

**SINTESIS DAN KARAKTERISASI KOMPOSIT
SILIKA GEL DARI ABU DAUN JAGUNG
DENGAN TANIN GAMBIR SERTA ANALISIS
ANTIBAKTERI DAN DAYA SERAP AIR**



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Sintesis dan Karakterisasi Komposit Silika Gel dari Abu Daun Jagung dengan Tanin Gambir serta Analisis Antibakteri dan Daya Serap terhadap Air

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ABSTRAK

Silika yang terkandung dalam abu daun jagung sebesar 64,62% berpotensi dimanfaatkan sebagai bahan baku alternatif pembuatan silika gel. Penelitian ini bertujuan untuk mensintesis dan memodifikasi silika gel berbasis abu daun jagung dengan penambahan tanin hasil ekstrak dari gambir (*Uncaria gambir* Roxb.), serta mengkarakterisasi sifat kimia, struktur kristal, morfologi, aktivitas antibakteri, dan kapasitas daya serap air komposit yang dihasilkan. Metode sol-gel digunakan dengan rancangan acak lengkap (RAL) pada variasi konsentrasi tanin 0%, 0,25%, 0,50%, 0,75%, dan 1%. Analisis *Fourier Transform Infrared Spectroscopy* (FTIR) mengonfirmasi adanya gugus fungsi fenolik dan aromatik pada komposit, serta gugus khas silika gel berupa silanol dan siloksan. Hasil *X-Ray Diffraction* (XRD) menunjukkan bahwa silika gel memiliki struktur semi-amorf dengan sedikit fase kristalin. Sementara itu, hasil *Scanning Electron Microscopy* (SEM) memperlihatkan morfologi berpori dengan bentuk partikel tidak beraturan dan ukuran bervariasi antara $\pm 2\text{-}53\text{ }\mu\text{m}$. Penambahan tanin meningkatkan aktivitas antibakteri terhadap *Escherichia coli* dan *Staphylococcus aureus*, dengan zona hambat terbesar masing-masing 13,75 mm dan 15,72 mm pada konsentrasi 1%. Kapasitas daya serap air tertinggi (44,33%) diperoleh pada perlakuan tanpa tanin (0%) dan menurun seiring peningkatan konsentrasi tanin hingga mencapai nilai terendah (38,33%) pada konsentrasi 1%, yang kemungkinan disebabkan oleh tertutupnya sebagian pori oleh molekul tanin.

Kata Kunci: antibakteri; daun jagung; daya serap air; silika gel; tanin gambir

Synthesis and Characterization of Silica Gel Composite from Corn Leaf Ash with Addition of Gambier Tannin and Its Antibacterial Activity and Water Absorption Capacity

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ABSTRACT

The silica content in corn leaf ash, measured at 64.62%, has potential as an alternative raw material for silica gel production. This study aimed to synthesize and modify silica gel derived from corn leaf ash with the addition of tannin extracted from gambier (*Uncaria gambir* Roxb.), as well as to characterize the resulting composite's chemical properties, crystal structure, morphology, antibacterial activity, and water adsorption capacity. The sol-gel method was employed using a completely randomized design (CRD) with tannin concentrations of 0%, 0.25%, 0.50%, 0.75%, and 1%. Fourier Transform Infrared Spectroscopy (FTIR) analysis confirmed the presence of phenolic and aromatic functional groups in the composites, along with typical silica gel groups such as silanol and siloxane. X-Ray Diffraction (XRD) results indicated that the silica gel exhibited a semi-amorphous structure with minor crystalline phases. Meanwhile, Scanning Electron Microscopy (SEM) revealed a porous morphology with irregularly shaped particles ranging in size from $\pm 2-53 \mu\text{m}$. The addition of tannin enhanced antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*, with the largest inhibition zones measured at 13.75 mm and 15.72 mm, respectively, at a 1% tannin concentration. The highest water adsorption capacity (44.33%) was observed in the treatment without tannin (0%) and decreased with increasing tannin concentration, reaching the lowest value (38.33%) at 1%, likely due to partial pore blockage by tannin molecules.

Keyword: antibacterial; corn leaf; gambier tannin; silica gel; water absorption