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(N. S. Gayathri)

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LIST OF ABBREVIATIONS AND NOTATIONS

PJB	*Prosopis juliflora* Bark
TIH	*Tamarindus indica* Hull
GH	Goat Hoofs
SEM	Scanning Electron Microscope
BET	Bruner Emmett Teller
BJH	Barrett Joyner Hammett
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
M_s	Saturation Magnetization
XRD	X-Ray Diffraction
TGA	Thermo Gravimetric Analysis
DTA	Differential Thermal Analysis
ZPA	Zeta- Potential Analyzer
PSA	Particle Size Analyzer
Conc.	Concentration
pH_{zpc}	pH at which the surface charge of the adsorbent is zero
q_e	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 Coefficient

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
ε	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

LIST OF INSTRUMENTS / EQUIPMENTS USED FOR VARIOUS STUDIES

1. Atomic Absorption Spectrophotometer
2. Atomic Force Microscope
3. BET Surface Analyzer
4. CHNS Analyzer
5. Scanning Electron Microscope
6. Energy Dispersive X- ray Spectrometer
7. Fourier Transform Infrared Spectrophotometer
8. Muffle Furnace
9. Ocular Micrometer
10. X-ray Diffractometer
11. Vibrating Sample Magnetometer
12. Particle Size Analyzer
13. Zeta- Potential Analyzer
14. Thermo Gravimetric – Differential Thermal Analyzer
15. Thermostat Controlled Mechanical Shaker
16. Digital pH Meter

Abstract

ABSTRACT

Metal pollution of water and its sources has been receiving considerable attention in recent times due to the increasing amounts of industrial effluents discharged into the environment. Metals like lead, cadmium, nickel, copper, chromium and zinc in their common oxidation states are declared toxicants and reported to cause several physiological disorders while exceeding their permissible limits. Several reclamation technologies have been developed to reduce their concentrations. A number of low-cost and indigenous materials are identified as successful adsorbents, to remove metal ions through the process of adsorption. In this context, treated adsorbents prepared from *Prosopis juliflora* Bark (TPJB), *Tamarindus indica* Hull (TTIH) and Goat Hoofs (TGH) are employed to reduce the concentrations of three selected metal ions, since they pose better chelating nature than their respective bare ones. Adsorption of Pb(II), Cd(II), Ni(II) ions by TPJB, TTIH, TGH have been investigated through batch and column operations. The characteristics of treated materials are examined using Atomic Absorption Spectrophotometer (AAS) and the adsorption processes are confirmed by BET/ BJH, SEM, EDAX and FT-IR analyses. The optimum conditions for achieving maximum adsorption of metal ions are established. The factors which influence the reaction rates and the dynamics of adsorption are studied in order to verify the sorption behavior. The nature of adsorption and kinetic behaviour are explained by different isotherm and kinetic models. Nano materials and magnetic nanocomposites are synthesized, characterized using AFM, XRD, TG- DTA, VSM, Zeta-Potential and Particle size analyzer and tested for their sorption nature. An assessment of the comparative ability of the three adsorbents along with the order of preferential adsorption among the metal ions is made on the basis of the valid conclusions drawn from the experimental results. The exhausted material is used as fertilizer to grow seeds. The efficiencies of the adsorbents are scaled up to industrial effluents, treatment and extended to field levels through installation of a prototype device.