Efficient hydrothermal synthesis of bifunctional Nb_2O_5 nanorods with high selectivity to remove cationic dyes from residual water

Roman Alvarez Roca[1], Edson Tobias de Jesus[2], Mayara C. Sá[2], Margaret Dawson[3], Luciana S. da Dias[4], Gilmar S. da Silva[4]

[1]Univerdade Federal de São Carlos (*Dpto de Química*) , [2]Instituto Federal de Educação, Ciência e Tecnologia do Maranhão (*Dpto de Ensino*) , [3]Embrapa Instrumentação (*LNNA*) , [4]Instituto Federal de Educação, Ciência e Tecnologia do Maranhão (*Dpto de Química*)

e-mail: cortes116@yahoo.es

The wide manufacture and use of textile dyes in the world has enhanced negative and harmful effects on human health and the environment, considering that many of these effluents exhibit high toxicity, as well as being carcinogenic to humans, with the final course being the aquatic environment. In this context, this work proposed to develop bifunctional materials based on niobium pentoxide nanoparticles, aiming at application in the removal of cationic dyes from wastewater. Initially, Nb_2O_5 nanoparticles were synthesized using practical and reliable methodologies, namely: method of polymeric and hydrothermal precursors, using non-aggressive starting reagents to the environment and neither to man, for example, ammoniacal niobium oxalate, citric acid and solvents such as ethylene glycol and water, with nucleation and particle growth control strategies. The materials produced were characterized by X-ray diffraction (XRD), Raman scattering spectroscopy (FT-Raman), infrared absorption spectroscopy (FT-IR), scanning electron microscopy with field emission source (SEM / FEG)), surface analysis using the Brunauer, Emmett and Teller method (BET) and diffuse reflectance spectroscopy (DRS). The optimized samples were subjected to the adsorption and photo-oxidation test against the methylene blue cationic dye, in the absence of light and under UV radiation, in that order. The results were investigated, using the Langmuir model as a basis to assess the maximum adsorptive capacity of dye on the surface of the samples, as well as the photoactivity of these materials were evaluated and correlated with the morphological and structural characteristics of each sample, in order to facilitate a mechanistic proposal for photodegradation of textile dye, by means of photocatalysts, in the reaction medium. It was observed that the bifunctional materials showed great potential for removing cationic dyes from wastewater, with possibilities of application on a large scale.