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Influence of precursor salt in properties of ferrites doped with Co

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Abstract – The main objective is to verify the effectiveness of the $Fe^{II}CoFe^{III}{}_4O_8$ nanoparticles in degradation of pollutant in water varying the precursor salts. The syntheses were done from salts of sulfate and chloride, using citric acid as a complexant agent, and ethylene-glycol as a polymerizing agent. The solutions were submitted to a thermal treatment at 450ºC. The performance of these nanoparticles was evaluated as heterogeneous catalyst through measures of degradation of Rodhamine-B (RhB) in the reaction Fenton. The results show that the ferrites synthesized by sulfate salts present better degradation of Rh-B than nanoparticles obtained by salts chloride precursors.

The current quest for the adequate use of water has become one of the main challenges in sustainable development. Therefore, processes for water decontamination are an ever growing topic of research, aimed at the rational use of this essential resource [1]. Decontamination processes are necessary for the restoration of polluted water sources and the prevention of future contamination through suitable treatment of effluents before their disposal. The Fenton process, one of the most active methods for generating highly oxidant species, is reportedly very efficient in the degradation of herbicides in water [2]. In present work, an objective is determine the effectiveness of ferrites nanoparticles doped with cobalt, as Fenton reactants in heterogeneous catalysis, and to investigate the effectiveness of the structures formed in processes dye Rodhamine-B (RhB) degradation. The focus was variety a precursor's salt in synthesis of nanoparticles. Starting of this variable, were studied a morphological properties and catalytic activity of the nanoparticles obtained. The syntheses was done from Fe^{2+}, Fe^{3+} and Co^{2+} salts, using citric acid as a complexant agent, and ethylene-glycol as a polymerizing agent. In the first synthesis, the salts utilized were: chloride, Fe^{2+}, Co^{2+} and Fe^{3+}. In the second synthesis, the salts utilized were: sulfate Fe^{3+}, chloride Fe^{2+} and chloride Co^{2+}. In both synthesis, a molar ratio of citric acid and metals were 12:1, and a molar ratio of ethylene glycol and citric acid were 1:1. The mixture was heated until 70ºC to promote a polymerization reaction. The solutions were submitted to a thermal treatment at 450ºC for 2h, and the powders were characterizes by X-ray diffraction (XRD) and Mossbauer Spectroscopy. For photocatalytic study, colloidal dispersions were prepared by mixing 3 mg of powder in 50 mL of RhB aqueous solution and 1mL of H_2O_2 solution (30% in volume, diluted 1000 times). Color removal of the dye was analyzed by UV–visible spectroscopy of time to monitor the temporal. The RhB concentration was determined by measuring the absorbance at 554 nm.[2] The results revealed that ferrites nanoparticles doped with cobalt synthesized starting sulfate salts can be used as heterogeneous catalysts, once in 4 minutes of reaction, it degraded the whole color. On the other hand, nanoparticles obtained by chloride salts didn't show catalyst properties. DRX and Mossbauer Spectroscopy evidenced a presence of Fe^{2+} in nanoparticles obtained starting sulfate salts, while that aren't Fe^{2+} in nanoparticles obtained starting chloride salts. This way, it is possible to conclude that the presence of Fe^{2+} was a decisive factor in the degradation of the dye, although samples without Fe^{2+} also showed satisfactory degradation profiles. Besides, strategies to stabilize Fe^{2+} in ferrite structures are under study and will be the topic of future work.

References

[1] MMA/SRH (2006) *Caderno setorial de recursos hídricos: agropecuária*. Ministério do Meio Ambiente
[2] Fallmann H, Krutzler T, Bauer R, Malato S, Blanco J (1999) Catal Today 54(2-3):309