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Preparation of Nanomaterials Based on Graphene Oxide/Nanocellulose, Characterization and its Application on Dye Removal in Waters

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Abstract

Dyes concentration has increased in water bodies due to the large use of it in industries. Dyes, such as basic fuchsin, are nocive to alive beings, so it is necessary to remove it from the water. Adsorption has shown as a good option to water treatment. This work aimed to evaluate the composites (formed by graphene oxide and nanocellulose) capacities as adsorbents. Results showed that the composites have better adsorbent capacity when basic fuchsin concentration is low.

Key words:

Graphene oxide, Nanocellulose, Adsorption, Basic fucshin.

Introduction

Basic fuchsin (BF) is a dye widely used in the textile, leather and laboratory industries. Its application in industry and removal difficulty in sewage treatment are responsible for dye reaches the water bodies, being able to cause adverse effects in the alive beings[1]. Adsorption treatment with GO is an option to remove it from the water. Graphene oxide (GO, Figure 1) is a nanomaterial derived from the oxidation of graphite. GO has remarkable properties as its large theoretical surface area[2], what enables the adsorption of pollutants in aqueous solutions.

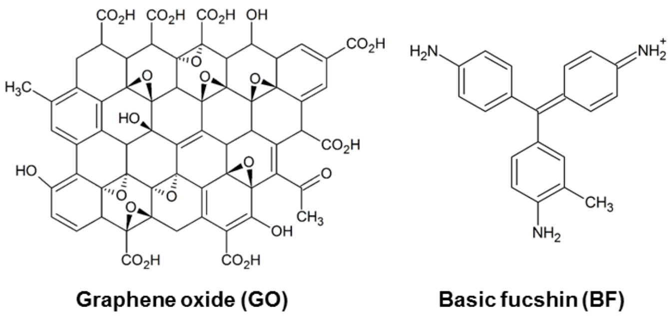


Figure 1. Structures of GO and BF.

Results and Discussion

The GO was synthesized by the modified Hummers method, by treating the graphite with $KMnO_4$, $NaNO_3$ in a strongly acidic medium.

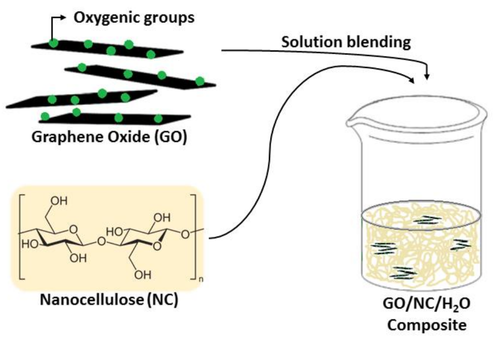
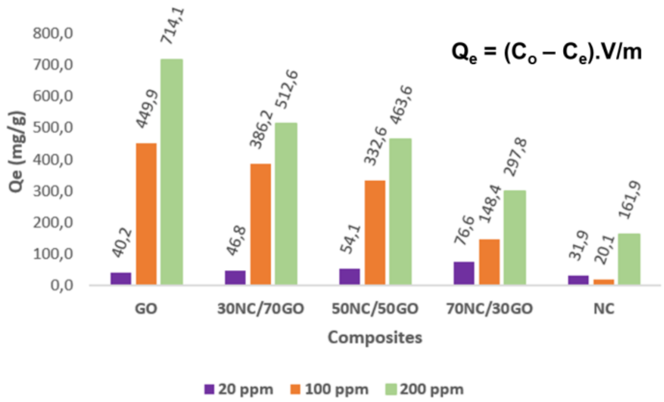


Figure 2. Preparation process of GO/Nanocellulose based composites.

Nanocellulose (NC) was used with GO, due to its adsorbent capacity and high hydrophilicity, to test if both together has amplified adsorbent capacity. The composites were created by varying the percentage concentrations between GO and NC as shown in figure 2.

Removal tests with BF were performed with initial concentrations of 20 to 200 mg/L, which were measured in a spectrophotometer at 545 nm.

Chart 1. BF adsorption by composites.



When the BF concentration was 20 ppm, the better adsorbents were the composites 70/30 and 50/50 NC/GO, indicating that NC was the most important material to the successful adsorption. In this case, the interactions between BF and the adsorbents are mainly electrostatic. On the other hand, when the BF concentration was 100 and 200 ppm, the best adsorbent was pure GO and followed by the composites 70/30 and 50/50 GO/NC. The last results suggest that at higher BF concentration the adsorption was due to *π-stacking* and hydrophobic interactions once GO has a great sp^2 system. Furthermore, it is necessary more research understand all the interactions between composites and the dye.

Conclusions

NC and GO composites were generated and applied to BF removal. At low BF concentration, the composites showed better BF dye adsorption. However, at higher BF concentration GO was found as the best adsorbent.

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