Optimizing Non-linear Adsorption Of Mercury In Water By A Wood Sawdust Based Filter

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The objective of this work is to control and optimize mercury removal in water by using a filter made from sawdust. To this end, a one-dimensional dispersion advection equation was used to model column transport experiments by considering both linear and non-linear adsorption equilibrium. We solved the advection-dispersion equation by considering both cases to determine the change in mercury concentration inside the filter. The resolution of the advection-dispersion equation by considering the linear adsorption equilibrium was done analytically by the Laplace transform method. In the case of the nonlinear adsorption equilibrium, we performed a numerical resolution also by the fourth-order Runge Kutta (RK4) method. The analysis of the results obtained using Matlab code shows a progressive decrease in the concentration of the pollutant throughout the filter in both cases; which proves the effectiveness of sawdust to largely remove mercury in solution. On the other hand, the non-linear adsorption equilibrium model shows an increase in the pollutant concentration at the outlet of the filter, as a function of time compared to the linear adsorption equilibrium model. Indeed, the concentration ratio closes to 0.1 is reached at t = 20 days, for filter depths x1 = 20 cm in the case of non-linear adsorption and x2 > 30 cm for linear adsorption model. These results show the importance of taking into account the adsorption model in the implementation of the filtering system.

KEYWORDS

Mercury, Wood sawdust, Adsorption, Advection, Dispersion equation, Linear, Non-linear, Water

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Assessment Of Surface Water Of Mahanadi River Through Water Quality Index At Cuttack and Paradeep, Odisha

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Water plays a central role in all aspects of life. Quality of water is degrading, so day by day aquatic ecosystems getting challenging environment for survival of aquatic flora and fauna. Contamination of water by natural and anthropogenic activities was continued, since the beginning of human development. The deteriorating water quality and pollution of aquatic ecosystems become a global concern. River Mahanadi is the lifeline of Odisha. Various physico-chemical parameters, like pH, temperature, total hardness, total alkalinity, total dissolved solids, total suspended solids, dissolved oxygen, biological oxygen demand, chemical oxygen demand, fluoride, chloride, chromium, iron, zinc and lead, etc., were analyzed from March 2018 to February 2019 in four different seasons (winter, summer, monsoon and post-monsoon) to assess the fitness of water for a variety of uses. Cuttack and Paradeep upstream and downstream of the Mahanadi river were the collection stations for water sampling. During the investigation, the parameters at monitoring sites were assessed and used for the determination of water quality indexing (WQI) of the river. The Mahanadi river water needs a suitable treatment method as well as preventive measures to curb the diminishing water quality which is clearly established through the average value of the parameters and that of WQI.

KEYWORDS

Water quality index, Surface water, Mahanadi river, Physico-chemical parameters

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Source Identification And Ozone Forming Potential Of VOCs In The Two Urban Cities Of India

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The current study identifies the sources of volatile organic compounds (VOCs) (benzene, toluene and xylene) in the Agra and Faridabad during the two seasons. The characteristics ratios, such as toluene/benzene (T/B), xylene/benzene (X/B) and toluene/xylene (T/X) have used to identify the sources for the studied sites. In addition to this, ozone forming potential (OFP) has been calculated for the VOCs dataset at the two studied sites. Results showed that toluene/benzene (T/B) ratios are found to be in the range of 1.28-5.86 and 1.5-9.40 for Faridabad and Agra, respectively indicated that the vehicular emissions are the main sources. On the other hand, xylene/benzene (X/B) ratios showed the values in the range of 0.39-2.21 and 0.34-2.25 for Faridabad and Agra, respectively suggested the old air mass. After analyzing the characteristics ratios in Faridabad, the values of toluene/benzene (T/B) and toluene/xylene (T/X) are found to be higher during summer as compared to winter. The present study also infers that the ozone forming potential (OFP) was found to be higher during winter as compared to summer for both sites. It was noticed that toluene contributed the most in ozone production as compared to benzene and xylenes.

KEYWORDS

Volatile organic compounds, Source estimation, Characteristics ratios, Ozone forming potential, Urban

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Health Risk Assessment Of Particulate Matter In Varied Micro-Environments Of Gwalior - A Case Study

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Large scale industrialization and urbanization led to a number of environmental problems, one of them being air pollution. The present study attempted to pave the way in examining the metal concentration in fine particulate matter and its potential health risk in different rural, urban and roadside micro-environments of Gwalior region. Fine particulate sampler (APM 550-Envirotech, New Delhi) was used to collect the fine particles on polytetrafluoroethylene (PTFE) filter paper during the monsoon season, that is August-September, 2017 and analyzed by atomic absorption spectroscopy (AAS) for metal concentration. Bioavailability index was also calculated for the toxic metals. Fine particles concentration was found to be higher in the rural area (80.91 μg/m^3) followed by urban (60.73 μg/m^3) and roadside (40.66 μg/m^3) areas. The full day variation revealed that at all site locations, the evening concentration was found to be higher than the morning and afternoon locations. The results also elucidated that persons residing in rural areas are subjected to higher cancer risk than those lying in the urban and roadside locations. Identification of sources and toxicity evaluation of these carcinogenic heavy trace metals will be studied in these locations may allow for better protection of human health and understanding to control them.

KEYWORDS

Fine particles, Atomic absorption spectroscopy, Bioavailability index, Toxic metals

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Investigation On Groundwater Qualities Of Some Areas Of Imphal West District Of Manipur

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Fourteen groundwater samples were collected from twelve dug wells and two hand pumps of different areas of Imphal west district during the pre-monsoon period (May) of 2019. They were analyzed for physico-chemical parameters, such as temperature, pH, total dissolved solids (TDS), electrical conductivity (EC), total alkalinity (TA) (CO$_3^{2-}$ and HCO$_3^-$), total hardness (TH), Ca^{2+}, Mg^{2+}, Na$^+$ and Cl$^-$. Except the groundwater represented by S-8, other remaining thirteen groundwaters represented by S-1 to S-7 and S-9 to S-14 are found to be in the drinking water category as their physico-chemical parameter values are within or below the corresponding acceptable limits of BIS standard of drinking water as well as that of WHO. However, for S-8, some further treatments are necessary so as to keep the values of TA, TH and Mg^{2+} below the corresponding acceptable limits of BIS standard of drinking water. All the groundwaters are found to be suitable for other domestic and irrigation purposes. Further from correlation co-efficient data, it is clearly seen that TDS shows strong positive correlations with EC, TA and TH. TA is mainly due to the presence of dissolved Ca(HCO$_3$)$_2$ and Mg(HCO$_3$)$_2$ but to a lesser extent, to the presence of NaHCO$_3$. Again total hardness is mainly attributed to the presence of dissolved Ca(HCO$_3$)$_2$ and Mg(HCO$_3$)$_2$.

KEYWORDS

Physico - chemical parameters, Drinking, Domestic, Irrigation, BIS, WHO

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Analysis Of Lead And Cadmium Pollution In Soil And Water At Telaga Punggur Landfill

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Waste is a product, that is produced from various human activities. The increase in the urban population also adds to the volume of waste generated. The waste management method applied in this research was in Telaga Punggur landfill, Batam, Indonesia, which is an open dumping controlled landfill. The purpose of this study is to analyze the characteristics of waste, indications of pollution in soil and groundwater and find more appropriate methods to be applied in this landfill. The study involved the analysis of heavy metals lead (Pb) and cadmium (Cd) using atomic absorption spectroscopy (AAS) in soil and water samples. Analysis of BOD, COD was done by titrimetric method and ammonia in water carried out by the distillation method. The results state that the soil and water of the landfill have been polluted mainly by Pb and Cd heavy metals. This pollution can endanger the environment and other living things. This pollution is caused by the waste management method, that is still not effective and not environmentally friendly. The method applied should be immediately evaluated and switched to the sanitary landfill method and the use of appropriate technology.

KEYWORDS

Cadmium, Lead, Heavy metal, Pollution, Waste

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Study Of Water Quality Trends Of Lake Pichola: An Urban Lake In Udaipur City

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The present study was aimed to examine the physico-chemical condition of Lake Pichola. The test was carried out for the evaluation of temperature, transparency, pH, dissolved oxygen, total dissolved solids, total hardness, biological oxygen demand, faecal coli and total coli for four different seasons of the year 2018. The study was aimed to assess the trends of water quality of lake Pichola with the change in season to determine the actual condition of Lake Pichola, so that efficient technique can be used for removal of pollutants. The study shows that lake water was found to be polluted due to the presence of significant quantities of faecal coli and total coli.

KEYWORDS

Urban lake, Dissolved oxygen, Faecal coliform, Total coliform

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Evaluation Of Climate Change Impacts On Vulnerability Of Rainfall In Jordan

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Water resources are affected by climate change directly and indirectly. Runoff, dam storage, rivers discharge, groundwater recharge are induced by precipitation. Evaluation of climate change effects requires continuous long-term record of climate data which is not available for many countries. Therefore, the utilization of global climate models (GCM) remains a viable option. In this research, we assess changes in precipitation intensity on a monthly basis using climate wizard and assess spatial variability using available data from local weather stations. Precipitation future trends were evaluated using the most recent fifth assessment IPCC (Intergovernmental Panel on Climate Change) scenarios using RegCLIM. Two representative concentration pathways (RCP) with the lowest emissions (RCP 2.6) and highest emissions (RCP 8.5) are simulated for Jordan. The historic period monthly analysis indicates a shift in precipitation pattern where December precipitation quantity has decreased and January precipitation quantity increased. For spring, March rainfall increased while April and May have decreased. For fall, rainfall events shifted from September to October. Spatial variation in precipitation is evaluated using short data set (2005-2013). Precipitation intensity increased in the west and north regions. Future climate scenarios predict a decrease in daily rainfall for wet months and an increase in precipitation in the spring months.

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Solar Photocatalytic Degradation Of Lead In Aqueous Solution Using TiO₂ Nanoparticles - Process Optimization By Response Surface Methodology

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Lead is highly poisonous metal; its extensive use is leading to the health and environmental problems in many parts of the world. Nanotechnology is gaining major importance in water and wastewater treatment in recent decades. In the present study, photocatalytic TiO₂ nanomaterial is used to study the degradation of lead from aqueous solution using a parabolic collector. The central composite design (CCD) and response surface methodology (RSM) are used to optimize the operating variables, such as pH, dosage, irradiation time. The obtained result shows that ideal conditions for lead degradation of 92.21% can be accomplished by means of the dosage of 0.2 g/L with pH 10 in irradiation time of 60 min. The experimental values and model prediction outcomes have shown excellent agreement according to the R^2 value of 0.9277.

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Quantification of Vehicular Particulate Matter Emissions in Kochi City

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High levels of urbanization, sharp increasing traffic, rapid economic development and industrialization and higher levels of energy consumption have resulted in an increase of particulate matter pollution load in most of the Indian cities. The aim of the present study is to assess the particulate matter pollution and to quantify the particulate matter emissions from vehicles in Kochi city. The annual average concentration of RSPM at six monitoring stations in Kochi city from 2008-2017 have analyzed and compared with WHO and NAAQ standards. The RSPM concentration at most of these monitoring stations exceeds the WHO and NAAQ standards. Therefore, an attempt has been made to estimate the deposition of particulate matter in human airway using the multiple path particle dosimetry model (MPPD). Studies using MPPD models shows that the particles with higher diameter get deposited in the head region and as aerodynamic size reduces, particles will reach the thoracic and pulmonary region and causes severe health effects if their concentration is high. Emission inventory results substantiate that heavy commercial vehicle (HCV) contributes 45% of total vehicular emission in Kochi city. Though their count is less, medium commercial vehicle (MCV) also contributes 20% of total vehicular emissions. Among these categories, those coming under the vintages 1991-1995 and 1996-2000 are highest emitters. Replacing these vehicles with new ones will reduce 16% of the total of three wheeler emission, 6% of total MCV emission and 16% of total emissions from buses.

KEYWORDS

Particulate matter, Emissions, Vehicles, Deposition

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Electricity Production From Food Waste Leachate Using Microbial Fuel Cell

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Nowadays, the generation of food waste is increasing dramatically with the rising population and global economic development. These wastes represent a significant source of environmental pollution and when left unprocessed, emit greenhouse gases into the atmosphere. In the light of rapidly rising costs associated with energy supply and increasing public concerns with environmental quality, the conversion of organic wastes to energy is becoming an eco-friendly and economically attractive practice. Microbial fuel cells (MFC) are a new type of bioreactors that use microorganisms for electrochemical energy production. The present study focuses on the feasibility of bioelectricity generation in a dual chambered microbial fuel cell, using canteen based food waste leachate as a substrate. The food waste leachate was generated in an anaerobic bioreactor and its physico-chemical characteristics were analyzed. The microbial fuel cell was made up of plastic bottles, containing two chambers having a capacity of 1750 mL each and the working volume was 1500 mL. The fuel cell consists of an anode and cathode compartment. The anode chamber was anaerobic and the cathode compartment was aerobic. The electrodes used in MFC setup were made of graphite. The percentage of degradation of food waste leachate was 95.39% after 70 days. The COD removal rate per day was found to be 9.321 mg/day. A maximum voltage of 0.49 V and current of 1.67 A was obtained. Thus, this study reveals the possibilities to reduce the quantity of food waste leachate alongwith the production of bio-electricity.

KEYWORDS

Food waste, Leachate, Microbial fuel cell, COD, Microorganisms

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Lightweight Concrete Using Pumice Stone And Rice Husk Ash

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In the present scenario, lightweight concrete finds its application in various areas. Lightweight concrete can be defined as a type of concrete which includes a foaming agent in which it increases the volume of the concrete and lessens the dead weight. It is lighter than conventional concrete. The main specialities of lightweight concrete are its rarity and thermal conduction. Its benefits are that there's a reduction of the burden, quicker building rates in construction and lower pulling and handling prices. Lightweight concrete maintains its large voids and not forming cement films when placed on the wall. This project is based on the performance of lightweight concrete with pumice powder and rice husk ash as fine aggregates. However, adequate water cement magnitude relation is significant to provide adequate cohesion between cement and water. Insufficient water will cause a lack of cohesion between particles, therefore, a loss in strength of concrete. Likewise, too much water can cause the cement to run off lightweight aggregate to form the cement film, subsequently weakens in strength. This project focuses on calculating different mix proportions for finding the optimum value of compressive strength and flexural strength of lightweight concrete. The mix proportions range from 1:3 to 1:7.

KEYWORDS

Lightweight concrete, Pumice powder, Rice husk ash

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Ecofriendly Construction Using PET Bottles

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The increased construction cost and depletion of natural resources lead to the necessity of new conventional building materials. Nowadays, polyethylene terephthalate (PET) bottles are used in the construction field and industrial byproducts as filling material for wall construction. PET bottles cannot be used as such because of its lesser compressive strength compared to brick. Hence, it has to be filled with fine material. The paper discusses with the construction of a room where half of the bottles are filled with compacted soil passing 4.75 mm IS sieve and the remaining bottles are filled with water. Using this same technique, houses can be built entirely out of plastic bottles which maintain a comfortable interior temperature and lighting effect. The brick-work is provided upto the sill level and the remaining portion is done with the PET bottles. The plastering and flooring are done with mud and cow dung. This method is a low cost, abundant, non-brittle, able to absorb abrupt shock loads, bioclimatic, reusable, needless construction material and are easy to build. It is also reported that, compared to brick and concrete block walls, plastic bottle walls cost 75% less. This method of construction would be a positive change in our urban fringe and slum areas' landscape.

KEYWORDS

Polyethylene terephthalate

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Compressive Strength Characteristics Of Stabilized Rammed Earthen Paver Blocks

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In contrast with the past, earthen blocks are widely used in the construction of lightly loaded structures, like footpaths, parking areas, gardens, etc., as the conventional construction of bricks using cement concrete technology is not sustainable and economical. However, the strength behaviour of these earthen bricks is still questioned. The reuse of deposited wastes can be incorporated in this scenario considering the strength as well as the environment to improve the quality of these bricks. Fly ash, a byproduct of thermal power plants deposited in a large quantity can be used to strengthen earthen blocks alongwith polyethylene terephthalate (PET) reinforcement. This paper study and demonstrates the potential of reclaimed PET strips as soil reinforcement for improving the engineering performance of flyash stabilized rammed earthen blocks (SREB). Samples were cast using different percentage of plastic strips alongwith an addition of 6% of flyash. The compressive strength test result of the specimen lies in an acceptable range of values when compared to ordinary sun-dried bricks. It is observed that the stabilized paver bricks have a good performance in load carrying, which is suitable for areas with light loads.

KEYWORDS

Polyethylene terephthalate, Soil stabilization, Flyash, Paver blocks, Stabilized rammed earthen blocks

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Removal Of Iron And Chromium From Contaminated Soil By Using Adsorbents And Mulches

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Infrastructure development processes have set the scene for increased soil pollution and biodiversity loss. People are more concerned about the quality of water and air, which is of immediate usage since we directly avail those. Similarly, we should give equal concern towards the soil health too. Soil health is greatly affected by the presence of metal traces, which results in soil contamination and leading to the damage in the quality of the environment. Heavy metal traces are the most dangerous substances that affect soil health due to their durability and high toxicity. A practical method for removing these contaminants and recovering soil health is the utilization of locally available, cost-effective green adsorbents and mulches. Various adsorbents, such as rice husk ash (RHA), sawdust ash (SDA), coconut shell ash (CSA) and biochar alongwith mulches, such as straw and crumb rubber were used in this study for varying the permeability. Soil columns with varying depths of adsorbents and mulches were designed for studying the removal efficiency of iron and chromium metal traces. The concentration of iron and chromium metal traces were kept as 5 mg/L and 15 mg/L. Test results indicate that traces of iron and chromium can be effectively removed by using these green adsorbents and mulches.

KEYWORDS

Heavy metals, Soil contamination, Adsorbents, Mulches

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Flexural Behaviour Of Sulphurcrete Beam

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This paper focuses on the behaviour of sulphur concrete, which is a composite construction material, composed mainly of sulphur and aggregate. Generally, a coarse aggregate made of gravel or crushed rocks and a fine aggregate such as sand are used. Cement and water are the important compounds in normal concrete, are not part of sulphur concrete. The concrete is heated above the melting point of sulphur, that is 140°C. The coarse and fine aggregates are also pre-heated. The required specimens are cast in moulds using this concrete. After cooling the concrete reaches a high strength, it doesn't need prolonged curing like normal concrete. The strength tests are also done using bitumen as a stabilizer in sulphurcrete and compared. Flyash is been used as a filler material and the corresponding strength results of specimens with and without flyash are also compared. Several tests are done in order to find the mechanical and flexural behaviour of sulphurcrete.

KEYWORDS

Sulphur, Sulphurcrete, Flyash, Coarse aggregates, Fine aggregates

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Rainfall Forecasting Using Multiple Regression And Artificial Neural Network

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Rainfall forecasting is a challenging task due to the uncertainty of natural phenomena. Flood impact is one of the most significant disasters in the world. More than half of the global, flood damages occur in Asia. The causes of floods are due to natural factors, such as heavy rainfall, high tides, etc., which results in losses of life and also damage properties. So the rainfall prediction is important for flood management, agriculture, irrigation, etc. There are many methods for long term prediction of rainfall, such as physical methods, soft computing methods and mathematical methods. In this study, soft computing techniques has been used, that is an artificial neural network (ANN) and multiple regression (MR) in the Software Statistical Package of Social Science (SPSS). These models are developed for the prediction of rainfall at Palayam station. Data from 2008-2017 has been collected and given as the input parameters, such as rainfall, temperature, humidity and wind speed. By providing these inputs we can obtain information about the flooding possibilities of an area and take necessary precautions before the catastrophic impacts on the communities. The artificial neural network (ANN) is developed in the form of a multi-layer perception. Both the models were developed and assessed by correlation coefficient (R^2) and root mean square error (RMSE). In multiple regression (MR), the value of RMSE and R^2 were 0.002 and 0.033, respectively and the value of the artificial neural network (ANN) achieved is 0.89, so it can be concluded that ANN is more accurate than MR.

KEYWORDS

Rainfall data, Humidity, Temperature, Wind speed

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Experimental Study Of Waffle Slab Inserting Coconut Shell

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Excessive usage of concrete leads to an increase in CO_2 production thereby causing global warming. Therefore, reducing concrete in building construction is one of the solutions to this problem. Hence, to cater to the problem, an alternate building technology, such as filler slabs are adopted. In this project, coconut shell is broken out in a semi-circle sphere shape and it is placed in between mesh of reinforcement bar. It is based on the concept where it looks like a waffle slab. So, by introducing this concept we can reduce the entire weight of the slab and in turn, reduces the amount of concrete to 20%. M25 grade of concrete is used for construction and 6 specimens (3 slabs without coconut shell and 3 slabs with coconut shell) were cast to check the behaviour of the structure. By comparing, we can identify its deflection behaviour and bending strength.

KEYWORDS

Filler slabs, Concrete, Coconut shell

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