ABSTRACT

Methylene blue and congo red dyes are non-biodegradable, mutagenic, and carcinogenic. Therefore, before dye waste is released into waterways, a method must be used to reduce its concentration, one of which is adsorption. Mesoporous silica-alumina can be used as an adsorbent and is synthesized from Lapindo mud. Solvothermal synthesis of mesoporous silica-alumina using a CTAB-gelatin template as a pore-forming agent. This study aims to characterize mesoporous silica-alumina for application as an adsorbent in the adsorption of methylene blue and congo red at different temperatures, enabling the determination of adsorption thermodynamic parameters. Based on the results of SEM, TEM, and GSA characterization test, the mesoporous silica alumina obtained shows that the particles bond with each other so that it form the large round particle clumps called agglomeration. The surface area of mesoporous silica alumina obtained is 77.56 m^2/g, pore volume 0,213 cm^3/g, and average pore size of 2.35 nm. The application of adsorption on mesoporous silica-alumina shows that the methylene blue adsorption process takes place spontaneously over all temperature variations, while the congo red adsorption process takes place spontaneously only at a temperature of 60°C. The adsorption process of methylene blue is exothermic, whereas the adsorption of congo red is endothermic. The adsorption of methylene blue and congo red is accompanied by an increase in molecular mobility as solvent molecules are desrobed from the SAM surface.

Keywords: Adsorption, Congo Red, Lapindo Mud, Silica-Alumina Mesoporous, Methylene Blue, Solvothermal, Temperature, Thermodynamics