

**SINTESIS DAN KARAKTERISASI HIDROKSIAPATIT BERBASIS
CANGKANG TELUR AYAM UNTUK ADSORPSI ZAT WARNA *REMAZOL*
*BLUE TURKISH***

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ABSTRAK

Penelitian ini memanfaatkan limbah cangkang telur ayam sebagai sumber kalsium untuk sintesis hidroksiapatit menggunakan metode presipitasi dengan variasi suhu kalsinasi. Hidroksiapatit yang dihasilkan dikarakterisasi menggunakan FTIR, XRD, dan SEM-EDX. Hasil karakterisasi menunjukkan bahwa hidroksiapatit yang dikalsinasi pada suhu 700 °C memiliki kristalinitas, morfologi permukaan, dan distribusi pori yang lebih baik dibandingkan suhu 600 °C. Kondisi optimum adsorpsi diperoleh pada waktu kontak 15 menit, pH 5, dan konsentrasi awal 40 mg/L dengan efisiensi adsorpsi sebesar 98,33%. Kinetika adsorpsi mengikuti model pseudo orde dua ($R^2 = 0,9924$), sedangkan isotherm adsorpsi mengikuti model Freundlich ($R^2 = 0,9547$) yang menunjukkan bahwa adsorpsi berlangsung pada permukaan heterogen. Analisis termodinamika menunjukkan bahwa proses adsorpsi berlangsung secara spontan ($\Delta G^\circ < 0$), bersifat eksotermik ($\Delta H^\circ < 0$), dan disertai penurunan ketidakteraturan sistem ($\Delta S^\circ < 0$). Hasil penelitian menunjukkan bahwa hidroksiapatit berbasis limbah cangkang telur ayam berpotensi digunakan sebagai adsorben untuk pengolahan limbah zat warna.

Kata Kunci: adsorpsi, cangkang telur ayam, hidroksiapatit, *remazol blue turkish*.

***SYNTHESIS AND CHARACTERIZATION OF CHICKEN EGGSHELL-BASED
HYDROXYAPATITE FOR THE ADSORPTION OF REMAZOL BLUE TURKISH
DYE***

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ABSTRACT

This study utilized chicken eggshell waste as a calcium source for hydroxyapatite synthesis through the precipitation method with different calcination temperatures. The synthesized hydroxyapatite was characterized using FTIR, XRD, and SEM-EDX. Characterization results indicated that hydroxyapatite calcined at 700 °C exhibited better crystallinity, surface morphology, and pore distribution than that calcined at 600 °C. Optimum adsorption was achieved at a contact time of 15 min, pH 5, and an initial dye concentration of 40 mg/L, with adsorption efficiencies of 98,33%. The adsorption kinetics followed the pseudo-second-order model ($R^2 = 0.9924$), while the adsorption isotherm was best described by the Freundlich model ($R^2 = 0.9547$), indicating adsorption on a heterogeneous surface. Thermodynamic analysis revealed that the adsorption process was spontaneous ($\Delta G^\circ < 0$), exothermic ($\Delta H^\circ < 0$), and accompanied by a decrease in system disorder ($\Delta S^\circ < 0$). These findings demonstrate the potential of chicken eggshell-derived hydroxyapatite as an effective adsorbent for dye-contaminated wastewater treatment.

Keywords: adsorption, chicken eggshell, hydroxyapatite, remazol blue turkish