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Pengembangan Parfum Berbasis Nanoemulsi dengan Senyawa Volatil Gama Melon Parfum
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Gama Melon Parfum (GMP) memiliki aroma khas, tetapi pemanfaatannya terbatas pada karakterisasi. Penelitian ini bertujuan mengembangkan parfum berbasis nanoemulsi dengan senyawa volatil GMP melalui optimasi komposisi *notes* dan formula parfum berbasis nanoemulsi serta evaluasi stabilitas fisikokimia dan keamanan.

Penelitian mencakup pengendalian bahan biologis dan ekstraksi kulit GMP; karakterisasi fisikokimia dan profil kimia tiga komponen aroma; optimasi komposisi *notes* menggunakan *D-optimal mixture design*; optimasi formula parfum berbasis nanoemulsi menggunakan *I-optimal mixture design*; evaluasi stabilitas fisikokimia pada bulan ke-0 dan ke-6 penyimpanan suhu ruang; serta uji mikrobiologi dan iritasi dermal.

Tanaman teridentifikasi sebagai *Cucumis melo* L. 'Gama Melon Parfum' dan dipanen 28 hari pascapolinasi. Ekstrak volatil GMP, minyak atsiri mawar, dan minyak atsiri vanila secara operasional diklasifikasikan sebagai *top notes*, *middle notes*, dan *base notes*. Komposisi *notes* terpilih memuat ketiganya berturut-turut sebanyak 0,95, 0,55, dan 0,50 mL (*desirability* 0,790; bobot jenis 0,8102; viskositas 0,7931 cps; hedonik 9,72 cm). Ketiga model *D-optimal* tidak signifikan dan tidak prediktif. Lima model *I-optimal* signifikan; prediktivitas model PDI lemah, sedangkan potensial zeta menghasilkan model rerata. Formula parfum berbasis nanoemulsi terpilih (*desirability* 0,781) memuat komposisi *notes* terpilih 1,50 mL, Kolliphor® EL 4,16 mL, PEG-400 0,30 mL, dan air deionisasi 14,04 mL dalam campuran rancangan 20,00 mL; 2-phenoxyethanol 0,20 mL ditambahkan terpisah. Formula menghasilkan transparansi 95,60%, bobot jenis 1,0422, viskositas 11,3939 cps, ukuran droplet 32,90 nm, PDI 0,176, potensial zeta −0,623 mV, dan pH 4,50. Bobot jenis berada di luar interval prediksi 95%, sedangkan potensial zeta tidak menunjukkan stabilisasi elektrostatik kuat. Setelah 6 bulan, transparansi, ukuran droplet, PDI, dan pH menjadi 95,50%, 23,38 nm, 0,149, dan 4,39. Angka lempeng total <10 cfu/mL; *C. albicans*, *S. aureus*, dan *P. aeruginosa* tidak terdeteksi. Indeks iritasi primer 0,17–1,83 menunjukkan respons sangat ringan hingga ringan dan reversibel. Hasil mendukung stabilitas fisikokimia terukur dan profil keamanan topikal awal dalam kondisi penelitian.

Kata kunci: ketertelusuran, sistem *notes*, desain campuran, stabilitas fisikokimia, keamanan topikal

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ABSTRACT

Gama Melon Parfum (GMP) has a distinctive aroma but has mainly been characterized. This study developed a nanoemulsion-based perfume containing GMP volatiles through fragrance-note and formulation optimization and physicochemical stability and safety evaluation.

The methods comprised biological control and extraction from GMP peel; physicochemical characterization and chemical profiling of three components; D-optimal optimization of fragrance-note composition; I-optimal optimization of nanoemulsion-based perfume formulation; physicochemical evaluation at months 0 and 6 of room-temperature storage; and microbiological and dermal irritation tests.

The material was identified as *Cucumis melo* L. 'Gama Melon Parfum' and harvested 28 days after pollination. GMP volatile extract, rose essential oil, and vanilla essential oil were operationally classified as *top notes*, *middle notes*, and *base notes*. The selected fragrance-note composition contained them, respectively, at 0.95, 0.55, and 0.50 mL (desirability 0.790; specific gravity 0.8102; viscosity 0.7931 cps; hedonic response 9.72 cm). The three D-optimal models were nonsignificant and nonpredictive. Five I-optimal models were significant; the PDI model was weakly predictive, whereas zeta potential yielded a mean model. The selected nanoemulsion-based perfume formulation (desirability 0.781) comprised 1.50 mL fragrance-note composition, 4.16 mL Kolliphor® EL, 0.30 mL PEG-400, and 14.04 mL deionized water in a 20.00-mL design mixture; 0.20 mL 2-phenoxyethanol was added separately. It yielded 95.60% transparency, 1.0422 specific gravity, 11.3939 cps viscosity, 32.90 nm droplet size, 0.176 PDI, −0.623 mV zeta potential, and pH 4.50. Specific gravity fell outside the 95% prediction interval, whereas zeta potential did not indicate strong electrostatic stabilization. After six months, transparency, droplet size, PDI, and pH were 95.50%, 23.38 nm, 0.149, and 4.39. Total plate count was <10 cfu/mL; *C. albicans*, *S. aureus*, and *P. aeruginosa* were not detected. Primary irritation indices of 0.17–1.83 indicated very slight to slight reversible responses. Results support measured physicochemical stability and a preliminary topical safety profile under study conditions.

Keywords: traceability, fragrance-note system, mixture design, physicochemical stability, topical safety