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Adsorption of dyes from aqueous solutions by domestic wastes: Analysis of the equilibrium state

Abel Navarro[1], Michelle Naidoo[1], Habib Zahir[2] and Maria Sun-Kou[3]

[1]Science Department, Borough of Manhattan Community College, CUNY, USA

[2]Biology Department, Hunter College, CUNY, NY, USA

[3]Departamento de Ciencias, Pontificia Universidad Catolica del Peru, Peru

Email: anavarro@bmcc.cuny.edu

Abstract

Spent green tea (GT) and Peppermint (PM) teabags were used as adsorbents of dyes to purify aqueous solutions. Basic Yellow 57 (BY) and Crystal Violet (CV) were chosen as model dyes due to their widespread use in the scientific and cosmetics industries. Equilibrium parameters such as pH, mass of adsorbent, initial dye concentration, salinity and presence of heavy metals were studied to maximize the adsorption of the dyes from aqueous solution in discontinuous experiments at room temperature. Experimental data indicate that adsorption of BY is maximized at pH 6, with optimum adsorbent masses of 100 mg and 75 mg for GT and PM respectively. The adsorbents also reached their highest adsorption in the absence of salts and heavy metal with maximum initial concentrations of 0.085 g/L and 0.2 g/L for GT and PM, respectively. On the other hand, CV was greatly adsorbed at pH 4 with adsorbent masses of 75 mg and 25 mg of GT and PM, respectively. Both adsorbents were able to adsorb CV dye concentrations of up to 0.075 g/L. The presence of salts and heavy metals also had negative effects on the adsorption. Finally, desorption of the dyes were studied to recycle the adsorbents in repetitive adsorption cycles. BY was surprisingly desorbed by using diluted HCl and ethanol solutions, while CV showed better desorption in front of ethanol and acetone solutions. We believe this “clean” technology will educate us to take advantage of inexpensive waste materials to improve water quality.

Biography

Abel E. Navarro got his Ph.D. degree in Biomolecular Chemistry at New York University. His expertise includes protein chemistry and structure as part of his graduate studies. Now, as a junior faculty at BMCC, Prof. Navarro is developing new bioremediation alternatives for the elimination of pollutants from wastewaters. He has a publication record of more than 25 papers in specialized and peer-reviewed journals and has participated in several conferences. He also serves as reviewer in many journals across the world.