

The Use of Agricultural Waste to Remove Heavy Metals from Mine Water¹

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Abstract: Scientists have been working towards a more environmentally friendly, cost-effective, and sustainable approach to addressing environmental pollution. There is growing attention to adapting sorption techniques using low-cost agricultural byproducts and waste to remove heavy metals from contaminated and polluted water systems, including mine water. This study evaluates the capacity of agricultural waste materials such as plantain and banana peels, bamboo stems, coconut coir, goat, and sheep dung as low-cost sorbents for removing specific heavy metals in synthetic-mine water. The study follows a batch sorption experiment mixing different masses of biosorbents to remove metals from a synthetic mine water solution, considering sorbent mass and pH as the optimized adsorption parameters. In the first trial, dry masses, 0.1, 0.5, 1, and 2 g of plantain peel, banana peel, bamboo stems, coconut coir, sheep dung, and goat dung were weighed and added to 35 mL working volume of synthetic mine water containing mercury, cadmium, lead, copper, zinc, and arsenic in a 50 mL centrifuge tube. The mixture was treated at a pH of 7 at initial concentrations of 0.33, 1.03, 1.33, 7, and 20.42 mg L⁻¹ for Cd, Cu, Zn, Pb, and Hg, respectively. The mixture was placed on a shaker at 150 rpm for 1,440 minutes and allowed to establish equilibrium for 4,320 minutes. After this time period, the metal-enriched sorbent was separated from the solution, and an Elmer Opima 4300DV ICP-OES was used to analyze the final concentration of the mine water. The experiment was conducted at room temperature, and at the end of first trial, the biosorbents showed a relatively high adsorption capacity for coconut coir, sheep dung, and banana peel. The amount of adsorbed metals per unit mass of adsorbent at equilibrium decreased as the mass of biosorbant used increased. It was a common trend for all sorbents.

Additional Key Words: Biosorbant, Adsorption, low-cost-agricultural-byproducts.

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