Developing a Sustainable Water Filtration System for Use in Low Income Countries

DeMessie , Sahle

Adsorption of bivalent heavy metal ions from polluted water was studied using dried powdered banana peels and banana peel pyrolyzed at 500°C and 600°C. The results were compared with adsorption using commercial activated carbon F-400. The morphology, physical, and chemical properties of the adsorbents were characterized using thermo-gravimetric analysis, Fourier transfer infrared spectroscopy, pH electrophoresis, surface area analysis, scanning electron microscopic imaging, and X-ray diffraction analysis. Pyrolysis of dried banana peels formed a porous, large surface area adsorbent (50 – 60 m^2/g), with negative surface charges resulting in increased adsorption capacity of by two orders of magnitude. The equilibrium adsorption data was modeled with the Freundlich and Langmuir isotherms. The degree of favorability of adsorption of Cu(II) ions and the adsorption capacity were 0.75, and 4.87mg/g for banana peel, and 1.25 and 351.1 mg/g for pyrolyzed banana peel. Adsorption kinetics followed pseudo-second order model. Fixed bed column studies were conducted to determine the flow effects and breakthrough point. The Thomas model and the Yoon–Nelson model were employed to determine parameters, such as adsorption rate and adsorption capacity, useful for process design. Extracting metal pollutants from water using pyrolyzed banana peel as an adsorbent is a low cost, suitable and sustainable, alternative for cleaning contaminated waters.

Awards Won:
Second Award of $2,000