

Development and application of layered materials in water treatments

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The increasing demand for clean water together with its decreasing supply caused by the expansion of industries, human population swelling, and long-term droughts, has become a serious problem all over the world [1]. An actual challenge is represented by the development of new practical and economical attractive technologies enabling reasonable water use. Layered double hydroxides (LDHs) are emerging as potential nano-structured adsorbents for water and wastewater treatment. LDHs, also known as hydrotalcite-like compounds, have been widely used as adsorbents, due to their high specific surface area and unique anion-exchange capability. Furthermore, the spent adsorbent can be easily regenerated, providing adsorption capacities comparable with the fresh LDH adsorbents. Recent studies have demonstrated LDHs as promising multifunctional materials for potential utilization in a wide range of applications such as adsorption, photocatalysis, energy storage, nanocomposites, and water purification [2]. This first study aims to assess the adsorption properties of a synthetic LDH concerning the target molecule methyl orange (MO, anionic dye). The study revealed that dye sorption was promoted by low temperatures and pH values. The adsorption performance of LDH was enhanced by anion exchange property, achieving a MO removal of 90 % in each test, regardless of the initial dye concentration (as shown in the figures below). Comparison carried out using rhodamine B (RhB, cationic dye) as a contaminant showed that ion exchange plays a predominant role in the performance of the material, promoting a preferential absorption of anionic species. In order to assess the potentiality of the proposed system to be exploited as alternative to the most popular commercially available alternatives, a comparison with the adsorbent capacity of activated carbon has been investigated.

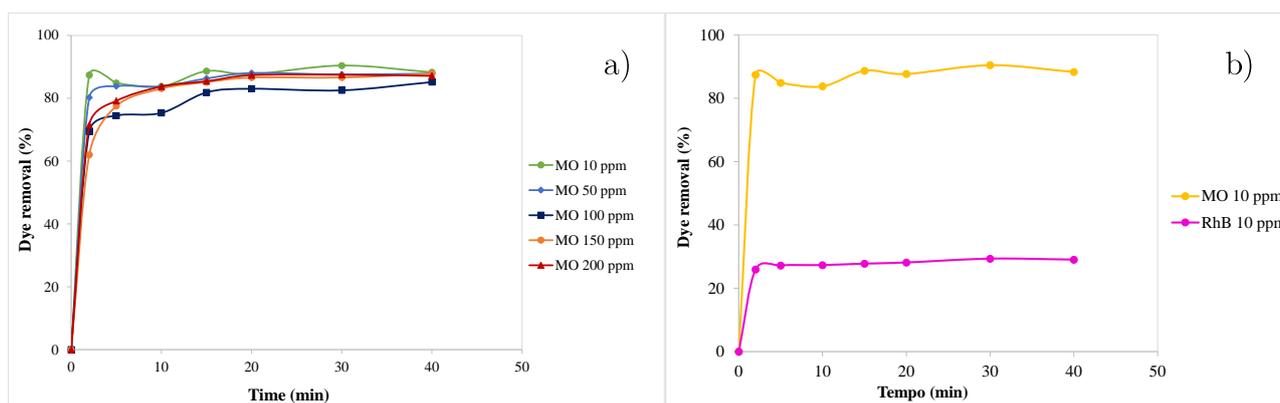


Fig.: a) MO removal percentage vs. time, varying the dye initial concentration; b) Comparison between MO and RhB adsorption vs. time.

Keywords: Layered double-hydroxides (LDHs), anionic dye, adsorption.

Selected references:

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