

THE USE OF RUBBER CRUMB AS AN ADSORBENT FOR ORGANIC WASTE

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ABSTRACT

Rubber crumbs were used to adsorb methylene blue yielding an uptake capacity of 80µg/g and maximum percentage removal of 84% for an initial concentration of 50mg/L methylene blue and a low 11.6% for an initial concentration of 250 mg/L. The linear relationship with different slopes on the Scatchard plot for rubber crumb, confirmed more than one sorption process could have taken place based on the binding sites on the adsorbent. By modeling the dye adsorption equilibrium data, the Freundlich isotherm is adopted as it has the lowest P value. Based on XRF analysis an ion-exchange mechanism was proposed in addition to adsorption and absorption owing to the composite nature of rubber crumb and its chars. Early contact times were responsible for most of the adsorption and late contact times were characteristic of the absorption by the polymer matrix. An adsorbent dosage of 0.2g yielded an 85% removal of methylene blue. The isoelectric point of rubber crumb was found to be at about pH 8.5 with the greatest percentage removal of 56% at pH 12. BET isotherm gave negative results, with only one adsorption point and two desorption points even after the rubber crumb was extracted using acetone. Burn off at elevated temperatures produced a greater extent of decrease in solid char, 90% and 92% for C600 and C800 respectively. Multicomponent loss at different temperatures was correlated to stacked IR analysis which revealed loss of polymer content and extractants due to elevated pyrolysis temperatures. XRD analysis confirmed the presence of calcite and zincite phases as related to XRF elemental analysis.

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