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ADSORPTION OF PHENOL ON ADSORBENTS PRODUCED FROM COCONUT TREE WASTE: KINETIC AND EQUILIBRIUM STUDIES

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Abstract

Agro-industrial waste are seen as potential precursors in the development of adsorbents for the removal of phenolic compounds, which exhibit a harmful effect to human health due to their high toxicity. This work evaluated the use of coal prepared from coconut tree agro-industrial waste, for the adsorption of phenol in aqueous solutions. Three coal samples were prepared as follows: carbonized only (C_b), activated with synthetic air (C_{air}) and activated with CO_2 (C_{CO_2}). Based on the results of characterization, it was observed that these adsorbents are mesoporous, with a predominantly amorphous structure. The C_{CO_2} demonstrated 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-nth 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_{CO_2} 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.

Keywords: adsorption, agro-industrial residues, coconut tree straw, phenol

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