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Preparation, characterization and properties of activated carbon derived from rice husk

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Rice, the staple food of the Sri Lankans is one of the important crops occupying 34% of the total cultivated area in the country. Thus, rice processing generates a large quantity of rice husk as waste material. The main objective of the present work was to investigate the potential of using this agricultural waste, rice husk as a precursor for the production of low-cost activated carbon (AC) as an adsorbent for the removal of heavy metals (Pb(II), Cd(II) etc.). Therefore, the present study was carried out to evaluate the effect of carbonization time and activating agent on AC production from rice husk and its Pb(II) removal capacity. Cleaned and dried rice husks samples (12.00 g) were separately carbonized at 400 °C under constant nitrogen flow for 60 minutes -150 minutes (60 min, 90 min, 120 min, 150 min) and chemically activated by HCl. The AC yield was calculated in each sample. In order to determine the lead removal percentages (Pb%) of AC derived from rice husk at different carbonized temperatures, first AC samples were added (1.00 g) separately to a Pb(II) standard solution (5.00 mg L⁻¹), stirred for 1 hour at pH 7 at room temperature. The solutions were filtered and the residual Pb was determined by Atomic Absorption Spectrophotometry (AAS). All the experiments were performed in duplicate. Further, the AC with the highest Pb removal capacity was characterized by Scanning Electron Microscopy & Energy Dispersive Spectroscopy (SEM/EDAX), and Fourier Transform Infrared Spectroscopy (FT-IR). Proximate analysis, of the AC were also studied. The percent yield of AC prepared from rice husk with HCl activation, and its corresponding % Pb removal potential were fluctuated with increasing carbonization time. The highest AC yield (20.50%), the highest % Pb removal (93.31%) was observed for the AC prepared by carbonization of rice husk at 400 °C for 120 minutes with HCl activation. The results of the proximate analysis revealed that the ash content, moisture content volatile matter content and fixed carbon content of the AC were 32.47%, 34.94%, 24.20%, and 8.39% respectively. Based on the results, it can be concluded that AC derived from rice husk can be considered as an efficient and cost-effective adsorbent for the removal Pb(II) from wastewater.

Keywords: Activated carbon, Pb(II) removal, Rice husk, Wastewater