ABSTRACT

Rhodamine B is a synthetic dye that is toxic, carcinogenic, and difficult to degrade, posing a high risk to the environment. This problem can be addressed, one of which is through adsorption. Adsorption is the absorption of a liquid substance onto the surface of an adsorbent material. Silica gel is a commonly used adsorbent, characterized by its large surface area, controllable pore size, and relatively stable chemical composition. The addition of magnetite is expected to facilitate magnetic separation of the adsorbent. Meanwhile, chitosan contains -NH_2 groups that can interact with polar groups in the Rhodamine B structure via hydrogen bonds. Therefore, in this study, chitosan@magnetite/silica gel (CTS@Fe_3O_4/SG) was synthesized for the adsorption of Rhodamine B dye. The composite was synthesized using the sol-gel method by coating magnetite with silica gel, followed by composite formation with chitosan at masses of 0 and 1.5 grams. Characterization was performed using Fourier Transform Infrared (FTIR) to identify functional groups, Surface Area Analyzer (SAA) to determine porosity and surface area, and Ultraviolet-Visible Spectroscopy (UV-Vis) to determine Rhodamine B concentration before and after the adsorption process. Application tests were conducted based on variations in contact time and Rhodamine B solution concentration. The results showed that the composite with the addition of 1.5 grams of chitosan exhibited the highest adsorption capacity of 5.62 mg/g at an initial concentration of 30 ppm and an optimal contact time of 30 minutes. FTIR spectra showed the presence of functional groups in the composite, such as -NH_2, -OH, and -SiOH. Based on SAA characterization, the addition of 1.5 grams of chitosan increased the surface area and porosity of the composite, thereby supporting the adsorption process. Overall, the CTS@Fe_3O_4/SG composite is effective as a Rhodamine B adsorbent.

Keywords: Rhodamine B, adsorption, chitosan, silica gel, magnetite