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ADSORPTION OF PHENOL ON ADSORBENT PRODUCED FROM COCONUT TREE STRAW: KINETIC AND EQUILIBRIUM STUDIES

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Abstract

Agro-industrial residues are seen as potential precursors in the development of adsorbents for the removal of phenolic compounds, which present a harmful effect to human health due to their high toxicity. This work evaluated the use of coal prepared from coconut tree straw, an agro-industrial residue, for the adsorption of phenol in aqueous solutions. Three coal samples were prepared: carbonized only (C_b), activated with synthetic air (C_{air}) and activated with CO_2 (C_{CO2}). Based on the results of characterization, it was observed that these adsorbents are mesoporous, with a predominantly amorphous structure. The C_{CO2} presented the highest thermal stability. Based on pH_{PZC}, it was found that after the activation process, the surface of the material became positively charged at a higher pH range of the solution; therefore favouring the adsorption of phenol. In the kinetic study the pseudo-*n*th order model obtained the best adjustment to the experimental data. The intra-particle diffusion model indicated that the adsorption processes are controlled by various steps. The experimental data of the equilibrium adsorption study were also evaluated; with no significant difference being found between the models that were better adjusted (Fritz-Schlunder, Redlich-Peterson, Radke-Prausnitz and Sips) according to the F-test at a 95% confidence level. The maximum adsorptive capacity for C_b, C_{air} and C_{CO2} were of 32, 41 and 56 mg g^{-1}, respectively. In this study, the coconut tree straw, an abundant agro-industrial residue that has not been previously evaluated as a precursor for the preparation of coal, was valued being used as an adsorbent in the removal of phenol.

Key words: adsorption, agro-industrial residues, coconut tree straw, phenol

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