

INTISARI

Minyak lemon (*Citrus limon*) dan asam hialuronat memiliki potensi sebagai agen anti-aging karena aktivitas antioksidan dan kemampuannya dalam meningkatkan kelembapan kulit. Minyak lemon mengandung senyawa bioaktif seperti limonene dan citral, sedangkan asam hialuronat berfungsi sebagai humektan untuk menjaga hidrasi dan elastisitas kulit. Penelitian ini bertujuan untuk menentukan perbandingan kadar hidroksipropil metilselulosa (HPMC) dan karbopol sebagai *gelling agent* yang menghasilkan karakteristik fisik dan stabilitas fisik optimum serta mengevaluasi aktivitas antioksidan dan daya lembap serum minyak lemon dan asam hialuronat

Optimasi formula dilakukan menggunakan metode *Simplex Lattice Design* (SLD) dengan perangkat lunak Design Expert® versi 13. Delapan formula serum gel diuji sifat fisiknya meliputi organoleptik, homogenitas, pH, viskositas, daya sebar, dan daya lekat. Uji stabilitas fisik dilakukan dengan metode *freeze-thaw* cycling selama tiga siklus. Aktivitas antioksidan diuji secara *in vitro* menggunakan metode DPPH, sedangkan uji daya lembab dilakukan menggunakan *skin analyzer* pada panelis.

Hasil penelitian menunjukkan bahwa formula optimum dengan kombinasi HPMC 0,89% dan karbopol 0,110% memiliki pH $6,504 \pm 0,0113$, viskositas $1803,333 \pm 14,142$ cPs, daya sebar $6,883 \pm 0,070$ cm, dan daya lekat $4,12 \pm 0,438$ detik. Serum stabil pada parameter viskositas, daya sebar, dan daya lekat tetapi tidak stabil pada parameter pH setelah pengujian uji *freeze-thaw*. Nilai IC_{50} aktivitas antioksidan minyak lemon sebesar $77,91 \mu\text{g/mL}$, serta terjadi peningkatan kelembapan kulit secara signifikan ($p < 0,05$) setelah penggunaan serum selama 5 hari.

Kata kunci: serum gel, minyak lemon, asam hialuronat, HPMC, karbopol, anti-aging.

ABSTRACT

Lemon oil (Citrus limon) and hyaluronic acid have potential as anti-aging agents due to their antioxidant activity and ability to increase skin moisture. Lemon oil contains bioactive compounds such as limonene and citral, while hyaluronic acid functions as a humectant to maintain skin hydration and elasticity. This study aimed to determine the optimal ratio of hydroxypropyl methylcellulose (HPMC) and carbopol as gelling agents to produce optimum physical characteristics and physical stability, as well as to evaluate the antioxidant activity and moisturizing effect of a lemon oil and hyaluronic acid serum.

Formula optimization was carried out using the Simplex Lattice Design (SLD) method with Design Expert® software version 13. Eight serum gel formulations were evaluated for their physical properties, including organoleptic characteristics, homogeneity, pH, viscosity, spreadability, and adhesiveness. Physical stability testing was performed using the freeze–thaw cycling method for three cycles. Antioxidant activity was tested in vitro using the DPPH method, while the moisturizing effect was evaluated using a skin analyzer on panelists.

The results showed that the optimum formula, with a combination of 0,89% HPMC and 0,110% carbopol, had a pH of $6,504 \pm 0,0113$, viscosity of $1803,333 \pm 14,142$ cPs, spreadability of $6,883 \pm 0,070$ cm, and adhesiveness of $4,12 \pm 0.438$ seconds. The serum was stable in terms of viscosity, spreadability, and adhesiveness, but unstable in pH after freeze–thaw testing. The IC_{50} value of the antioxidant activity of lemon oil was $77,91 \mu\text{g/mL}$, and a significant increase in skin moisture ($p < 0,05$) was observed after using the serum for 5 days.

Keywords: *serum gel, lemon oil, hyaluronic acid, HPMC, carbopol, anti-aging*