ST107-BAS-003

Adsorption of Methyl Red from Textile Dyeing Wastewater Using Coffee Husks Biochar

Njeri Jacinta N. [a], Nthiga Esther W. [b] and Muthakia Gerald [a]

[a] Department of Chemistry, Dedan Kimathi University of Technology: Email: jacintan08@gmail.com

[b] Department of Chemistry, Dedan Kimathi University of Technology: Email: esther.nthiga@dkut.ac.ke

[c] Department of Chemistry, Dedan Kimathi University of Technology: Email: gkmuthakia@dkut.ac.ke

Abstract

Contamination of water has become a global problem in the twenty-first century due to the entry of both organic and inorganic toxins into the water system. Enormous amounts of wastewater are discharged into the environment from the dyeing processes. Because of their great chemical stability, industrial effluent from textile production combined with insufficient dye degradation results in significant water contamination. Dye-contaminated wastewater poses major health concerns, including cancer, as well as problems for the aquatic environment. A common azo dye used in textile manufacture and as an antibiotic is methyl red dye (MRD) which finds its way into the water system when directly released or stray during the dyeing process. It is known to be poisonous, carcinogenic, teratogenic, mutagenic, and cause respiratory issues. Therefore, it is crucial to keep an eye on the quality of water. There is a need therefore to remove these toxins from the environment and water. Coffee husks biochar (CHB) was produced by gentle pyrolysis of coffee husks at 350 °C followed by characterization using FT-IR, and SEM. Analysis using FT-IR revealed the vanishing of the O-H grop in the coffee husks and the emergence of C=C, C=O, and C-O in the CHB indicating the conversion of husks to biochar. Besides, the SEM investigation demonstrated a change in the surface morphology of the CHB. In batch investigations, the impacts of CHB dose (0.2-1.2 g), medium pH (1-12), time of contact (5-60) minutes, and initial dye concentration (20-150 mgL^{-1}) were investigated. Coffee husks biochar demonstrated remarkable efficacy in eliminating MRD with an impressive removal efficiency of up to 96.56% at optimum conditions. At pH 2 and 0.6 g of CHB, an adsorption equilibrium capacity of 10.42 mg g^{-1} was reached in 25 minutes. Langmuir isotherm proved to be the appropriate model for describing the MRD adsorption onto CHB, assuming a chemisorption mechanism.

ST107-BAS-004