

## ABSTRAK

### SINTESIS NANOPARTIKEL ZINC OXIDE (ZnO) SECARA KOPRESIPITASI MENGGUNAKAN EKSTRAK BUAH PINANG (*Areca catechu L*) DAN APLIKASINYA SEBAGAI ANTIBAKTERI PADA *Salmonella Typhimurium*

Sintesis nanopartikel *zinc oxide* (ZnO) dapat dilakukan melalui rute sintesis hijau (*green synthesis*). Rute tersebut dilakukan dengan menambahkan ekstrak tumbuhan pada tahap sintesisnya untuk menghindari aglomerasi. Dalam kerja kami, dipilih buah pinang (*Areca catechu L*) yang mana ekstrak buah pinang diperoleh menggunakan cara maserasi dalam pelarut etanol 96%. Sintesis ZnO diawali dengan menambahkan 1 mL ekstrak buah pinang ke dalam 50 mL larutan prekursor zinc asetat dihidrat ( $[Zn(CH_3COO)_2] \cdot 2H_2O$ ) 1M, lalu ditambahkan 25 mL natrium hidroksida (NaOH) 2M secara perlahan melalui pengadukan. Kemudian endapan dinetralkan, dikeringkan, dan dikalsinasi pada suhu 400 °C untuk mendapatkan sampel ZnO. Sampel ZnO dikarakterisasi menggunakan *X-Ray Diffraction* (XRD) dan *Scanning Electron Microscope* (SEM). Sampel komposit ZnO/ekstrak dibuat melalui sonikasi dengan memvariasikan massa ZnOnya. Daya hambat seluruh sampel di uji pada bakteri *Salmonella typhimurium*. Hasil uji fitokimia menunjukkan bahwa ekstrak etanol buah pinang mengandung alkaloid, flavonoid, tanin, dan triterpenoid. Pengukuran XRD menunjukkan sampel ZnO telah terbentuk, dengan ukuran partikel 17,87 nm melalui perhitungan *Debye Scherrer* dan persen kristalinitas 60,34%. Analisis SEM menunjukkan morfologi partikel ZnO adalah heksagonal dengan ukuran partikel  $19,67863 \pm 0,4727$  nm melalui analisis *ImageJ*. Hasil uji daya hambat terhadap bakteri *Salmonella typhimurium* menunjukkan bahwa ekstrak buah pinang, komposit (ZnO-ekstrak), ZnO hasil pengeringan termasuk dalam kategori lemah sebagai antibakteri yaitu 7,52 mm , (7,26 mm; 6,48 mm; 7,02 mm) , dan 7,60 mm secara berurutan. Namun, sampel ZnO hasil kalsinasi memberikan daya hambat sebesar 12,75 mm dan tergolong sedang dalam menghambat bakteri *Salmonella typhimurium*. Hasil uji ZnO komersil menunjukkan daya hambat 6,88 mm dan kontrol positif 16,36 mm.

Kata-kata kunci: nanopartikel ZnO; biosintesis; *Areca catechu L*; buah pinang; kopesipitasi; *salmonella typhimurium*.

## ABSTRACT

### ***SYNTHESIS OF ZINC OXIDE (ZnO) NANOPARTICLES VIA CO-PRECIPI-TATION USING FRUIT EXTRACT OF (Areca catechu L) AND THEIR APPLICATION TOWARD Salmonella Typhimurium BACTERIA***

*Synthesis of zinc oxide (ZnO) nanoparticles can be carried out via green synthesis route. This route is carried out by adding plant extracts at initial stage of the synthesis to avoid agglomeration. The fruit of Areca catechu L was taken in this research and its extract was obtained by using 96% ethanol solvent via maceration method. The synthesis of ZnO begins by adding 1 mL of the extract to the 50 mL of 1 M zinc acetate dihydrate solution then adding 25 mL of 2 M sodium hydroxide slowly followed by stirring. After the precipitate is resulted, it is neutralized, dried and calcined at 400 °C to obtain a sample of ZnO. Then the precipitate was dried and calcined to obtain a ZnO sample. ZnO samples were characterized using X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). The composite samples were obtained with blend the extract into ZnO sample assisted by sonication with varying the mass of ZnO. The inhibitory strength of all samples was tested on Salmonella typhimurium bacteria. The result of Phytochemical test show that the extract contains alkaloid, flavonoid, tannin and triterpenoid. From X-Ray Diffraction (XRD) measurement showed that the ZnO sample had been successfully formed with the particle size of 17.87 nm determined by Debye Scherrer calculations and the crystallinity percentage of 60.34%. The analysis of Scanning Electron Microscope (SEM) shows that morphology of the ZnO sample is predicted seems as hexagonal with the particle size of  $19,67863 \pm 0,4727$  nm based on ImageJ. The results of the inhibition test on Salmonella typhimurium bacteria showed that the extract, all composite, the dried precipitate were grouped as weakly inhibiting, namely in the value range of 6.48-7.60 mm. However, the calcined ZnO sample provided an inhibitory strength of 12.75 mm and was classified as moderate for inhibiting Salmonella typhimurium bacteria. As a comparison, a commercial ZnO and a positive control (amoxicillin) showed that their inhibitory strength are 6.88 mm and 16.36 mm, respectively.*

*Keywords: ZnO nanoparticles; biosynthesis; Areca catechu L; areca nut, coprecipitation; salmonella typhimurium.*