occur in the probability XML file. We have assigned .4 to that token[12].
- d. The probability that the mail is a Spam is

$$\frac{p_1 p_2 \dots p_{15}}{p_1 p_2 \dots p_{15} + (1 - p_1) (1 - p_2) \dots (1 - p_{15})}$$

- e. Treated mail as Spam if the algorithm above gives it a probability of more than .9 of being Spam.

At this stage, maintained two XML files (Spam XML file, No spam XML file) for each corpus, mapping tokens to number of occurrences

- f. According to combined probability if message is a spam then we count the number of times each token (ignoring case) occurs in message and update Spam XML file. And if it is no spam we update No spam XML file.

- g. Also the number of spam or no spam mails is updated based on message status.

- h. Looked through the entire user's email and, for each token, calculated the ratio of spam occurrences to total occurrences.

$$P_i = \text{Spam occurrences} / \text{Total occurrences}$$

For example, if "cash" occurs in 200 of 1000 spam and 3 of 500 no spam emails, its spam probability is (200/1000) (3/500 + 200/1000) or .971.

- i. Whenever the no. of Spam and Ham mails will reach 1000 then probability XML will be updated according to above formula.

It was desired to bias the probabilities slightly to avoid false positives.

**Bias Used:**

There is the question of what probability to assign to words that occur in one corpus but not the other. We choose .01(For not occurring in Spam XML) and .99(For not occurring in No spam XML).

Considered each corpus to be a single long stream of text for purposes of counting occurrences; we use their combined length, for calculating probabilities. This adds another slight bias to protect against false positives.

The token probability is calculated if and only if the no. of both Spam and Ham mails reaches 1000. Here we have used 1000 but you can use even larger corpus of messages.

Unless and until the message no. For both Spam and Ham mails reach 1000 the messages having probability greater than 0.6 will be treated as Spam. Afterwards 0.9 is used[4].

Used very large corpus of token probabilities in Probability XML instead of corpus of Spam and Ham messages.

If user marks a non-Spam mail as Spam the Spam and non Spam XML will be updated accordingly also all words will be assigned high probability in Probability XML, until the no. Of mails reaches 1000.

**3. Bayesian model of Spam and non Spam words:**

The spam filtering technique implemented in software is Bayesian statistical probability models of spam and non-spam words.

The general idea is that some words occur more frequently in known spam, and other words occur more frequently in legitimate messages. Using well-known mathematics, it is possible to generate a "spam-indicative probability" for each word. Another simple mathematical formula can be used to determine the overall "spam probability" of a novel message based on the collection of words it contains[5].

Bayesian email filters take advantage of Bayes' theorem. Bayes' theorem, in the context of spam, says that the probability that an email is spam, given that it has certain words in it, is equal to the probability of finding those certain words in spam email, times the probability that any email is spam, divided by the probability of finding those words in any email:

$P_i$  = spam occurrences / Total occurrences

### 3.1 Process:

Particular words have particular probabilities of occurring in spam email and in legitimate email. For instance, most email users will frequently encounter the word Viagra in spam email, but will seldom see it in other email[7]. The filter doesn't know these probabilities in advance, and must first be trained so it can build them up[1].

To train the filter, the user must manually indicate whether a new email is spam or not. For all words in each training email, the filter will adjust the probabilities that each word will appear in spam or legitimate email in its database. For instance, Bayesian spam filters will typically have learned a very high spam probability for the words "Viagra" and "refinance", but a very low spam probability for words seen only in legitimate email, such as the names of friends and family members.

After training, the word probabilities (also known as likelihood functions) are used to compute the probability that an email with a particular set of words in it belongs to either category[8]. Each word in the email contributes to the e-mail's Spam probability. This contribution is called the posterior probability and is computed using Bayes' theorem. Then, the e-mail's spam probability is computed over all words in the email, and if the total exceeds a certain threshold (say 95%), the filter will mark the email as a Spam. Email marked as Spam can then be automatically moved to a "Spam" email folder, or even deleted outright

### 3.2 Advantages:

- (1) A statistical model basically just works better than a rule-based approach.
- (2) Feature-recognizing filters like Spam Assassin assign a spam "score" to email. The Bayesian approach assigns an actual probability.
- (3) Makes the filters more effective.
- (4) Lets each user decide their own precise definition of spam.
- (5) Perhaps best of all makes it hard for spammers to tune mails to get through the filters.

### Conclusion

With more and more people use email as the everyday communication tool, there are more and more spam, viruses, phishing and fraudulent emails sent out to our email Inbox[6]. Several email systems use filtering techniques that seek to identify emails and classify them by some simple rules. However, these email filters employ conventional database techniques for pattern matching to achieve the objective of junk email detection. There are several fundamental shortcomings for this kind of junk email identification technique, for example, the lack of a learning mechanism, ignorance of the temporal localization concept, and poor description of the email data [9].

Spam Filter Express is a powerful spam filter quickly identifies and separates the hazardous and annoying spam from the legitimate email. Based on Bayesian filtering technology, Spam Filter Express adapts itself to the email automatically, filtering out all of the junk mail with close to 100% accuracy. No adding rules, no complex training, no forcing friends and colleagues to jump through hoops to communicate with others.

### REFERENCE:

- [1] M. Sahami, S. Dumais, D. Heckerman, E. Horvitz (1998). "A

Bayesian approach to filtering junk e-mail". AAAI'98 Workshop on Learning for Text Categorization.

- [2] [BOW] Bowers, Jeremy, Spam Filtering Last Stand, <http://www.jerf.org/iri/2002/11/18.html>, November 2002
- [3] [JGC] Graham-Cumming, John, 2004 MIT Spam Conference: How to beat an adaptive spam filter, <http://www.jgc.org/SpamConference011604.pps>, January 2004
- [4] [ROB3] Robinson, Gary, Spam Filtering: Training to Exhaustion, [http://www.garyrobinson.net/2004/02/spam\\_filtering\\_.html](http://www.garyrobinson.net/2004/02/spam_filtering_.html), February 2004.
- [5] Better Bayesian filtering by Paul Graham <http://www.paulgraham.com/better.html>
- [6] Graham (2002) Paul Graham. A plan for spam. WWW Page, 2002. URL <http://www.paulgraham.com/spam.html>.
- [7] "On what type of email should I (not) use Spam Cop?" (FAQ). Spam Cop FAQ. Iron Port Systems, Inc.. Retrieved on 2007-01-05.
- [8] Scott Hazen Mueller. "What is spam?". Information about spam. [spam.abuse.net](http://spam.abuse.net). Retrieved on 2007-01-05.
- [9] Why Am I Getting All This Spam? Unsolicited Commercial E-mail Research Six Month Report". Center for Democracy and Technology (March 2003). Retrieved on 2007-06-05. (Only 31 sites were sampled, and the testing was done before CAN-SPAM was enacted.)
- [10] "Spamhaus Statistics : The Top 10". Spamhaus Blocklist (SBL) database. The Spamhaus Project Ltd. (dynamic report). Retrieved on 2007-01-06.
- [11] Shawn Hernan; James R. Cutler; David Harris (1997-11-25). "I-005c: E-Mail Spamming countermeasures: Detection and prevention of E-Mail spamming". Computer Incident Advisory Capability Information Bulletins. United States Department of Energy. Retrieved on 2007-01-06.
- [12] Gary Robinson. Spam detection. URL <http://radio.weblogs.com/0101454/stories/2002/09/16/spamDetection.html> accessed 18 November 2002, 22:00 UTC.
- [13] Yerazunis, W. "The Spam Filtering Accuracy Plateau", MIT Spam Conference 2003 [http://crm114.sourceforge.net/Plateau\\_Paper.pdf](http://crm114.sourceforge.net/Plateau_Paper.pdf)
- [14] I. Androutsopoulos, G. Paliouras, V. Karkaletsis, G. Sakkis, C.D. Spyropoulos, and P. Stamatoopoulos, "Learning to filter spam e-mail: A comparison of a Naive Bayesian and a memory-based approach," Proceedings of the workshop: Machine Learning and Textual Information Access, 2000, pp. 1-13



# Study of TCP Variants over Wireless Network

**Dhananjay Bisen**  
Lecturer RITS Bhopal  
bisen.it2007@gmail.com

**Ashish Kumar Khare**  
Head IT-RITS Bhopal  
Prof\_ashish@rediffmail.com

**Vijayta Patil**  
Lecturer RITS Bhopal  
cse.vijayta@gmail.com

## Abstract

The performance of wireless ad-hoc networks is affected extensively by TCP; the magnitudes of lost packets are usually high under TCP due to congestion. In a mobile ad hoc network, temporary link failures and route changes occur frequently, with the assumption that all packet losses are due to congestion, TCP performs poorly in such an environment. TCP was designed specifically for wired, reliable network thus, any packet loss is attributed to congestion in the network. Transport Control Protocol (TCP), a basic communication language, consists of a set of rules that control communication. There are many improved versions of TCP, which were designed time to time as per necessities. This paper reveals the study of different TCP variants specifically Tahoe, Reno, New Reno, Selective Acknowledgment (SACK) and TCP Vegas. TCP New Reno algorithm and TCP Vegas are explained with new structure mechanism and new congestion avoidance and modified slow start mechanisms. This paper also presents a comparative analysis of TCP variants on the basis of algorithm.

**Keywords:-** Congestion Avoidance, Tahoe, Reno, New Reno Fast recovery, Fast retransmission and slow start, Mobile Ad-hoc Network.

## I. INTRODUCTION

Mobile ad hoc networks (MANETs) [1] are collections of mobile nodes, dynamically forming a temporary network without centralized administration. These nodes can be arbitrarily located and are free to move randomly at any given time, thus allowing network topology and interconnections between nodes to change rapidly and unpredictably. There has been significant research activity over the past 10 year into performance of such networks with the view to develop more efficient and robust TCP variants. Transmission control protocol (TCP) [2] provides reliability, end-to-end congestion control mechanism, byte stream transport mechanism, flow control, and congestion control. Comparing to wire networks, there are many different characteristics in wireless environments, which makes TCP congestion control mechanism is not directly suitable for wireless networks and many improved TCP congestion control mechanisms [3] have been presented. However, TCP in its present form is not well suited for mobile ad hoc networks. In addition to all links being wireless, frequent route failures due to mobility can cause serious problems to TCP as well. Route failures can cause packet drops at the intermediate nodes, which will be misinterpreted as congestion loss.

TCP (Transmission Control Protocol) is widely used by many Internet services including HTTP (and World Wide Web) and FTP (File Transfer Protocol). Even if the network infrastructure may change in the future, it is very likely that TCP and its applications would be continuously used. However, TCP Tahoe and Reno versions (and their variants), which are widely used in the current Internet, are not perfect in terms of throughput and fairness among connections, as having been shown in the past literatures. Therefore, active researches on TCP have been made, and many improvement mechanisms have been proposed (see in [4, 5]). Among them, a TCP Vegas version [6] is one of the most promising mechanisms by its high performance. TCP Vegas enhances the congestion avoidance algorithm of TCP Reno. In essence, TCP Vegas dynamically increases/decreases its sending window size according to observed RTT (Round Trip Times) of sending packets, whereas TCP Tahoe/Reno only

continues increasing its window size until packet loss is detected.

The author in [6] concludes through simulation and implementation experiments that TCP Vegas can obtain even 40% higher throughput than TCP Reno. However, we need to consider a migration path when anew protocol is deployed in the operating network, i.e., the Internet. It is important to investigate the effect of existing TCP versions (Tahoe and Reno) on TCP Vegas in the situation where those different versions of TCP co-exist in the network.

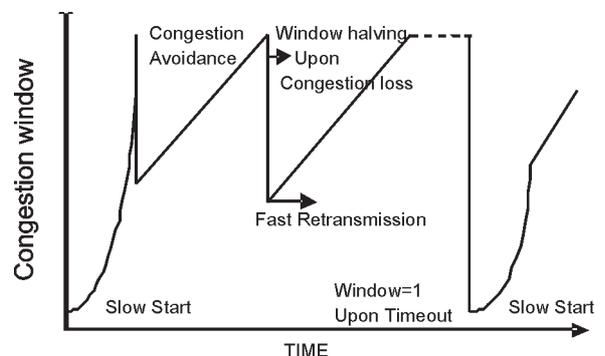
The authors in [7] have pointed out that when connections of TCP Reno and Vegas share the bottleneck link, the Vegas connection may suffer from significant unfairness. However, the authors have assumed that only a single TCP Reno connection shares the link with another TCP Vegas connection.

Most of research paper are concentrating on congestion, corruption control and improve retransmission time out condition, improving performance metrics and security threats of protocol. Hence this thrust area of mobile ad-hoc network become the choice of interest for us.

This paper is organized in such a manner that section II describes Congestion Control Algorithm followed by performance evaluation of TCP variants and comparison studies. Section III describes corruption control by TCP. Section IV is based on study of different TCP variants, and Section V presents a comparative study of various TCP variants. The conclusion is covered by section VI.

## II. CONGESTION CONTROL ALGORITHM

The major responsibilities of TCP include congestion control, flow control, in-order delivery of packets, and reliable transportation of packets. Congestion control [3] deals with excess traffic in the network which may lead to degradation in the performance of the network, whereas flow control controls the per-flow traffic such that the receiver capacity is not exceed. The TCP sender starts the session with a congestion window value of one MSS. It sends out one MSS and waits for the ACK. Once the ACK is received within the retransmission timeout (RTO) period, the congestion window is doubled and two MSSs are originated. This doubling of the congestion window with every successful acknowledgment of all the segments in the current congestion window is called slow-start or exponential start show in figure 1 and it continues until the congestion window reaches the slow-start threshold.



**Figure 1**

Once it reaches the slow-start threshold, it grows linearly, adding one MSS to the congestion window on every ACK received. This linear growth, which continues until the congestion window reaches the receiver window, is called congestion avoidance, [8] show in figure 1 as it tries to avoid increasing the congestion window exponentially, which will surely worsen the congestion in the network. TCP updates the RTO period with the current round-trip delay calculated on the arrival of every ACK packet. If the ACK packet does not arrive within the RTO period, then it assumes that the packet is lost. TCP assumes that the packet loss is due to the congestion in the network and it invokes the congestion control mechanism. The TCP sender does the following during congestion control:

- (i) Reduces the slow-start threshold to half the current congestion window or two MSSs whichever is larger,
- (ii) Resets the congestion window size to one MSS,
- (iii) Activates the slow-start algorithm, and
- (iv) Resets the RTO with an exponential back-off value which doubles with every subsequent retransmission.

The TCP sender also assumes a packet loss if it receives three consecutive duplicate ACKs (DUPACKs). Upon reception of three DUPACKs, the TCP sender retransmits the oldest unacknowledged segment. This is called the fast retransmit scheme show in figure 1. Among the several extensions of TCP, some of the important schemes are discussed below. The regular TCP which was discussed above is also called as TCP Tahoe [9].

TCP Reno [9] is similar to TCP Tahoe with fast recovery. On timeout or arrival of three DUPACKs, the TCP Reno sender enters the fast recovery and congestion window size to half the size of the current congestion window, and increments the congestion window linearly with every subsequent DUPACK. On reception of a new the TCP Reno resets the congestion window with the slow-start threshold and enters the congestion avoidance phase similar to TCP Tahoe.

TCP with selective ACK (SACK) [9] improves the performance of TCP by using the selective ACKs provided by the receiver. The receiver sends a SACK instead of an ACK, which contains a set of SACK blocks. These SACK blocks contain information about the recently received packets which is used by the TCP sender while retransmitting the lost packets.

### III. CORRUPTION CONTROL

In wireless mobile networks, usually, loss of packets is because of corruption of data on the wireless link. Wireless networks are characterized by large error rates due to fading, noise, interference from other sources and mobile host movement [15]. Due to large error rate, packet losses due to corruption in the wireless link are more as compared to congestion losses. The corruption loss rate is the packet loss rate due to corruption. Packet sending rate is not adjusted when the corruption loss rate is low, but it is required to decrease the sending rate rapidly to improve the reliability when the corruption loss rate becomes higher. Otherwise, there will be more lost packets due to corruption and more packets will be retransmission, responding the poor transmission reliability and more energy consumption of mobile hosts.

### IV. PERFORMANCE EVOLUTION OF TCP VARIANTS

In the very earliest achievement of TCP, little was done to minimize the network congestion. Implementation used cumulative positive acknowledgements and the expiry of a retransmit timer to provide

reliability based on a simple go-back- n model. Several succeeding versions of TCP based on congestion control and avoidance mechanism have been developed, nowadays. In this section, we argue the performance of various TCP versions like regarding Tahoe, Reno, New Reno, SACK and Vegas.

#### A. TCP Tahoe

One of the TCP congestion control algorithms, is TCP Tahoe described [9, 10], adds some new and enhance the earlier TCP implementation, including slow start, congestion avoidance and fast retransmission. This enhancement comprises change in round-trip-time estimation used to position retransmission time out values. TCP Tahoe fast retransmission algorithm outperforms the most when the packets are lost due to congestion. Sender should be waiting for retransmission timer to expire in the without fast retransmit algorithm. Hence, fast retransmission can save numerous seconds every time packet loss occurs, and the throughput is improved, consequently. The shortcoming in TCP Tahoe is that packet loss is detected after the whole timeout interval. When a packet loss is detected, TCP Tahoe performance becomes slow. Due to this reason transmission flow decreases rapidly. While fast retransmit makes Tahoe perform significantly better than a TCP implementation in which means of loss detection are merely the retransmission timers. It obtains significantly less than optimal performance on high delay bandwidth connections because of its initiation of slow start (which TCP Reno conversed in following section). Also, in the case of multiple losses within a single window, it is possible that the sender will retransmit packets which have already been delivered.

The problem with Tahoe is that it takes a complete timeout interval to detect a packet loss and in fact, in most implementations it takes even longer because of the coarse grain timeout. Also since it doesn't send immediate ACK's, it sends cumulative acknowledgements, there fore it follows a 'go back n' approach. Thus every time a packet is lost it waits for a timeout and the pipeline is emptied. This offers a major cost in high band-width delay product links.

#### B. TCP Reno

The Reno TCP mechanism is similar to the TCP Tahoe except it maintains improvements over Tahoe by adding to the fast recovery phase known as fast recovery algorithm [10]. The significant improvement in TCP Reno in contrast to TCP Tahoe, prevent the communication path "pipe" from going empty after fast retransmit, and in that way it avoids slow start to fill it again after a packet loss. TCP Reno maintains the clocking of new data with duplicate ACKs which make it more beneficial than TCP Tahoe. In this way, TCP allows to directly cut its throughput in half without the need for a slow start period to re-establish clocking between the data and ACKs. This improvement has the most noticeable effect on long delay-bandwidth connections where the slow start period lasts longer and large windows are needed to achieve optimal throughput. When a single packet is lost from a window of data, TCP Reno maintains it by fast recovery mechanism, in contrast when multiple packets are lost, Reno's performance are same here as Tahoe. This indicates that if multiple packets are lost from the same window, TCP Reno almost immediately drag out of fast recovery, and stop until no new packet can be sent. The above discussion leads to conclusion that fast recovery mechanism introduced by TCP Reno handles multiple packet losses within a single window poorly.

In TCP Reno, the window size is cyclically changed in a typical situation. The window size continues to be increased until packet loss occurs. TCP Reno has two phases in increasing its window size; slow start phase and

congestion avoidance phase. When an ACK packet is received by TCP at the sender side at time  $t + t_A$  [sec], the current window size  $cwnd(t + t_A)$  is updated from  $cwnd(t)$  as follows:

$$cwnd(t + t_A) =$$

Slow start phase:

$$cwnd(t) + 1, \quad \text{if } cwnd(t) < ssth(t);$$

Congestion avoidance phase:

$$cwnd(t) + 1/cwnd(t) \quad \text{if } cwnd(t) \geq ssth(t);$$

Where  $ssth(t)$  [packets] is a threshold value at which TCP changes its phase from slow start phase to congestion avoidance phase. When packet loss is detected by retransmission timeout expiration,  $cwnd(t)$  and  $ssth(t)$  are updated as;

$$cwnd(t) = 1;$$

$$ssth(t) = cwnd(t)/2$$

On the other hand, when TCP detects packet loss by a fast retransmit algorithm [8], it changes  $cwnd(t)$  and  $ssth(t)$  as;

$$ssth(t) = cwnd(t)/2;$$

$$cwnd(t) = ssth(t)$$

### C. TCP New Reno

The experimental version of TCP Reno is known as TCP New Reno [11]. It is slightly different than TCP Reno in fast recovery algorithm. New Reno is more competent than Reno when multiple packets losses occur. New Reno and Reno both correspond to go through fast retransmit when multiple duplicate packets received, but it does not come out from fast recovery phase until all outstanding data was not acknowledged. It implies that in New Reno, partial ACK do not take TCP out of fast recovery but they are treated as an indicator that the packet in the sequence space has been lost, and should be retransmitted. Therefore, when multiple packets are lost from a single window of data, at this time New Reno can improve without retransmission time out. The retransmitting rate is one packet loss per round trip time until all of the lost packets from that window have been transmitted. It exist in fast recovery till all the data is injected into network, and still waiting for an acknowledgement that fast recovery was initiated.

The critical issue in TCP New Reno is that it is capable of handling multiple packet losses in a single window. It is limited to detecting and resending only one packet loss per round-trip-time. This insufficiency becomes more distinct as the delay-bandwidth becomes greater. However, still there are situations when stalls can occur if packets are lost in successive windows, like all of the previous versions of TCP New Reno which infer that all lost packets are due to congestion and it may therefore unnecessarily cut the congestion window size when errors occur. There are some steps of congestion control for New Reno transmission control protocol.

Step 1: Initially

$$0 < cwnd \leq \min(4 * mss, \max(2 * mss, 4380 \text{ bytes}))$$

$$ss\_threshold = \max(cwnd/2, 2 * MSS)$$

Step 2: Slow Start Algorithm (Exponential Increases)

If (receive Acks &&  $cwnd < ss\_threshold$ )

$$cwnd = cwnd + 1;$$

Step 3: Congestion Avoidance Algorithm (Additive Increase)

If (receive ACKs) {

If ( $cwnd > ss\_threshold$ )

$$cwnd = cwnd + segsize * segsize / cwnd;$$

Else

$$cwnd = cwnd + 1; \}$$

Step 4: Congestion Detection Algorithm (Multiplicative Decrease): Fast Retransmission and Fast Recovery

If (congestion) {

If (Receive same Acks 3 time or retransmission time out)

{  $SS\_threshold = cwnd/2$ ;

If (Retransmission time out) {  $cwnd = initial$ ;

Exit and call Slow Start step;

Else /\* Receive same Acks 3 time\*/

$$cwnd = SS\_threshold;$$

Exit and call congestion avoidance step; } }

### D. TCP Vegas

TCP Vegas [6, 7] is an implementation of TCP based on TCP Reno with modifications in the sending side that try to achieve a more efficient use of available bandwidth. It was developed at the University of Arizona, and the authors claim that it achieves 40% to 70% better throughput with one-fifth to one-half the losses compared to TCP Reno. Vegas feature a new retransmission mechanism, a congestion avoidance mechanism, and a modified Slow Start.

The feature of Vegas that wireless ad hoc networks in particular could benefit from is the more efficient retransmission mechanism. It reads the system clock for each segment and thus calculates a more accurate RTT time. This mechanism allows it to measure a timeout with higher precision and retransmit without having to wait for three duplicate ACKS or the less precise, and thus longer, retransmission timer to time out. The authors of TCP Vegas found the average timeout interval of Reno to be more than three times higher the correct value that would be calculated with an accurate clock. This inaccuracy in Reno's timers introduces significant delays to retransmissions, lowering overall throughput. Vegas also adds another improvement; when a non-duplicate ACK is received and it is the first or second after a retransmission, Vegas checks if the time interval since the segment was sent is larger than the timeout value. If it is, it retransmits the segment without having to wait for a duplicate ACK to arrive.

TCP Vegas controls its window size by observing RTTs (Round Trip Time) of packets that the sender host has sent before [12]. If observed RTTs become large, TCP Vegas recognizes that the network begins to be congested, and throttles the window size. If RTTs become small, on the other hand, the sender host of TCP Vegas determines that the network is relieved from the congestion, and increases the window size again. Hence, the window size in an ideal situation is expected to be converged to an appropriate value.

That is,

$$cwnd(t + t_A) =$$

$$\begin{aligned}
 & cwnd(t) + 1, && \text{if } diff < a/base\_rtt \\
 & cwnd(t), && \text{if } a/base\_rtt \leq diff \leq b/base\_rtt \\
 & cwnd(t) - 1, && \text{if } b/base\_rtt < diff
 \end{aligned}$$

$$diff = cwnd(t)/base\_rtt - cwnd(t)/rtt$$

Where rtt [sec] is an observed round trip time, base\_rtt [sec] is the smallest value of observed RTTs, and a and b are some constant values.

**E. SACK TCP**

The objective of SACK TCP [9, 10] is to alleviate TCP's poor performance when multiple packets are lost from one window of data. SACK TCP defines TCP's selective acknowledgement option, which allows the receiver to inform the sender which packets have been received, thereby giving the sender a better picture of the receiver's buffer. The sender can then retransmit only the missing data segments. Without SACK, the sender is forced to either wait a roundtrip time to find out about each lost packet, or to retransmit segments which have already been correctly received, generating needless retransmissions. It is possible for the receiver to send up to four SACK blocks in each segment, although if the timestamp option is used for Round Trip Time Measurement (RTTM), this is reduced to three SACK blocks. The receiver must follow these rules if it chooses to send a SACK option:

1. The first SACK block must specify the block of data containing the segment which triggered this ACK, unless that segment advanced the Acknowledgement Number field in the header.
2. Include as many distinct SACK blocks as possible in the SACK option.
3. The SACK option should be filled out by repeating the most recently reported SACK blocks. After the first SACK block, the following SACK blocks may be listed in arbitrary order.

The redundancy of blocks in the SACK option increases the robustness in the presence of lost ACKs; if one ACK is lost, the next ACK will contain overlapping information.

**V. TCP VARIANTS COMPARISON STUDY**

**Table: 1**

Algorithms/ TCP Variants	TCP Tahoe	TCP Reno	TCP New Reno	TCP SACK	TCP Vegas
Slow Start	Yes	Yes	Yes	Yes	UV
Congestion Avoidance	Yes	Yes	Yes	Yes	UV
Fast Retransmit	Yes	Yes	Yes	Yes	Yes
Fast Recovery	No	Yes	UV	UV	Yes
Retransmission Mechanism	N	N	N	N	NM
Congestion Control Mechanism	N	N	N	N	NM
Selective ACK Mechanism	No	No	No	Yes	No

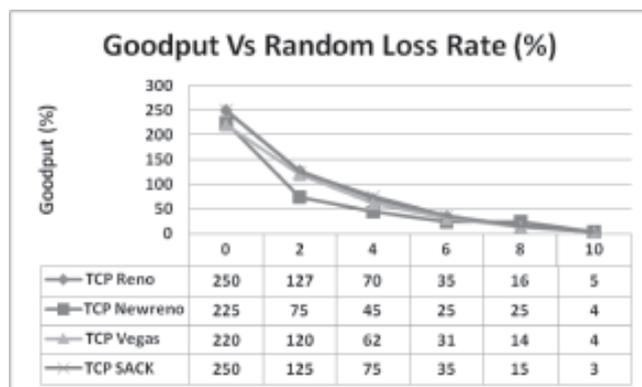
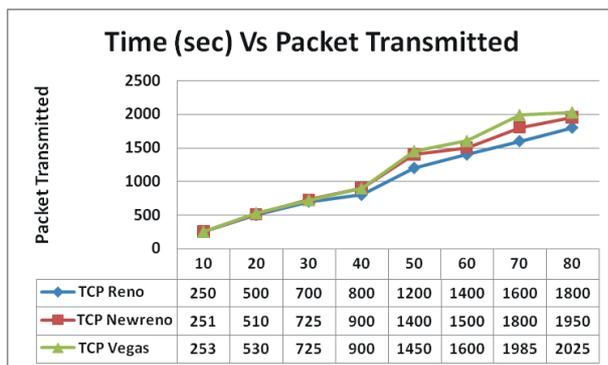


Table 1 shows a summary of comparative study of different variants of TCP.

From the survey of different literatures, it has been observed that TCP Reno has a fast recovery mechanism. TCP NewReno and TCP Sack have an updated mechanism for recovery. But TCP Vegas has a new mechanism for Retransmission and Congestion Control with updated mechanism of recovery, as shown in table 1.

Due to these new mechanisms TCP Vegas can transmit more packets than TCP Reno and TCP New Reno as shown in figure 2. TCP Vegas also perform well when random loss rate increases. From figure 3 it can be observe, Goodput calculated for TCP Vegas is comparatively better than other.

**VI. CONCLUSION**

This paper presents a study of five recently TCP protocols optimized for wireless networks, TCP Tahoe, TCP Reno, TCP New Reno, TCP SACK, TCP Vegas. This paper concluded that congestion is the main problem in different variants of TCP. Each variant has different mechanism to control congestion in network. But TCP Vegas has improved mechanism to recover the loss of packet due to congestion and corruption in network. It has improved mechanism for Slow Start and Congestion Avoidance and also included new mechanism for Retransmission and Congestion Control. So it can be analyzed that TCP Vegas performs better than other TCP variants.

**REFERENCES**

[1] Imrich Chlamtac, Marco Conti, Jennifer J.-N. Liu .Mobile ad hoc networking: imperatives and challenges, School of Engineering, University of Texas at Dallas, Dallas, TX, USA ,b Istituto IIT, Consiglio Nazionale delle Ricerche, Pisa, Italy ,c Department of Computer Science, University of Texas at

- Dallas, Dallas, TX, USA. Ad Hoc Networks 1 (2003)
- [2] Hanbali, Eitan Altman, And P. Nain, "A Survey of TCP over Ad Hoc Networks," IEEE communications Surveys Tutorials, vol 7, Third Quarter 2005, no. 3.
  - [3] Fu Lin Deng Yi Zhang, Wenbin Hu "An Improved TCP Congestion Control Mechanism Based on Double-Windows for Wireless Network", 2008.
  - [4] Michel Perloff and Kurt Reiss, "Improvements to TCP performance," Communications of ACM, vol. 38, no. 2, pp. 90-100, February 1995.
  - [5] Matthew Mathis and Jamshid Mahdavi, "Forward acknowledgment. Refining TCP congestion control," ACM SIGCOMM Computer Communication Review, vol. 26, no. 4, pp. 281-291, October 1996.
  - [6] TCP Vegas: New techniques for congestion detection and avoidance. In Proceedings of ACM SIGCOMM'94, pages 24-35, May, 1994.
  - [7] Lawrence S. Brakmo, Sean W.O'Malley, and Larry L. Peterson, "TCP Vegas: New techniques for congestion detection and avoidance," in Proceedings of ACM SIGCOMM'94, October 1994, pp. 24-35.
  - [8] W. Stevens. TCP slow start, congestion avoidance, fast retransmit, and fast recovery algorithms. IETF RFC 2001, January 1997.
  - [9] Jinwen Zhu, Tianrui Bai , Performance of Tahoe, Reno, and SACK TCP at Different Scenarios, 27-30 Nov. 2006, On page(s): 1-4.
  - [10] Qureshi, M. Othman, Member, IEEE, and N. A. W. Hamid Progress in Various TCP Variants (February 2009).
  - [11] S. Floyd, the New Reno Modification to TCP's Fast Recovery Algorithm, RFC 3782, April 2004.
  - [12] V.Paxson and M. Allman, "Computing TCP's Retransmission Timer," RFC 2988, Standards Track, NASA GRC/BBN, November 2000.
  - [13] F. Wang and Y. Zhang, "Improving TCP Performance over Mobile Ad Hoc Networks with Out-of-order Detection and Response," Proc. ACM MOBIH-OC, Lausanne, Switzerland, June 2002, pp. 217-25.
  - [14] Pawan Kumar Gupta "Throughput Enhancement of TCP over Wireless Links" January 2002."http://etd.ncsi.iisc.ernet.in/bitstream/2005/48/1/Throughput\_Enhancement\_Of\_TCP\_Over\_Wireless\_Links\_Text.pdf".
  - [15] Lawrence S. Brakmo, Student Member, IEEE, and Larry L. Peterson TCP Vegas: End to End Congestion Avoidance on a Global Internet, OCTOBER 1995.



# Wind Power: Resource Assessment

Dr. Arun Shandilya & Deepak Verma

Deptt. of EX, MANIT, Bhopal

deepakverma16@gmail.com

## Abstract

Energy is a major input for overall socio economic development of any society. Heavy use of fossil fuels is expected to boost the economic development process of a majority of the world population during the next two decades. By the period 2020-2050 fossil fuels are likely to reach their maximum potential and their price will become higher than other renewable energy options on account of increasingly constraints production and availability.

The objective of the paper is to present the estimated wind power potential and detailed list of wind monitoring stations in Madhya Pradesh (India), And showing the procedural steps for setting up wind power project (Small size and large size).

**Keywords:** Socio economic development, fossil fuels, renewable energy, wind power, mapping, growth, DPR, grid, evacuation, EHV, WPD, TPS, WEG.

## I. Introduction:

Renewable energy sources are expected to play a key role in accelerating development and sustainable growth in the second half of this century, accounting for 50 to 60% of the total global energy supplies.

Wind power happens to be the fastest growing industry in the world with annual growth rate of about 20%. As of 31, October 2009 the world's total installed capacity is 121,188 MW.[1], and wind power in India was 10,891 MW, mainly spread across Tamil Nadu (4301.63 MW), Maharashtra (1942.25 MW), Gujarat (1565.61 MW), Karnataka (1340.23 MW), Rajasthan (738.5 MW), Madhya Pradesh (212.8 MW), Andhra Pradesh (122.45 MW), Kerala (26.5 MW), West Bengal (1.1 MW) and other states (3.20 MW) [2] It is estimated that 6,000 MW of additional wind power capacity will be installed in India by 2012. [3] Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power.[4] India ranks 4th in terms of total installed capacity and 3rd in terms of current market size. National Hydro Development Corporation (NHDC) invests money in a 100 MW wind energy plant in Kukru area in Betul district. Approval for initial survey for establishments of wind power project has been granted by Madhya Pradesh Urja Vikas Nigam (MPUVN) in Jan 2010.

## II. Wind Resource Assessment:

The amount of power in the wind is very dependent on the speed of the wind. Because the power in the wind is proportional to the cube of the wind speed, small differences in the wind speed make a big difference in the power you can make from it. A 10% difference in speed makes about a 33% change in power. This gives rise to the primary reason for wind resource assessment. In order to more accurately predict the potential benefits of a wind power installation, wind speeds and other characteristics of a site's wind regime must be accurately understood.

There are also important technical reasons for studying a site's wind characteristics. Wind speeds, wind shear, turbulence and gust intensity all need to be specified when procuring a wind turbine, designing its foundation, etc.

Wind speed generally increases with height above the ground. However there could be exponential cases where speed decreases with height due

to special geographical features. Wind speed at a height could be projected from an empirical formula using the Power Law Index (PLI), which is derived from wind speed data at two known heights, at the same location. [6]

Some typical PLI's at different location in India are given in Table [1]. Negative PLI signifies decreasing of wind speed at higher height.

TABLE I

TYPICAL PLI'S AT DIFFERENT LOCATION

Location	PLI	Wind Speed in kmph at height of	
		10m	30m
Ayikudy, Tamil Nadu	0.23	18.2	23.5
Harsnath, Rajasthan	0.44	13.9	22.5
Rramakalamedu, kerala	-0.01	30.0	29.7

### A. Estimated Wind Power Potential In India.

TABLE II: WIND POWER POTENTIAL IN INDIA

Sl. No.	State and Installed capacity	Gross potential (MW)
1.	Tamil Nadu (4301.63 MW),	4500
2.	Maharashtra (1942.25 MW),	3650
3.	Gujarat (1565.61 MW),	9675
4.	Karnataka (1340.23 MW),	6620
5.	Rajasthan (738.5 MW),	5400
6.	Madhya Pradesh (212.8 MW),	5500
7.	Andhra Pradesh (122.45 MW),	8275
8.	Kerala (26.5 MW),	875
9.	West Bengal (1.1 MW)	450
10.	other states (3.20 MW)	1700
Total		46645

### B. Estimated Wind Power Potential In Madhya Pradesh.

In Madhya Pradesh, Gross potential of Wind Energy is 5500 MW, Technical Potential 1000 MW (Achievement 212.8 MW).

### C. Establishment of Wind Monitoring Station in Madhya Pradesh [M.P.].

As shown in table III.

TABLE III  
ESTABLISHMENT OF WIND MONITORING  
STATION IN M.P.

Year	No. of stations
1992	5
1993	-
1994	1
1995	-
1996	6
1997	-
1998	4
1999	3
2000	4
2001	4
2002	-
2003	-
2004	4
2005	-
2006	2
2007	3
2008	2
2009	
<b>Total</b>	<b>37</b>

E. WIND MONITORING STATION IN MADHYA PRADESH. [5] & [6]

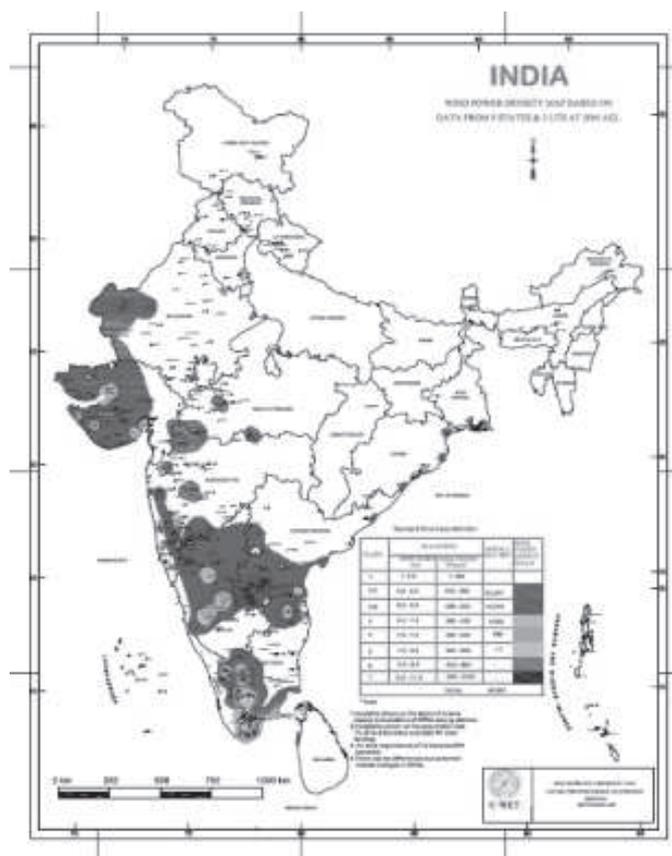


Figure1. Wind Power density map INDIA

TABLE IV.  
LIST OF WIND MONITORING STATION IN M.P.

S. No	Station	Dist.	Date of Commencement	Date of Closing	Mast Height	Air Density	Mean Annual Wind Speed at 20/25 m.	Power Law Index	Mean Wind Power density at 20/25 m.
					(m)				gm/m <sup>3</sup>
1	Aalot	Ratlam	07/06/99	22/11/00	25		4.56		096
2	Barkheri Bazar	Ujjain	28/12/01	21/02/03	25		5.11		108
3	Baroli	Indore	19/04/96	21/08/97	20		4.47		103
4	Betama	Indore	11/03/92	22/12/93	20		4.25		079
5	bhopal	Bhopal	29/06/04	26/08/05	25		-		-
6	Bodhina	Ratlam	22/01/01	05/10/02	25		5.14		131
7	Chorasia badaila	Ratlam	10/12/98	19/09/00	20		4.94		121
8	Garhidadar	Shahdol	02/06/04	-	50		-		-
9	Jaithal hills	Ujjain	30/12/01	21/02/03	25		4.53		082
10	Jamgodrani	Dewas	12/03/92	19/04/95	20	1108	5.06	0.19	130
11	Jhabua	Jhabua	12/12/98	15/09/00	20		4.22		074
12	Kalapahad	Sehore	17/09/00	11/10/01	20		3.94		060
13	Kawasa	Ratlam	16/09/00	13/10/01	25		4.22		080
14	Kheda	Dhar	10/03/92	18/04/95	20	1102	5.14	0.17	126
15	Kukru	Betul	16/08/94	27/08/97	20	1051	5.28	0.22	157
16	Lahori	Shajapur	13/02/00	21/03/01	25		4.75		100
17	Machaliya ghat	Jhabua	06/08/99	23/01/01	25		4.94		106
18	Machla	Indore	10/06/99	19/11/00	25		4.58		096
19	Mahuriya	Sajapur	24/04/96	04/08/98	25	1114	5.28	0.13	171
20	Mamatkheda	Ratlam	10/12/98	21/01/01	20		5.57		169
21	Mirzapur	Sehore	12/03/92	20/04/95	20	1114	4.31	0.24	076
22	Nagda-1	Dewas	21/04/96	19/08/97	25		-		-
23	Nagda-2	Dewas	06/08/98	-	25		6.25		219
24	Padsoli	Ratlam	19/10/96	08/12/98	25		-		-
25	Purtala	Chhindwara	20/04/04	-	50		-		-
26	Sanawad	Khargon	13/03/92	23/12/93	20		3.97		085
27	Sendhwa	Khargon	20/04/96	02/08/98	20	1111	5.03	0.13	163
28	Sodang hills	Ujjain	29/12/01	21/02/03	25		4.95		121
29	Tanoriya	Shajapur	24/04/96	23/08/97	20		4.45		093
30	Tawa dam	Hosangabad	17/08/04	-	25		-		-
31	valiyarpani	khargon	09/02/00	17/03/02	20		5.25		191
32	Barodia		23/07/06	Mar.09	50		3.78		055
33	Banbir kheri		20/07/06	Mar.09	50		4.73		094
34	Mandwa		29/11/07		50				
35	Kanchroota		01/12/07		50				
36	Machanbor		02/12/07		50				
37	Bori		03/05/08		50				
38	Sanai dongri		23/05/08		50				

### III. PROCEDURAL STEPS FOR SETTING UP WIND POWER PROJECT[7]

Wind power project are characterized by low running cost with low level of generation (capacity factor rarely exceeding 25-30%), but the plant

cost at about Rs. 4.0 to 5.5 crore per MW is comparable to conventional thermal power station (TPS). Wind power project should be "tailored" to get optimum power output from the Wind Electric Generators (WEG's)

under the prevailing site condition and avail the fiscal benefits allowed for this power sector.

Following procedural steps shall be a useful guideline to examine whether the project proposal is viable both in technical and financial terms, as also ensure trouble free implementation.

**A. Management Decision.**

Company Outlook:

- Company's business out look and its consistency with present operation.
- A diversification project
- Capacity to absorb accelerated depreciation benefits under section 32 and 80-IA of application Tax Act 1961
- State incentives (which vary from state -to-state). Interaction with state Nodal Agency for application procedures and eligibility criteria.
- Size of investment proposed.
- Financial viability of project
- Interest rate on loan.
- Selection of complete technical Consultancy Firm for the project

**Power Requirement:**

- In- house power requirement, it criticality of use and future demand;
- Installed capacity of proposed wind farm, whether for captive consumption, or planning for fully/partly sale to the state utility/ third party.
- Wheeling/banking.

**B. Small Size Project.**

If the size of the project envisaged is small e.g. up to 5.0 MW installed capacity, the best option is to take advantage of facilities being provided by experienced wind farm developers. The developer develops a large size wind farm, where several investors can install wind turbines. In this process developer does the following:

- Selection of suitable site for development of wind farm.
- Acquisition of detailed project report.
- Sanction of project.
- Development of infrastructure viz. approach road, internal roads, grid extension.
- Supervision of construction, erection and commissioning of wind electric generators along with associated civil and electrical works.

- Operation and maintenance of wind farm during full life-time of wind electric generators.
- Performance monitoring and improvements.

The small investor just has to arrange for funds and obtain benefits.

**C. Large Size Project.**

If the size of the project is more than 5.0 MW, it is considered worth-while to follow the following procedure:

**Feasibility Study:**

- Selection of competent technical consultancy organization having experience in all the fields related to wind farm development.
- Selection of suitable site, preferably from among those identified by government agency based on wind data monitoring or by an experienced consultant.
- Availability of land adequate for the proposed installed capacity.
- Acquisition of land, government or private. Its availability and cost.
- Analysis of wind data and assessment of potential at the selected site.
- In case wind data is not available from a near-by wind monitoring mast, immediate action is to install a mast for monitoring wind condition (anemometry for minimum one year and reference of general wind condition)
- Study grid and power evacuation facility with particulars on nearby sub-station(s) and the grid quality (capacity, voltage, failure data etc.) as also the scope for future expansion plan.
- The extent of grid extension required and modification in upstream Extra High Voltage (EHV) sub-station.
- Approach road and transport facility.
- Water source and other infrastructure.

**Preparation of DPR:**

Detailed Project Report (DPR), prepared by an expert consultancy organization should include specific activities enumerated below, in addition to those covered in feasibility study:

- Capacity of wind farm
- Mode of project financing
- Site identification finalized based on assessment that the wind potential have wind power density (WPD) more than 200 W/m<sup>2</sup> at 50 m above ground level.
- Purchase/acquisition of land (Govt. land/private land).

- Interaction with WEG manufacturers/their representatives, for budgetary price and machine particulars.
- Detailed contour survey of the site and to further assess the land pattern for and around the wind farm area.
- Annual estimated generation for different options of WEGs.
- Grid and power evacuation facility to examine requirement of capacity enhancement of existing sub-station and grid. The cost of grid extension if required should also be studied.
- Wind farm layout drawing showing location of WEGs, internal road, unit sub-stations, over-head lines, metering station etc.
- Estimated project cost and cash flow statement.
- Selection of WEGs preferably out of the latest list published by centre for wind energy technology(C-WET).

**Project Implementation Report:**

- Retaining services of expert consultancy organization.
- Micro-sating of WEGs.
- No objection certificate, to obtain from State Nodal Agency of the State Electricity Board/Regulatory Commission.
- Acquisition of land.
- Power Purchase Agreement, with State Nodal Agency/State Electricity Board/third Party.
- Submitting proposal for loan
- Soil testing
- Preparation of bid document, techno-commercial evaluation of bids and selection of equipment.
- Preparation of Bar chart showing project activities.
- Engaging experienced contractor for site work.
- Preparatory work at site-arranging for water and electricity during construction. Creation of storage facility.
- Insurance for material in store/during erection.
- Construction of approach/internal roads.
- Erection and commissioning activities.
- Safety Certificate from the Chief Electrical Inspector to Government (CEIG) prior to commissioning of the grid and the wind farm.
- Training of operating and maintenance of the wind farm during erection and commissioning.
- Observation on performance of the WEGs and other equipment.
- Handing over/Taking over of the wind farm.

**D. Implementation of wind farm project**

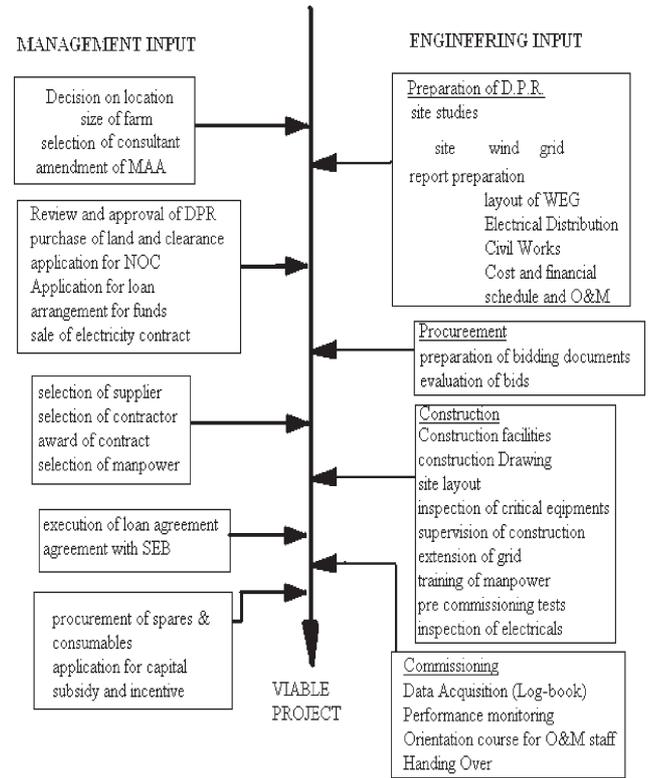


Figure1. Implementation of wind farm project

**IV. CONCLUSION**

With advancement of wind power technology, WEGs are steadily growing in unit capacity, with rating up to 3.6 MW presently available in the market. Accordingly, to capture more wind power, longer blades (exceeding 60 m) and taller tower (close to 120 m) have been developed. At the same time, with better understanding of wind load and material characteristic, WEG components have shed-off weight making the top-head mass much lighter to cut down on the cost. The conversion efficiency has also substantially increased, which together with enhanced reliability has made the machine almost maintenance and down time free.

Tow trend-setting technologies are prominent, specially in the MW range. These are variable pitch WEGs with doubly fed induction generator and direct drive systems. It is anticipated that in the long term, WEGs in sub MW class will also opt increasingly for more advanced pitch controlled variable speed systems, with or without gearboxes.

As the Indian power sector market and the rural electrification aspects there is much possibility to supply rural areas by the separate WEG in place of interrupted and poor quality supply with subsidies, and it can become a very good approach for the government for those areas where the wind energy potential is good, for electrification in future.

**REFERENCES**

[1] "World Wind Energy Report 2008", 8th World Wind Energy

Conference & Exhibition, South Korea, World Wind Energy Association (WWEA), February 2009.

[2] "Wind Power Installed Capacity" [http://www.indianwindpower.com/installed\\_wind\\_capacity.php](http://www.indianwindpower.com/installed_wind_capacity.php)

[3] "Economy & Policy" <http://www.business-standard.com/india/storypage.php?tp=on&autono=44562>

[4] "India's wind power boom is failing to deliver" <http://www.peopleandplanet.net/doc.php?id=3357>

[5] "Wind Resource Assessment" <http://www.cwet.tn.nic.in/>

[6] "Directory Indian Wind Power 2005"

Fifth Annual Edition-August 2005, Published by Consolidated Energy Consultants Ltd., Section-3 Page 3-1 to 3-46.  
"Directory Indian Wind Power 2005"

[7] Fifth Annual Edition-August 2005, Published by Consolidated Energy Consultants Ltd., Section-1 Page 1-14 to 1-18.

