

Adsorptive Removal of Methylene Blue Using Low Cost and Efficient Biosorbent : Equilibrium, Kinetics and Thermodynamics Studies

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We report an efficient and low cost biosorbent, *Acalypha indica* leaf powder for the removal of the textile cationic dye from aqueous solution by batch adsorption process. We have employed methylene blue (MB) as a model textile cationic dye. This study investigates the adsorption capacity of biosorbent by varying time, dye concentration, dose, temperature and pH. The change in the concentration of methylene blue dye has been followed by using UV-Vis spectrophotometry. In various iterations, the percentage of the dye removal has been found to increase with increase in temperature, adsorbent dose and pH. The experimental data have been analyzed by Langmuir and Freundlich models to describe the equilibrium isotherms. The isotherm data are in accordance with the Langmuir isotherm with a monolayer adsorption capacity of about 40.0 (mg/g) at 30°C. The FT-IR spectrum indicates the presence of functional group, amide (*et al.*) [-C(O)NH₂] in the adsorbent surface. Adsorption kinetics of dye follows pseudo-second order kinetics. Thermodynamic parameters, such as ΔH^0 , ΔS^0 and ΔG^0 have also been evaluated. The thermodynamic studies show that the methylene blue dye adsorption onto *Acalypha indica* leaf powder is a spontaneous, endothermic and physical reaction. The results indicate that *Acalypha indica* leaf powder could be used as a novel natural biosorbent for the removal of methylene blue cationic dye.

KEYWORD

Cationic dye, *Acalypha indica* leaf powder, Langmuir and Freundlich isotherm, Thermo-dynamic parameters.

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Evaluation of Lead (II) Removal by Carbons Derived From Oil Cake of *Sesamum indicum*

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Activated carbons were prepared from gingelly oil cake (GOC) by thermal, sulphuric acid, zinc chloride activation methods and their Pb(II) removal capacities were compared with that of commercial activated carbon (CAC). The effect of experimental parameters, such as pH, initial concentration, contact time and adsorbents dose for Pb(II) removal were studied. Langmuir and Freundlich models were tested to describe the equilibrium isotherms. The maximum adsorption capacity of the adsorbents calculated from Langmuir isotherm was found to be 123.46 mg/g, 117.65 mg/g, 86.67 mg/g and 105.26 mg/g for thermal activated (TAGOC), sulphuric acid treated (STGOC), zinc chloride treated (ZTGOC) gingelly oil cake carbons and commercial activated carbon, respectively. R^2 values show that both Langmuir and Freundlich models fit well to explain the adsorption phenomenon for thermal activated gingelly oil cake, sulphuric acid treated gingelly oil cake, zinc chloride treated gingelly oil cake and commercial activated carbon. The kinetic data fits best to pseudo second order kinetic model. Gibbs free energy of adsorption showed the feasibility of process and spontaneous nature of the adsorption. The carbon adsorbents were also tested for the removal of Pb(II) from lead battery wastewater and were found to remove Pb(II) effectively.

KEYWORD

Pb(II) removal, Gingelly oil cake, Thermal activated gingelly oil cake, Sulphuric acid treated gingelly oil cake, Zinc chloride treated gingelly oil cake, Commercial activated carbon, Adsorption isotherm, Pseudo first order kinetics, Synthetic lead battery wastewater.

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Degradation Studies of Vat Red R1 Dye Using Advanced Oxidation Process

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Synthetic dyes comprising largest groups of organic compounds when discharged into water bodies cause discolouration of water and affects the aquatic life. Removal of these colours and other organic materials is a priority for ensuring a safe and clean environment. Advanced oxidation process (AOP) with the mixture of semiconductors (ZnO and CuO) under UV irradiation is proven methods to degrade dyes in aqueous media without the formation of hazardous by- products. Herein, the synthesis of nano size zinc oxide and copper oxide by hydrothermal method and its applications in dye stuff removal (Vat Red R1) from aqueous medium is presented. The removal of the dye was quantified by measuring the colour intensity using UV/VIS (Helios Zita UV-VIS) spectrophotometer at a wavelength of 613 nm. The effect of pH, contact time, initial concentration and photocatalyst dose on the removal of Vat Red R1 was studied by batch experiments. The percentage of dye removal was found to be directly proportional to increase in pH from 2 to 7 and inversely proportional from the pH 7 to 14. It was observed that the percentage removal decreases with increase in dye concentration and remained nearly constant after 120 min, the equilibrium time. Photocatalytic degradation capacity at equilibrium for Vat Red R1 increased from 25 to 97 mg/g for 0.002 mg/L, 20 to 94 mg/g for 0.004 mg/L, 18 to 85 mg/g for 0.006 mg/L, 14 to 79 mg/g for 0.008 mg/L and 11 to 75 mg/g for 0.01 mg/L. In order to examine the effect of photocatalyst dose on the removal efficiency of VR1 degradation, experiments were carried out with varying dose between 1 g and 5 g for mixed nanoparticles. The percentage removal decreased from 96 % to 74 %.

KEYWORD

Advanced oxidation process (AOP), Photocatalysis, Hydrothermal, Vat dye.

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Impact of Open Cast Coal Mining on the Growth of Herbs (Dicots) : A Case Study of Jharia Coalfields

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Opencast mining is the predominant mode of coal mining worldwide, but it is less environmental friendly. Impact of coal mining on phytodiversity is created by human being to enhance the standards of living. In the Indian coal industry the dependence on opencast mining has been increased rapidly during the last 2 decades due to mechanization and modernization of mining operation. The large opencast mines have advantage of low gestation period and higher recovery of coal and are more amenable to heavy mechanization and modern technologies than underground mines, thus ensuring speed and economy in implementation. The mining activity in the Jharia Coalfields provides raw materials in the form of crusher, gravels and stones, etc., for construction of roads and other infrastructure. Due to coal mining, number of natural and semi natural habitat being destroyed. The land loss and land degradation due to underground mining is of lower magnitude compared to opencast mining. Surface necessitates full uncovering of the mineral deposit and overlying vegetation and soil are completely destroyed. Open cast mining of coal deposits involves removal of overlying soil rock debris. This debris is heaped in the form of dumps and is called overburden. Lack of vegetation cover on such dumps often leads to acute problem of soil erosion and environmental pollution. It results in the impact on phytodiversity and physiographic features of concerned region.

KEYWORD

Coal mining, Overburden, Biodiversity, Environment, Species.

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GIS Based Spatial Distribution Analysis of Groundwater Quality Index in Lower Pennaiyar Watershed, Tamil Nadu

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Groundwater is the major source for drinking and irrigation purposes. The demand for groundwater has increased over the years and this has led to water scarcity in many parts of the world. The situation is infuriated by the problem of water pollution and improper management of water resources. The study area which falls in the semiarid region and subsequently facing water scarcity and quality problems. The present study was intentional to calculate water quality index of a rural watershed of Cuddalore and Villupuram districts. Water samples were collected from 33 sample locations in the study area were analyzed for pH, sodium, total hardness, total dissolved solid (TDS), chloride, magnesium, calcium, sulphate and potassium. Geographic information system (GIS) was used for spatial mapping of water quality in the study area. Water quality index (WQI) was determined based on physico-chemical parameters and thematic maps of water quality index were also developed. The water present in the villages, like Edaiyar, Kalpattu, Kongarayanur, T.V. Nallur, Tenmangalam, Panampattu, Pakkam, Salamedu, Tiruppachanur, Panchamadevi was found to be polluted for drinking. The outcome of the present research may be very much useful for proper decision making for design of the treatment facilities by the authorities. This study will also be helpful to adopt proper management strategies in the study area.

KEYWORD

Watershed, Groundwater, Water quality index, Geographic information system (GIS).

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Classification of Water Quality by Water Quality Index of Perennial River Tamirabarani, Tirunelveli, Tamil Nadu

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The river Tamirabarani is one of the perennial rivers in India which feed 2 major districts (Tirunelveli and Thoothukudi) of Tamil Nadu. Due to high anthropogenic activities, urbanization practices, irrigational and livestock activities along the river bank habitations increases pollution threat. The present study was carried out to assess the quality of water and to classify the river stretches using multiplicative aggregation function. The results showed water quality deterioration during the month of April whereas remaining periods showed the quality upto fair level. Excellent quality of water was recorded at 21.53 %, very good quality at 28.47 %, good quality at 33.33 %, fair quality at 13.89 % and marginal quality at 2.78 % of sampling sites during the study tenure. Correlation study between physico-chemical properties also reveals significant negative relationship with the water quality index (WQI) scores. The index function makes easy interpretation of results which in-turn increases the effectiveness of management strategies to bringing back the originality of the river.

KEYWORD

Water quality index, Tamirabarani, Sub Index, Correlation, Urbanization.

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Assessment and Prediction of NO_x Concentration at Key Intersections Around an Upcoming Airport Using Simulation Software

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In this paper an attempt has been made to analyze the concentration level of NO_x at key intersections around an upcoming airport at Navi Mumbai. Air monitoring was carried out at 7 intersections around the airport and the results were analyzed. Location of the monitoring stations was decided according to WHO and CPCB guidelines. Prediction of the NO_x pollutants for future scenario were done through a traffic simulation software called VISSIM. Predicted values of NO_x were compared with the standards prescribed by Central Pollution Control Board (CPCB). It has been found that concentration level of NO_x pollutant at some intersections are exceeding the prescribed limit whereas at some of the intersections it is well within the prescribed limit for the study period.

KEYWORD

Air pollution, VISSIM, Simulation, NO_x pollution, Modelling.

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A Study on Physical and Chemical Properties of Soils in Waltair, Visakhapatnam

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Soil is one of the most important ecological factors. Soil is usually defined as any part of Earth's crust in which plants root. The soil complex has different components, such as mineral matter, soil organic matter, soil water, soil atmosphere and biological system of flora as well as fauna. Soil is formed as a result of the actions and reciprocal influences of parent rocks, climate, topography, plants, animals and age of the land. Soil is the first defence line of the hydrogeological setting to groundwater pollution vulnerability. In the present study Waltair region of Visakhapatnam has been considered. The soils have been identified following IS classification system. The permeability of soils is interpreted based on the type of soil analysed as per IS classification. The pH value of the soils and the chlorides content is also determined to study the influence of soils on water quality.

KEYWORD

Soil, Soil classification, Permeability.

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