Sorption of As (III) and As (V) onto Dalbergia sissoo & Arundo donax Sawdust

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FOREWORD

The dissertation work entitled "**Sorption of As (III) and As (V) onto Dalbergia sissoo & Arundo donax Sawdust"** submitted by **Pushpa Bhattarai** for the M.Sc. Degree in Chemistry of Tribhuvan University is carried out under my supervision. During the research period, she had worked sincerely and satisfactorily. No part of this thesis has been submitted for any other degree.

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ABSTRACT

The application of low-cost, ecofriendly bioadsorbents as an alternate to the conventional methods of removing As (III) and As (V) ions from aqueous media has been investigated. Present study deals with the adsorption of As (III) and As (V) from aqueous solution onto chemically modified form of saw dusts. The Chemically modified Dalbergia sissoo sawdust and Arundo donax sawdust were obtained by performing phosphorylation followed by treatment with iron (III) solution in aqueous media. Batch studies were performed at an initial concentration of 1 mg/l to evaluate the influence of various parameters such as pH, equilibrium time, amount of adsorbent and concentration of adsorbate. Studies showed that pH of aqueous solution drastically affected As (III) and As (V) adsorption as a result the removal efficiency altered with the change in initial pH of the solution. The maximum efficiency for the iron (III)-loaded phosphorylated Dalbergia sissoo sawdust [FePDSD] and iron (III) - loaded phosphorylated Arundo donax sawdust [FePASD] were achieved at pH 9, & 7 for As (III) and at pH 3, & 5 for As (V) respectively at an initial concentration of 1 mg/l. Kinetics and isotherm modeling studies demonstrated that the experimental data best fit a pseudo-first order and Langmuir isotherm model, respectively. The maximum adsorption capacities were found to be 1.334 mg/g & 1.667 mg/g for As (III), 3.646 mg/g & 2.631 mg/g for As (V) with FePDSD and FePASD respectively. In summary, Dalbergia sissoo & Arundo donax sawdusts can be used as an efficient and economical material for the adsorptive removal of As (III) and As (V) from aqueous system.

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ABBREVIATIONS

% R = Percentage removal

1/n = Adsorption intensity

A^0 = Angstrom

AAS = Atomic Absorption Spectrophotometer

C_e = Equilibrium concentration of arsenic

C_f = Final concentration of arsenic

C_i = Initial concentration of arsenic

EPA = Environmental Protection Agency

FePASD = Iron (III) - loaded phosphorylated Arundo donax sawdust

FePDSD = Iron (III)-loaded phosphorylated Dalbergia sissoo sawdust

ICP = Inductively Coupled Plasma

K_1 = Pseudo-first order rate constant in min^{-1}

K_2 = Pseudo-second order rate constant in g mg^{-1} min^{-1}

K_L = Langmuir equilibrium parameter

m mol/g = Millimole per Gram

mg/l = Milligram per Litre

mg/l = Milligram per Litre

Ml = Milliliter

MPL = Maximum Permissible Limit

ppb = Parts per billion

q_e = Amount adsorbed at equilibrium in mg g^{-1}

q_m = Maximum adsorption capacity in mg g^{-1}

q_t = Amount adsorbed at time‘t’ in mg g^{-1}

R^2 = Correlation coefficient

V_o = Initial adsorption rate in mg g^{-1} min^{-1}

W = Weight of adsorbent in gram

WHO = World Health Organization