FORMULASI *DISSOLVING MICRONEEDLE* DENGAN KOMBINASI POLIMER *HYALURONIC ACID* DAN PVP K90 *LOADED α-MANGOSTIN* UNTUK *TRANSDERMAL DRUG DELIVERY SYSTEM*

TESIS

MUTMAINNAH SOLEMAN
C242009

PROGRAM STUDI MAGISTER FARMASI
SEKOLAH TINGGI FARMASI INDONESIA
YAYASAN HAZANAH BANDUNG
2026

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Sebagai salah satu syarat untuk memperoleh gelar Magister Farmasi

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LEMBAR PENGESAHAN

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Agustus 2026

Disetujui Oleh :

Pembimbing	Pembimbing
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KUTIPAN

Kutipan atau saduran baik sebagian atau pun seluruh naskah, harus menyebut nama pengarang dan sumber aslinya, yaitu Sekolah Tinggi Farmasi Indonesia

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ABSTRAK

α-Mangostin merupakan senyawa xanton utama pada kulit buah Manggis yang memiliki bioavailabilitas oral rendah karena bersifat hidrofobik dan kelarutan rendah serta mengalami metabolisme lintas pertama. Penelitian ini bertujuan menentukan rasio kombinasi polimer *hyaluronic acid* (HA) dan polivinilpirolidon K90 (PVP K90) serta konsentrasi α-mangostin yang menghasilkan *dissolving microneedle* (DMN) dengan karakteristik optimum, sekaligus memperoleh profil difusi. DMN dibuat dengan metode *micromolding* pada lima perbandingan rasio HA:PVP K90, yaitu 1:1; 1:2; 2:1; 1:5; dan 5:1. Basis optimum selanjutnya dimuati α-mangostin 0,1%; 0,2%; dan 0,3% b/v dengan penambahan trietanolamin (TEA) sebagai peningkat kelarutan. Evaluasi meliputi pH, viskositas, pengamatan visual, uji *compression*, *breaking force*, kelembapan, uji penyisipan, morfologi dengan SEM, serta uji difusi *in vitro* menggunakan sel difusi Franz dengan membran kulit mencit. Rasio 2:1 (F3) terpilih sebagai basis optimum dengan penetrasi penuh hingga 254 µm, gaya tekan 18,70 N, gaya patah 4,90 N, dan kelembapan 13,18%. Keunggulan gaya patah F3 terhadap F1 terbukti bermakna secara statistik. Pemuatan α-mangostin 0,1% memberikan hasil terbaik dengan gaya patah 48,80 N, gaya tekan 17,92 N, kelembapan 10,73%, dan penetrasi penuh, sedangkan konsentrasi 0,2% dan 0,3% DMN tidak terbentuk sempurna. Pencitraan SEM memperlihatkan jarum F3 + 0,1 α-mangostin berbentuk piramida dengan tinggi 766 µm, lebar dasar 429 µm, dan jarak antarjarum 405 µm. Uji profil difusi menunjukkan pelepasan cepat, persen terdifusi kumulatif 83,53 ± 6% pada menit ke-120, jauh melampaui larutan α-mangostin murni (8,78 ± 0,30%). DMN F3 + α-mangostin 0,1% merupakan formula paling optimum.

Kata Kunci: *dissolving microneedle*; α-mangostin; *hyaluronic acid*; PVP K90; *micromolding*.

ABSTRACT

α-Mangostin is the principal xanthone compound derived from mangosteen (Garcinia mangostana L.) pericarp, which suffers from poor oral bioavailability owing to its high lipophilicity, low aqueous solubility, and extensive first-pass metabolism. This study aimed to determine the optimum polymer ratio of hyaluronic acid (HA) to polyvinylpyrrolidone K90 (PVP K90) and the optimal concentration of α-mangostin to fabricate dissolving microneedles (DMNs) with optimal characteristics, as well as to evaluate their diffusion profiles. DMNs were fabricated via the micromolding method using five different HA:PVP K90 weight ratios (1:1, 1:2, 2:1, 1:5, and 5:1). The optimum polymer base was subsequently loaded with α-mangostin at concentrations of 0.1%, 0.2%, and 0.3% (w/v) with the addition of triethanolamine (TEA) as a solubilizing agent. Characterization included evaluations of pH, viscosity, organoleptic appearance, compression behavior, breaking force, moisture content, insertion capability, morphology via scanning electron microscopy (SEM), and in vitro diffusion using Franz diffusion cells with mouse skin membranes. The 2:1 polymer ratio (F3) was identified as the optimum base, exhibiting full penetration depth up to 254 µm, a compression force of 18.70 N, a breaking force of 4.90 N, and a moisture content of 13.18%, with the breaking force of F3 being statistically superior to F1. Loading of 0.1% α-mangostin yielded the most optimal formulation, demonstrating a breaking force of 48.80 N, a compression force of 17.92 N, a moisture content of 10.73%, and complete skin penetration, whereas needle fabrication failed at 0.2% and 0.3% concentrations. SEM imaging revealed that the F3 + 0.1% α-mangostin needles possessed a sharp pyramidal geometry with a height of 766 µm, a base width of 429 µm, and an inter-needle spacing of 405 µm. The permeation profile demonstrated rapid release with a cumulative diffused percentage of 83.53 ± 6% at 120 minutes, significantly outperforming the pure α-mangostin control solution (8.78 ± 0.30%). Overall, the DMN formulation composed of F3 loaded with 0.1% α-mangostin represents the most optimum.

Keywords: *dissolving microneedle; α-mangostin; hyaluronic acid; PVP K90; micromolding.*

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