Photocatalytic degradation of ibuprofen over magnesium ferrite derived from layered double hydroxide (HDL) by artificial and solar radiation

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1. Introduction – The presence of pharmaceutical residues in water resources intakes has been becoming a global concern. Pharmaceuticals are introduced to the environment by pharmaceutical industry, hospitals, medical facilities, households, farming, etc. Many pharmaceutical residues are non-biodegradable and resistant against conventional wastewater treatments. Non Steroidal Anti-Inflammatory Drugs (NSAIDs), as ibuprofen (IBP), is one of the most consumed drugs. IBP is ubiquitous in the aquatic environment and has been detected in many water sources at concentrations up to l g L^{-1}. These last years, various semiconductor-based materials were applied for the photocatalytic degradation of organic pollutants [1-3], in particular, the mixed metal oxides prepared by thermal treatment of layered double hydroxides (LDHs). The diversity of metals used to synthesize LDHs matrix could tune the semiconductor properties of the metal oxides derived from LDH phases.

2. Experimental - The magnesium ferrite derived from layered double hydroxide (molar ratio Mg/Fe =2) was prepared by a co-precipitation method. The precursors was calcined in air at 800 °C for 4 h at constant heating rate of 5 °C min^{-1} , and allowed to cool down to room temperature. These obtained mixed-metal oxides with the Mg/Fe mole ratio of 2:1.

3.Results and Discusion- The XRD analysis indicated that the prepared Mg-Fe-LDH corresponded to phase-pure of the hydrotalcite structure and no other peaks from possible impurities were detected. The sharp and symmetric reflections planes at low values of 2θ angles (11–23◦) and broad, asymmetric reflections at higher 2θ angles (34–66◦) were observed in the P-XRD patterns of LDHs (Fig. 1). The powder XRD patterns of mixed oxides derived from Mg-Fe-LDH calcined at 800°C.

The degradation rate of IBP decreased as the catalysts concentration was increased. These observations can be explained, when the catalyst concentration was 15 mg, the diffusion of light throughout the surface of the catalyst in solution was more important resulted in a increase in the number of active $OH^{\cdot}$ radicals which can participate in the degradation of ibuprofen. In addition, the phenomenon consequently increase the contact area between active site ,light and IBP.

4. Conclusions - The magnesium ferrite derived from layered double hydroxide (molar ratio Mg/Fe = 2), synthesized by coprecipitation method exhibited significantly higher photocatalytic activity than a naked semiconductor in the photodegradation of Ibuprofen. The origin of the high level of activity is discussed based on the results the physicochemical properties of photocatalyst.

5. References

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