

**SYNTHESIS AND CHARACTERIZATION OF CHITOSAN  
MODIFIED SPENT COFFEE WASTE EXTRACT FOR  
REACTIVE RED 4 DYE REMOVAL**

**AS SYIFA DEERA BINTI ROZAIDE**

**BACHELOR OF SCIENCE (Hons.) CHEMISTRY WITH  
MANAGEMENT  
FACULTY OF APPLIED SCIENCES  
UNIVERSITI TEKNOLOGI MARA**

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This Final Year Project Report entitled “**Synthesis and Characterization Of Chitosan Modified Spent Coffee Waste Extract For Reactive Red 4 Dye Removal**” was submitted by As Syifa Deera binti Rozaide in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry with Management, in the Faculty of Applied Sciences and was approved by

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Dr. Abu Hassan bin Nordin  
Supervisor  
B. Sc. (Hons.) Chemistry with Management  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau  
Perlis

---

Dr. Siti Nurlia binti Ali  
Project Coordinator  
B. Sc. (Hons.) Chemistry with  
Management  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau

---

Dr. Nur Nasulhah binti Kasim  
Head of Programme  
B. Sc. (Hons.) Chemistry with  
Management  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau

Date: 11 February 2025

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## **ABSTRACT**

### **SYNTHESIZE AND CHARACTERIZATION OF CHITOSAN MODIFIED SPENT COFFEE WASTE EXTRACT FOR REACTIVE RED 4 DYE REMOVAL**

Chitosan, a natural biopolymer which is biodegradable and non-toxic is used as an adsorbent to remove contaminants such as dye from wastewater. Chitosan based adsorbents have a very high ability to strongly attach to the contaminants found in polluted water and wastewater. However, chitosan has some limitations including low adsorption capacity and solubility in an acidic medium. Chitosan can be modified physically and chemically to change its physiochemical properties. A chitosan modified with spent coffee waste extract (chitosan-SCWE) was developed to investigate the effectiveness as an adsorbent for removal of reactive dye (reactive red 4, RR4). The result revealed the optimum conditions for preparing chitosan-SCWE were 10 g of chitosan, 33.33 mg/L of SCWE and 20.73 hours of impregnation time. Then, the adsorbents were characterized by Fourier transform infrared (FTIR), field emission scanning electron microscopy (FESEM), x-ray diffraction (XRD) and point zero charge (PZC). The best adsorption conditions in batch system were 30 minutes of contact time, initial RR4 dye concentration of 50 mg/L, adsorbent dosage of 0.01 g, temperature of 27°C and solution pH of 3 with the adsorption capacity of RR4 dye solution is 95.20 mg/g. The adsorption data in the batch system best fitted well with pseudo-second order model, indicating adsorption process involved chemisorption. For isotherm models, Langmuir model correlated well with the adsorption data with  $q_{\max}$  of 138.89 mg/g. Adsorption thermodynamic revealed the adsorption process was spontaneous, exothermic, and favourable. In conclusion, chitosan-SCWE was successfully synthesized as an effective and promising adsorbent for reactive dye.