

Simulating Studies on Phosphate Removal from Laundry Wastewater Using Biochar: Dudinin Approach

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Abstract : Laundry wastewater contains a diverse range of chemical pollutants that can have detrimental effects on human health and the environment. In this study, simulation studies by Spyder Python software v 3.2 to assess the efficacy of biochar in removing PO_4^{3-} from wastewater were conducted. Through modeling and simulation, the mechanisms involved in the adsorption process of phosphate by biochar were studied by altering variables which is specific to the phosphate from common laundry phosphate detergents, such as the aqueous solubility, initial concentration, and temperature using the Dudinin Approach (DA). Results showed that the concentration equilibrate at near the highest concentrations for Sugar beet-120 mgL^{-1} , Tailing-85 mgL^{-1} , CaO- rich-50 mgL^{-1} , Eggshell and rice straw-48 mgL^{-1} , Undaria Pinnatifida Roots-190 mgL^{-1} , Ca-Alginate Granular Beads -240 mgL^{-1} , Laminaria Japonica Powder -900 mgL^{-1} , Pinesaw dust-57 mgL^{-1} , Ricehull-190 mgL^{-1} , sesame straw- 470 mgL^{-1} , Sugar Bagasse-380 mgL^{-1} , Miscanthus Giganteus-240 mgL^{-1} , Wood Bc-130 mgL^{-1} , Pine-25 mgL^{-1} , Sawdust-6.8 mgL^{-1} , Sewage Sludge-, Rice husk-12 mgL^{-1} , Corncob-117 mgL^{-1} , Maize straw- 1800 mgL^{-1} while Peanut - Eucalyptus polybractea-, Crawfish equilibrated at near concentration. CO_2 activated Thalia, sewage sludge biochar, Broussonetia Papyrifera Leaves equilibrated just at the lower concentration. Only Soyer bean Stover exhibited a sharp rise and fall peak in mid-concentration at 2 mgL^{-1} volume. The modelling results were consistent with experimental findings from the literature, ensuring the accuracy, repeatability, and reliability of the simulation study. The simulation study provided insights into adsorption for PO_4^{3-} from wastewater by biochar using concentration per volume that can be adsorbed ideally under the given conditions. Studies showed that applying the principle experimentally in real wastewater with all its complexity is warranted and not far-fetched.

Keywords : simulation studies, phosphate removal, biochar, adsorption, wastewater treatment

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