ABSTRAK

STUDI ADSORPSI KARBON AKTIF KAYU JATI (*TECTONA GRANDIS* L.F) TERAKTIVASI H_3PO_4 TERHADAP CONGO RED SEBAGAI SUMBER BELAJAR KONTEKSTUAL

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Congo Red merupakan zat warna azo yang sulit terdegradasi dan dapat meningkatkan kadar COD dan BOD di lingkungan perairan apabila dibuang tanpa pengolahan yang benar, sehingga perlu dilakukan metode adsorpsi sebagai alternatif pengolahan limbah yang efektif dan ekonomis. Penelitian ini bertujuan untuk mengevaluasi kemampuan adsorben karbon aktif berbahan dasar kayu jati (*Tectona grandis Linn f.*) dalam menyerap zat warna Congo Red. Karbon aktif dibuat melalui tahap *post – carbonization* menggunakan aktivator H_3PO_4. Karakterisasi permukaan karbon aktif dilakukan dengan instrumen FTIR dan SEM. Karbon aktif tersebut menunjukkan luas permukaan yang tinggi melalui uji bilangan iodin sebesar 978,88 mg g^{-1} yang menunjukkan adsorben berkualitas baik dengan efisiensi adsorpsi pada kondisi optimal sebesar 48,884%. Penelitian ini mengikuti model isoterm Langmuir dengan nilai R^2 sebesar 0,9492, menunjukkan mekanisme adsorpsi monolayer dengan kapasitas adsorpsi sebesar dengan kapasitas adsorpsi maksimum (q_{max}) sebesar 42,3728. Sementara itu, model isoterm Dubinin-Radushkevich menghasilkan E = 10 kj mol^{-1}, menunjukkan bahwa mekanisme dominan mengikuti mekanisme kemisorpsi. Kinetika adsorpsi mengikuti model *pseudo-second order* (PSO) serta menunjukkan tahap difusi film sebagai mekanisme pengendali laju berdasarkan hasil analisis pada model Weber-Morris dan Boyd. Hasil penelitian ini menunjukkan bahwa karbon teraktivasi H_3PO_4 berbahan dasar kayu jati efektif dalam menyerap zat warna Congo Red.

Kata kunci: Congo Red, karbon aktif, model isoterm, model kinetika, *Tectona grandis*

ABSTRACT

ADSORPTION STUDIES OF CONGO RED DYE USING H_3PO_4-ACTIVATED CARBON FROM TEAK WOOD (TECTONA GRANDIS L.F) AS A CONTEXTUAL LEARNING RESOURCE

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Congo red is an azo dye that is difficult to degrade and can increase COD and BOD levels in aquatic environtment if discharged without proper treatment, therefore adsorption is an effective and economical alternative method for wastewater treatment. This study aims to evaluate the ability of teak (Tectona grandis Linn f.)-based activated carbon to adsorb Congo Red dye. The activated carbon was produced through a post-carbonization process using H_3PO_4 as an activator. Surface characterization of the activated carbon was performed using FTIR and SEM instruments. The activated carbon exhibited a high surface area, as indicated by an iodine number of 978.88 mg g^{-1}, indicating a high-quality adsorbent with an adsorption efficiency of 48.884% under optimal conditions. This study followed the Langmuir isotherm model with an R^2 value of 0.9492, indicating a monolayer adsorption mechanism with a maximum adsorption capacity (qmax) of 42.3728. Meanwhile, the Dubinin-Radushkevich isotherm model yielded E = 10 kJ mol^{-1}, indicating that the dominant mechanism follows chemisorption. The adsorption kinetics followed the pseudo-second-order (PSO) model and indicated that the film diffusion stage was the rate-limiting mechanism, based on the results of the Weber-Morris and Boyd model analyses. The results of this study show that H_3PO_4-activated carbon derived from teak wood is effective in adsorbing Congo Red dye.

Keywords: *activated carbon, Congo Red, isotherm model, kinetic model, Tectona grandis*