Abs Nr. OR-002

Reutilization of Industrial Solid Wastes for Industrial Effluent Treatments

C. Namasivayam[1]

Abstract

As the problem of solid wastes disposal has now attained complex dimensions, it becomes essential either to find suitable ways for the safe disposal of these wastes or to suggest novel use, considering them as by-products. Otherwise, these will remain an accumulated waste, contributing highly to environmental pollution. In the absence of uses for the waste materials there are added costs for building and maintaining the lagoons of these wastes. Finding a profitable use for this waste could further benefit the economics of the industry. Chromium (VI) compounds are used as corrosion inhibitors in cooling water systems in industries.

The wastewater containing Cr (VI) is treated by reducing Cr (VI) to Cr (III) using Fe (II), that is generated electrolytically. Fe (III)/Cr (III) ions produced are precipitated as hydroxide sludge using lime. The resulting Fe (III)/Cr (III) hydroxide sludge is discarded as waste.

In developing countries like India, industries cannot afford to use conventional wastewater treatment chemicals like alum, ferric chloride, polymer flocculants and activated carbon because they are not cost-effective. Among the treatment methods adsorption seems to be an effective method. As the manufacturing and regeneration cost of activated carbon is high, inexpensive and more easily available adsorbents would make the removal of pollutants an economically viable alternative. The abundance and easy availability makes "waste" Fe (III)/Cr (III) hydroxide, a strong candidate in the search for an economical adsorbent to remove heavy metals, dyes and pesticides from wastewaters. Namasivayam and co-workers have employed the "waste" Fe (III)/Cr (III) hydroxide for the treatment

[1] Professor, Environmental Chemistry Lab, Department of Environmental Sciences, Bharathiar University, Coimbatore 641 046, Tamil Nadu

of wastewaters from industries such as dyeing, fertilizer, dairy, distillery, electroplating radiator manufacturing and tannery. The non-conventional adsorbent is also capable of removing Hg (II), As (III), As (V), toxic anions and pesticides. The efficiency of these nonconventional adsorbents/flocculants is more or less equal to and sometimes better than commercial adsorbents/flocculants. This lecture includes studies on the adsorption kinetics of the removal of heavy metals from water by ‘waste’ Fe (III)/Cr (III) hydroxide and applications to the treatment of real industrial wastewaters containing the heavy metals.

Abs Nr. OR-004

Chemical Species of Sedimentary Phosphorus in Tuticorin Coastal Water Ecosystems

C. Veerabahu[1], D. Radhika[1] & V. Ramadhas[2]

Abstract

The present investigation was carried out in four stations. (Pullavazhi brackish water, Tuticorin Mangrove, Sewage polluted fishing harbour area, and the near shore water). In these four stations four different fractions of sedimentary phosphorus (exchangeable sedimentary (E-P), sedimentary phosphorus bound to carbonate (CO_3-P), phosphorus bound to oxides of Iron and Manganese (O-Fe & Mn-P), phosphorus bound to sedimentary organic phosphorus (P-O), phosphorus bound to Iron and Aluminium (Fe-Al-P), Apatite phosphorus (A-P) and Residual Phosphorus (R-P) were investigated for a period of one year. Among the four different chemical species of sedimentary phosphorus apatite phosphorus appeared as the major contributor to total sedimentary phosphorus and P-O ranked to it. Fe & Al-P appeared as the third / fourth major contributor. Mostly exchangeable phosphorus contributed to the lowest percentage of Total sedimentary phosphorus. The study affirmed that ever under the phosphate limiting condition, biological fertility of the coastal water was mostly decided by the supply of phosphate from the sedimentary organic phosphorus and phosphate bound to Fe & Al. Based on the chemical speciation of sedimentary phosphorus stations are compared with respect to their magnitude of supply of phosphorus to the coastal water.

[1] Dept. of Zoology, V.O.Chidambaram College, MS University, Thoothukudi 8
[2] Fisheries College Research Institute, TANUVAS University, Thoothukudi 8

Abs Nr. OR-013

Concentration of Group iib Metals in the Drinking Water of Bharathiar University, Coimbatore and their Accumulation on a Freshwater Fish *cyprinus carpio*

R. Rama[1], M. Ramesh[2] and V.Maruthappan[2]

Abstract

Man's activities are measurably changing the chemical make up of soil, air and water; these changes are increasing with the growing world population and the per capita consumption of energy and materials; everything that Man injects into the biosphere, inorganic, organic or biological may finally reach natural waters. Metals are being used widely in industries like electronics, machines and the artifacts of every day life as well as high tech applications and consequently tend to reach the environment from a vast array of anthropogenic sources as well as natural geo-chemical processes. The metals, which are present in these industrial effluents, may enter into the aquatic ecosystem, which in turn reaches the human system through the food chain.

Among the metals zinc, cadmium and mercury comes under the group IIB metals. Zinc finds wide application in industry; agriculture and medicine and the varied industrial application of zinc stems from its chemical and metallurgical properties; extractive and power industry are the mine source of environmental contamination with zinc. Cadmium a non-essential and non-beneficial element is highly toxic in nature and the volcanic activity, exudates from vegetation, forest fire, wind blow dust and leaching of rocks have resulted with natural cadmium input in the biosphere. Mercury is a highly toxic heavy metal, which is bio-concentrated up through the food chain. A number of industrial process make use of mercury and the mercury containing effluents are discharged into the water body.

[1] Department of Environmental Sciences, Bharathiar University, Coimbatore 641 046
[2] Department of Zoology, Bharathiar University, Coimbatore 641 046

Coimbatore is one the leading industrial city in Tamil Nadu. There are more than 25 thousand small, medium, large and tiny industries. The water resources include Bhavani, Noyyal and other small and large water bodies. The Noyyal water is highly polluted one. Based on the above literature in the present study an attempt was made to study the concentration of zinc, cadmium and mercury in drinking water of Bharathiar University Campus and its accumulation was also noted in a freshwater fish under laboratory condition to implement the lab to field work analysis.

During the above study, a trace amount of zinc was noted in the drinking water (8.13ppm) whereas cadmium and mercury were below the detectable limits. When fishes were exposed to above metals the following accumulation trend was noted in the organs studied (kidney > liver > gill). The present study clearly indicated that the accumulation of zinc, cadmium and mercury level in freshwater fish are highly toxic to human beings. Since, Coimbatore is an industrial city the industries while discharging the effluents should follow the maximum permissible limits recommended by the Tamil Nadu Pollution Control Board.

Abs Nr. OR-019

Hydrochemistry of Lake Naivasha, a Rift Valley, Kenya.

A.L. Ramanathan[1], J.W. Njenga[2] and V. Subramanian[2]

Abstract

Lake Naivasha, situated in the Great Rift Valley, Kenya is a unique lake in that it is a fresh water lake in an area where all other lakes are saline. The lake provides water both for agriculture and fisheries for the people living in the surrounding area.

A Hydrochemical investigation, which is important for the assessment of water quality, has been carried out to study the sources of dissolved ions in the lake.

Results indicate that the lake is alkaline in nature with an average pH value of 8. Electrical conductivity ranges between 220.and 2480 μS/cm. Sodium is the major cation while chloride and bicarbonate are the major anions. Silicate weathering seems to be the major contributing factor to the bicarbonate content in the Rift Valley Lake. The relatively high (Na+K)/TZ+ ratio and the low equivalent ratio of (Ca+Mg)/(Na+K) indicate that dissolved ions are contributed mainly by the weathering of aluminosilicate mineral. Fluoride content is very high ranging between 2-25 mg/l.

The observed chemical data of the lake was used to predict the mineral assemblages in the carbonate and silicate systems. Dolomite seems to be the possible mineral that is in equilibrium in Lake Naivasha system. Silicate system on the hand indicates that the water chemistry of the Lake is in the range of stability field of kaolinite.

Although the lake Naivasha water seem to be suitable for both irrigation and aquaculture purposes, the fluoride content is too high and might be detrimental to the users.

[1] School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110067, India.
[2] Jomo Kenyatta University of Agriculture and Technology, Chemistry Department, P.O Box 62000, Nairobi Kenya

Abs Nr. OR-029

Treatment of Tannery Waste Water Using Cyanobacteria with Special Reference to Chromium – An Eco-friendly Technology

V. Shashirekha[1], L. Stanley Abraham[2] and Mahadeswara Swamy[1]

Abstract

There has been an ever-increasing public health problem due to pollution by rapid industrialization and anthropogenic activities. Indiscriminate release of industrial effluents, especially tannery wastewater from leather industry, into ground and surface water leads to their contamination with heavy metals and other toxicants, which are deleterious to flora and fauna. Leather industry is one of the major water consuming industry and needs large volumes of water with about 210 million litres being consumed daily in Indian tanneries. A huge quantity of effluent water containing toxic chemicals is being released into the environment. A majority of tannery effluents contains chromium in the trivalent state besides chlorides, sulphides, sulphates, total dissolved solids and suspended solids with high BOD and COD. Therefore, the recycling/treatment of this water assumes much importance as they can be reused in tanneries or for agriculture besides preventing pollution of the land and water bodies. In the present work Cyanobacterial species have been used for purification and recycling of tannery wastewater. They are found to be very effective in removal of chromium and chlorides besides reducing BOD and COD level. The effects of different concentrations of chromium on the growth response of these species in biomass and chlorophyll-a were also studied. Furthermore, the better performance in field conditions gave positive indication of their usefulness in treatment of tannery wastewater. The system when standardized would not only be economical but also eco-friendly and sustainable.

[1] Bio-products Lab, Central Leather Research Institute, Chennai 600 020
[2] Shri. A.M.M. Murugappa Chettiar Research Center, Chennai 600 113.

Abs Nr. OR-040

Nature of Solute Load in a Tidal River-a Case Study of River Rupsha, SW Bangladesh

S. K. Saha[1], Md. Sohrab Hossain and Dilip K. Datta

Abstract

Throughout history water has been considered a natural resource critical to human survival. The Rupsha River around the Khulna Metropolitan City of southwestern Bangladesh is having tropical monsoonal climate characterized by relatively high temperature, heavy rainfall, and excessive humidity and fairly marked seasonal variations. About 90% of annual rainfall occurs during monsoon period (May-Oct.) and the rest 10% occurs during non-monsoon period (Nov-Apr).

In the river water, chloride, bicarbonate, sodium, magnesium and sulfate are dominating constituents. The calculated hydrologic budget of the Khulna area are: the mean annual rainfall is about 1700 mm/yr and the surface water runoff are estimated to be 139 mm/yr. The average chloride concentration in river water is 337.89 mg/l in the monsoon period and in the non-monsoon period, it is 459.50 mg/l. Cl^{-1} is abnormally high in all seasons. The total dissolved solids ranged from 574.87 mm/l to 1078.1 mm/l. TDS is higher in monsoon period in surface water shows enrichment of TDS in monsoon indicating the influence of weathering process. In monsoon HCO_3 is higher compared to other seasons suggesting the occurrence of maximum chemical weathering.

The sources of major ions in water observed that the major mechanism controlling the water chemistry is the chemical weathering of the denudation regime in the monsoon period whereas evaporation-crystallization regime in the non-monsoon period (Gibbs 1970). The alkali earth elements viz., Ca and Mg constitutes 40-50% of the total cations, while the bicarbonates make up 30-40% of the total anions.

[1] Assistant Professor, Khulna University, Khulna 9208, Bangladesh

Stallard and Edmond (1987) mentioned that a 1:1 relationship should exist between (Ca+Mg) and HCO_3 on an equivalent basis in a carbonate dominated water chemistry. Excellent positive correlation exists between HCO_3 with Ca and Mg (r=0.8 and 0.4 respectively).

Statistics of surface water show poor-good correlation with each other ions. The few ion pairs like EC-Ca^{+2}, Ca^{+2}-HCO_3, $Cl^{-}Ca^{+2}$, $Cl^{-}Na^{+}$, SO_4-Mg^{+2} , EC-Na^{+}, TDS with EC, SO_4, Cl^{-}, Ca^{+2}, Mg^{+2} and Na^{+} show moderate to good correlation. Good correlation indicates chemical weathering and leaching of secondary salts contribution followed by multiple source inputs of industrial effluents. The suitability of river water for irrigation and industrial purposes varies from place to place with season.

Abs Nr. OR-045

Heavy Metal Pollution in Sediments of Hussain Sagar Lake: Comparison of Microwave and Conventional Digestion Methods

D. Motati Suneela[1], Malleshwara Reddy, K. Saritha and M.S.Sastry

Abstract

The present study deals with the heavy metal content in sediments of Hussain Sagar Lake and the use of microwave heating over conventional heating procedure has been studied and the two techniques were compared with each other.

Five sediment samples (coded as KN, BN, PN, VH, and HSJ) were collected at different locations with respect to the inflow water coming into the lake during August- October 2002. The experiments were performed on three sets of sub-samples. Conventional digestion was accomplished on the hot plate to dryness using conical flask, while microwave digestion in CEM (HP-500 plus) vessels was performed in a microwave oven (CEM MARS-5).

Recoveries of heavy metals from the sediment samples using the both techniques were reasonably comparable, in spite of big difference in time required. Higher results were obtained in Microwave extraction technique than the conventional one. The above scheme allows shortening the sequential extraction time from days to minutes. The order of the contamination in the studied sediments was Zn>Pb>Cu>Ni. Among the five sediments tested the order of most contaminated sediments are KN>BN>PN>VH>HSJ.

[1] Laboratory, Environment Protection Training Research Institute (EPTRI), 91/4 Gachibowli, Hyderabad 500 032, A.P. India

Abs Nr. OR-046

Biogeochemical studies of Flood Plain Sediments of Yamuna River Basin (Sub-basin of Ganga) During Recent Past (Holocene)

D.P.Saxena[1] and V. Subramanian[1]

Abstract

"Present is key to past " on this famous geological phrase we can also add that past is an alarm to the present. To understand ice age, global warming and sea level rise etc, it is necessary to understand the properties of drainage basin and their role in the past and their present behaviour in order to extrapolate it to the future.

Floodplains are in large measures produced by physical process of river deposition. Floodplains have a history of recording the environmental changes of recent past. It can be an important accumulation zones for pollutants that are dispersed by fluvial activities.

In the present study Floodplains of river Yamuna was studied, which is the largest tributary of the river Ganga, guided by the Himalayas watershed The core samples were collected by manual drilling up to local water table in t from the floodplains of Yamuna basin, at five sampling stations, Sharanpur (next to Himalayas), Delhi, Jagmanpur, Hamirpur, and Allahabad. Core sediments were used for metal Analysis (Pb, Zn, Fe, Cu, Ni, Cr, Ti, Ba, Ca, and Al), Carbon, Sulphur and Phosphorous Age of the core was calculated by Pb^{210} .

All the metals show, higher concentration in the upper part of the cores except, Jagmanpur core sediments. The higher values are due to the increase of industrialization and urbanization in the recent past. All the metals at Delhi region reported higher values in comparisons to the locations. Delhi is the highly industrialized area in the entire basin. The industrial effluents of Delhi contribute

[1] School of Envrionmental Sciences, Jawaharlal Nehru University, New Delhi 67

large amount of metals to the main stream and other drainage channels carry them from the catchment area and deposited with the flood plain sediments.

Delhi sediments which shows highest values for all the metals, but not of Calcium, which is lithogenic in origin. . It reflect the high pollution flux in the mainstream and catchment area, due to industrial waste.

Phosphorous concentration ranges from 272 ug/g to 940 ug/g. This is comparable to the range of average content of phosphorous in the sediments of Indian rivers, 11000 mg/g (Subramanian 1989), Delhi sediments reported highest value 321-940.mg/g. Carbon and sulhpur values are higher in younger strata (upper) than older strata of floodplain. It signifies the change in nutrition dynamic of basin in recent past as a result of anthropogenic activity.

Abs. Nr. OR-050

Photosynthetic Rate of *Rhizoclonium riparium* (CHLOROPHYTA Cladophorales) *E*xposed to Copper and its Use Like Bioindicator.

W. Montoya[1], E.J.Peña[2], and R. Benítez[3].

Abstract

Algae have been used as bioindicators by having several advantages such as they have short life cycles, they can take up nutrients directly from water, they are generally easy to collect in sufficient amounts from various habitats; and they readily accumulate compounds present in seawater, making tissue analyses reliable indicators of water quality. In order to evaluate the bioremoval capability of the green alga *Rhizoclonium riparium*, the photosynthetic responses to heavy metal pollution under different sublethal concentrations of copper was assessed. Photosynthetic rates were significantly low ($p < 0.05$) at low copper concentrations, between (0.01 y 10 mg/l). Maximum photosynthetic values were shown at 30 y 60 mg/l and almost cero at 150 mg/l of Cu. During the first 24 hours of exposure there was a significant reduction ($p < 0.05$) of photosynthesis in all studied concentrations, whereas between 24 and 96 exposure times, rates increased significantly. These results suggested that plants exhibited an “alarm phase” related with diffusion processes and metal ions exchange at the cell wall level. The photosynthesis behaviour along the concentration gradient indicated the resistance and tolerance capacity of the alga as well as its potential use for copper removal in coastal waters.

[1]University of Cauca, Popayàn city, Cauca Department, Colombia, South America.
[2] Associate Professor, Department of Biology, University of Valle, Cali city, Valle del Cauca Department. Colombia, South America**.**
[3] Titular Professor, Department of chemistry, University of Cauca, Popayàn city, Cauca Department, Colombia, South America.

Abs. Nr. OR-052

Commercially Important and Endemic Fish Species and Management Issues in Major Rivers in Northern Philippines

E.V. Agasen[1]

Abstract

The survey was conducted from January to November 2001 covering the areas of Ilocos Norte, Ilocos Sur, La Union, Pangasinan, Tarlac and Pampanga. These areas are considered as commercial fishing grounds of commercially important and endemic fish species such as freshwater prawns, eel, goby, "ludong", etc. In the early 60's to 80's, fishing is considered as the major source of livelihood of the fisherfolk in the area.

Major management issues identified are the following: declining fish catch due to illegal fishing, i.e. cyanide fishing, electro-fishing and fishing with the use of fine-mesh net, excessive fishing effort, barricades, degraded habitat due to pollution caused by domestic wastes from household, agriculture and factories and conflict on water resources use.

Illegal fishing such as eletro-fishing, cyanide fishing, use of fine-mesh nets, excessive fishing efforts and construction of barricades is observed in all the areas surveyed except in Pampanga River Delta. Declining catch caused by domestic wastes from agriculture was reported in Laoag River. On the other hand, water pollution from factories is reported in some parts of Abra River and Pampanga River Delta.

Some rivers are partly dried up downstream and this maybe due to conflict of water resource use. Aside from increasing needs for human use, it was observed that great volume of water is diverted to irrigation for agricultural purposes. This may contribute to the decline or extinction of the migratory fish

[1] Senior Aquaculturist, National Fisheries Research and Development Institute, Kayumanggi press Bldg., Quezon Avenue, Q.C, Philippines

species because they may not be able to reach the sea and return to freshwater to complete their life cycle.

Some fishery management and conservation measures and anti-pollution laws are already exists but they are not strictly implemented.

Abs. Nr. OR-053

Biological Treatment of Tannery Soak Liquor in a Sequencing Batch Reactor Using Halophilic Bacteria

O. Lefebvre[1], N. Vasudevan[2], K. Thanasekaran[2] and R. Moletta[1]

Abstract

The Indo French Cell for Bioprocesses of Environment has been created in 2002 to initiate the Indo-French cooperation on wastewater treatment. A first research field of common interest has been identified as being the treatment of hypersaline wastewater (i.e. wastewaters containing more than 35 g l^{-1} Total Dissolved Solids (TDS)).

Hypersaline effluents are generated by various industrial activities. Those wastewaters, rich in both organic matter and TDS, are difficult to treat using conventional biological wastewater treatment processes. Use of halophilic bacteria is required. Biological treatment of those hypersaline effluents could represent up to 5% of the total effluents produced worldwide.

Among the industries generating hypersaline effluents, two categories are prominent in India, which are tanneries and textile industries. Tanning is one of the oldest professions in India, with 2000 units spread mostly across Tamil Nadu, West Bengal, Uttar Pradesh, Andhra Pradesh, Karnataka, Rajasthan and Punjab. Leather tanning is almost wholly a wet process from which a large volume of liquid waste is continuously generated. Due to the variety of chemicals added at different stages of processing of hides and skins, the wastewater has complex characteristics.

In this study, tannery wastewater from soak pit was treated in a bench scale bioreactor for the removal of organics. This soak liquor is characterised by high organic load, high suspended solids (lime, hairs, flesh, etc.) and high salinity. Because of that high salt content, this wastewater is generally segregated and

[1] Laboratory of Environmental Biotechnology – Institut National de la Recherche Agronomique, Avenue des Etangs, 11100 Narbonne, France
[2] Centre for Environmental Studies, Anna University, Chennai 600 025, India

sent to evaporation pans. Thus tanneries require large areas to dispose the soak liquor and the salt obtained can't be reused because of its high organic content. Then this salt is discharged and contributes to soil and water pollution. Treatment of this soak liquor in order to remove the excess of organic matter would:

Enhance the evaporation speed – inhibited by organic matter – thus reducing the surface required for evaporation pans

Improve the purity of the salt obtained, allowing it to be reused in the pickling stage of the tannery process, or to be sold

A bench scale bioreactor has been set up in the Centre for Environmental Studies (CES), Anna University, Chennai, India, in order to remove the organic content of the soak liquor. This bioreactor was designed as an aerobic Sequencing Batch Reactor (SBR) which works in a discontinuous way, each batch being divided into four stages: filling, reaction, settling and withdrawal. The SBR technology has the advantage to proceed with the reaction and settling stages in the same volume, thus reducing investments.

The 10l reactor was operated with an organic load of 0.6 kg m^{-3} d^{-1} Chemical Oxygen Demand (COD). A mixture of non-halophilic bacteria obtained from a sewage treatment plant and from a tannery common effluent treatment plant was first inoculated. Then a mixture of halophilic bacteria was added to the reactor in order to enhance its performances. Biodegradation of organic matter (COD, Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Orthophosphates (PO_4^{3-}), suspended solids (SS)) and growth of biomass (measured as Mixed Liquor Volatile Suspended Solids (MLVSS)) in the reactor were measured.

The characterisation of the soak liquor showed that this effluent is biodegradable – though non easily – and highly variable depending on the origin and the nature of the hides. TDS was in the range of 23 to 57 g l^{-1} and COD was in the range of 2 to 3 g l^{-1}. Despite the variations in the quality of the soak liquor, the reactor achieved stable removal of organic matter performances, once the acclimation of the microorganisms was achieved. It could successfully remove Carbon, Nitrogen, Phosphorus and SS from the soak liquor. Breakdown yields up to 95, 94, 96, 93 and 83% were reached concerning COD, N-NH_3, N-TKN, P-PO_4^{3-} and

SS respectively. Evolution of the biomass content in the reactor showed constant changes, due to the dynamic equilibrium and competition phenomenon between bacteria and protozoa.

Abs. Nr. OR-059

Eutrophication of Lakes in Urbanised Areas: Case of the Yaounde Municipal Lake in Cameroon (Central Africa)

N. Kemka[1], T. Njiné [2], S.H. Zébazé Togouet[1], D. Niyitegeka[2], M. Nola[2], A. Monkiedje[2], J. Demanou[2], G. Ajegah[2] & S. Foto Menbohan [2]

Abstract

The qualitative and quantitative evaluation of phytoplankton and chlorophyll-*a*, as well as some physico-chemical parameters were recorded at 3 stations (A, B and C) in a small shallow tropical lake (Z_{max} 4.3 m) in Cameroon: the Yaounde municipal lake (3°51'N, 11°30'E, and 710.8 m above sea level). Alongside, physico-chemical measurements were regularly done in its main tributary (Mingoa stream). Analyses were carried out on a weekly sampling basis, from November 1996 to December 1997, in order to assess the lake health status and to propose measures of controlling its degradation process.

In this lake, the Secchi disk transparency is globally low and exceptionally exceeds 1 m. Water conductivity is higher near the lake bottom, reaching 422, 408 and 437 µS cm^{-1} at station A, B and C respectively. The superficial layers more oxygenated are in relation with an accumulation of phytoplanktonic elements, while strong deficiency in oxygen contents, and sometimes anoxia, recorded from 2.5 m depth leaded to a production of high quantities of ammoniacal nitrogen reaching 17.74 mgNH_4^+ L^{-1}, and probably to a phosphorus release by sediments. The total phosphorus (TP) contents vary from 80 to 2290 µgP L^{-1}, and the total Kjeldahl nitrogen (TKN) contents fluctuate between 3 and 15 mgNH_4^+ L^{-1}. Upstream to the lake, the Mingoa exhibited a TP contents ranged from 0.6 to 3.8 mgP L^{-1} (average 1.82 mg L^{-1}), and a TKN contents ranged from 10 to 22 mgNH_4^+ L^{-1} (average 14.07 mgNH_4^+ L^{-1}).

The fertility of this biotope favours a great development of phytoplanktonic algae (102 specific taxa), with more diversified Euglenophytes and Chlorophytes

[1]Hydrological Research Centre, Institute for Geological and Mining Research, PO Box 4110 Nlongkak Yaounde, Cameroon.
[2] Laboratory of General Biology, The University of Yaounde I, P.O. Box 812 Yaounde, Cameroon.

especially. Phytoplanktonic biomass and chlorophyll-*a* concentrations reached 225 µg ml^{-1} and 566 mg m^{-3} respectively. Analysis of these parameter's fluctuations reveals the allogenic nature of the functioning of this ecosystem, particularly stressed by its permanent supply by great amounts of decayed organic matters. This is an alarm-cord pulled for this lake and many other water bodies in Cameroon, which are or could be affected by anthropogenic impacts. Urgent actions need to be undertaken, in order to rehabilitate this hypertrophic hydrosystem.

Abs. Nr. OR-064

Sea Water Desalination via Fuel Cell Operation Cycle

G. Marimuthu[1]

Abstract

Fuel cells are considered as future source of electrical energy. Fuel cells generate electricity from hydrogen and oxygen. Final products are electricity and pure water. While discussing fuel cells, the attention is always focused on electricity production. The other product, namely, water is conveniently neglected. Fuel cells could be ideal source of pure water for domestic and industrial purpose if available technologies are strategically combined and applied.

Fuel cell requires hydrogen and oxygen for its operation to produce electricity and water, which is reverse of water electrolysis. The sources of hydrogen for fuel cells are ploughed back to fossil fuels and organic resources such as methanol and hydrocarbons. Seawater may be the source of hydrogen for fuel cells. The hydrogen in its pure form is obtained by electrolysis of purified seawater. Electrolysis of seawater generates chlorine, caustic soda besides hydrogen. The commodity chemicals, chlorine and caustic soda make the process economically viable and the cost of production of pure water becomes nil.

If fuel cells operate @ 65% efficiency to generate D.C. power (which is driven back again to electrolysis) based on electric power consumption for sea water electrolysis, other products are obtained at a cost of only deficiency in efficiency of fuel cells, estimated @ 35%. If values of chlorine and caustic soda are taken into calculation, pure water from sea water (indirectly through fuel cells) is obtained almost free of cost.

The paper discusses the progress made in this direction at our firm and economic viability data for implementation for 100 MLD pure water production plant.

[1] Arun Electrochemical Systems Pvt. Ltd, Plot No.415, Viduthalai Nagar, S.Kulathur, Chennai

Abs. Nr. OR-065

Coastal Management Issues and Concerns of Pulicat Lake, Tamil Nadu

Sarah Coulthard[1]

Abstract

India's wetlands are amongst some of the most threatened eco-systems in the continent. Pulicat Lake situated at the border between Tamil Nadu and Andhra Pradesh is India's second largest brackish water lagoon, covering 600km square. 52,000 people depend upon the lake for their daily livelihood, and this number is increasing. Meanwhile, available evidence suggests that the life-supporting fishery of the lake is in decline, jeopardizing the survival of the fishing communities that have inhabited its shores for generations, and threatening an important national economic and ecological asset.

The causes of this decline are not straight forward, and have been the centre of many debates within the state of Tamil Nadu and further afield. The complexities surrounding the environmental and social structures of Pulicat Lake are such that a multi-disciplinary, cross-departmental approach in its research and management is now vital in order to establish the true picture of what is happening to the lake and its people, and why.

For the past two years PhD research has been carried out in conjunction with the Universities of Bath and Newcastle (in the UK) and Anna University (Chennai). It aims to contribute to the ongoing national and international efforts to understand the social and environmental dynamics of Pulicat Lake and the problems its people face. Through research into the lives and opinions of fisher folk from 5 villages at Pulicat Lake and the gathering of secondary environmental data, the PhD outputs will be a set of potential coastal management options, specifically designed for Pulicat Lake.

[1] Centre for Coastal Management, Newcastle University, United Kingdom
E-mail- s.l.coulthard@ncl.ac.uk

The presentation will firstly provide an introduction to the uses of Integrated Coastal Management and interdisciplinary science using Pulicat Lake as a case study example. The presentation will then proceed to offer a more detailed insight into some of the problems that Pulicat Lake fishing communities are facing today.

Part 1 Introduction to the PhD objectives and the use of Integrated Coastal Management as a tool to manage the many issues facing coastal areas.

Part 2 A description of Pulicat Lake and the characteristics of the fishing communities that inhabit its shores.

Part 3 Discussion on some of the views held by the fishing communities, what they perceive to be the major problems at Pulicat Lake and what priorities they feel exist for potential future management.

Abs. Nr. OR-067

Land Cover Mapping Using Remote Sensing and GPS Technologies for Shadegan Marsh, Southern Part of Iran

Saeed Saroei[1] ,Parviz Zeaiean Firouzabadi [2]

Abstract

Remote sensing and GPS technologies have shown their abilities to map our environment. In this research an attempt has been made to study the usefulness of remote sensing data to produce maps of coastal marsh of Shadegan area Southern part of Iran in the scale of 1:50000. This marsh had already a general land cover of types *Phragmites sp* and T*ypha sp*. As a result of drought since late 1998 in this area, these species have been replaced with other plant communities. In the managerial point of view, the recognition of the replaced new plant communities is very important for further marsh management. In this regard, Landsat ETM + geocoded data pertaining to the study area used to first generate an enhanced image data through fusion algorithm of GEOMATICA image processing software from ETM+ bands 2,3,4 and 8. Using this enhanced image data set and based on MLC algorithm a map showing 14 land cover plant categories was generated. It is resulted that the trend of plant species from center part of marsh to outer part observed to be from marsh species to non-marsh species. The overall classification accuracy was 97 percent in comparison with a sampling ground truth map (about 2 percent of total area).

[1] Remote Sensing Expert, Office of Statistics and Information Technology, Ministry of Jahad-e-Agriculture, Tehran Iran
[2]Asstn. Prof., Department of Geography, Teacher Training University, Tehran Iran

Abs. Nr. OR-068

Reversal Mapping of Heavy Metal Pollution in Receiving Water Systems

D. Walther[1], H.-D. Olbrisch[2], P. Selvapathy[3]

Abstract

Heavy metals belong to the most common industrial pollutants in river, drainage and sewer systems serving as receiving watercourses of urban areas. They originate mostly from typical point-sources like industries, small industries or hospitals. The sources are numerous and difficult to locate. Thus a comprehensive control of these industrial pollutants is often not satisfactory or lacking.

Due to the characteristics of heavy metals to precipitate rather than to remain in solution they hardly can be traced in water unless it has been sampled close to the source. In most cases, heavy metal pollution occurs batch-wise and not continuously. Thus sampling becomes extremely difficult.

The city of Braunschweig is located in the centre of Germany close to one of the largest irrigation areas in a heath land region called “Lüneburger Heide”. Here a method has been developed to trace back contamination sources for industrial pollutants and from that a systematic approach for detection, recording, validating and controlling of the pollutants has been derived. Due to the success in generating a wastewater register for industrial pollutants allowing for separate collection and treatment, Braunschweig is one of the few places in Germany eligible to use wastewater for irrigation purposes.

A similar approach has been adapted to investigate heavy metal pollution in river Adyar/Chennai in a systematic way. The basic strategies and the results of the investigation will be presented in this paper.

[1] CIM-Expert, Centre for Environment Studies, Anna University, Chennai, India.
[2] Professor, University of Applied Sciences, Northeast Lower Saxony, Germany.
[3] Professor, Centre for Environment Studies, Anna University, Chennai, India.

Abs. Nr. OR-069

Fresh Water Algalogical Studies of River Gomti of Lucknow-Uttar Pradesh

M.R. Suseela[1]

Abstract

The ancient river Gomti originates from Pilibhat in the sub-Himalayan tarai belt and runs across nine districts of Uttar Pradesh and finally joins in the river Ganges at Gomti Mohana in the district Varanasi. Having length of 11.5km in the Lucknow city of Uttar Pradesh it is the backbone of its economy. About 70% of water supply is carried through this river for two million people of Lucknow. This dense population has also led to the industrialization of the city. Over the years several encroachments have sprung upon the banks of the river. The river banks are unusually abuzz due to untreated city sewage effluents from municipality, industries and run off from the land find their way into river. This has changed the natural composition of river water.

Therefore over the years Gomti river has become polluted. The analytical data on various parameters indicated that the river water quality is extremely poor and dissolved oxygen level of the river water has sharply decreased with significant elevations in BOD and COD levels. Monitoring by the state pollution control board reveals that the river water is unfit for consumption. The extent of pollution is such that the biodiversity of the river is being affected. As a part of conservation of biological diversity of fresh water algal flora the present investigation has been carried out.

The role of algae in self purification and pollution control of lotic water has met with causal attention in India. A total of 80 algal forms out of which 25 blue green algae, 10 green algae and the remaining 45 diatoms are reported. Predominance and seasonal variation of these algal forms are discussed in this paper

[1] Algology section, National Botanical Research Institute, Lucknow 226 001, Uttar Pradesh, India

Abs. Nr. OR-071

Waste Water Treatment Using Aerobic Filter Technology

K.V.Emmanuel[1] and R.A. James[1]

Abstract

Treatment of domestic sewage has become an integral part of modern city management. While the situation with sewerage and sewage treatment in India still needs a lot of improvement, the few sewage treatment plants, which have been implemented, too were not functioning very satisfactorily. Almost all these treatment plants employed suspended growth aerobic systems after primary clarification, mostly aerated lagoon or activated sludge plants. The requirement of continuous power for these systems makes it quite costly in operation and dependent on high level of operation, monitoring and maintenance. It is seldom found easy for the plant authorities to ensure continuous power, which in turn, results in under-optimized performance of these units. Needless to say, a system, which is not as sensitive as the existing one, but can match the regulatory requirements, would be the need of the hour. The stringent stands laid down for treated sewage (20 mg/l BOD and 30 mg/l Suspended solids) makes it quite difficult for anaerobic systems in itself to totally replace the aerated lagoon/activated sludge plants. Combination of anaerobic and simple aerobic systems e.g. a UASB followed by stabilization ponds could achieve the results, but it would be preferable to achieve the results using one-step treatment system and hence the interest in aerobic filters. The aerobic filters are quite suitable for sewage treatment, as on one hand it can provide the high efficiency required and on the other, the operation and maintenance of the system would be cheaper and easier. The technical details of the aerobic filters and its performance details are described in subsequent chapters.

[1] BORDA-Centre for Environment Studies, Anna University, Chennai 600 025

Abs. Nr. OR-076

Influence of Sea Water Intrusion on Soil Chemical Properties

A. Baskar[1], R. Sankar, U. Bagavathi Ammal and P. Selvaraj

Abstract

The Pondicherry region of the union Territory of Pondicherry lies in the coastal belt of Bay of Bengal. The soils of this region are highly suitable for variety of crops, which are irrigated with mostly ground water. The Bahour commune is considered to be the rice bowl of Pondicherry region where the crop cultivation is mainly depending on ground water resources.

During the *sornawari* season (May – August) of 2002, the paddy crop suffered a serious set back resulting in complete failure in this commune. The field investigation of the affected area had shown the hydrogen sulphide injury as seen from the dark black colour of the surface soils and rotten egg smell. The root samples were also covered with the precipitate of iron sulphide resulting in root rot and die back symptoms. To investigate further, soil and water samples were collected from the affected area and analysed for various parameters.

The results have suggested that the soils of this commune are fine textured in nature, the clay content ranging from 25.90 to 43.15 per cent. Interestingly, the pH measurements taken in soil water suspension had shown drifting values, which was attributed to the high sulphate nature of the soil samples as indicated by Hesse (1994). As suggested by Dent (1986), the pH measurements were made in hydrogen peroxide medium, which had shown that the majority of the soil samples were acidic in nature with pH values ranging from 1.20 to 6.20. It was also seen that the organic C content of all the soils were unusually high which was attributed to the oxidation of pyrite in the soil samples as supported by Dent (1986). The calcium chloride extractable S registered very high values ranging from 78 to 2921 mg kg^{-1}. The other chemical properties had shown that the soils were saline, non-sodic with excess quantities of DTPA-Fe and Mn.

[1] Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal 609 603

The water samples used for irrigating paddy were found to be very high saline, medium sodic to very high saline to high sodic as per USDA classification. The ionic composition of the ground water had suggested a clear indication of sea water intrusion into the ground water as seen from the relative decrease in the concentration of HCO_3^-, together with a relative increase in the concentration of Cl^- and SO_4^{2-} among the anions and decrease in the concentration of Ca^{2+} together with an increase in the concentration of Na^+ and Mg^{2+} among the cations as had been inferred by Krishna (1988). Based on the analytical results, it was concluded that the ground waters of Bahour commune were intruded with seawater. Irrigation with the seawater intruded ground water had resulted in the formation of potential saline acid sulphate soils, which was identified for the first time in the Pondicherry region.

Abs. Nr. OR-077

Wastewater Irrigation

P. Nila Rekha[1], N.K. Ambujam[2], D. Deboral Vimala and M.Jayanthi

Abstract

With increasing global population, the gap between the supply and demand for water is widening and is reaching such alarming levels that in some parts of the world it is posing a threat to human existence. Scientists around the globe are working on new ways of conserving water. On the other hand disposal of municipal wastewater and industrial effluents are causing major environmental problems . In India, it is estimated that 3,650 m^3 of wastewater is generated from urban and local bodies and 750 million m^3 of wastewater is generated from industrial units every year. At present the water actually consumed by effluent reuse is only about 15 – 20% and the balance 80% is going as waste The arid and semi arid areas of the world can easily augment 15 to 20% of their water supply through reuse of wastewater. There is a great scope in utilizing this water after treating the same to the extent necessary. If the used water in the municipalities and industries are reclaimed, it is estimated that more than one lakh acres can be brought under irrigation in Tamil Nadu alone. Waste water reclamation and reuse may produce reliable source of water even in drought years. Applying wastewater to agricultural lands is a more economical alternative and more ecologically sound than uncontrolled dumping of municipal and industrial effluents into lakes and streams. In arid and semi arid regions where water is in short supply, wastewater reuse is one of the measures, which take care of the water needs, and concerns for environmental safety at a single stoke. Recycling of wastewater for irrigation thus proves to be an appropriate technology. Municipal wastewater and Agro based industrial wastewater irrigation with better management practices will reap rich benefits. A critical review about the waste water irrigation has been presented in this paper .

[1] Central Institute of Brackish water Aquaculture, Chennai 600 028
[2] Center for Water Resources, Anna University, Chennai

Abs. Nr. OR-085

Design of Sewage Farms as Constructed Wetlands with Mixing Cell Method

Benny Joseph[1] and N.K. Ambujam[2]

Abstract

In the 21st century developing countries around the world are still grappling with the problems of scarcity of clean water, wastewater treatment and disposal. Low cost-low energy treatment systems and reuse of wastewater are the few prime solutions in the horizon. Sewage farms and constructed wetlands are two of the low cost treatment systems which could be of high utility for a tropical country like India. Constructed wetlands emphasize on the treatment aspect of wastewater, whereas the sewage farms play the prima donna role of resource recovery in the form of farm produce in addition to substantial changes brought about in the characteristics of wastewater by way of reduction of organic matter content. In many parts of the world, water is scarce and often polluted. In many countries, population density and the location and size of reservoirs create water distribution problems. Inadequate wastewater collection and treatment facilities even in the richest countries allow untreated sewage into rivers, lakes and oceans. The impact of the discharge of urban wastewater into rivers, lakes, estuaries and the sea is a matter of great concern in most countries. Conventional solutions to wastewater treatment are not only expensive, but are designed to throw water away. Further they do not address issues of water scarcity and distribution or limited financial resources. The high cost of the some of the conventional treatment processes has produced economic pressures and has caused engineers to search for creative, cost effective and environmentally sound ways to control water pollution. As result of the above, alternative systems designed to mimic nature are operating around the world to address the problems of conventional wastewater treatment facilities. These alternative

[1] SG Lecturer, Mepco Schlenk Engineering College, Sivakasi 626 005
[2] Assistant Professor, Centre for Water Resources, Chennai

systems use man-made ponds, constructed wetlands and designed soil filters to transform wastewater into usable water resource. Compared to conventional treatment systems, constructed wetlands are low cost, are easily operated and maintained, and have a strong potential for application in developing countries, particularly by small rural communities. The combination of multiple treatment environments within constructed wetlands can provide water quality suitable for reuse. One of the technical approaches in the present context is to construct artificial ecosystems as a functional part of wastewater treatment. Wastewater has been treated and reused successfully as water and nutrient resource in agriculture and green belt irrigation. The conceptual change that has allowed these innovative processes is to approach wastewater treatment as water pollution control with the production of useful resources rather than a liability. US Environmental Protection Agency (EPA) in its design manual for the design of constructed wetlands has proposed a plug flow reactor (PFR) model for BOD removal predictions in constructed wetlands and was validated using the measured values from the constructed wetland at Listowel, Canada. Later in 1999 Chen et al have proposed a rigorous mathematical model for BOD predictions, assuming the constructed wetland as made up of number of continuous flow stirred tank reactors (CFSTRs). The above model yielded much realistic results when compared with USEPA model. In 2000 Vogler et al proposed a model, again considering the constructed wetland as made up of number of CFSTRs and a much simpler derivation technique had resulted in predicted values comparable to the earlier models. In the above contest the need for a simpler model in terms of parametric requirements and concept, which could yield better results has been identified and taken up as the prime task of the present study.

In sewage farms, sewage is applied to land, which is used for cultivation. This is a type of land application to treat wastewater. In fact it can be thought of as slow rate application system from which a part of the sewage evaporates and the remainder percolates into the soil and ultimately to escape into subsurface drainage channel or joins the ground water. As sewage irrigates the land it adds

to the fertilizing value due to the presence of nitrates, phosphates etc. in it. Crops like cotton, sugarcane, potatoes and grass can be profitably grown in the sewage farms. As far as the modus operandi of sewage farms is concerned, it is basically a constructed wetland with provision for resource recovery. The vegetation will be more selective depending on the cultivation practices. The produce from the sewage farms finds a ready market in the near vicinity in most of the cases. From the resource recovery and low cost waste treatment perspective, it is the need of the hour to improve and promote sewage farms in a planned way in developing countries. This study is an attempt to contribute towards the above end. Application of wastewater to constructed wetlands and sewage farms must be free of unreasonable risks to public health. Pathogenic organisms may be present in both wastewater and sludge and their control is one of the fundamental reasons for waste management. To protect farmers' and consumers' health, the World Health Organization (WHO) published guidelines for the safe use of wastewater in agriculture. The application of the guidelines, however, has been found to be difficult in many field situations.

In this paper a design procedure is proposed for sewage farms with special reference to Indian conditions, making use of the proposed model for the removal of BOD from constructed wetlands. Since constructed wetland design varies with the characteristics of the specific site, all designs should be prepared and reviewed on a site specific basis. The various factors influencing the performance of the wastewater treatment wetland system are accommodated in the proposed design procedure and first order BOD reaction rate is assumed and the soil parameters that could have a bearing on the reaction rate such as porosity and specific surface area are given due weightage. A design procedure and guidelines as per the proposed mathematical model in comparison with existing practices are narrated here. The design procedure with the proposed organic and hydraulic loading criteria is illustrated for the city of Madurai with reasonable margins against unforeseen organic and hydraulic overloads. The effectiveness of the designs for varying operating parameters and environmental conditions requires further investigation.

Abs. Nr. OR-093

Studies on Biological Liquefaction and Biomethanation of Organic Solid Waste Generated from Tanneries

P. Muthukrishnan[1], R. Suthanarajan, Ravithranath, K.Chitra, S.Rajamani and P.Lakshmanapermalsamy[2]

Abstract

The tanning Industry is one of the oldest and fastest growing industries in south and southeast Asia. There are more than 3000 tanneries located in India with a total processing capacity of 7,00,000 tonnes of hides and skins per year. In Tamil Nadu nearly 934 tanneries in which give 65% production share. More than 90% tanneries are in small and medium scale sector with processing capacities of less than 2-3 tons of hides/skins per day. They follow traditional practices, mostly unorganized and unplanned on environmental pollution control aspects.

Major solid waste generated from tanning industry are: fleshing, trimming, shavings, buffing dust and sludge from Effluent Treatment Plants (ETP). Such fleshing is dumped as land fill or disposed of along with other solid wastes. The unutilised fleshing containing high concentration of organic matter lime and sulfide, putrefy and produce obnoxious odour, cause groundwater pollution, attract flies and rodents. Due to high moisture content handling and transportation of such fleshing become difficult. To solve the disposal problem of fleshing, a study was carried out to digest it anaerobically after biological liquefaction.

The fleshing can be anaerobically digested in closed digesters and digested sludge used as manure. For efficient anaerobic digestion in UASB reactor, the fleshing has to be reduced in size. Though the biogas generated in the process

[1] Department of Environmental Sciences, Bharathiar University, Coimbatore

[2] Department of Environmental Technology, Central Leather Research Institute (CLRI)

can be recovered and used as energy. One of the major problems faced in biomethanation of fleshing is pulverisation for easy feeding and better digestion. One of the methods studied was liquefaction of fleshing and then biomethanation of the liquefied fleshing in UASB reactor.

Traditional disposal methods can produce odours in the local community and generate air pollutant emissions. For example, disposing of waste in landfills has the potential for leaching contaminants into the groundwater and also generating significant of global warming gases (Dave Ryan, 2001), land filling also results in making the soil anaerobic by depletion of dissolved oxygen, which makes the land unsuitable for plant and tree growth, Therefore, land filling its not a correct option. The most suited mode of disposal is incineration, but the rising cost of incineration and the need to maximize energy recovery and digestion of these solid wastes makes the anaerobic degradation process a very attractive alternative to the mass burn technology (Brac and Six, 1999). Moreover the high water content and organic fraction combination makes energy recovery by anaerobic digestion a favorable proposition (Marguerite Lake).

The liquefied fleshing is mixed with tannery waste water and treated using UASB reactor for biogas recovery. The COD removal efficiency was increased to a maximum of 70 % from 10 %. The study was carried out for a period of 75 days. The reactor was monitored continuously for the parameters such as pH, VFA, COD, waste water flow and biogas production. The waste water was pumped into the UASB reactor using peristaltic pump. The quantity varies between 4 to 9.6 litres per day. The HRT maintained during the study period is in the range of 12 – 30 hours COD removal efficiency was very low during the start up period. Maximum COD removal efficiency of 70 % was observed only after 60 days of start up of the reactor with an average COD loading rate of 7 $kg/m^3/d$. This delay may be due to the acclimatization of the microorganisms present in the sludge to the substrate provided and less sludge activity etc during the startup period. The maximum biogas produced during the study period was about 6.7 litres per day. 230 to 275 ml of biogas was produced per gm of COD removed.

Abs. Nr. OR-094

Factors Influencing Suspended Load in the Meltwaters

of Dokriani Glacier, Garhwal Himalaya

P.G. Jose[1] and S.I. Hasnain

Abstract

Solute and suspended load in the meltwaters of the Dokriani glacier has been monitored during the ablation season. The suspended sediment concentration varied from a low of 22 mg/l to a high of up to 228 mg/l. Maximum suspended load was observed in the months of July and August coinciding with heavy monsoonal rainfall. The average suspended sediment load for 1999-2000 has been computed at about 16900 tons/km^2/year. There is a pronounced relationship between the amount and intensity of rainfall and the suspended load. The rainfall variation from year to year has been significantly high. The thick debris cover in the lower ablation zone of the glacier is a major factor contributing to the suspended load. The character of the glacier hydrological system also plays a significant role in controlling the sediment transport.

[1] Glacier Research Group, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi

Abs. Nr. OR-119

Hydrogeochemsitry of the Achankovil River Basin, India

Balakrishna Prasad[1] and A.L. Ramanathan

Abstract

A study of major cations and anions of the Achankovil river basin and its two major tributaries has been carried out to assess the geochemical and solute acquisition processes. The river has been sampled during February 2002 (Pre-monsoon), June/July 2002 (Monsoon) and October 2002 (Post-monsoon) and analyzed for various cations and anions. Cl, HCO_3 and H_4SiO_4 account for almost 90% of anions and Na and Ca 85% of major cations. This study shows that surface water was dominated by Cl>Ca+Mg/ HCO3 and Ca+Mg/Na+K and other ratio shows the major contribution of ions from precipitation induced silicate weathering followed by carbonate weathering with minor anthropogenic sources. High EC and TDS were observed in the monsoon and post monsoon samples. There is a minor seasonal variation in the TSM concentration that shows the abundance of highly resistant rocks in the river basin. The water is in equilibrium with Dolomite and Kaolinite minerals. Chemical weathering is predominant than physical weathering. The annual river discharge is 1.48 km3/yr and delivers the solute load of 1389 X 10 6 t/yr. and suspended load of 27 X 10 6 t year-1 to the Vembanad Lake and in turn to the ocean. The amount of solute transfer is very high in comparison to its small drainage area and discharge.

[1] School of Environmental Sciences, Jawaharlal Nehru University, New Delhi

Abs. Nr. OR-121

Pollution of Freshwater Ecosystems in Bangladesh

Dilip Kumar Datta[1]

Abstract

The importance of freshwater ecosystems lies in the fact that the great civilizations developed in floodplains where the foundation of agriculture and the earliest settlements were laid (Gopal 1993). The freshwater ecosystems of Bangladesh constitute important repositories of fresh-water, and nutrient rich sediments. The Ganges-Brahmaputra-Meghna (G-B-M) is globally important because they are the primary conduit of an estimated 1060 million tons of suspended solids, more than 1330 km^3 of freshwater and more than 173 million tons of total dissolved load to the Bay of Bengal yearly (Milliman and others 1995). Because of low elevation (between 5 and 6 masl: Milliman and others 1989), frequent flooding (Rasid and Paul 1987) and Holocene sea level changes (Umitsu 1993) Bangladesh serves as a reservoir of the sediments and fresh water carried by the G-B-M system.

The freshwater ecosystem of Bangladesh also represents important sites of genetic resources, and provides habitat for a large number of plants and animals. About 260 indigenous fish species (belongs to 55 families), 150 species of birds, about 12 exotic species and 24 shrimp species and 24 species of tortoise and turtles live in freshwater ecosystem of Bangladesh (Sarker and Sarker 1988 in Ali 1997). These ecosystems supports nearly 50 to 56 percent of the total aquatic flora of the country, and 80 percent of the total inland freshwater capture fisheries (61 percent of the country's total fisheries), and thereby supports the livelihood of 10 million people (Khondker 1995).

Freshwater ecosystems in Bangladesh also meeting the increasing demands for water in industrial and municipal use. A considerable amount of irrigation water is

[1] Environmental Science Discipline, Khulna University, Khulna 9208, Bangladesh

also supplied by these freshwater bodies. Thus the freshwater ecosystems are important in Bangladesh both ecologically and economically