

**Equilibrium studies on the adsorption of heavy metals, dyes and phenol by phosphoric acid modified rice husk**

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The removal of contaminants from wastewater is still far away from a satisfactory solution. In fact, the selection of a particular wastewater treatment technology should not be based uniquely on its efficiency, but should rather integrate environmental and economical aspects. Within this framework, the main objective of this study is the removal of various contaminants in wastewater including heavy metals (Cadmium and Copper), dyes (Methyl Red and Methylene Blue) and Phenolic compounds via an environmental friendly green technology method. In this study, grounded rice husk was examined as sorbent material which was chemically modified with Phosphoric acid (1.0 M) and was found to be effective in removing the contaminants. Batch studies were performed on synthetic wastewater at room temperature to evaluate the effects of various parameters such as contact time, pH, initial concentration of the solution and adsorbent dose on removal efficiency of the pollutants. The experiment was also applied to treat two samples of industrial wastewater containing Cadmium and Carmoisine E122. The removal efficiency was found to be pH dependant. The removal efficiency was higher for Phenol and Methyl Red at low pH values and it was shown that the removal efficiency was higher for heavy metals and Methylene Blue at higher pH values. The equilibrium was reached approximately in 2 hours for all the contaminants. Equilibrium sorption data were fitted into Langmuir, Freundlich, Temkin and Dubinin-Radushkevich (D-R) isotherms. Of the four adsorption isotherms, the  $R^2$  value was higher for D-R isotherm for the adsorption of Cadmium (0.979), Freundlich and Temkin isotherms for the adsorption of Copper (0.945), Freundlich isotherm for the adsorption of Methyl Red (0.994), Temkin isotherm for the adsorption of Methylene Blue (0.953) and Langmuir isotherm for the adsorption of Phenol (0.987). Adsorption data were well described and adsorption isotherm constants were determined from the respective adsorption isotherm equations. The present study analyzed the adsorption of rice husk and concluded that treated rice husk gave comparatively better adsorption efficiency. The treated rice husk can be implemented on large scale industrial applications after field studies.

**Keywords:** Adsorption isotherm, Heavy metals, Phenol, Rice husk, Wastewater

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