Journal of Environmental Science & Engineering (JESE)

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Started in 1958, Journal of Environmental Science & Engineering (JESE) is a peer reviewed quarterly journal published by the National Environmental Engineering Research Institute (NEERI, CSIR), Nagpur reporting various significant achievements in the field of environmental science and engineering, according to the R&D thrust areas of the Institute. The journal is providing communication links among the members of the scientific community engaged in research in India and abroad covering all the major aspects of environmental science and engineering.

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The scope of this journal covers Environmental Science and Engineering and the related areas. The journal intends to timely disseminate information related to monitoring of the environmental status across the country and abroad, innovative and effective S&T solutions to environmental and natural resource problems, significant R&D activities in the field of environmental science and technology, environmentally sound technologies and policy analysis. The journal aims at publishing both review and research articles in the field of environmental science and engineering. Case studies and short communications are also published to inform about the hazards and risks likely to occur to the people and environment due to certain materials, and the ways of controlling these hazards and associated risks. Various topics covered in the journal include: air quality monitoring, modeling and management; air pollution control; source management and apportionment studies; carrying capacity based developmental planning; soil and water chemistry, monitoring and management of land degradation; river and lake ecosystem studies; application of fly ash, sewage, sludge and mine tailing on land; ecological approaches to improve ecological and socio-economic values of land-use systems; integrated natural resource management; conservation and sustainable management of under ground biodiversity, remote sensing applications in environmental geo-science; ground water and rain water harvesting; water and waste water treatment; solid and hazardous waste management; eco-friendly technologies; waste land management; biodiversity assessment; biogeochemistry of rivers and estuaries; pollution chemistry, particularly metal speciation and bioavailability in water and soil systems; PAHs and volatile organics in atmosphere; environmental analytical methodologies; monitoring and modeling of urban noise; environmental impact and risk assessment studies; environmental audit studies; chemical process simulation and development; environmental policies; bioremediation and biodegradation studies; environmental biotechnology and genomics studies; research on environmental materials, etc.

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5. Solid and hazardous waste management
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Effect of Precipitation on Obliteration of Ambient Air Pollutants during Diwali Festival in an Indian City

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Abstract : One of the major festivals celebrated in India is Diwali which is celebrated with firecrackers bursting. These firecrackers release Particulate Matter (PM) and various gases in the atmosphere leading to variation in ambient air quality for short and long duration. This study aims to analyze this variation by continuous monitoring of ambient air pollutants viz., PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO (measured daytime and night time) before, during and after the Diwali festival at Nagpur city, Maharashtra state, India. The measured concentrations of PM_{10} and $PM_{2.5}$ exceeded the prescribed National Ambient Air Quality Standards (NAAQS) during day and night time for majority of the days of the monitoring duration viz., before, during and after Diwali. The concentrations of PM_{10} and $PM_{2.5}$ were 6 – 7 times higher than the NAAQS on the main ritual night of Diwali. The effect of precipitation on obliteration of pollutants was studied using first order decay equation. Effect of precipitation on pollutant obliteration indicated that the decay rate during precipitation was 40- 50% higher than the decay rate representing non-precipitation duration. Precipitation had very good scavenging effect on PM_{10} and $PM_{2.5}$ concentrations on the non-Diwali days as indicated with the high correlation coefficients. The quantification of the precipitation assisted pollutant obliteration can be utilized for the air quality prediction models.

Keywords: *Diwali festival, Particulate Matter, Gaseous pollutants, Decay Rate Constant, Precipitation*

Introduction

Diwali is an ancient Hindu festival celebrated in autumn every year in India. In the Gregorian calendar, Diwali falls between mid-October and mid-November. The festival preparations and rituals typically extend over a five-day period with firecrackers burning at the night time. Firecrackers comprise variety of chemicals like potassium nitrates, potassium perchlorate, potassium chlorate, sulfur, strontium nitrate, charcoal, sodium oxalate, barium nitrate, manganese, aluminum and iron dust powder etc. (Ravindra et al., 2003; Wang et al., 2007). The bursting of such firecrackers releases various particulate and gaseous air pollutants leading to air pollution. The fine particles ($PM_{2.5}$) due to fireworks on Diwali festival were analyzed in Lucknow city. Barman et al., (2009). Diwali air pollution arising from fireworks was studied in Howrah, India by monitoring concentrations of SPM, PM_{10} and $PM_{2.5}$ during Diwali festival in Salkia, Kolkata, India. Thakur et al., (2010). Diab and Hatzopoulou (2013) studied the impacts of major events like Montreal's largest festivals on downtown air quality. Their observations indicated that fireworks have a positive and statistically significant effect on fine Particulate Matter ($PM_{2.5}$) concentrations. There was large increase in trace gases and black carbon at Dibrugarh, India from fireworks which was reported by Pathak et al. (2013). Various celebrations, religious and occasional firecrackers bursting worldwide are reported to be responsible for emitting high concentrations air pollutants into the ambient air. These changes the air quality of that area for the short and long time scales which results in adverse health impact on exposed human beings.

The main objective of this study is to measure the variation in ambient air quality before, during and after Diwali season. The pollutant life was studied for two ambient conditions viz., with precipitation and without precipitation. Quantification of scavenging effect of precipitation on the

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Study of the Vegetation and the Sediment Transport Effects on the Flood Control: Case of the Medjerda River in Tunisia

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The floods occurrence in the Boussalem city at the Medjerda watershed causes considerable socioeconomic disruption and human and environmental destroys. the Medjerda river dredging action and some of its tributaries was conducted in 2015 in the Jendouba, Boussalem, and Beja areas. The aim of this study is to consider the dredging impact on floods by means of numerical simulations. The numerical simulations were designed to provide the dredging activities improvements, and their effects to delay and control floods. The results analysis shows that after the wadi cross-sections dredging activities, the threshold flow causing the flooding is greatly increased compared with the case before dredging, in fact these activities have reduced the water level. This can be encouraging, as this could lead to the resolution of several problems encountered at the Medjerda river. In a second part, and in order to better visualize the vegetation and the sediment transport effects on the flood's amplification, experiments were carried out in an artificial channel at the INAT laboratory, considering the turbidity measurements in a vegetated environment with sediments presence. These experiments clearly show that the turbidity is an important indicator that measures sediments depositions, leading to an important increase in the flooding probability.

Keywords: *Dredging, Experiments, Floods, Numerical simulation, Turbidity.*

Introduction

The vegetation impact on sediment transport is a crucial issue for the irrigation networks management and for the natural flow's management. By reducing the velocity, the vegetation presence can increase sediment deposition and thus increase the flooding risk due to the combined effects of increasing roughness and decreasing the river main channel flow area [Luhar et al., 2008; Romdhane et al., 2019; Romdhane et al., 2018; Wu et He, 2009].

In fact, for most countries around the Mediterranean, there is the flooding problem. In Tunisia, these problems are found in the Medjerda watershed. Several works have been carried out on studying the Medjerda hydrodynamics [Rodier et al., 1981; Habaieb, 1992; Nippon et Co, 2009; Hammami, 2011; Djebbi, 2012; Gharbi et Soualmia, 2012], in order to model the most significant floods occurred in the Medjerda watershed. The repetitive floods in the Boussalem region cause extensive damage with serious consequences, both at the human level and at the socio-economic level in general. The Tunisian decision-makers and officials were thus led to take urgent measures. A dredging project of the Medjerda river and some of its tributaries (in particular Bouhertma wadi) were carried out during 2015 and continuing, in the Jendouba (Boussalem) and the Beja areas.

The numerical simulation tool is necessary to determine the spatio-temporal evolution of the flow characteristics at the Medjerda river with vegetation presence.

In the other hand, in a vegetated environment, turbidity is an important indicator of sediments transport. In the water quality control field, the turbidity measurement was a convincing parameter in many applications. This is the case in the drinking water treatment, and in the chemical sector [Abdoulaye, 2013]. In fact, an important turbidity characteristic is the indication of the suspended particles quantities that are present in water. It is an optical water characteristic, related to its ability to diffuse or absorb incident

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Effects of Inorganic and Organic Chemicals on Non-Coding RNA Conformational Flexibility

PATRIZIO ARRIGO

The investigation on the effects of pollution is particularly challenging because it is influenced by several factors such as composition of pollutant and its environmental characteristics. The 'omic' technologies are focused on gene expression changes; on the other hand, they provide little information about the direct interactions between chemical pollutants and a RNA molecule. RNAs are single strand macromolecules distinguished by an elevated conformational flexibility. This property enables RNA to assume complicates high order structures. The elasticity may be a factor enhancing the capability to interact both with other intracellular macromolecules and small organic and inorganic chemicals. It has been clearly demonstrated that several ions have a significant role in structural stability and functionality of RNAs. It is difficult to experimentally discover chemical modifications at nucleobases level of RNA. Flexibility and chemical variability are evidences that RNAs may be directly targeted by environmental contaminants. Molecular dynamics (MD) are elective tools to study both folding and the interaction between ligands and RNA. This paper delineates molecular structure flexibility of RNA upon interactions with chemicals, might affect the recognition of RNA by its functional partners. The analysis summed up underlines the different changes of flexibility in a sample of different structures of RNAs.

Keywords: *Computational biology, structural genomics, non-coding RNA, environmental contaminant, Normal Mode Analysis*

1 Introduction

Chemical contaminants, mainly originated from human activities, represent a serious threat on both the environmental biodiversity and human health. The launch of 'Omics' technologies have enabled toxicologist to deeply explore basic molecular facets of the adverse effects of pollution on molecular phenotype expression. Such technologies are particularly valuable to analyse those chemical pollutants missing data about their toxicity. A biological system, primarily human being, is susceptible to concurrent pollution sources. Adverse effects of pollution may now be examined in a multiscale approach also considering geo-climatological and social information [Chevin,2017; Horwood 2019]. The effects of a chronic exposure might now investigate using a holistic approach known as the 'exposome' [Wild,2012; Rappaport,2012] which requires the integration of different aspects both toxicological and ecotoxicology. Application of high-throughput screening methods in eco-toxicology have renewed the interest to explore post-transcriptional and epigenetic injury caused by environmental toxicants [Burris &Baccarelli,2014]. Epigenetic [Roundtree & He,2014] is a genetic regulatory system well-known for a long time. It involves several complex regulatory modules which range from small biochemical mechanisms, excluding the DNA mutations, to high-order macromolecular rearrangements. [Ding et al,2016; Rider and Carlsten,2019]. The severity of environmental epigenetic injury depends upon the organism, duration of exposure, and the composition of the pollutant mixture. Comparative studies of post-transcriptional and epigenetic changes may recognize the common regulatory elements impacted by chemicals [Johansson et al. 2019]. The significance of this kind of molecular damage has been certified through the inclusion of these data into standard protocols for environmental risk assessment [Cote et al,2017].

During the past decade, non-coding RNAs have emerged as a pivotal regulatory element in post-transcriptional and epigenetic regulation; this class regulatory RNAs reveals a variety of control functions. Transcriptomic screening has revealed that a modified expression of miRNA is linked to individual response against environmental changes [Kotsyfakis & Patelarou,2019].

This information is useful to predict molecular phenotype alteration; neverthless, they are not helpful to study the barely visible structural modifications caused by direct interaction between toxicants and non-coding RNA molecules. The analysis of conformational changes might be valuable to assess the impact of imperceptible RNA-ligand interaction affecting RNA folding and, therefore on its biological functionality.

Currently available knowledge about these events appears to be not sufficient for a systematic analysis of non-

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A Cluster Analysis of Particulate Pollution in Major Indian Cities

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Particulate pollution has been the buzzword in recent times as particulate pollutants are the most hazardous pollutants in the air. The United Nations has envisaged reducing population-weighted particulate pollution levels in the urban areas to achieve sustainable development goals by 2030. India is one of the countries where particulate pollution has reached alarming levels and needs to be tackled seriously. The cities may be grouped into various clusters using machine learning, based on their similarity in particulate pollution, and suitable measures may be taken in all the cities of each cluster to reduce it. This will help in the optimal usage of the resources in hand. Also, the need for a periodic assessment of particulate pollution at various cities is indispensable to judge the efficacy of the measures taken. The cities in India with a population of 400,000 and higher have been considered in this study. For categorising the cities based on their respective particulate pollution levels, a cluster analysis has been performed on the cities with population-weighted values of PM_{10} and $PM_{2.5}$ as the variables.

Keywords : *air pollution; particulate matter; $PM_{2.5}$; PM_{10}; cluster analysis*

1. Introduction

PM stands for particulate matter. It is a general term used to denote a mixture of solid particles and liquid droplets found floating in the air. They range from large particles like dust, soot to very fine particle that can only be detected using an electron microscope. Particulate matter includes:

- PM_{10}: Particles with a diameter less than or equal to 10 micrometres. These are inhalable particles.
- $PM_{2.5}$: Particles with a diameter less than or equal to 2.5 micrometres. These are also inhalable but are more harmful to people.

Particulate matter can be produced due to natural or anthropogenic causes. Natural sources include volcanic eruptions, storms, etc., whereas some are emitted directly from artificial sources such as construction sites, unpaved roads, fields, smokestacks or fires. Most particles in the atmosphere are created as a result of complex reactions of chemicals such as sulphur dioxide and nitrogen oxides at power plants, industries or automobiles (EPA, n.d.).

The WHO, in a report in 2018, estimated that around 7 million people die each year from exposure to fine particulate pollutants in the air. The fine particles penetrate deep into the human lungs and cardiovascular system, causing diseases including stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and many respiratory infections, including pneumonia. Of these, $PM_{2.5}$ are more harmful as they, owing to their tiny size, get into the bloodstream very easily. $PM_{2.5}$ are the main cause of reduced visibility which lead to train and flight delays and even fatal accidents. Particles may be carried over long distances by wind and then settle on ground or water. They may then change the nutrient balance in coastal waters and large river basins, make lakes and streams acidic, contribute to acid rain effects, damage sensitive forests and farm crops. A statistically significant association between the PM level and suicidal tendency has been established recently (Braithwaite et al., 2019). The air quality guideline values set by the WHO stipulates the annual mean value of PM_{10} and $PM_{2.5}$ at 20 and 10 $\mu g/m^3$ respectively. In reality, the pollutant levels in many urban areas, particularly, in Asia and Africa are way higher than the stipulated values. This poses a great risk to the population residing in those cities.

The Air *(Prevention and Control of Pollution)* Act was enacted in 1981 and amended in 1987 to provide for the prevention, control and abatement of air pollution in India. However, the issue of particulate pollution has come under the spotlight recently in our country after the severe pollution in the Delhi- NCR region.

The Statistical Commission of the United Nations *Economic and Social Council* has recognised the above-mentioned issues (IAEG, 2016) and aims to reduce the adverse per capita environmental impacts of cities by monitoring the annual mean levels of fine particulate matter (e.g. $PM_{2.5}$ and PM_{10}) in cities (population-weighted) to reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality (IAEG, 2016).

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Self Reported Health Complaints and Knowledge on use of Pesticides and their Safety Practices among Grape Garden Workers

RAVICHANDRAN B., AVINASH G., MALA A., SHRIDHAR K., DHANANJAYAN V., PANJAKUMAR K., SEN S.

The aim of the study was to assess knowledge, attitude, practice and self-reported health complaints related to pesticide exposure among Indian grape garden farm workers and to determine the impact of pesticide on their health, a case-control study was adapted for investigation. Fifty four male participants were recruited in this study with twenty seven participants in each group as case and control. The questionnaire based survey was conducted to record the occupational exposure period, type of pesticide handled, work practices and sign & symptom reported with self-perceived health effects of acute pesticide poisoning during, before/after pesticide application. In the study group 66.7% participants were pesticide handlers and 33.3% were pesticide sprayers. The study subjects informed that there were 51.9% of them not used PPE (Personal Protective Equipment) involved in pesticides spraying less than 10 years during their work. The symptoms complained by the workers were irritation of eyes (44.4%), burning of eyes (70.4%), tears in eyes (40.7%), headache (55.6%) and the control subjects complained (7.4%) irritation in eyes and 29.6 % headache which clearly showed the impact of improper use of pesticides without the PPEs in their work. About 50% of the pesticide handlers and sprayers not using Personal Protective Equipment (PPE) and the other 50% to used PPE were not in proper combination. The result reveals the lack of knowledge about pesticide spray and exposures. This study has highlighted that there is need to create awareness through educating the farmers and provide training, intervention by local authority to use the pesticides in appropriate manner.

Keywords: Farmer knowledge, Pesticide poisoning, Pesticide sprayers, Personal protective equipment, Safety practice

1. Introduction

The International labour organization reports that around 1.1 billion people are engaged in agriculture activities, which account for 31 per cent of global employment in the year 2013. In South Asia region 46.3% of workers constitute in agriculture. Universally, a large numbers of casual and temporary workers are engaged by small and large growers. Unpaid family members carry out agricultural work as unrecognized farm labour or to support small-scale family farming [ILO, 2014]. The growing population and the demand for food production necessitates the farmers to use pesticide for economic and crop boosts. In recent years there has been an increase in the use of pesticides in developing countries. Researchers have concluded that farm workers in developing countries will continue to use pesticides in increasing quantities because of lack of alternatives to pesticides, ignorance of the sustainability of pesticide use. Extensive use of such pesticides results in substantial health and environmental threat. Despite the instructions provided on pesticide containers, there are several hurdles that restrict their implementation. Lack of awareness among farmers and farm worker is the foremost barrier. Majority of pesticide exposure is seen more in middle and low income countries due to increased use of agrochemicals in agricultural sector [Jesslin et al. 2010]. The Food and Agriculture Organization of the United Nations (FAO) recommends that governments of developing countries promote pesticides that require little PPE [WHO, 2009]. The improper use of pesticides can cause human poisonings, build up as residues in food and the environment, and also lead to the development of resistance in pests. Occupational poisonings due to low-dose and chronic exposure are under-reported not only because people often do not seek medical help [Patel and Zed, 2002] but also they are often not aware of the symptoms of poisoning [Thunga et al. 2014]. Approximately 200,000-300,000 people die worldwide from pesticide poisoning every year with the majority of deaths occurring in developing counties [Sekiyama et al. 2007]. Our

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Development of Adsorption Technology for Removal of Arsenic by Brick Powder

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Abstract : Due to commercialization and industrialization the global nature is undergoing several changes that show a bad impact on the life of living organisms. As a part of this, the mining operations or mine waste dumps and industrial effluents discharge the inorganic pollutants into groundwater that leads to the mortality of living organisms. Many researchers have been developing controlling techniques to remove these inorganic and organic contaminants from groundwater with small and low-cost operations. For this, the low-cost and the most effective adsorbents were utilized in the process of adsorption. The brick powder is one of the most low-cost adsorbents that were used for the removal of Arsenic (III) from its aqueous solution. This study was carried out with parameters like contact time, Adsorbent dosage, concentration, pH, and the Arsenic removal efficiency on Brick powder was reported in the range of 70% to 75%. The experimental data was drawn with Adsorption Isotherm models and kinetic models to investigate the efficiency of low-cost adsorbent, brick powder for Arsenic removal from the contaminated water. This analysis shed light on Freundlich adsorption isotherm and pseudo-second-order with better interpretation and thermodynamic studies explored that the adsorption process was endothermic and spontaneous.

Keywords : *Arsenic, Adsorption, Kinetic model, Isotherm models, Brick powder.*

1. INTRODUCTION: Arsenic (III)is the most toxic element which is released into the water bodies through industries, combustion of fuels, and use of arsenic pesticides, herbicides as denoted (Hering, Katsoyiannis, Theoduloz, et al, 2017). It is easily solubilized in groundwater and occurs in both organic as well as inorganic forms. Consumption of Arsenic through drinking water causes damage to the central nervous system, kidneys, skin, liver, lungs in humans as indicated (Ersboll, Monard, Sorensen, et al, 2017) So, it is known as one of the hazardous pollutants in many regions of the world. The removal of Arsenic from water can be achieved by different techniques such as adsorption, coagulation, ion exchange, reverse osmosis among all these; adsorption is the most effective method with low operational cost. Taking these factors into consideration the batch experiment is carried for the removal of Arsenic from groundwater using brick powder as an adsorbent. Different parameters influenced the Arsenic adsorption process affirming that the percentage of Arsenic removal increases with an increase in contact time, dosage, concentration, temperature, and pH. Kinetic studies reported that Freundlich Isotherm was followed with better correlation than the Langmuir isotherm. The experimental data of thermodynamic parameters reported that the adsorption process is endothermic and spontaneous.

1.1: Objectives:

a) To develop the controlling technology for the removal of Arsenic from groundwater.

b) To make a water filter for the removal of Arsenic.

c) To develop a low-cost eco-friendly technology for the removal of Arsenic from water.

2. Methods and Materials:

2.1. Selection of Adsorbent:

Fuller earth is composed of natural clays that are of Magnesium Aluminum Silicates which are in the form of minerals Attapulgite and Montmorillonite. Bricks are structured by heating and drying the clay. Bricks are soaked in the water for 24 hours to increase their weight to almost one

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