

ABSTRAK

Dalam satu dekade terakhir, terjadi peningkatan signifikan terhadap minat perawatan kulit, salah satunya anti penuaan. Vitamin D3 memiliki efek diferensiasi keratinosit sebagai pertahanan sawar kulit, menjaga kelembaban dan menjaga elastisitas kulit. *Smix-oil* (*Surfactant mixture-oil*) merupakan media yang tepat untuk melarutkan vitamin D3 yang bersifat sangat lipofil. *Smix-oil* vitamin D3 akan dicampur dengan basis hidrogel untuk meningkatkan aseptabilitas dan waktu retensi di kulit. Penelitian ini bertujuan untuk mencari formula optimum *Smix-oil* vitamin D3 dan *Smix-oil* vitamin D3 berbasis hidrogel, serta mengevaluasi aktivitas elastase yang dimilikinya. Optimasi *Smix-oil* vitamin D3 dan *Smix-oil* vitamin D3 berbasis hidrogel masing-masing dilakukan dengan metode *D-Optimal Mixture* dan *Simplex Lattice Design* pada piranti lunak *Design Expert 10*. Sementara aktivitas elastase diuji menggunakan *Drug Discovery Kit Enzo Life Science (Manual, Neutrophil Elastase Colorimetric)*. Komposisi *Smix-oil* vitamin D3 optimum terdiri atas: 1,3423 g Miglyol 812 N; 2,9121 g Tween 80 dan 0,7455 g PEG 400, dengan kandungan vitamin D3 2 mg/g. Formula tersebut memiliki ukuran partikel $56,78 \pm 5,45$ nm dan indeks polidispersitas $0,44 \pm 0,017$. Sementara formula optimum *Smix-oil* vitamin D3 berbasis hidrogel terdiri dari: 0,177 g Carbopol 940, 0,122 Triethanolamin (TEA), 0,075 g Phenoxyethanol, 500 μ L *Smix-oil* vitamin D3 (mengandung 2 mg vitamin D3/g *Smix-oil*) dan aquadest hingga 100 g. *High Performance Liquid Chromatography* (HPLC) digunakan sebagai instrumen untuk menganalisis vitamin D3 dalam sediaan. Uji kesesuaian sistem, penentuan spesifisitas, linearitas dan rentang dilakukan sebagai tahap awal. Analisis vitamin D3 dilakukan menggunakan standar internal vitamin D2, yang kromatogramnya menghasilkan resolusi 2,205 terhadap vitamin D3. Metode membran dialisis, sebagai metode terpilih ekstraksi hidrogel, menghasilkan RSD > 11% sehingga dapat dikatakan bahwa hasil dari metode ini belum konsisten. Uji pelepasan dan uji permeasi menggunakan media *Phosphate Buffer Saline* (PBS) pH 7,4 + Tween 80 0,5%, namun berbeda pada pemilihan membran yaitu selofan untuk uji pelepasan dan kulit ular untuk uji permeasi. Jumlah rerata vitamin D3 yang terlepas dari *Smix-oil* vitamin D3 ialah 2,12% selama 300 menit percobaan. Uji permeasi tidak menunjukkan deteksi vitamin D3 pada semua sampel. Uji liberasi (tanpa menggunakan membran), mengkonfirmasi bahwa ternyata vitamin D3 mampu terlepas sebesar 62,12% dari sediaan *Smix-oil* berbasis hidrogel pada 5 menit pertama dalam media PBS pH 7,4 + Tween 80 0,5%. Uji aktivitas elastase menunjukkan bahwa nilai penurunan hambatan *elastase* oleh inhibitor lebih rendah pada *Smix-oil* vitamin D3 dibandingkan vitamin D3 bentuk tunggal atau dalam bentuk *Smix-oil* berbasis hidrogel. Penelitian ini menunjukkan bahwa *Smix-oil* vitamin D3 memiliki aktivitas hambatan elastase yang lebih baik.

Kata Kunci: *elastase*, hidrogel, *Smix-oil*, vitamin D3

ABSTRACT

In the past decade, there has been a significant increase in skincare interest, one of them being anti-aging. Vitamin D3 has a keratinocyte differentiation effect and acts as a skin barrier. Other than that, it also maintains skin hydration and skin elasticity. High lipophilicity of vitamin D3 has been a consideration in choosing Smix-oil as a carrier to increase the penetration of vitamin D3. Smix-oil was entrapped in a hydrogel base to improve its acceptability. The study aims to optimize the formulation of Smix-oil vitamin D3 and Smix-oil vitamin D3 based hydrogel, and to evaluate their elastase activity. The optimization of Smix-oil vitamin D3 and Smix-oil vitamin D3 based hydrogel were analyzed respectively using D-Optimal Mixture and Simplex Lattice Design by Design Expert 10 software. Meanwhile, the elastase activity was measured using Drug Discovery Kit Enzo Life Science (Manual, Neutrophil Elastase Colorimetric). The optimum formula of Smix-oil vitamin D3 consisted of 2 mg/g vitaminD3, 1.3423 g Miglyol 812 N, 2.9121 g Tween 80, and 0.7455 g PEG 400. The formula has particle size as 56.78 ± 5.45 nm and polydispersity index as 0.44 ± 0.017 . On the other side, the optimum formula of Smix-oil vitamin D3 based hydrogel was 0.177 g Carbopol 940, 0.122 Triethanolamine (TEA), 0.075 g Phenoxyethanol, 500 μ L Smix-oil vitamin D3 (contains 2 mg vitamin D3/ g Smix-oil), and aquadest ad 100 g. Vitamin D3 assay was analyzed using High-Performance Liquid Chromatography (HPLC). System suitability test, specificity, linearity and range were the parameter tested by HPLC. Vitamin D2 has been used as an internal standard, which has a resolution of 2.205 to the vitamin D3. Dialysis membrane method, as the chosen method for hydrogel extraction, yielded %RSD >11%. The data emphasized the inconsistency of the results. Release test and permeation test were observed using cellophane membrane and shed snake skin, respectively. Both of the tests were using phosphate buffer saline (PBS) pH 7,4 (contains Tween 80 0,5%) as the media. The percentage of vitamin D3 released from Smix-oil was 2.12% after 300 minutes of observation. There were no detection of vitamin D3 during permeation test of all samples. The liberation test was designed in the membrane-free method to measure the release of vitamin D3 from Smix-oil -based hydrogel. The result showed that vitamin D3 was released at 62.12% in the first five minutes of the trial. Smix-oil vitamin D3 best reached the inhibitor's decrease of neutrophil elastase activity. Its decrease was lower than Smix-oil vitamin D3-based hydrogel, even the vitamin D3 in a single form. It can be concluded that Smix-oil vitamin D3 had the best effect in inhibiting elastase activity.

Keywords: elastase, hydrogel, Smix-oil, vitamin D3