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Results of the study of chemical-, vacuum drying- and plasma-pretreatment of coconut(Cocos nucifera) lumber sawdust for the adsorption of methyl red in water solution

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The study to be presented is motivated by the need of certain industries to implement a cost-effective method of cleaning up wastewater from industrial processes, for example the clean-up of dye-tainted wastewater from textile mills. Biomass by-products, for a long time, have been the popular choice for the role of clean-up agents for certain applications but sometimes the efficiency for adsorption of the targeted waste material is not promising and thus the need for pretreatment of the biomass material. This work will present the results of a study using three methods of pretreating coconut(Cocos nucifera) lumber sawdust for the adsorption of methyl red dye in water solution, namely; 1. Chemical processing using formaldehyde treatment and sulfuric acid treatment, 2. vacuum drying, and 3. plasma treatment. The vacuum drying and plasma treatment utilized a hexapole-magnetized microwave plasma device that uses a 2.45 GHz magnetron. The results showed that there is a dramatic increase in the removal efficiency(% removal) after the treatment of the coconut sawdust. The highest recorded % removal are as follows: formaldehyde treatment (20.51%), sulphuric acid treatment (40.45%), vacuum dried (61.74%), hydrogen plasma (64.54%), oxygen plasma (66.89%) and argon plasma (69.57%). It was also shown that the % removal is dependent on the initial dye concentration, adsorbents dosage, contact time, and pH. The adsorption results of this study were fitted with Freundlich and Langmuir isotherm models but the data is better described by the Freundlich isotherm model as compared to Langmuir. From the results of the study, it is concluded that the methods of vacuum drying and plasma pretreatment are more effective alternative to chemical processing of the coconut lumber sawdust in the adsorption of dye in wastewater.

Keywords

wood treatment
plasma modification
vacuum drying
chemical treatment
wastewater treatment