KEMUDAHAN BIODEGRADASI SELULOSA BAKTERI DARI LIMBAH CAIR UBI KAYU DENGAN PENAMBAHAN GLISEROL DAN KITOSAN YANG TERDEPOSIT NANOPARTIKEL PERAK

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ABSTRAK

Penelitian ini bertujuan untuk mempreparasi nanopartikel perak dari larutan $AgNO_3$ dengan natrium sitrat dan penstabil gelatin, mempelajari pengaruh penambahan gliserol dan kitosan terhadap kemudahan biodegradasi selulosa bakteri dari limbah cair ubi kayu, mengetahui karakteristik selulosa bakteri terdeposit nanopartikel perak yang paling mudah terbiodegradasi, dan mempelajari pengaruh lama biodegradasi terhadap kemudahan biodegradasi selulosa bakteri yang terdeposit nanopartikel perak.

Selulosa bakteri dari limbah cair ubi kayu dibuat melalui proses fermentasi menggunakan bakteri *Acetobacter xylinum*. Selanjutnya selulosa bakteri yang diperoleh didepositkan dengan nanopartikel perak konsentrasi $1x10^{-3}$ M hasil sintesis dengan metode reduksi kimia. Selain sampel selulosa bakteri, dilakukan modifikasi dengan penambahan gliserol dan kitosan yaitu selulosa-gliserol, selulosa-kitosan, dan selulosa-gliserol-kitosan Modifikasi selulosa bakteri dilakukan untuk mengetahui kemudahan biodegradasi selulosa bakteri terdeposit nanopartikel perak. Karakterisasi selulosa yang dilakukan meliputi analisis gugus fungsi dengan FTIR-ATR, kristalinitas dengan XRD, dan kemudahan biodegradasi melalui penentuan kehilangan massa dan laju kehilangan massa. Sampel dibiodegradasi dengan metode *soil burial test* pada kedalaman tertentu dan dilakukan penimbangan pada hari ke-2, 4, 7, 9, 11,dan 14.

Hasil penelitian menunjukkan bahwa nanopartikel perak berhasil dipreparasi yang ditunjukkan oleh puncak absorpsi pada panjang gelombang 418,80 nm. Penambahan gliserol dan kitosan menurunkan kemudahan biodegradasi selulosa bakteri. Lama biodegradasi mempengaruhi kemudahan biodegradasi selulosa bakteri yang ditunjukkan dengan peningkatan kehilangan massa dan penurunan laju kehilangan massa. Karakteristik selulosa bakteri terdeposit nanopartikel perak yang paling mudah terbiodegradasi menunjukkan hilangnya serapan cincin piranosa, peningkatan kristalinitas sesudah biodegradasi, serta peningkatan kehilangan massa dan penurunan laju kehilangan massa.

Kata kunci: selulosa bakteri, nanopartikel perak, biodegradasi, *soil burial test*

THE BIODEGRADABILITY OF BACTERIAL CELLULOSE FROM CASSAVA LIQUID WASTE WITH THE ADDITION OF GLYCEROL AND CHITOSAN DEPOSITED BY SILVER NANOPARTICLES

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ABSTRACT

This research aimed to prepare silver nanoparticle from $AgNO_3$ using trisodium citrate and gelatin stabilizer, to study the effect of glycerol and chitosan addition at the biodegradability of bacterial cellulose from cassava liquid waste, to know the characteristic of bacterial cellulose that is highly degraded and deposited by silver nanoparticle, and to study the effect of biodegradation time at the biodegradability of bacterial cellulose which is deposited by silver nanoparticle.

Bacterial cellulose was done from cassava liquid waste through a fermentation process using *Acetobacter xylinum*. Then, the bacterial cellulose was deposited by the synthesis product of silver nanoparticle with $1x10^{-3}$ concentration. Beside the bacterial cellulose sample, the modification was also done by adding glycerol and chitosan which were glycerol-cellulose, chitosan-cellulose, and chitosan-glycerol-cellulose. The bacterial cellulose were modified in order to know the biodegradability of bacterial cellulose which is deposited by silver nanoparticle. The cellulose characterization included functional group analysis with FTIR-ATR, cristallinity with XRD, and biodegradability through mass degradation and mass degradation rate determination. The samples were biodegraded with soil burial test method in particular deepness and then were weighed on the 2^{nd}, 4^{th}, 7^{th}, 9^{th}, 11^{th}, and 14^{th} day.

The research result showed that silver nanoparticles has been prepared successfully which is indicated by its absorption peak at the wavelength 418.80 nm. Glycerol and chitosan addition decreased the biodegradability of bacterial cellulose from cassava liquid waste. Biodegradation time affected the biodegradability of bacterial cellulose which was shown with mass lost increased and mass lost rate decreased. The characteristic of bacterial cellulose deposited by silver nanoparticle which is the most biodegradable revealed the lose of pyranose ring absorption, the increase in cristallinity after biodegradation, as well as the increase in mass lost and the decrease in mass lost rate.

Key Words: bacterial cellulose, silver nanoparticle, biodegradation, *soil burial test*