Optimasi Dan Karakterisasi *Nanostructured Lipid Carrier* L-DOPA-*Palm Oil-Myristic Acid* (NLC-DPM) Sebagai Kandidat Obat Parkinson

SKRIPSI

Diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Sains pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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FAKULAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM

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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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Dengan ini menyatakan bahwa karya tulis ini merupakan hasil kerja saya sendiri. Saya menjamin bahwa seluruh isi karya ini, baik sebagian maupun keseluruhan, bukan merupakan plagiarisme dari karya orang lain, kecuali pada bagian yang telah dinyatakan dan disebutkan sumbernya dengan jelas.

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KATA PENGANTAR

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ABSTRAK

L-DOPA adalah obat yang digunakan dalam pengobatan penyakit Parkinson tetapi memiliki keterbatasan dalam bioavailabilitas dan stabilitas. Penelitian ini bertujuan untuk mengembangkan sistem penghantaran obat yang berbasis Nanostructured Lipid Carrier (NLC) menggunakan lipid asam miristat dan minyak sawit (NLC-DPM) untuk meningkatkan karakteristik L-DOPA. NLC-DPM diformulasikan melalui metode homogenisasi panas dan ultrasonikasi dengan variabel optimasi seperti rasio lipid, konsentrasi surfaktan, durasi dan *power* rate ultrasonikasi. Karakterisasi meliputi ukuran partikel, indeks polidispersitas dan zeta potensial (PSA), morfologi (TEM dan SEM), gugus fungsi (FTIR), efisiensi enkapsulasi serta profil pelepasan obat (UV-Vis). Hasil penelitian menunjukkan bahwa kondisi optimum tercapai pada rasio lipid 1:9, dengan surfaktan 2%, serta waktu dan daya ultrasonikasi selama 80 menit dan 50%. NLC-DPM memiliki ukuran partikel 87,2±0,1, PI 0,114, dan zeta potensial -40,7 mV. Analisis FTIR menunjukkan adanya interaksi antara L-DOPA dan lipid pada gugus O-H, N-H, dan C=O, serta morfologi berbentuk bulat dengan ukuran 63.097 nm (TEM) dan dengan pemetaan EDS yaitu C (69.87%), N (7,82%) dan O (27,95%) yang menunjukkan bahwa L-DOPA sudah terperangkap dalam sistem NLC (SEM). Efisiensi enkapsulasi tercatat sebesar 51,36%, dengan profil pelepasan yang terkontrol hingga 8 jam, mencapai 19,45% pada pH 1,2 mengikuti kinetika pelepasan orde 1 dan 27,22% pada pH 7,4 mengikuti kinetika pelepasan orde 0. NLC-DPM memiliki potensi sebagai sistem penghantaran L-DOPA untuk terapi Parkinson.

Kata kunci: L-DOPA, Parkinson, NLC, Asam miristat, Minyak sawit, Formulasi

ABSTRACT

L-DOPA is a medication utilized in the treatment of Parkinson's disease; however, it has limitations regarding bioavailability and stability. This study aims to develop a drug delivery system based on Nanostructured Lipid Carrier (NLC) using myristic acid lipid and palm oil (NLC-DPM) to enhance the characteristics of L-DOPA. NLC-DPM is formulated through a hot homogenization and ultrasonication method, with optimization variables such as lipid ratio, surfactant concentration, duration, and power rate of ultrasonication. Characterization includes particle size, polydispersity index, and zeta potential (PSA), morphology (TEM and SEM), functional groups (FTIR), encapsulation efficiency, and drug release profile (UV-Vis). The research results indicate that optimal conditions are achieved at a lipid ratio of 1:9, with a surfactant concentration of 2%, and ultrasonication time and power of 80 minutes and 50%, respectively. NLC-DPM exhibits a particle size of 87.2±0.1, a PI of 0.114, and a zeta potential of -40.7 mV. FTIR analysis reveals interactions between L-DOPA and lipids at the O-H, N-H, and C=O groups, as well as a spherical morphology with a size of 63.097 nm (TEM) and EDS mapping showing C (69.87%), N (7,82%), and O (27,95%), indicating that L-DOPA is encapsulated within the NLC system (SEM). The encapsulation efficiency is recorded at 51.36%, with a controlled release profile over 8 hours, reaching 19.45% at pH 1.2 following first-order release kinetics and 27.22% at pH 7.4 following zero-order release kinetics. NLC-DPM shows potential as a delivery system for L-DOPA in Parkinson's therapy.

Keywords: L-DOPA, Parkinson, NLC, Myristic acid, Palm oil, Formulation

DAFTAR ISI

DAFTAR GAMBAR

DAFTAR TABEL

DAFTAR LAMPIRAN

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