PENYERAPAN ZAT WARNA *CRYSTAL VIOLET* MENGGUNAKAN BIJI ALPUKAT (*Persea americana* Mill.)

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PADANG

2025

ABSTRACT

ADSORPTION CRYSTAL VIOLET DYE USING AVOCADO SEEDS (*Persea americana* Mill.)

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The development of the textile industry has produced a number of pollutants, such as crystal violet (CV) dye, which cause serious environmental problems. Biosorption is a method of absorbing synthetic dyes through chemical and physical interactions. Avocado seeds have the potential to be used as biosorbent because it contain active compounds such as cellulose, hemicellulose, and lignin. These compounds contain hydroxyl, carbonyl, and carboxyl groups, which have the potential to be used as absorbent materials. This study aims to investigate the ability of avocado seeds to remove crystal violet dye. The pH_{pzc} value obtained for the avocado seed biosorbent was 6.1. Optimal absorption of crystal violet was achieved at pH 7, initial concentration of 1100 mg/L, contact time of 60 minutes, and biosorbent heating temperature of 25°C. The adsorption of crystal violet dye by avocado seed biosorbent under optimal conditions resulted in a maximum adsorption capacity of 97.6639 mg/g. The application of optimal crystal violet adsorption conditions by avocado seeds on laboratory waste showed good potential with a removal rate of 93.43%. The adsorption process of crystal violet dye by avocado seed biosorbent followed the Langmuir isotherm model (R^2 = 0.9591), indicating the formation of a monolayer. The adsorption kinetics model followed the pseudo-second-order model (R^2 = 0.9924), indicating the occurrence of chemical interaction (chemisorption). The thermodynamic study of adsorption showed that the adsorption process occurred spontaneously, exothermic, and with an increase in disorder. Analysis using Fourier Transform Infrared Spectroscopy (FTIR) revealed the involvement of hydroxyl (O-H), carboxylate (COOH), and aromatic (C=C) groups in electrostatic mechanisms, hydrogen bonding, and π-π interactions. Scanning Electron Microscopy - Energy Dispersive X-ray Spectroscopy (SEM-EDX) analysis shows an irregular biosorbent surface involving pores in the adsorption of crystal violet, and X-ray Fluorescence (XRF) analysis indicates the involvement of cation exchange between K, Mn, and Zn with crystal violet. Thermogravimetric Analysis (TGA) analysis indicates thermal stability that influences the performance of the biosorbent in the absorption process of crystal violet dye.

Keywords: *Adsorption, avocado seed, crystal violet, batch method, biomass*