

State of Libya
Ministry of Education
Al-Asmarya Islamic University
Faculty of Engineering



**FIXED BED ADSORPTION COLUMN STUDY FOR
REMOVAL OF CONGO RED DYE USING
SUSTAINABLE SORBENTS DERIVED FROM
PLANT LEAF POWDER**

**A graduation project submitted in partial fulfillment of the requirements
of Al-Asmarya Islamic University for the Degree of Bachelor of Science.**

BY

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ABSTRACT

Adsorption processes are simple and inexpensive separation processes compared to other separation methods, which made them especially important in water treatment and pollutant removal. Batch adsorption processes are good when conducting studies, in laboratories, or when working on a small scale, but in industrial applications and when working on a large scale, continuous adsorption processes (adsorption columns) are used.

In this research, an adsorbent was made from the leaves of *Mesembryanthemum crystallinum* (MC) plant to be used in the adsorption of organic pollutants from aqueous solutions using a fixed bed adsorption column. Congo red dye (CRD) was used as an example for these pollutants in water. The effect of different operating conditions was verified on the adsorption efficiency, which includes the bed depth, the initial concentration of the dye, pH, flow rate, and temperature. Kinetic models were also applied to study the kinetics of dye adsorption, which are Thomas, Yoon-Nelson and Adams, and the standard error SSE of these models was studied. The results showed that the used adsorbent material showed a high potential in removing pollutants, where a removal rate of about 86 % was achieved. The results also indicated that increasing the bed depth and the temperature enhance the adsorption efficiency. and decreasing the flow rate and initial concentration of the dye enhances the adsorption efficiency as well. Thermodynamic investigations showed that the adsorption of CRD onto MC was a spontaneous and endothermic process.