

Particulate Matter And Its Influence On Air Quality For Mumbai And Agra

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Most of the cities in India are under the severe threat of air pollution. In this context, particulate pollution seems to play a pivotal role in the total air pollution perspective for an area. In view of the inevitable threat posed by the particulate fractions (PM₁₀), the present paper tries to highlight the dominance of the particulate fractions on the air quality of an area. The two sampling sites chosen were Agra (27°10'36.0120"N, 78°0'29.0592"E) and Mumbai (18°58'30"N, 72°49'33"E), both highly polluted and driven by intense traffic combustion. The other pollutants taken into consideration in the study are sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). The dominance of the particulate fractions to the total air pollution in the two areas have been reflected in terms of the air pollution index (API) and exceedance factor (EF). In fact, it has been observed that throughout the three years the API calculated with respect to PM₁₀ is about 2.688 and 1.476 times than those calculated considering the contribution of all the three pollutants together for Agra and Mumbai, respectively. As for the EF, the average EF for PM₁₀ has been found to be 2.666 for Agra and 1.825 for Mumbai over the three years of study. Lastly, an attempt has been also made in the paper to present the seasonal variation of the pollutants over the three years of study.

KEYWORDS

PM₁₀, SO₂, NO₂, Air pollution, Air pollution index, Exceedance factor, Seasonal variation, Principal component analysis, Hysplit back trajectory model

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Comparison Between Two Halophyte Species For Potential Removal Of Salt Under Different Soil Salinity Conditions

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Salt induced land degradation has gradually increased in several major irrigation schemes within arid and semi-arid regions. To maximize crop productivity under saline conditions, either salt tolerance crops should be cultivated or areas should be desalinated. One of the most promising and cost-effective ways to maximize crop productivity is to use salt tolerant plants to remove salt from the soil. For this study, four levels of saline soils were cultivated with the halophyte species (*Ricinus communis* and *Olea europaea*) in pots. The soils had the following salinity levels: non-saline soil (OSS, 0.9 dS/m), slightly saline soil (LSS, 4.2 dS/m), moderately saline soil (SMS, 7.2 dS/m) and highly saline soil (SHS, 14.1 dS/m). To assess the salt tolerance capacity of the halophytes, physiological and biochemical parameters as well as the accumulation of leaf Na⁺ and Cl⁻ ions in the halophytes were investigated. Soils were additionally evaluated for electrical conductivity, pH and soil ion concentrations prior to planting and the following harvest. The fresh and dry weights of both halophytes increased with increasing salinity levels ($P \leq 0.05$). The proline contents of *Ricinus communis* and *Olea europaea* were 3.1 and 4.6 times higher, respectively than within the same species grown under control conditions. The malondialdehyde and membrane stability index values for *Ricinus communis* were insignificant under all salt conditions. Only *Olea europaea* showed significantly higher membrane damage under SHS conditions. In a similar manner, the chlorophyll content of both halophytes was not impacted for all of the salinity levels. Na⁺ and Cl⁻ concentrations significantly decreased in soils that were planted with both halophytes ($P \leq 0.05$). The impact of *Ricinus communis* on the removal of Na⁺ from SHS was significantly higher than that of *Olea europaea* and removed 151.4 mmol Na⁺/pot as compared to the removal of 61.2 mmol Na⁺/pot by *Olea europaea*.

KEYWORDS

Halophytes, Salt stress, *Ricinus communis*, *Olea europaea*, Phytoremediation

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Optimization Of Cellulase Production By *Bacillus cereus* Through Response Surface Methodology And Its Application In Saccharification Of Biomass

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In the present study, *Bacillus cereus* was isolated from decaying wood sample collected from Western Ghats of Karnataka for cellulase production and its gene sequence was deposited in gene bank (*Bacillus cereus* MH590292). The basal media (Czapek Dox) was optimized with respect to pH, temperature, carbon (*Typha latifolia*) and nitrogen (yeast extract) source using response surface methodology (RSM). Maximum Fpase production (exoglucanase) was recorded at pH 7.0, 45°C temperature, 9% carbon and 0.7% nitrogen source. Crude cellulase enzyme from *Bacillus cereus* had effectively saccharified biomass into reducing sugar which shows that cellulase production from this strain using cheap lignocellulosic material is economically feasible for bioethanol production.

KEYWORDS

Bacillus cereus, Exoglucanase, Cellulose, *Typha latifolia*, Saccharification, Response surface methodology

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Influence Of Additives On Surface And Strength Properties Of Clayey Soil – An Experimental Study

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A large part of central India and a portion of south India are covered with high plasticity of clayey soils. These soils swell by absorbing water and shrink when they dry out. These soils are the worldwide problem that possesses several challenges for civil engineers. The most common and economical method for stabilizing these soils are by using additives that reduce volume changes. In this study, the effect of using additives, like flyash, marble powder, aggregate waste and lime are added in examining the strength of the clayey soil as well as swelling potential. Lime is added to the soil at 0-10% by weight of the soil. Flyash, aggregate dust and marble powder are added to the soil at 0-20% by weight of the soil. The effect of additives on the properties of the soil, like grain size distribution, Atterberg limits, compaction characteristics, strength characteristics (UCS), etc., and surface properties, that is cation exchange capacity (CEC) and specific surface area (SSA) of the fine grained soils are determined. This paper presents the outcomes from the laboratory study with specific importance on the use of additives that provide economic benefits as well as reduced environmental impact.

KEYWORDS

Stabilization, Unconfined compressive strength, Cation exchange capacity, Specific surface area

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A Statistical Investigation Into Ammoniacal Nitrogen Adsorption On Chitosan /Bentonite Nanocomposite Films By Response Surface Methodology

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The highly effective chitosan-bentonite nanoclay film composite is prepared for the first time and its ability for NH₃-N removal from aqueous solution was studied. The synthesis of films requires only acetic acid as the dissolving agent makes the preparation process economic and environment friendly. Also, the film structure provides ease of continuous operation. Characterization of the films was conducted by thermogravimetric analysis (TGA), Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscope (SEM) analysis. Energy dispersive x-ray analysis (EDAX) spectroscopy data of the films before and after adsorption shows the increase in weight percentage of nitrogen on the films confirm the nitrogen adsorption capacity of the nanocomposite films. Response surface methodology (RSM) has been employed to evaluate and optimize the effects of initial ammonia concentration, pH, contact time and temperature. The optimum conditions obtained from the predicted model were pH (6.12), temperature (46.16°C), concentration (26.56 mg/L) and time (60 min) to get 94.03% of NH₃-N removal. The equilibrium adsorption data were fitted with Freundlich ($K_f=2.335$ L/mg, $1/n=0.77$ and $R^2=0.94$) and Langmuir isotherms ($K_L=0.433$ L/mg, $q_m=36.36$ mg/g and $R^2=0.82$) with Freundlich model providing a better prediction. The kinetic studies suggested the ion exchange mechanism in the adsorption. The values of thermodynamic parameters proposed that the adsorption is a spontaneous and exothermic process.

KEYWORDS

Box-Behnken design, Characterization, Isotherm, Kinetics, Thermodynamics

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Chromium Removal By *Eclipta prostrata* Plant Powder: Thermodynamic Study And Characterization

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Since the last few decades, there has been increasing global concern over the public health impacts due to environmental pollution. Among the various water pollutants, chromium (VI) is the most toxic one as it is carcinogenic in nature. Adsorption is an important surface operation with cost as an important parameter for comparing any adsorbent material. The objective of this study was to investigate a low cost adsorbent from *Eclipta prostrata* (Bhringraj) plant for effective removal of chromium (VI) from aqueous solutions. The effect of the presence of surface functional groups on the adsorption of chromium (VI) was analysed by observing the shifting of Fourier transform infrared spectroscopy peaks after adsorption experiments. The morphology and structure of the adsorbent were characterized using scanning electron microscopy and x-ray diffractometry. The thermodynamic parameters, such as Gibbs free energy (ΔG), the enthalpy (ΔH) and the entropy change of sorption (ΔS) were also evaluated and it was found that the adsorption process was spontaneous, feasible and endothermic in nature.

KEYWORDS

Biosorption, Bhringraj, Chromium (VI), Surface characterization, Thermodynamics, Adsorbent

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Hydrocarbons As Alternate Refrigerants In Domestic Refrigerators - An Overview

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The thermodynamic properties of hydrocarbons, namely propane, cyclopropane, propene, methyl acetylene, propadiene and dimethyl ether as alternatives to replace R12 have been predicted using SRK EOS. The values of vapour pressure, liquid specific volume, vapour specific volume, liquid enthalpy, vapour enthalpy, liquid entropy, vapour entropy have been estimated over the temperature range from -25°C to +55°C. Simulation of 89 W domestic refrigerator is carried out using ten state point vapour compression cycle. The theoretical performance of the hydrocarbons has been comparatively assessed using standard refrigeration parameters. According to our results, propane, propene are appropriate and recommended as alternatives of R12 with lower displacement compressor and cyclopropane as a direct substitute. Also implications with respect to material and lubricant oil compatibility, heat transfer characteristics are discussed.

KEYWORDS

COP, Compressor work input, Discharge temperature, Displacement volume, Volumetric efficiency

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The Effect Of Mercuric Toxicity In Saline Soil On Growth, Soluble Sugars, Photosynthetic Pigments And Some Of Enzymes In Turnip

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Mercury (Hg) is a heavy metal causing oxidative stress in plants. Saline soil in pots was treated with three levels of Hg (0, 75 and 150 mg/L) by using mercuric chloride salt 10 days after planting (plants at three leaf stage). The experiment was conducted as a factorial in a completely randomized design with three replications. 60 days after planting, leaf samples were collected and investigated for photosynthetic pigments, soluble sugars, the activity of peroxidase and catalase enzymes and chlorophyll a, chlorophyll b, total chlorophyll, SPAD value and carotenoids. Plants were harvested 70 days after sowing and root and shoot fresh and dry weights and mercury concentration in root and shoot of turnip were determined. The results showed that the maximum concentration of mercury occurred in roots followed by shoots. Soluble sugars in the shoot were reduced significantly, chlorophyll a, chlorophyll b, total chlorophyll contents and SPAD value were significantly reduced with 75 and 150 mg/L mercury treatments compared to control. Carotenoid content and catalase and peroxidase activities in leaf decreased significantly with mercury levels of 75 and 150 mg/L treatments compared to control. But shoots and roots dry weights were decreased with increasing mercury levels compared to control. Moreover, the TF value was <1 and BCF value >1.

KEYWORDS

Mercuric toxicity, Photosynthetic pigments, Peroxidase, *Brassica rapa* L

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Model Validation Of Temperature Process

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Modelling of a system or a process is of great importance in any analysis pertaining to environmental safety. Any complicated system can be modelled and various studies can be made on the model rather than testing on the real system so that the upcoming hazards can be minimized to a greater extent. There are different methods of modelling, but it is still important to validate the model. The validation tells us how closely the model mimics the real system. Only after validating the model then further analysis can be convincing. Hence this paper suggests a model validation method with a case study on air temperature control system modelling. By validation, the model operating close to the system is chosen and used for further study. The optimized transfer function is obtained from various methods and can be used to design controllers.

KEYWORDS

Mathematical modelling, Validation, Process station, Step test

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Effect Of Organic Loading Rate On Performance Of Continuous Stirred Tank Reactor Operating On Distillery Effluent

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In order to understand the viability and performance, anaerobic treatment of distillery effluent having very high chemical oxygen demand (COD) (110000–140000 mg/L) and biochemical oxygen demand (BOD) (55000–65000 mg/L) was studied on continuous stirred tank reactor (CSTR). Under various organic loading rates (OLR), optimum conditions for maximum COD removal and biogas generation was found to be, for OLR of 0.10 COD kg/day to 0.11 COD kg/day, hydraulic retention time (HRT) of 15-14 day and volatile fatty acids (VFA) to alkalinity ratio of around 0.12. Maximum COD removal efficiency was found to be around 73% for OLR of 9.166 kg COD/m³/day. For optimum conditions, biogas generation was observed to be around 30 L/day with a conversion coefficient of 0.405. These figures are particularly significant when operating the anaerobic biodigesters for treatment of distillery effluent and to produce biogas as an energy source. Anaerobic CSTR can successfully be employed for the treatment of distillery effluent but post biodigestion effluent still contains high COD concentration and needs to be treated further to meet the pollution norms and standards.

KEYWORDS

Anaerobic continuous stirred tank reactor, Biogas, Distillery effluent, COD, Pollution

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Colour Removal Using Neem Leaf Powder

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The main objective of the study is to remove the colour from the wastewater which was generated from the pulp and paper mill industry and to use the neem leaf powder in colour removal. The effluent is dark in colour due to the presence of synthetic dyes, wood extractives, lignin, tannins, resins, etc. The adsorbent used in this experiment is neem leaf powder for colour removal. The effect of adsorbent on dosage, contact time, agitation speed, pH are studied. Freundlich and Langmuir's isotherms were plotted. It is proved to be an acceptable adsorbent effective in colour removal of the effluent.

KEYWORDS

Freundlich isotherm, Langmuir isotherm, Neem leaf powder, Removal of colour

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Improving Corrosion Protection Of Al/Phosphor Bronze Metal Alloys Using Alumina/Silica Ceramic Coating

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Nowadays marine vehicles are widely used for transportation. Keeping the transporting vehicles to be more reliable, the material strength of these vehicles should be durable and long-lasting. The most common using metal alloys for ship propellers are phosphor bronze alloy (C51000) and aluminium bronze (C95400). In this work, the ceramic coating has been performed on aluminium bronze alloy with alumina (Al_2O_3) and phosphor bronze alloy with silicon dioxide (SiO_2) using a plasma spray coating method. The rockwell hardness and salt spray corrosion tests have been performed to analyze the effectiveness of the coating. The results of coated and uncoated alloys are compared. The results show that the coating of these metals with ceramics increases the hardness and corrosion resistance properties of the base metal alloys. Hardness for phosphor bronze increased from 80 Brinell hardness number (BHN) to 84 BHN and aluminium bronze from 77.2 - 84 BHN. After coating, there is no rust formation of both metals.

KEYWORDS

Aluminum bronze, Phosphor bronze, Alumina, Silicon dioxide, Plasma coating, Corrosion

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Artificial Recharge Practice Of Treated Domestic Sewage-Its Challenges And Opportunities In Indian Perspective: A Mini Systematic Review

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This study aims to review the published research papers in artificial recharge of treated domestic sewage. A country like India, with wide diversified set of beliefs and traditions follows a different means of usage of water available as per the seasons. Although we have different sources of water, but today there are concerns on how to manage the treated wastewater and return to environment, on the other hand as a producer. The main objective of the study is to develop baseline data for the recharge of treated sewage, which may ease the problem of disposal into the streams and provide an alternative means of disposal which not only serve the purpose of replenishing ground water but also generate a new form of disposal for all weather conditions. In this study, we are reviewing the state of problem in developing country in terms of disposal of treated sewage and how it could be better managed by artificial recharge by reducing the level of treatment which need to be better understood to develop baseline data in future perspective. Through Boolean search, a systematic review with narrative synthesis was conducted. Relevant electronic bibliographic databases and references lists of pertinent review articles were searched. The entire article is based on the guidelines and checklists provided by PRISMA (preferred reporting items for systematic review guidelines). A total of 6 papers which includes developing and developed country were finalized for the study and the results reveals that no reviews have been done based on the different stages of treatment on artificial recharge of treated domestic sewage in unconfined aquifer. This paper would provide valuable insights for India, by generating baseline data for quality after recharge in unconfined aquifer in specific to quality of soil. Although the relevance of method adopted has been acknowledged, the different stages of treatment and its effect in quality after recharge needs attention.

KEYWORDS

Treated sewage, Artificial recharge, Pollutants, Unconfined aquifer

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Physico-chemical Characteristics Of Ranbir Canal Of Akhnoor To Jammu Region And Its Suitability For Irrigation

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The present work was conducted to monitor Ranbir canal water. The water quality was analyzed and physico-chemical parameters were determined. Canal water samples were collected from five different locations from Akhnoor to Jammu region. Various physico-chemical parameters, such as colour, temperature, pH, electrical conductance (EC), total alkalinity (TA), total dissolved solids (TDS), dissolved oxygen (DO), chemical oxygen demand (COD) and biological oxygen demand (BOD) were analyzed. It was found that some water quality parameters were above the pollution level for Ranbir canal water at different stations.

KEYWORDS

Ranbir canal water, Physico-chemical characteristics, Irrigation

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