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Review of the synthesis methods of layers double hydroxide and their application in removing water pollutants

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In recent decades, a class of anionic clays known as layered double hydroxides (LDHs) or hydrotalcite-like compounds (HTlc) has attracted substantial attention. The structure of LDHs is intercalation of anions in the hydrated interlayer regions. Double layer hydroxides belong to a group of clay minerals, which have physical and chemical properties very close to clay minerals and are known as anionic clays. These compounds are obtained naturally and synthetically. LDHs can be represented by the general formula$[M^{2}_{1-x}.M^{3}_{x}(OH)^{X+}]$ $(A^{n-}_{x/n}).mH_2O$ where M^{2+} and M^{3+} are divalent and trivalent cations, respectively; the value of x is equal to the molar ratio of $M^{3+}/(M^{2+}+M^{3+})$, whereas A is the interlayer anion of valence n. The identities of M^{2+}, M^{3+}, x, and An may vary over a wide range, thus giving rise to a large class of isostructural materials with varied physicochemical properties.

LDHs exist as naturally occurring minerals, they are also relatively simple and economical to synthesize. LDHs have relatively weak interlayer bonding and, as a consequence, exhibit excellent ability to capture organic and inorganic anions. The most interesting properties of LDHs include large surface area, high anion exchange capacity (2–3meq/g) that is comparable to those of anion exchange resins, and good thermal stability. LDHs have been studied for their potential use in a wide range of important areas, i.e. catalysis, photochemistry, electrochemistry, polymerization, considerable interest in using LDHs to remove environmental contaminants since environmental pollution has emerged as an important issue in the recent decades. Significant progress has been achieved in the research and development of LDHs' application in environmental protection, such as their use as environmental catalysts in removing organic and inorganic wastes. Indeed, increasing interest has recently been diverted to evaluating the ability of LDHs to remove inorganic contaminants such as oxyanions (e.g. arsenite, chromate, phosphate, selenate, borate, nitrate.) and monoatomic anions (e.g. fluoride, chloride, bromide, and iodide) from aqueous solutions by the process of adsorption and ion exchange[1].This review article provides an overview of LDH synthesis methods, LDH characterization techniques.

Keywords: layered double hydroxides, Brucite-like sheets, Anionic clays.

References

[1] K.-H. Goh, T.-T. Lim, Z. Dong, Application of layered double hydroxides for removal of oxyanions: a review, Water research, 42 (2008) 1343-1368.