World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:17, No:04, 2023

Performance Evaluation and Kinetics of Artocarpus heterophyllus Seed for the Purification of Paint Industrial Wastewater by Coagulation-Flocculation Process

Authors : Ifeoma Maryjane Iloamaeke, Kelvin Obazie, Mmesoma Offornze, Chiamaka Marysilvia Ifeaghalu, Cecilia Aduaka, Ugomma Chibuzo Onyeije, Claudine Ifunanaya Ogu, Ngozi Anastesia Okonkwo

Abstract : This work investigated the effects of pH, settling time, and coagulant dosages on the removal of color, turbidity, and heavy metals from paint industrial wastewater using the seed of Artocarpus heterophyllus (AH) by the coagulation-flocculation process. The paint effluent was physicochemically characterized, while AH coagulant was instrumentally characterized by Scanning Electron Microscope (SEM), Fourier Transform Infrared (FTIR), and X-ray diffraction (XRD). A Jar test experiment was used for the coagulation-flocculation process. The result showed that paint effluent was polluted with color, turbidity (36000 NTU), mercury (1.392 mg/L), lead (0.252 mg/L), arsenic (1.236 mg/L), TSS (63.40mg/L), and COD (121.70 mg/L). The maximum color removal efficiency was 94.33% at the dosage of 0.2 g/L, pH 2 at a constant time of 50 mins, and 74.67% at constant pH 2, coagulant dosage of 0.2 g/L and 50 mins. The highest turbidity removal efficiency was 99.94% at 0.2 g/L and 50 mins at constant pH 2 and 96.66% at pH 2 and 0.2 g/L at constant time of 50 mins. The mercury removal efficiency of 99.29% was achieved at the optimal condition of 0.8 g/L coagulant dosage, pH 8, and constant time of 50 mins and 99.57% at coagulant dosage of 0.8 g/L, time of 50 mins constant pH 8. The highest lead removal efficiency was 99.76% at a coagulant dosage of 10 g/L, time of 40 mins at constant pH 10, and 96.53% at pH 10, coagulant dosage of 10 g/L and constant time of 40 mins. For arsenic, the removal efficiency is 75.24 % at 0.8 g/L coagulant dosage, time of 40 mins, and constant pH of 8. XRD imaging before treatment showed that Artocarpus heterophyllus coagulant was crystalline and changed to amorphous after treatment. The SEM and FTIR results of the AH coagulant and sludge suggested there were changes in the surface morphology and functional groups before and after treatment. The reaction kinetics were modeled best in the second order.

Keywords : Artocarpus heterophyllus, coagulation-flocculation, coagulant dosages, setting time, paint effluent
Conference Title : ICSC 2023 : International Conference on Surface Chemistry
Conference Location : Cape Town, South Africa
Conference Dates : April 13-14, 2023