Reunião Anual do INCT-FCx - 2022

De 26 a 29/Outubro de 2022,
Hotel Estância Atibainha, Nazaré Paulista/SP

Hybrid magnetic $CoFe_2O_4$@γ-Fe_2O_3@CTAB nanocomposites as efficient and reusable adsorbents for remazol brilliant blue R dye

Helena Augusta Lisboa de Oliveira[1,2], Guilherme Gomide[3], Clauber Alex de Melo Vieira[3], Ana Alice Andrade Meireles Guerra[1,2], Jerome Depeyrot[3], Alex Fabiano Cortez Campos[1,2]*

[1]*Laboratory for Environmental and Applied Nanoscience, Faculty UnB – Planaltina, University of Brasília, 73345-010, Brasília-DF, Brazil*

[2]*Institute of Chemistry, University of Brasília, 70910-900, Brasília-DF, Brazil*

[3]*Complex Fluids Group, Institute of Physics, University of Brasília, 70919-970, Brasília-DF, Brazil*

Abstract: Magnetic nanoadsorbents have been emerging as promising materials to remove dyes from water [1]. In this context, the main goal of the present survey was to elaborate, characterize and evaluate the efficiency of ferrite-based nanoparticles modified with cetyltrimethylammonium bromide (CTAB) as potential magnetic nanoadsorbents to remove Remazol Brilliant Blue R (RBBR) from water. It is proposed an innovative nanomaterial architecture based on highly magnetic and chemically stable core@shell nanoparticles covered by an adsorptive surface layer of CTAB ($CoFe_2O_4$@γ-Fe_2O_3@CTAB). Samples of two different mean sizes (7.5 and 14.6 nm) were synthesized using a hydrothermal coprecipitation followed by surface treatment and functionalization. Batch tests were performed to evaluate the influence of contact time, temperature, pH, shaking rate, presence of interferents and mean size on the performance of the proposed nanomaterials. The kinetics of the adsorption process followed the pseudo-second-order model with an equilibrium time of 20 min. The adsorption capacity was estimated by the Langmuir isotherm model and was found to be 56.3 mg/g (smaller size) and 45.6 mg/g (larger size) at pH = 3 and a shaking rate of 400 rpm. The process was spontaneous, exothermic, and showed increased randomness. Sulfate ions negatively impacted the removal of RBBR. The best performance of the nanoadsorbent based on smaller mean sizes can be correlated to its larger surface area. Regeneration and readsorption tests showed that the nanoadsorbents retain more than 80% of their original removal capacity, therefore they can be effectively recycled and reused.

Key-words: magnetic nanoadsorbents; dye removal; adsorption; water remediation
Support: This work has been supported by FAPDF, CNPQ and INCT-FCx.

References:

[1] A.F.C. Campos, P.H. Michels-Brito, F.G. Da Silva, R.C. Gomes, G. Gomide, J. Depeyrot, J. Environ. Chem. Eng., 7, 103031 (2019).