

**NANOENKAPSULASI EKSTRAK KARA BENGUK (*Mucuna pruriens*)
BERBASIS NANOSELULOSA DAN NANOPATI, SERTA UJI
AKTIVITASNYA SEBAGAI OBAT ANTI-PARKINSON**

TESIS

diajukan untuk memenuhi sebagian dari syarat memperoleh gelar magister sains di
bidang kimia



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Agustus 2022

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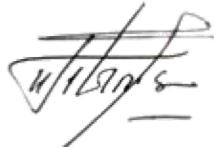
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PERNYATAAN

Dengan ini saya menyatakan bahwa tesis berjudul "**NANOENKAPSULASI EKSTRAK KARA BENGUK (*Mucuna pruriens*) BERBASIS NANOSELULOSA DAN NANOPATI, SERTA UJI AKTIVITASNYA SEBAGAI OBAT ANTI-PARKINSON**" ini beserta seluruh isinya merupakan karya saya sendiri. Saya tidak melakukan plagiasi maupun pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung resiko/sanksi apabila dikemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

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KATA PENGANTAR

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Penulis berharap tesis ini dapat meningkatkan wawasan dan kontribusi bagi penulis sendiri, pembaca, dan peneliti selanjutnya dalam bidang kimia. Penulis menyadari bahwa masih terdapat kekurangan pada tesis ini. Oleh karena itu, kritik dan saran yang bersifat membangun dari berbagai pihak selalu diharapkan untuk perbaikan dan penyempurnaannya.

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ABSTRAK

Penyakit Parkinson merupakan salah satu penyakit neurodegeneratif yang disebabkan oleh adanya kerusakan sel saraf dopaminergik pada otak sehingga produksi dopamin menurun. Hal tersebut menyebabkan gangguan sistem koordinasi gerakan seperti bradikinesia, kekakuan otot, dan katalepsi yang merupakan gejala motorik penyakit Parkinson. Levodopa merupakan obat yang biasa digunakan dalam terapi penyakit Parkinson. Proses nanoenkapsulasi diharapkan dapat mengatasi beberapa keterbatasan penggunaan obat herbal seperti *M. pruriens* meliputi rendahnya kelarutan dalam air, bioavailabilitas, dan stabilitas yang menyebabkan efek terapeutik obat herbal masih rendah. Nanoselulosa dan nanopati telah banyak digunakan sebagai matriks untuk mengenkapsulasi senyawa obat karena sifatnya yang stabil, biodegradabilitas yang baik, dan tidak beracun. Tujuan penelitian ini adalah untuk memperoleh kondisi optimum proses nanoenkapsulasi ekstrak *M. pruriens* berbasis nanoselulosa dan nanopati, karakteristiknya, serta potensinya sebagai obat anti-Parkinson. Proses nanoenkapsulasi dilakukan dengan cara mencampurkan larutan ekstrak dengan masing-masing matriks enkapsulan yaitu nanoselulosa, nanoselulosa-kitosan-tripolifosfat, nanopati, dan nanopati-maltodekstrin pada berbagai variasi perbandingan masa pereaksi. Nanoenkapsulasi dilakukan melalui metode ultrasonifikasi pada amplitudo 62 % selama satu jam. Karakterisasi produk nanoenkapsulasi ekstrak *M. pruriens* (NC-MPn, NC-CS-TPP-MPn, NS-MPn, dan NS-MD-MPn) dilakukan menggunakan FTIR, SEM, TEM dan penentuan efisiensi enkapsulasi dilakukan menggunakan spektrometer UV-Vis. Evaluasi aktivitas anti-Parkinson produk nanoenkapsulasi diuji melalui uji katalepsi model *horizontal bar test* dan data yang dihasilkan diolah secara statistik *one-way ANOVA*. Proses nanoenkapsulasi ekstrak *M. pruriens* berbasis nanoselulosa dan nanopati berhasil dilakukan melalui metode ultrasonifikasi pada amplitudo 62 % selama satu jam dengan perbandingan massa matriks enkapsulan dan ekstrak *M. pruriens* 3:1. Karakterisasi FTIR menunjukkan pergeseran, perubahan intensitas, dan terbentuknya puncak serapan baru dari vibrasi ikatan C-H aldehid, C=C aromatis, dan C=O karbonil untuk produk nanoenkapsulasi berbasis nanoselulosa serta vibrasi ikatan C=C aromatis dan C=O karbonil untuk produk nanoenkapsulasi berbasis nanopati. Karakterisasi SEM dan TEM menunjukkan keempat produk nanoenkapsulasi memiliki morfologi permukaan *non-spherical* dan berbentuk sferis atau bulat. NC-MPn berukuran 567,47 nm, NC-CS-TPP-MPn berukuran 761,12 nm, NS-MPn berukuran 234,98 nm, dan NS-MD-MPn berukuran 90,85 nm, serta masing-masing persentase efisiensi enkapsulasi masing-masing sebesar 39,60 %, 42,39 %, 21,35 %, dan 30,02 %. Keempat produk nanoenkapsulasi ekstrak *M. pruriens* menunjukkan aktivitas penurunan katalepsi secara signifikan. Aktivitas penurunan katalepsi yang ditunjukkan produk nanoenkapsulasi lebih besar dibandingkan dengan aktivitas penurunan katalepsi yang ditunjukkan ekstrak *M. pruriens*.

Kata kunci: anti-Parkinson, *Mucuna pruriens*, nanoenkapsulasi, pati, selulosa

ABSTRACT

*Parkinson's disease is a neurodegenerative disease caused by a damaged dopaminergic nerve cells in the brain causing dopamine production decreased. This causes disturbances in the coordination system of movements such as bradykinesia, muscle rigidity, and catalepsy which are motor symptoms of Parkinson's disease. Levodopa is a drug commonly used in the treatment of Parkinson's disease. The nanoencapsulation process is expected to be able to overcome some of the limitations of the use of herbal medicines such as *M. pruriens* including low water solubility, bioavailability, and stability which causes the therapeutic effect of herbal medicines to remain low. Nanocellulose and nanostarch have been widely used as a matrix for encapsulating drug compounds because of their stability, good biodegradability, and non-toxicity. The aim of this study was to obtain the optimum condition of nanocellulose and nanostarch-based nanoencapsulation process of *M. pruriens* extract, its characteristics, and its potential as an anti-Parkinsonian drug. The nanoencapsulation process is carried out by mixing the extract solution with each encapsulation matrix, namely nanocellulose, nanocellulose-chitosan-tripolyphosphate, nanostarch, and nanostarch-maltodextrin at various ratios of reactant mass. Nanoencapsulation was carried out by ultrasonication method at an amplitude of 62% for one hour with a mass ratio of the matrix and *M. pruriens* extract 3:1. The characterization of nanoencapsulated products of *M. pruriens* extract (NC-MPn, NC-CS-TPP-MPn, NS-MPn, and NS-MD-MPn) was carried out using FTIR, SEM, TEM and determination of encapsulation efficiency was carried out using a UV-Vis spectrometer. Evaluation of the anti-Parkinson activity of nanoencapsulated products was tested through the catalepsy test of the horizontal bar test model and the resulting data was statistically processed one-way ANOVA. The FTIR characterization showed a shift, a change in intensity, and the formation of new absorption peaks from the C-H bond vibrations of aldehyde, C=C aromatic, and C=O carbonyl for nanocellulose-based nanoencapsulated products and C=C aromatic and C=O carbonyl bond vibrations for nanostarch-based nanoencapsulated products. SEM and TEM characterization showed that the four nanoencapsulated products had non-spherical surface morphology and were spherical or spherical in shape. NC-MPn measuring 567,47 nm, NC-CS-TPP-MPn measuring 761,12 nm, NS-MPn measuring 234,98 nm, and NS-MD-MPn measuring 90,85 nm, and each percentage of encapsulation efficiency by 39,60 %, 42,39 %, 21,35 %, and 30,02 % respectively. The four nanoencapsulated products of *M. pruriens* extract showed significant catalepsy-reducing activity. The catalepsy-reducing activity shown by the nanoencapsulated product was greater than the catalepsy-reducing activity shown by *M. pruriens* extract itself.*

Keywords: anti-Parkinsonian, cellulose, *Mucuna pruriens*, nanoencapsulation, starch

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