FABRICATION OF LAYERED DOUBLE HYDROXIDE (LDH) – BASED MATERIALS FOR REMOVAL OF HEAVY METAL IONS FROM AQUEOUS SOLUTION

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ABSTRACT

FABRICATION OF LAYERED DOUBLE HYDROXIDE (LDH) – BASED MATERIALS FOR REMOVAL OF HM IONS FROM AQUEOUS SOLUTION

The presence of high concentrations of heavy metals (HMs) in aquatic ecosystems poses a significant threat to both human health and the environment. Conventional methods for the removal of HM possibly lead to adverse environmental impact, high costs, and less efficient. Considering this, it is crucial that we promptly develop inventive and sustainable measures to address this substantial issue. Layered double hydroxides (LDHs), well known as anionic clay materials, consist of a particular structure with a surface hydroxyl group and a tunable property concurrent with the polymer group in terms of crystallinity and thermal stability, making them vastly attractive. LDH Ca-Fe with hydrotalcite-like structure as an adsorbent was tested for the removal of copper ions from an aqueous solution. 0.1 M $CaCl_2$ and 0.05 M $FeCl_3$ for a ratio of 2:1 was mixed with 0.03 M NaCl to obtain the LDH Ca-Fe adsorbent and dropwise addition of 2 M NaOH to maintain the pH of the solution. The sedimentation that occurs after the adsorption test will indicate the removal of Cu has been physically captured, and the clear layer will be further analyzed to observe the removal rate of Cu. The parameters of cation ratio, pH, contact time, and initial concentration were investigated. LDH Ca-Fe has a great performance on the adsorption of copper at 10 ppm concentration, with optimum ratio 2:1, pH 12.5, and 60-minute contact time. The characterization of the sample was analyzed using FTIR, ICP-OES, and a turbidity meter. LDH Ca-Fe successfully removed 90% of Cu ions (initial concentration at 10 ppm) and 80% of Cu ions (initial concentration at 60 ppm). This study recommends adsorption as a cost-effective and efficient method for removing heavy metal ions from the environment.

Keywords: Layered double hydroxide, heavy metals, adsorbent, adsorption

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