ABSTRACT

Industrialization and technological advancements have led to the generation of numerous pollutants such as heavy metals into the aquatic ecosystem. These toxic compounds are extremely dangerous to human health and the environment due to their non-biodegradability, severe toxicity, ability to accumulate and contaminate ground and surface waters. Subsequently, pursuance of sustainable materials and technologies for better attainment of environmental sustainability is critical. This study reports the synthesis of geopolymers GP-1, GP-2 and GP-3 from different clays. Geopolymers were hydrothermally synthesized using clay and rice husks waste as an alumina and silica source respectively. The geopolymers were characterized using Fourier transform-infra red, energy dispersive spectrometry, X-ray diffraction and scanning electron microscope. Batch and gravitational column experiments using Pb (II) and Cd (II) ions were carried out. Increased metal ion uptake was recorded with raised Si/Al ratio of the adsorbents. The mean percentage uptake of 90.23 ± 0.4 and 89.63 ± 0.18 of Pb (II) and Cd (II) were achieved at pH of 4.0 and 5.0 respectively using GP-3. Langmuir, Freundlich and modified Langmuir Freundlich isotherms were used in equilibrium studies. Data for adsorption of Pb (II) and Cd (II) fitted best in the modified Langmuir Freundlich model. The highest adsorption capacities of Pb (II) and Cd (II) were 209.9 and 136.2 mg/g respectively, attained using GP-3. Based on the results obtained, geopolymers produced from common clay and rice husk waste displayed promising potentials in the removal of heavy metal ions from the aqueous phase. Considering the availability of raw materials for geopolymerization and the high metal ions uptake capacities of geopolymers, they can also be used as adsorbents for removal of heavy metals in industrial wastewater.