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Contents

CONTENTS

List of Tables

LIST OF TABLES

List of Figures

LIST OF FIGURES

List of Abbreviations and Notations

LIST OF ABBREVIATIONS AND NOTATIONS

WHO	World Health Organization
USEPA	United States Environmental Protection Agency
PJBAC	*Prosopis juliflora* Bark Activated Carbon
GDAC	Goat Dung Activated Carbon
CFC	Cobalt Ferrite Composite
SEM	Scanning Electron Microscope
BET	Bruner Emmett Teller
BJH	Barrett Joyner Halenda
FT-IR	Fourier Transform Infra Red spectrophotometer
EDAX	Energy Dispersive X-ray spectrometer
AFM	Atomic Force Microscope
AAS	Atomic Absorption Spectrophotometer
VSM	Vibrating Sample Magnetometer
Ms	Saturation Magnetisation
XRD	X-Ray Diffraction
TGA	Thermo Gravimetric Analysis
DSC	Differential Scanning Calorimetry
HPLC	High Performance Liquid Chromatography
Conc.	Concentration
pH_{zpc}	pH at which the surface charge of the adsorbent is zero

q	Amount of metal ions adsorbed per gram of the adsorbent(mg/g)
C_i	Initial metal ion concentration (mg/L)
C_e	Equilibrium metal ion concentration in solution (mg/L)
R^2	Correlation co- efficient
q_e	Amount of metal ions adsorbed per gram of adsorbent at equilibrium (mg/g)
q_t	Amount of metal ions adsorbed per gram of adsorbent at time 't' (mg/g)
q_m	Maximum monolayer adsorption capacity (mg/g)
b	Langmuir adsorption constant
K_F	Freundlich adsorption capacity (mg/g)
n	Freundlich isotherm constant
A_T	Tempkin equilibrium binding constant
b_T	Tempkin heat of adsorption
R	Gas constant (8.314 J/mol K)
β_{DR}	Mean free energy of sorption per mole of adsorbate (mol^2/J^2)
ε	Polanyi Potential
E	Mean free energy (kJ/mol)
k_1	Pseudo-first-order adsorption rate constant (min^{-1})
k_2	Pseudo-second-order adsorption rate constant (g/mg min)
SSE	Sum of Error Squares

α	Elovich initial adsorption rate (mg/g min)
β	Elovich adsorption constant (g/mg)
K_i	Intraparticle rate constant (g/mg $min^{1/2}$)
$\Delta G°$	Gibb's free energy change of adsorption (kJ/mol)
$\Delta H°$	Enthalpy change of adsorption (kJ/mol)
$\Delta S°$	Entropy change of adsorption (J/mol K)

List of Instruments/Equipments used for Various Studies

LIST OF INSTRUMENTS / EQUIPMENTS USED FOR VARIOUS STUDIES

1. Atomic Absorption Spectrophotometer
2. Atomic Force Microscope
3. BET Surface Analyser
4. CHNS Analyser
5. Differential Scanning Calorimeter
6. Digital Conductivity Bridge
7. Digital Electronic Balance
8. Digital pH Meter
9. Energy Dispersive X- ray Spectrometer
10. Flame Photometer
11. Fourier Transform Infrared Spectrophotometer
12. Hot Air Oven
13. Muffle Furnace
14. Occular Micrometer
15. Orbital Mechanical Shaker
16. Scanning Electron Microscope
17. Thermostat controlled Mechanical Shaker
18. Vibrating Sample Magnetometer
19. X-ray diffractometer
20. UV-Visible Spectrophotometer

Abstract

ABSTRACT

The unrelenting industrial development has led to a subsequent increase in the amounts of wastewater generation. Industries viz., textile, leather, paper, food, printing, carpet, cosmetics use dyes to colour their products. Among the industries, textile industries generate large volumes of coloured wastewaters containing dyes/heavy metal ions and discharge into the natural water bodies. Untreated disposal of this coloured waters not only cause damage to aquatic life, but also to human beings through mutagenic/carcinogenic effect. Removal of dyes/metal ions from coloured effluents is one of the major environmental concerns in the present days. Among numerous techniques available for the reclamation of dyes and metal ions, adsorption has been reported convenient, due to its manageable properties. Two ecofriendly materials of plant and animal origins viz., *Prosopis juliflora* Bark, Goat Dung are identified as potential sorbents in the removal of Direct Brown 2, Reactive Red 152 and Cu(II) ions from aqueous and textile wastewater samples. These materials are subjected to modification, activation, synthesis of magnetic nano composites. The physio-chemical characteristics of the prepared activated carbons are studied using standard methods. Surface morphology and presence of functional groups of the carbons are explored by SEM, EDAX, BET, BJH and FT-IR analytical techniques. The optimal conditions viz., initial concentration, contact time, sorbent doses, pH, temperature environments for the maximum removal of dyes/metal ion are established through batch equilibration method. Desorption and regeneration experiments are performed for dyes/metal laden carbons to enumerate their reusability. The efficiency of nano modified sorbents for the removal of dyes is investigated. Varied isothermal and kinetic models are employed to verify the adsorption equilibrium and kinetic behavior of the sorption process. The thermodynamic constants of adsorption are evaluated. Performance of the six systems is substantiated by statistical tool verification (SPSS software). A comparative assessment on the sorption ability of activated carbons and their corresponding magnetic nanocomposites are made on the basis of experimental results. The sorption capacities of the identified materials are upscaled to textile wastewaters. Column experiments are carried out to quantify the carbons' efficiencies for the aqueous/effluent dye solutions.