PENGEMBANGAN NANOEMULSI KOMBINASI ALFA ARBUTIN DAN ASAM KOJAT DIPALMITAT : STUDI AKTIVITAS *IN VITRO*, POTENSI SITOTOKSISITAS, DAN STABILITAS

SKRIPSI

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Sebagai salah satu syarat untuk memperoleh gelar Sarjana Farmasi

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ABSTRAK

Hiperpigmentasi merupakan masalah dermatologi umum yang dapat diatasi dengan pencerah kulit. Kombinasi alfa arbutin (AA) dan asam kojat dipalmitat (AKD) dalam nanoemulsi berpotensi mengatasi hiperpigmentasi. Penelitian ini bertujuan untuk mengevaluasi aktivitas inhibisi tirosinase, potensi sitotoksisitas, dan stabilitas sediaan nanoemulsi kombinasi AA dan AKD. Nanoemulsi dibuat menggunakan formula optimum dengan minyak biji bunga matahari dan isopropil miristat (3:2) sebagai fase minyak, PEG-40 *hydrogenated castor oil* dan PEG-400 (3:1) sebagai surfaktan dan kosurfaktan dengan teknik pengadukan cepat. Uji aktivitas inhibisi tirosinase dilakukan menggunakan metode difenolase dengan substrat L-DOPA. Uji sitotoksisitas menggunakan metode *microculture tetrazolium technique* (MTT) pada sel melanoma B16-F0. Uji stabilitas dipercepat dilakukan selama 90 hari pada kondisi 45°C dan 75% RH dengan evaluasi organoleptik, ukuran droplet, indeks polidispersitas, zeta potensial, pH, dan viskositas. Hasil penelitian menunjukkan nanoemulsi kombinasi AA dan AKD memiliki aktivitas inhibisi tirosinase 79,75±0,11% dengan nilai IC_{50} sitotoksisitas 20,73 ppm. Nanoemulsi stabil secara fisik dengan ukuran droplet 20,87±0,35 nm, indeks polidispersitas 0,35±0,02, pH 5,03±0,085, dan viskositas 1030±67 cP tanpa pemisahan fase. Meskipun tidak stabil secara elektrostatik (-16,50 mV), stabilitas fisiknya memadai. Kesimpulan dari penelitian ini menunjukkan nanoemulsi kombinasi AA dan AKD menunjukkan potensi sebagai pencerah kulit yang efektif dengan stabilitas fisik yang baik.

Kata kunci: nanoemulsi, pencerah kulit, inhibisi tirosinase, sitotoksisitas, stabilitas dipercepat

ABSTRACT

Hyperpigmentation is a common dermatological problem that can be addressed with skin brightening agents. The combination of alpha arbutin (AR) and kojic acid dipalmitate (AKD) in nanoemulsion has potential to treat hyperpigmentation. This study aimed to evaluate tyrosinase inhibition activity, cytotoxicity potential, and stability of nanoemulsion formulation containing AR and AKD combination. Nanoemulsion was prepared using optimum formula with sunflower seed oil and isopropyl myristate (3:2) as oil phase, PEG-40 hydrogenated castor oil and PEG-400 (3:1) as surfactant and cosurfactant using high-speed stirring technique. Tyrosinase inhibition activity test was conducted using diphenolase method with L-DOPA as substrate. Cytotoxicity test was performed using microculture tetrazolium technique (MTT) on B16-F0 melanoma cells. Accelerated stability test was conducted for 90 days at 40°C and 75% RH with evaluation of organoleptic properties, droplet size, polydispersity index, zeta potential, pH, and viscosity. The results showed that AR and AKD combination nanoemulsion had tyrosinase inhibition activity of 79.75±0.11% with cytotoxicity IC_{50} value of 20.73 ppm. The nanoemulsion was physically stable with droplet size of 20.87±0.35 nm, polydispersity index of 0.35±0.02, pH of 5.03±0.085, and viscosity of 1030±67 cP without phase separation. Although electrostatically unstable (-16.50 mV), its physical stability was adequate. In conclusion, AR and AKD combination nanoemulsion demonstrated potential as an effective skin lightening agent with good physical stability.

Keywords: *nanoemulsion, skin brightening, tyrosinase inhibition, cytotoxicity, accelerated stability*

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