

Removal of Erythrosine Using Bottom Ash as an Adsorbent

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Structured Abstract

Background: This research explores the use of bottom ash, a byproduct of coal-fired power plants, as a cost-effective adsorbent to remove the hazardous dye erythrosine from wastewater. Erythrosine, commonly used in various industries, poses significant environmental and health risks due to its persistence and toxicity. Additionally, the disposal of bottom ash faces challenges due to limited disposal sites, creating potential environmental pollution concerns. This study aims to optimize the adsorption process by evaluating the effects of pH, dye concentration, and adsorbent dosage on removal efficiency.

Methods: Characterization techniques, including Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy - energy dispersive X-ray spectroscopy (SEM-EDX), and X-ray diffraction (XRD) were used to assess the bottom ash's properties.

Results: FTIR analysis revealed functional groups such as hydroxyl and silicates, which facilitate adsorption through electrostatic interactions and hydrogen bonding. SEM analysis showed a porous, rough, and uneven surface in the activated bottom ash, ideal for adsorption. After erythrosine adsorption, the surface became smoother, indicating dye interaction with the adsorbent. The adsorption studies demonstrated that pH significantly influences removal efficiency, with nearly 100% removal observed at pH 2. This is due to increased protonation of the adsorbent surface, enhancing electrostatic interactions with the anionic erythrosine molecules. As pH increased, removal efficiency decreased due to reduced protonation and competitive adsorption from hydroxide ions. The removal efficiency also increased with increasing erythrosine concentration, reaching a plateau at around 70 ppm, indicating saturation of the adsorbent's active sites. Furthermore, removal efficiency increased with higher adsorbent dosage until saturation was reached.

Conclusion: In conclusion, bottom ash is an effective and sustainable adsorbent for dye removal from wastewater, offering a dual benefit of treating wastewater while promoting the reuse of industrial waste. This method improves water quality and has potential health and environmental benefits.

Keywords: Erythrosine, bottom ash, adsorbent

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