Journal of Environmental Science and Engineering

(http://www.neeri.res.in)

ISSN 0367-827 X

Volume 55 | No. 4 | October 2013

CONTENTS

The journal is covered by the following leading abstracting, indexing and current awareness services:

- Chemical Abstracts Service
- Sci-Search - A Citied Reference Science Database
- Engineering Index
- Current Contents
- Research Alert
- Cambridge Scientific Abstracts
- INSPEC
- Biotechnology and Bioengineering Abstracts
- Biological Abstracts
- EMBASE
- Scopus
- IC Journals
- CAB Abstracts
- Elsevier Biobase - Current Awareness in Biological Sciences (CABS)
- Indian Science Abstracts
- BIOBASE
- BAILSTEIN
- IARAS
- Compendex
- ACM
- Ulrich's
- National Library of the Netherlands
- French National Library
- British Council Library
- British Council Libraries
- German National Library of Science and Technology
- National Library

Environ. Science & Engg. Vol. 55, No. 4, p. 397-408, October 2013

Decision Making Software for Effective Selection of Treatment Train Alternative for Wastewater Using Analytical Hierarchy Process

A.D. PRASAD[1]* AND A.R. TEMBHURKAR[2]

Proper selection of treatment process and synthesis of treatment train is complex engineering activity requires crucial decision making during planning and designing of any Wastewater Treatment Plant (WWTP). Earlier studies on process selection mainly considered cost as the most important selection criteria and number of studies focused on cost optimization models using dynamic programming, geometric programming and nonlinear programming. However, it has been noticed that traditional cost analysis alone cannot be applied to evaluate Treatment Train (TT) alternatives, as number of important non-tangible factors cannot be easily expressed in monetary units. Recently researches focus on use of multi-criteria technique for selection of treatment process. AHP provides a powerful tool for multi-hierarchy and multi-variable system overcoming limitation of traditional techniques. The AHP model designed to facilitate proper decision making and reduce the margin of errors during optimization due to number of parameters in the hierarchy levels has been used in this study. About 14 important factors and 13 sub factors were identified for the selection of treatment alternatives for wastewater and sludge stream although cost is one of the most important selection criteria. The present paper provides details of developing a soft-tool called "ProSelArt" using an AHP model aiding for proper decision making.

Key words: *Decision making, judgement, analytical hierarchy process, multi criteria analysis, process selection, planning, optimization, wastewater*

1. Introduction

Rapid requirement of properly operating wastewater treatment plants has increased in recent past leading to new construction or up-gradation of old treatment plant to treat wastewater in order to achieve the required effluent quality for discharge [1]. The best treatment process may be the one associated with minimum capital cost, minimum pollutant discharge and maximum environmental/ social benefits [2]. Various treatment processes and technologies exist which are capable of reducing the concentrations of one or more contaminants. A treatment train is sequence of selection of individual unit processes where the effluent of one

[1]Research Scholar, Civil Engineering Department, Visvesvaraya National Institute of Technology, Nagpur - 440 010 (India); e-mail: arti_prasad @ rediffmail.com
[2]Associate Professor, Civil Engineering Department, Visvesvaraya National Institute of Technology, Nagpur-440 010 (India); e-mail: artembhurkar@ rediffmail.com
*Corresponding author: Postal Address: Yoglaxmi Apartment, C- 308, Modi No.1, Sitabuldi, Nagpur-440 012, Maharashtra, India

viron. Science & Engg. Vol. 55, No. 4, p. 409-416 , October 2013

Discritization of the Gaussian Plume Model

A. KAMESWARA RAO[1]* AND T. SRINIVAS [2]

In general a plume is more known than a puff for stack emissions. A plume may be regarded as a number of puffs ejected out in quick succession. Conversely a continuous plume can be discritized (dissected) at intervals to form puffs. The main objective of the present study is to establish a relationship between a plume and a puff by dissecting the plume longitudinally and equating the contents of the segmented plume to a spheroidal shaped puff for different distances and stabilities to meet vagaries of weather.

Key words : Air pollution, Gaussian plume model, Gaussian puff model, mathematical modeling, stability, discritization

oduction

A plume is a continuous emission out of the strial stack. It goes along the direction of wind axis) and gets dispersed along a horizontal direction sverse to the direction of wind (Y-axis) and along vertical direction (Z-axis). The dispersion fficients for different distances from the source are n by Pasquil-Gifford curves.

Martin gave the values (Table 1) which fairly ee with Pasquil-Gifford Curves.

$$\sigma_y = ax^{0.894} \text{ and } \sigma_z = cx^d + f$$

Gaussian Plume models are widely used for point sources. They are reasonably successful in predicting experimental results for single elevated point sources.[2] Gaussian Plume assumes steady and continuous emission for considerable time under homogeneous conditions.

Concentration at any downstream point is given by [3]

$$C_{(x,y,z)} = \frac{Q}{2\pi\sigma_y\sigma_z U} e^{-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2} \left[e^{-\frac{1}{2}\left(\frac{z-h}{\sigma_z}\right)^2} + e^{-\frac{1}{2}\left(\frac{z+h}{\sigma_z}\right)^2} \right]$$

ble 1: Martin's Dispersion Coefficients[1]

tability	a*	c*	d	f
	0.442975	0.000240146	2.094	-9.6
	0.324433	0.05498285	1.098	2
	0.216288	0.112805	0.911	0
	0.141419	1.25431	0.516	-13
	0.105025	6.73767	0.305	-34
	0.07071	18.054	0.18	-48.6

[Martin expressed distance x (along the direction of wind) in km and the same was adopted in metres and hence the change in constants a and c]

Associate Professor, Department of Civil Engineering, Chaitanya Engineering College, Visakhapatnam (India)
Professor, Department of Biotechnology, Institute of Technology, GITAM University, Visakhapatnam (India)

J. Environ. Science & Engg. Vol. 55, No. 4, p. 417-426, October 2013

Variation in Temperature During Composting of Food and Vegetable Waste

KUNWAR D. YADAV*, N. J. MISTRY, BHUPESH GANVIT AND DAXESH PANDYA

Composting is one of the suitable method for disposal of organic waste and convert it in to organic fertilizer. For effective composting, role of temperature within the composting heap is important. Variation of temperature in the composting heap is the indicator of type of microbial biomass present during the composting. Present study was conducted to find out the minimum volume of waste for effective composting. The present study was conducted in two phases. The first phase of study was conducted to monitor the temperature variation in different volume of composting heap and second phase of study was conducted to study the leachate production in food and vegetable waste. The results of the present study revealed that minimum 80 and 100 kg of food and vegetable waste required maintaining the thermophilic and mesophilic stage. To attain the thermophilic stage the minimum volume should be around 0.5 m^3 and minimum height 0.6m. Leachate was produced at initial stage of degradation and it was more in vegetable waste compared to food waste.

Key words: *Composting, waste, food, vegetable, temperature, leachate*

Introduction

Composting of source-separated organic usehold wastes is becoming a more common practice several countries[1]. Composting is one of the few tural processes in which, microbial decomposition organic matter occurs in aerobic conditions[2]. mposting generates considerable heat, CO_2 and water por into the air while minerals and organic matter e converted into a potentially reusable soil endment[3-7]. Composting also reduces volume and ass of solid waste, thereby increasing its value and ansforming it into a safe soil amendment [8]. hermophilic stage during composting process is ecessary to kill the pathogens as well as to break the gnin and tannin portion in the organic waste.

Vegetable waste is differentiated from green waste, which includes the biodegradable waste from gardens and municipal parks [9]. Vegetable waste is considered a good input material as it is a pure organic material and it is relatively easy to decompose, especially if compared to garden waste, which usually is high in lignin, due to the wood waste included [10]. Composting of vegetable waste may reduce the environmental impact on climate change, at a rate of about 40% and 70% respectively, compared to land filling and incineration [11]. Amongst the many available alternatives for reusing of food waste, composting is envisaged as the best way of disposal of food waste by using it on the land as organic fertilizer [12]. Composting

Environmental Section, Department of Civil Engineering, SV National Institute of Technology (NIT), Surat-395 007, Gujarat (India)
*Corresponding author: e-mail: kdjhansi@yahoo.com; Mob. +91-9428398266

Environ. Science & Engg. Vol. 55, No. 4, p. 427-432, October 2013

Physico-Chemical Change in Vertical Soil Horizon Characteristics of Distillery Affected Soil

FARID ANSARI*, A.K. AWASTHI** AND P. KUMAR***

Effect of treated distillery effluent on the physico-chemical characteristics of vertical soil horizon was studied to observe the impact of effluent on soil of nearby area where distillery canal flows. The studies were also carried out with respect to the unaffected region to compare the soil characteristics. The results showed that in distillery affected soil pH, bulk density and alkalinity increased with depth whereas water holding capacity, chloride, organic carbon, available nitrogen, phosphorus and potassium decreased with depth compared to unaffected soil horizon. Preliminary study revealed that although most of the parameters were high in distillery affected soil horizon which might promote growth of plants but increase in pH and other toxic substances with depth could cause ground water pollution through constant and continuous leaching.

Key words: *Distillery effluents, soil horizon, soil quality*

Introduction

Industrial effluent utilization of water sources is crucial to agricultural production. To meet e challenge posed by disposal of industrial effluent, s either used or disposed of on land for irrigation rpose due to non-availability of fresh water. These fluents contain undesirable elements which create ny serious changes in soil, water and physiological sorder in plants, human beings and animals. Among e different polluting elements, the toxic substances eate serious problem when they accumulate in biotic mponents. The unwise continuous use of industrial aste water for irrigation has elevated the levels of ailable toxic substances in the surface and sub-rface of soil.

The distillery effluents are a great hazard and have affected soil characteristics and the surface and underground water quality. Distilleries produce huge amount of waste water every day that is rich in organic materials and other toxic substances, which adversely influences the soil fertility status. Whereas it contains high nutrient elements and helps in production and reduces pressure on industrial fertilizers. The continuous use of concentrated effluent for irrigation purpose will enhance the exchangeable sodium content of the soil which affects the soil permeability and texture and leads to pudding and reduced rate of water intake [1]. The higher amount of salts and high concentration of sodium in the waste waters increases the salinity of the soil to the harmful level of phytotoxicity.

*Professor, School of Environmental Biology, A.P.S. University, Rewa, M.P. (India)
**Head of Department (H.O.D.), Department of Environmental Science, Post Graduate College Ghazipur (U.P.) - 233 001 (India).
***School of Environmental Biology, A.P.S. University, Rewa, M.P. (India)
Corresponding author: e-mail: ansarisir07@gmail.com; Mob. +919467071665

vironm. Science & Engg. Vol. 55, No. 4, p. 433-440, October 2013

Five Year Studies on Suspended Particulate Matter and Heavy Metals Trends in Brass City of India

MAHIMA[1], RAINA PAL[1], D. SINGH[1], ANAMIKA TRIPATHI [1]* AND G. S. SINGH[2]

Moradabad is historically an important city of western Uttar Pradesh which is popularly known as "Brass City of India, as about one thousand large and small scale brassware industries are located in and around the city. Suspended Particulate Matter (SPM) was collected two times in a week using High Volume Samplers (HVS) at six selected sites representing different areas of the city. The result indicates the annual and seasonal variations of SPM from 2005-2010. The highest value (869µg/m^3) was recorded at industrial site, i.e. Mughalpura in June (2008-09) while lowest value (71µg/m^3) at PTC in the month of July (2005-06). Five heavy metals, i.e. Cu, Zn, Fe, Cd and Pb were also observed at all the sites. Among the metals highest concentration of Zn were recorded at almost all the sites whereas Cu and Zn were found at industrial site, may be attributed to melting of Brass silly to prepare the different Brassware items. Pb and Cd were abundant at commercial site, located nearby Railway station as traffic density remains high during the day and night.

Key words: *Suspended Particulate Matter (SPM), heavy metals, seasonal trend, brassware industries, traffic density*

roduction

The presence of air pollutants beyond a cified limit in the lower atmosphere is injurious to an, animals, plants, fruits, vegetables and microbial , and may even damage property[1]. Vehicular ution is the primary cause of air pollution in the an areas (60%), followed by industries (20-30%) ndia[2]. Airborne pollutants[3] such as Suspended ticulate Matter and PM_{10} are considered as a ldwide concern because they are associated with ous human health effects, i.e. chronic respiratory blems and mortality [3-5]. The interaction within major pollutions play key role in both local and atmospheric environment [6]. In many cities, vehicular sources are the major contribution to the total pollution load [7-8]. Suspended Particulate Matter (SPM) heavily contributes to air pollution as shown by long term monitoring of the metro cities. Exposure assessment studies carried out in the developing world on several air pollutants are reviewed by some workers [9-10].

During the life time Particulate Matter are suspended to serve as media for the transfer or distribution of metals across various environmental reservoirs on earth's system [11-12]. Suspended particles

llution Ecology Research Laboratory, Department of Botany, Hindu College, Moradabad-244 001, U.P. India
titute of Environment and Sustainable Development, Banaras Hindu University, Varanasi- 221 005, U.P. India
rresponding author: Dr. Anamika Tripathi, Associate, Professor, Pollution Ecology Research Laboratory, partment of Botany, Hindu College, Moradabad 244 001, U.P. (India)
mail: anamikambd@rediffmail.com

Environ. Science & Engg. Vol. 55, No. 4, p. 441-455, October 2013

Measurement and Chemical Speciation of PM_{10} in Mumbai City, India

ABHAYSINH SALUNKHE, INDRANI GUPTA*, SUGANDHA SHETYE* AND RAKESH KUMAR

Mass concentrations of PM_{10} were high at all locations of Mumbai city in all seasons. From the enrichment analysis, it was observed that high enrichment of metals existed at all sites, the reason for which could be the effects of meteorology and trans-boundary movement of pollutants. Multivariate statistical analysis tools were used to identify common sources, viz. road dust, biomass burning, secondary aerosol, brake wear, residual oil combustion, smelting, natural soil, vehicles tyre wear, and marine aerosol. Findings indicate that most of the sites were dominated by local sources based on activities in the vicinity of the sampling locations.

Key words: *Mass concentration, particulate matter, multivariate statistical analysis, Mumbai*

Introduction

Particulate Matter (PM) in recent past has been considered one of the most potent pollutants with regard to its impact on human health. PM with aerodynamic diameter less than 10 μm (PM_{10}) has been shown to be associated with increases in mortality [1, 2]. In addition, many researchers and scientists have observed higher rates of hospitalization, emergency room visits for respiratory illnesses like asthma or cardiovascular diseases during times of high PM concentrations [3,4,5]. On a global scale, PM emissions reach 3400 million tonnes/yr. It is required to determine accurately the sources of natural and anthropogenic aerosols and their precursors. The present study examines the qualitative contribution of local emission sources contributing to aerosol mass, which is an important factor in the development of effective strategies for the control of aerosol-associated problems. The objectives of the study were as follows: (a) Evaluate PM_{10} levels in Mumbai with different activity pattern, viz. residential, industrial, commercial and background locations, (b) Chemical characterization of different chemical components such as heavy metals, ions, and water soluble carbonaceous species associated with PM_{10} mass as the tracers of different anthropogenic and natural sources, and (c) Source distribution of PM_{10} using statistical tools such as factor and cluster analysis for these sites.

Study area

Mumbai, the most populous city of India, has an estimated population of about 20.4 million by the 2011 census with an area of 468 km^2. Mumbai suffers from the major urbanization problems seen in many fast growing cities in developing countries - traffic congestion. In the present study, PM_{10} was measured at four sites during summer (April to June), post monsoon (October to December) and winter (December

CSIR - National Environmental Engineering Research Institute (CSIR-NEERI), Worli, Mumbai –400 018 (India). (abhay.salunkhe@rediffmail.com, i_gupta@neeri.res.in, sudhashetye@gmail.com, r_kumar@neeri.res.in)
*K.J. Somaiya College of Science and Commerce, Vidyanagar, Vidyvihar, Mumbai-400 077 (India).
*Corresponding author: Postal address: Mumbai Zonal Laboratory, CSIR - National Environmental Engineering Research Institute (CSIR-NEERI), 89/B, Dr. A.B.Road, Worli, Mumbai –400 018; e-mail: i_gupta@neeri.res.in

J Environ. Science & Engg. Vol. 55, No. 4, p. 456-465, October 2013

Assessment of Water Quality Index of Bore Well Water Samples from Some Selected Locations of South Gujarat, India

TRIPATHI S.[1*], PATEL H.M.[2], SRIVASTAVA P.K.[3] AND BAFNA A.M.[4]

The present study calculates the water quality index (WQI) of some selected sites from South Gujarat (India) and assesses the impact of industries, agriculture and human activities. Chemical parameters were monitored for the calculation of WQI of some selected bore well samples. The results revealed that the WQI of the some bore well samples exceeded acceptable levels due to the dumping of wastes from municipal, industrial and domestic sources and agricultural runoff as well. Inverse Distance Weighting (IDW) was implemented for interpolation of each water quality parameter (pH, EC, alkalinity, total hardness, chloride, nitrate and sulphate) for the entire sampled area. The bore water is unsuitable for drinking and if the present state of affairs continues for long, it may soon become an ecologically dead bore.

Key words: *Water quality index, bore well, Inverse Distance Weighting (IDW)*

Introduction

Water is essential for the survival of any form of life. Groundwater is a precious natural resource used for both domestic and industrial purposes. Three percent of global fresh water is large enough to meet the requirements of man for millions of years. Water pollution is a phenomenon that is characterized by the deterioration of its quality as a result of various human activities. In India, only 12% of people get good drinking water (Kudesia, 1980)[6]. The most common source of calcium and magnesium in ground water is through the erosion of rocks, such as limestone dolomite, and minerals, such as calcite and magn (Marque *et al.*, 2003)[7]. Magnesium gives undesir taste to drinking water. Nitrogen is essential in living things, but high levels of nitrate-nitrogen drinking water can be dangerous to hea especially in infants and pregnant women (Bukov *et al.*, 2001)[3]. Therefore, a continuous period monitoring of water quality is necessary so t appropriate steps can be taken for water resou management practices. The present investigation w carried out to calculate the water quality index (W

[1]Assistant Professor, Department of Agricultural Chemistry and Soil Science, N.M. College of Agricultu Navsari Agricultural University, Navsari-396 450, Gujarat (India).
[2]Assistant Professor, Polytechnic Department, Aspee College of Horticulture and Forestry, Navsari Agricultu University, Navsari-396 450, Gujarat (India)
[3]Professor, College of Forestry, Navsari Agricultural University-Navsari - 396 450, Gujarat (India)
[4]Professor and Head, Department of Agricultural Chemistry and Soil Science, N.M. College of Agricultur Navsari Agricultural University, Navsari-396 450, Gujarat (India)
*Corresponding author

J Environ. Science & Engg. Vol. 55, No. 4, p. 466-471, October 2013

Bioremediation of Municipal Solid Waste by Windrow Composting

G. MANJULA[1*], S. P. RAVIKANNAN[2] AND T. MEENAMBAL[3]

Due to rapid urbanization and economic development the urban cities are facing the problem of solid waste management. It is one among the major challenges faced by governing bodies. Bioremediation of municipal solid waste can be effectively done by windrow composting. In this study, a consortium of effective microorganisms was used for the windrow composting process. About 500 kg of shredded waste was placed in two windrows and 1 litre effective microorganisms were sprayed on one of the windrows. The variation in physical and chemical parameters was monitored throughout the process. The results indicate that usage of effective microorganisms not only shortens the stabilization time but also improves product quality. The final product was more stable and homogenous and can be effectively used as soil conditioner.

Key words: *Municipal solid waste, effective microorganisms, windrow composting*

Introduction

Rapid urbanization has led to overstressing urban infrastructure services including municipal solid waste management because of limited resources available with the municipality. [1] Tamil Nadu is one among most urbanized states in India with its 43.86% of population living in urban areas. The rate of urbanization in Tamil Nadu has doubled from 22% in 1961 to present level in 2001[2]. Solid waste management is a science associated with management of generation, storage, collection, transportation, processing and disposal of solid waste using best principle and practices of public health, economics, engineering, conservation, aesthetics and other environmental conditions.

Management of solid wastes is a problem of increasing concern throughout the world. The biodegradable fraction in wastes that cannot be recycle or converted into new products is increasingly treate through composting. It is the lowest cost alternative landfilling for many wastes. Backyard composting h also started to play an important role. Industries u composting as a process for the destruction of tox by-products through a process known a "bioremediation"[3]. The degradation rate can b increased by maintaining the moisture level. Th composting process is able to replace more cost treatment procedures for the destruction and contr of human, animal and plant pathogens.

Compost is a humus-rich soil improver, an it is a stable organic substance that plays a major ro in the physical properties of soil[4]. Depending on th planned crops, their fertilizing requirements and th local soils/climatic conditions, the use of compost ca

[1]Senior Lecturer in Civil Engineering, Karpagam University, Coimbatore - 641 021(Tamil Nadu, India)
[2]Assistant Engineer, Coimbatore Corporation, Coimbatore - 641 001(Tamil Nadu, India)
[3]Assistant Professor, Government College of Technology, Coimbatore - 641 013(Tamil Nadu, India)
*Corresponding author: G.Manjula, 10D 14 A, Lakshmi Villa, Balaji Nagar, Sundarapuram, Coimbatore - 641 024 (Tamil Nadu, India); e-mail: manjulakucivil@gmail.com; Mob. +91 9942090106

J Environ. Science & Engg. Vol. 55, No. 4, p. 472-480, October 2013

Experimental Study on Biodegradation of Dairy Wastewater Using Bacterial Isolate

LIVINGSTON PETER GOLDWYN. P*, SASEETHARAN M.K**, JEYANTHI . J.*** AND NUZRAT BEGUM N.****

The activated sludge process facilitates the removal of carbonaceous BOD, the coagulation of colloidal solids and the stabilization of organic matter by a variety of microorganisms (principally bacteria). *Bacillus sporogenes* is one of the predominant bacteria found in dairy waste water. The bacteria *Bacillus .sp* was isolated from the dairy wastewater and inoculated into the samples taken from the dairy industry. Laboratory tests were carried out by inoculating varied cell concentrations and incubating under aerobic conditions to determine the removal of COD and protein from the samples. During the incubation, microbial growth was monitored by the measurement of optical density. The biodegradation ability of the native bacteria was also compared with the commercial inoculum of the same isolate. It was observed that the sample inoculated with 5 x 10^6 CFU/mL cell concentration showed a maximum protein degradation of 92.8% after 14 days and COD removal of 91.3% in 18 days. The COD removal was higher for the commercial inoculum and the protein removal was higher in the selected native strain.

Key words : *Biodegradation , dairy wastewater, bacillus sp, protein removal*

Introduction

Aerobic bacteria are responsible for converting the organic matter into removal of inorganic substances, in the aerobic treatment of waste water. Although a variety of bacteria survive and grow in the wastewater only few bacteria are useful in degrading the organic substances. Rajeshkumar *et.al,* (2004)[1] identified *Bacillus.sp* as one of the biodegrading bacteria found in the dairy waste water. Adamse (1966)[2] examined more than 1000 strains of bacteria present in the dairy activated sludge and classified them into three groups, according to their ability of biodegradation. Jen-Kuo Yanga *et.al* (2002)[3] analyzed the production and purification of protease with the *Bascillus* bacteria an found to be very effective in deproteinizing. Kossev *et.al* (2002)[4] examined the thermophilic bioremediatio strategies for a dairy waste and observed that th addition of *Bascillus.sp* in the dairy waste resulted i greater reductions in COD, lactose, and protein. Ya *et.al,* (2007)[5] studied the isolation, characterizatio and identification of bacteria from activated sludg and soluble microbial products in wastewater treatmer systems. The effect of seasonal variations and salinit variations on the bacterial species was also studie by him. Vida Maghsoodi *et.al* (2007)[6] studied th biodegradation of effluents from dairy plant wit bacterial isolates and confirmed that the addition o

*Principal, VLB Janakiammal Polytechnic College, Coimbatore – 641 042, India.
**Prof. in Civil Engineering., Govt. College of Technology, Coimbatore–641 045, India.
***Asst. Prof. in Civil Engineering, Govt. College of Technology, Coimbatore–641 045, India.
****PG Student, Govt. College of Technology, Coimbatore–641 045, India.

J Environ. Science & Engg. Vol. 55, No. 4, p. 481-490, October 2013

Adequacy Assessment Studies of Improved Circular Clarifier for Type – II Settling for Storm Water Treatment

NANDITA AHUJA[1] AND GIRISH R. POPHALI[2,*]

The adequacy of an improved circular clarifier was assessed for solids-liquid separation of chemically treated storm water. The storm water was treated with alum and polyelectrolyte to enhance settling. The performance of the clarifier was studied under various operating conditions by varying suspended solids concentrations and turbidity, and the hydraulic retention time. It was observed that the clarifier worked at an optimum hydraulic retention time of 1.5 hours for initial suspended solids concentration of less than 500 mg/L. However, for treatment of storm water with suspended solids concentration more than 500 mg/L, the hydraulic retention time needs to be selected taking the required effluent turbidity and effluent usage into consideration, i.e. for high turbidity removal an optimum hydraulic retention time of 2 hours must be used against a hydraulic retention time of 1.5 hours for a relatively low turbidity removal. Thus, the clarifier can be effectively used on field scale for solids-liquid separation of flocculent suspensions.

Key words: *Improved circular clarifier, suspended solids, turbidity, hydraulic retention time*

Introduction

The main objective of a primary clarifier in water and wastewater treatment plants (WTP) is to remove suspended solids from the influent (AWWA 1999)[3]. The efficient functioning of clarifier has direct influence on the subsequent treatment units (Kawamura 2000)[7]. The understanding of the dynamics of primary clarifiers is, indeed, important to the overall effectiveness of the treatment plant (Lindeborg *et al.*1996)[9]. The working principle on which a clarifier is based is referred to as sedimentation or settling (Chris *et al.* 2002)[3].

Sedimentation or settling is the gravity separation of a suspension into a supernatant clear fluid and denser slurry containing a higher concentration of solids (Kirk 2008)[8]. Chief determinants of rate and degree of sedimentation are the suspension characteristics and characteristics of the fluid in which suspension is present (Degremont, 2007)[5]. Sedimentation is divided into four major categories depending upon the type of suspension to be settled (Hendricks 2006)[6]. Type-I Settling is called "Discrete Particle Settling" in dilute suspensions. This type of settling takes place in suspensions in which the particle concentration is low and particles do not flocculate.

[1] Under-graduate Student, Department of Environmental Engineering, Delhi Technological University (formerly Delhi College of Engineering), New Delhi, India-110 042 (e-mail: nandita.ahuja@dce.edu)
[2] Senior Scientist, CSIR - National Environmental Engineering Research Institute (CSIR-NEERI), Nehru Marg, Nagpur- 440 020, India
[*] Corresponding author: e-mail: girishrpophali@yahoo.com, gr_pophali@neeri.res.in; Tel: (O) +91 712 2249885–88, Extn. 411, Fax: (O): + 91 712 2249900

Environ. Science & Engg. Vol. 55, No. 4, p. 491-497, October 2013

Treatment of Textile Dyehouse Effluent Using Ceramic Membrane Based Process in Combination with Chemical Pretreatment

PRIYANKARI BHATTACHARYA, SOURJA GHOSH*, SWACHCHHA MAJUMDAR AND SIBDAS BANDYOPADHYAY

Treatment of highly concentrated dyebath effluent and comparatively dilute composite effluent having mixture of various reactive dyes collected from a cotton fabric dyeing unit was undertaken in the present study. Ceramic microfiltration membrane prepared from a cost effective composition of alumina and clay was used. Prior to microfiltration, a chemical pretreatment was carried out with aluminium sulphate in combination with a polymeric retention aid. An optimum dose of 100 mg/L of aluminium sulphate and 1 ml/L of a commercial flocculant Afilan RAMF was found effective for dye removal (>98%) from the synthetic solutions of reactive dyes with initial concentration of 150 mg/L in both the single component and two component systems. In the microfiltration study, effect of operating pressure in the permeate flux was observed for both the pretreated and untreated effluents and permeate samples were analyzed for dye concentration, COD, turbidity, TSS, etc. during constant pressure filtration. About 98-99% removal of dyes was obtained in the combined process with COD reduction of 54-64%.

Key words: *Reactive dye, dyehouse effluent, chemical coagulation, ceramic membrane, microfiltration*

1. Introduction

Textile dyeing and finishing processes involve use of alkalis, salts, carbonates, different types of dyes, softening agents and other chemicals and generate huge volume of effluent with high organic strength and colours. In general, conventional biological treatment processes have certain difficulties in degrading those dye chemicals which contribute high COD and colour to the effluent. When effluents containing water insoluble dyes are discharged to a conventional sewage treatment works, most of the colour is removed by adsorption on the biomass[1]. However, conventional biological treatment processes often fail to achieve adequate colour removal for the water soluble reactive dyes[2].

Different coagulants were used for treatment of the fresh and thermally treated desizing wastewater[3]. Coagulation – flocculation – decantation process was used to optimize water recovery from the concentrate[4]. Membrane based processes have been used in combination with different physicochemical methods for treatment of textile wastewater[5].

In the present study performance of ceramic membrane was studied using concentrated dyebath effluent collected from a hosiery dyehouse where 100% cotton knits wear are dyed in winch machine using various reactive dyes. Nanofiltration with polymeric membranes is increasingly used for dye removal from coloured effluent[6]. However, it has been observed that polymeric membranes are susceptible to chemical and

Ceramic Membrane Division, CSIR-Central Glass and Ceramic Research Institute (CSIR-CGCRI), 196, Raja S.C.Mullick Road, Kolkata – 700 032, India
*Corresponding author : e-mail : sourja@cgcri.res.in, sourja.g@gmail.com
Tel. : +91 33 2473 3469 / 76; Fax : +91 33 2473 0957

J Environ. Science & Engg. Vol. 55, No. 4, p. 498-516, October 2013

Ergonomic Evaluation of the Wood Cutting Task Using Chain Saw

GAURAV RAGHAV[1], MOHD FAROOQ[2], ABID ALI KHAN[2,*] AND MOHAMMAD MUZAMMIL[2]

Workers whose hands are regularly exposed to hand-arm vibration may suffer from damage to the tissues of the hands and arms, which cause the symptoms collectively known as hand-arm vibration syndrome. However, investigations have shown that vibration hazards can be controlled and risks might be reduced by good design of the task/tools. In the present study, an experiment was conducted for the evaluation of risk in operating chain saw. The evaluation of chain saw ergonomically performed based on four parameters - Discomfort level, EMG activity of seven different forearm muscles (ECRB, ECU, EPB, FCR, FDS, FCU and PT), angular deviation in hand-arm system and the vibration transfer to hand-arm system, while operating the chain saw on a wooden block. Ten male candidates participated for the discomfort level experiment, four participants volunteered for the EMG activity and angular deviation experiment and two participants were involved in vibration transfer recordings. The results showed that ECRB muscle was mostly affected muscle in this task of operating a chain saw. The findings also indicated that the problems were occurred due to the bad design of the rear handle of chain saw in association with the available vibration levels on hand arm system.

Key words: *Hand arm vibration, EMG activity, discomfort, wood cutting*

1. Introduction

In early 1900s reports began to appear that linked hand held vibratory tools with vascular spasm in the hands[1]. Since then so many other reports and investigations have been published on what has become known as Vibration Induced White Finger (VWF). Workers affected with HAVs appear to have reduced blood flow in the hands under normal conditions in addition to experiencing vascular attacks[2].Vibration transmission generated by hand-held power tools to operators can originate several types of illnesses, v associated symptoms such as problems with the bl supply, nerves, tendons and muscles of hand-a system[3]. People suffering from these diseases r experience whiteness of the fingers in cold conditio tingling and/or numbness of the fingers, and difficul in manipulating small objects sometimes resulting loss of grip strength in the hand[4,5]. The hand-a vibration syndrome (HAVS) involves circulat disorders, sensory and motor disorders, a musculoskeletal disorders, which may occur in work

[1]Department of Mechanical Engineering, Aligarh Muslim University, Aligarh, UP, India - 202 002
[2]Ergonomics Research Division, Department of Mechanical Engineering, Aligarh Muslim University, Aligarh, UP, In
*Corresponding author: Dr. Abid Ali Khan, Associate Professor, Ergonomics Research Division, Department Mechanical Engineering, Aligarh Muslim University, Aligarh - 202 002 (U.P.), India; e-mail: abida.khan@amu.ac
Tel. +91-571-2700926 ext 1861

Environ. Science & Engg. Vol. 55, No. 4, p. 517-536, October 2013

Gaseous and Bioaerosol Emissions from Municipal Wastewater Treatment Plants

SEETHA N.[1], RENU BHARGAVA[2] AND B. R. GURJAR[3]*

Wastewater treatment plants (WWTPs) are identified as potential emission sources of greenhouse gases (GHGs) and bioaerosols. This paper reviews and analyse the potential sources of GHGs and bioaerosols from different unit operations and processes of WWTPs. Aeration tanks of activated sludge process (ASP) are found to be the most important sources of GHGs as well as bioaerosol emissions. Nitrification and denitrification processes are found to be important sources of nitrous oxide (N_2O) emissions. To minimize the N_2O emissions from WWTPs, dissolved oxygen (DO) concentration should be kept greater than 2 mg/L in nitrification process, whereas purely anoxic condition (0 mg/L DO) is required in denitrification process. Diffused aeration emits fewer microbes into the air than surface aerators. It is observed that fixed-film processes emit microbes by two orders of magnitude less than aeration tanks. The various WWTPs discussed in this study used different methods of treatment sample collection and species of microorganisms studied. It is realised that the standardisation of the microorganisms to be analysed and methods of sample collection needs to be done. It is also found that from the microbiological point of view, there is no clean air in the vicinity of a WWTP.

Key words : *Green house gas, bioaerosol, wastewater treatment plant, emission*

Introduction

Wastewater is treated to prevent environmental ollution and to reuse it. On the other hand wastewater eatment facilities are identified as potential emission urces of green house gases (GHGs) such as carbon oxide (CO_2), methane (CH_4), nitrous oxide (N_2O), lorinated hydrocarbons; a wide variety of aliphatic d aromatic volatile organic compounds (VOCs); veral odorous gases and vapours such as hydrogen lphide, ammonia, organic sulphides, amines, dehydes, volatile fatty acids etc. and bioaerosols ntaining pathogenic microorganisms.

Wastewater treatment plants (WWTPs) account r approximately 5% or 20-25 Tg of the total global CH_4 emissions per year[1], which is an important GHG and play an important role in tropospheric photochemistry. Also, N_2O is involved in photochemical reactions in the stratosphere leading to nitric oxide (NO) that destroys stratospheric ozone[2]. Halocarbons such as carbon tetrachloride, methyl chloroform etc. are released from the WWTPs. They contribute to global warming as well as cause stratospheric ozone depletion. Certain VOCs are highly toxic, mutagenic and carcinogenic and hence affect human health. They are also one of the dominant precursor groups involved in the formation of tropospheric ozone. They are responsible for smog formation, which is injurious to human health, reduces atmospheric visibility and damages vegetation[3]. Most of the odorous gases from wastewater treatment facilities are caused by anaerobic

[1] Research Scholar, Department of Civil Engineering, Indian Institute of Science, Bangalore-560 012, Karnataka (India)
[2] Professor, Department of Civil Engineering, Indian Institute of Technology Roorkee, Roorkee-247 667, Uttarakhand (India)
[3] Associate Professor, Department of Civil Engineering, Indian Institute of Technology Roorkee, Roorkee-247 667, Uttarakhand (India)
* Corresponding author : email : bholafce@iitr.ernet.in; brgurjar@gmail.com

J Environ. Science & Engg. Vol. 55, No. 4, p. 537-539, October 2013

Nitrate in Ground Water of Beed City of Maharashtra (India)

SHAIKH ABDUL RAHEEM[a], SAYYED HUSAIN[b] AND MAZAHAR FAROOQUI[c*]

An attempt was made to investigate the water pollution caused by nitrate in the ground water of Beed City of Maharashtra in India. The samples were collected randomly at different time periods from different places of Beed City and analysed for nitrate contents. The level of nitrate was found high and above permissible limit in the groundwater of the city.

Key words: *Ground water quality, nitrate concentration*

Introduction

Ground water is the major source of drinking water in both urban and rural India. It is also important source for agriculture and industrial sector. Groundwater is usually clean and fresh. It becomes polluted due to urbanization and dumping of solid waste or industrial waste[1,2]. The areas of residential development and subsequent high concentration of nitrate and dissolve solids have been identified throughout Carson Valley, Nevada[3] where lands near wells with increasing nitrate concentrations have a high percentage of residential properties on septic systems. It was also reported that the incidence of cancer of the brain and central nervous system was found to be higher in areas with higher nitrate level[4]. Adverse health effects[5,6] due to nitrate in drinking water are most likely the result of a complex interaction of the amount of nitrate ingested the concomitant ingestion of the nitrosoting cofactor and precursors and maniacal condition of the host that may increase nitration. The indepth study is required to understand relation between drinking water nitrates and cancer, adverse reproductive and other health outcomes[7]. In the waste treatment systems, high amount of nitrate denote aerobic condition and high stability of waste. High concentration of nitrate is useful in irrigation but their entry into water resources increase the growth of naissance algae and trigger eutrophication.

Beed is a district with a population of approximately five lakh. Apart from corporation water supply, most of the population depends on ground water for their daily use. Keeping in view above fact it was decided to analyze the groundwater for its nitrate content.

Materials and methods

Ground water samples were collected from 10 different localities of Beed city and analyzed for nitrate concentration during summer and rainy season of 2009(April, May, June and July) by referring standard procedures[8] of APHA. Nitrate content was estimated by colorimetric methods. All chemicals used were of analytical grade from SD fine chemicals Ltd. A double distilled water was used for the preparation of solutions.

[a]Department of Chemistry, Milliya College, Beed, Maharashtra (India) - 431 122
[b]Department of chemistry, Sir Sayyed College, Aurangabad, Maharashtra (India) - 431 001
[c]Post Graduate and Research Centre, Maulana Azad College, Aurangabad, Maharashtra (India) - 431 001
*Corresponding author: mazahar_64@rediffmail.com