

Synthesis of MMT-La-Alginate composite for water purification

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In this study, MMT-La-Alginate (MMT-La-ALG) composite was synthesized, characterized, and analyzed for its fluoride adsorption capacity and antibacterial properties. The composite was synthesized using MMT, lanthanum nitrate, and sodium alginate, and characterized using SEM-EDX, TGA, and FT-IR. Investigation of the morphology of the composite using SEM-EDX mapping showed the uniform distribution of Lanthanum (III) throughout the surface of composite. The TGA analysis of the composite showed the presence of a 1:0.6 (w/w) ratio of alginate and inorganic materials (MMT and lanthanum based materials) in the composite. Also the blue shift appeared at the region 1644 cm^{-1} (stretching vibrations of O-C-O) of FT-IR spectrum of MMT-La-ALG evidence the formation of La alginate complexes. The prepared MMT-La-ALG composite was used for the removal of fluoride ions from drinking water. The adsorption isothermal profile of the fluoride was well fitted with the Langmuir adsorption isothermal model and it indicates that the adsorption process at equilibrium is on a homogeneous surface and binding sites of MMT-La-ALG for fluoride ions are energetically equivalent. In this study, it was found that the equilibrium fluoride adsorption capacity on the composite was 40 mg/g. Furthermore, kinetic studies carried out showed that the fluoride adsorption on to MMT-La-ALG follows pseudo-second-order kinetics. Further, the antibacterial performance of MMT-La-ALG against *E. coli* and *S. aureus* was also studied by monitoring the bacterial inactivation. Results showed significant anti-bacterial property of MMT-La-ALG, indicating its potential in applying water disinfection protocols. Consequently, it can be concluded that the prepared MMT-La-ALG is a versatile adsorbent and therefore promising material to be used in water purifications.

Key words: Adsorption, antibacterial study, fluoride, MMT-La-Alginate, water purification
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