A Novel Geopolymer For Heavy Metals Removal

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Contamination of water with heavy metals is of worldwide cocern as they are toxic to humans and other organisms and are not easily broken down naturally. In recent years, geopolymer adsorbents have received a considerable research attention in the field of water remediation. This family of mineral binders that based on Si-O-Al polymer system can be synthesized at relatively low temprature and from waste materials and low cost aluminosilicate sources. The negatively charged 3-D framework structure provides suitable sorption sites for heavy metal sequestration from aqueous solutions. Here, we present a novel adsorbent for heavy metal removal synthesized by geopolymerization of marlstone. The composition of marlstone, which include mixed clays and calcareous components, qualify it to be a potential source for reactive Si, and Al, in addition to the presence of Ca, that are essential to undergo a geopolymerization reaction.

Marlstone shows a propensity for geopolymerization upon alkali activation. The geopolymerization reaction has been evidenced by the shift of the main FT-IR absorption band (Si-O-T, with T=Al or Si) in the raw material after alkali activation. The XRD and SEM analyses confirmed the microstructural changes due to geopolymerization with formation of C-S-H and C-A-S-H reaction products. Batch adsorption experiments showed that the formulated geopolymer at 8 M NaOH was able to remove Cd(II), Mn (II) and Ni(II) after 1 hour of reaction at 25 °C using initial concentration of 20 ppm and adsorbent dosage of 0.05 g in 100 ml solution. Further studies are currently conducted to determine the effect of other parameters on the adsorption characteristics of the produced geopolymer and to optimize the formulation conditions to maximize the adsorption capacity.