The Effectiveness of the Particle Sizes of Rice Husk Powder and Clearing Nut Seed Powder for Removal Efficiency of Cd (II) from Wastewater

K. Tharshigah, A.P. Henagamage* and H.M.J.C. Pitawala

Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka

Biomaterials are considered as efficient removers of heavy metals from wastewater through biosorption. The main goal of this study was to investigate the effect of particle sizes of Rice Husk Powder (RHP) and Clearing Nut Seed (*Strychnos potatorum*) Powder (CNSP) for the removal efficiency of Cd (II) in synthetic wastewater. Rice husks collected from the Badulla area were thermally treated at 200°C for 3 hours and clearing nut seeds collected from the same area were dried at room temperature for 7 days and powdered. Batch experiments were conducted to study the effect of particle sizes of biomaterials (0.5-1.0 mm, 150-500 µm, <63 µm) and contact time (2, 4, 6 hours) in removal efficiency by keeping other factors at constant (Adsorbent dosage = 1.5 g, pH = 5, Cd(II) initial concentration = 100 ppm, Cd(II) volume = 50 ml, Temperature = 25±2°C, Agitation speed = 150 rpm). The characterization of the materials before and after treating with Cd (II) was analyzed using SEM, FT-IR, XRD, and XRF. The characterization analysis revealed that both are fibrous in nature and rich in SiO2. The results of the study showed a linear positive strong correlation between removal efficiency and reducing particle size for both materials ($p < 0.05$). The lowest particle size (<63 µm) of RHP and CNSP showed higher removal efficiency except for the mixture of materials and they were 84.12% & 78.74% respectively. The highest removal efficiency (85.12%) was obtained for 1:1 mixture of the materials with the particle size <63 µm at the contact time of 4 hours. The reduction of FT-IR peak intensity for Si-O after the treatment confirms the participation of functional groups in metal binding. SEM images confirmed the changes in surface morphology of materials after the treatment. In conclusion, a decrease in particle size causes an elevation in removal efficiency of Cd (II) due to the presence of large surface area for biosorption and 1:1 mixture of RHP and CNSP is an efficient biomaterial for Cd (II) removal.

Keywords: Rice husk powder, Clearing nut seed powder, Particle size, Cadmium, Removal efficiency