Influence of the interlamellar anion in CuMgFe-LDH on the degradation of the anticancer drug 5-Fluorouracil

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The effect of the catalytic decomposition of H_2O_2 was evaluated by four copper-based Layered Double Hydroxide (LDH) for generation of reactive oxygen species on the degradation of the anticancer drug 5-fluorouracil (5-FU) in the dark. The pyroaurite type LDHs were synthesized at pH 11.0 ± 0.5 by the co-precipitation of magnesium and iron (3:1 molar ratio) with copper nitrate insertion to result in 7% of copper in the isomorphic substitution of the Mg(II) cation by Cu(II), relative to the total amount of Mg(II) and Fe(III), with different interlamellar anion: BO_3^{3-}, SO_4^{2-}, CO_2^{2-} and NO_3^-. The XRD diffraction patterns and FEG-SEM of all materials presented the basal planes 003,006 and 009 of the LDHs which demonstrates that the materials present lamellar structure, stacking plans, and morphology organized in the form of a flower ball [1]. The degradation experiments show that the interlamellar anion influences the degradation processes with pseudo-first order rate constants of 0.133, 0.0179, 0.010 and 0.009 min^{-1} for the interlamelar anions BO_3^{3-}, NO_3^-, SO_4^{2-} and CO_2^{2-}, respectively. The highest degradation rate observed with CuMgFe-BO_3 can be explained by the fact that boron on the surface of the material structure can assist in the reduction of Fe(III) to Fe(II) and Cu(II) to Cu(I) [2], improving the degradation mechanism in the Fenton system and generating radicals $HO^{\bullet}$, $HO_2^{\bullet}/O_2^{\bullet -}$ and $^1O_2$ for the degradation of 5-FU. The increase of Cu(I) on the catalyst surface was confirmed by X-ray photoelectron spectroscopy. The reuse of CuMgFe-BO_3 was evaluated in four cycles of 120 min maintaining the catalytic activity. These results demonstrated the potential of CuMgFe-BO_3 as a catalyst for the degradation of emerging contaminants, offering the benefits of easy preparation, high efficiency, and reuse in the Fenton process.

Acknowledgments:
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References:

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