ADSORPTION AS AN ENVIRONMENTAL SOLUTION TO DEVELOP A HIGHLY LUMINESCENT HYBRID MATERIAL

Anna Carolina A. M. Neto[1]*, Thales Jati[2], Kátia J. Ciuffi[1], Eduardo J. Nassar[1], Miguel A. Vicente[3], Raquel Trujillano[3], Vicente Rives[3], Emerson H. Faria[1]

[1]*Universidade de Franca-UNIFRAN, Franca SP, Brasil,* [2]*Centro Universitário Municipal de Franca-UNI-FACEF, Franca Sp, Brasil*[3] Universidad de Salamanca, Salamanca, Spain.

*e-mail: anna.medici.carolina@gmail.com and/or emerson.faria@unifran.edu.br

The detection of contaminants in ground water has become a major concern. In this context, the ability to understand the interactions between contaminants and soil fractions is vital to predict the presence of contaminants in water and soil. Clay minerals consist of extremely fine particles (size $\leq$ 2 μm) and are characterized by a layered structure composed of tetrahedral (silica) and octahedral (alumina)sheets. Due to their very interesting layered structures and cationic properties, clay minerals have been successfully used to remove dyes from aqueous solutions. Bentonite clay is a complex mixture of TOT clay minerals majority composed by montmorillonite, $(yM^{+}\cdot nH_2O)(Al_{2-y}{}^{3+}\ Mg_y{}^{2+})(Si_4{}^{4+})O_{10}(OH)_2$, has a 2:1 (or TOT) layer structurewith one octahedral sheet sandwiched between two tetrahedral sheets as the repeating unit. Rhodamine B (RhB) is a cationic xanthene dye used in printing, textile, and photographic industries and as a water tracer fluorescent material. Thus, the development of rhodamine-containingstable hybrid materials to improve their luminescent properties are feasible and the goal of many studies. Development of luminescent chemical sensors by removal of the dye by adsorption from aqueoussolutions on bentonite clay mineral has not received much attention earlier and this possibilityis explored inthe present work. To prepare the nanohybrid luminescent sensors based on bentonite a typical adsorption bath methodology was employed (kinetic and equilibrium experiments), 5mL of RhB (concentrations between 1 to 800 mg/L) were contacted in glass vials withconstantmassof 50mgof bentonite in an isothermic system at 25ºC. The suspensionswere maintainedunder magnetic stirring for 1 hour.Then, the solid phase was separated by centrifugation at 2000 rpm, and the final concentration of the RhB in solution was determined by UV-Vis spectroscopy. The kinetic study revealed that optimum time for RhB removal was 5 minutes, the fast removal of the dye could be explained by the cationic exchange between bentonite and RhB solution; the maximum adsorption capacity was 72.9 mg/g. The equilibrium studies (variation of concentration) revealed that the maximum amount of RhB incorporation was 73.51 mg/g. The structural characteristics and optical properties of the hybrid material were characterized by X-ray powder diffraction and diffuse reflectance infrared absorption spectroscopy. XRPD showed the variation of the basal spacing from 12.83 to 14.42 Å and revealed the presence of RhB between bentonite interlayer spaces.Absorption and fluorescence spectra of Bent-RhB were similar to the dye solution. Fluorescence spectra proved that only minor molecular aggregation of intercalated RhBocurred until 100 mg/L solution. Partial fluorescence quenching was also observed in the spectra and was confirmed at higher concentration (larger than 200 mg/L) by fluorescence quantum yield measurements. Other materials based on intercalated clays with various photoactive molecules could be synthesized by the strategy used in this work.

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