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UJI AKTIVITAS ANTIOKSIDAN DAN ANTI-ELASTASE SECARA IN VITRO TERHADAP EKSTRAK BUNGA AJERAN (Bidens pilosa L.) DAN FORMULASINYA SEBAGAI SERUM GEL WAJAH
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INTISARI

Penuaan kulit dipercepat oleh stres oksidatif dan peningkatan aktivitas enzim elastase sehingga diperlukan bahan aktif alami yang memiliki aktivitas antioksidan dan anti-elastase. Bunga ajeran (*Bidens pilosa*) diketahui mengandung berbagai senyawa bioaktif yang berpotensi dikembangkan sebagai bahan aktif kosmetik anti-aging. Penelitian ini bertujuan menentukan pelarut ekstraksi terbaik, memperoleh formula optimum serum gel wajah, serta mengevaluasi stabilitas fisik dan aktivitas biologis sediaan.

Ekstrak bunga ajeran diperoleh dengan metode maserasi menggunakan air, etanol 70%, dan etil asetat. Aktivitas antioksidan diuji menggunakan metode DPPH dan ABTS, sedangkan aktivitas anti-elastase diuji secara *in vitro*. Ekstrak terbaik diprofilkan menggunakan *Liquid Chromatography–High Resolution Mass Spectrometry* (LC-HRMS), kemudian diformulasikan menjadi serum gel yang dioptimasi menggunakan metode *D-optimal mixture design* berdasarkan respons pH, viskositas, dan daya sebar. Formula optimum selanjutnya dievaluasi karakteristik fisik, stabilitas *freeze–thaw*, serta aktivitas biologis setelah formulasi. Ekstrak etanol 70% menunjukkan aktivitas terbaik dengan nilai IC_{50} DPPH 87,28 ± 4,52 µg/mL, IC_{50} ABTS 54,09 ± 1,78 µg/mL, dan aktivitas anti-elastase 52,64 ± 22,82% pada konsentrasi 300 µg/mL. Analisis LC-HRMS mengidentifikasi 364 senyawa, dengan 80 senyawa memiliki *best match confidence* >90% yang didominasi asam amino, fenolik, flavonoid, dan turunan asam fenolat. Formula optimum terdiri atas hidroksietil selulosa 0,8%, gliserin 0,4%, dan propilen glikol 18,8%, memenuhi persyaratan karakteristik fisik dan stabilitas, serta mempertahankan aktivitas antioksidan (57,85 ± 7,11%) dan anti-elastase (54,17 ± 7,21%). Ekstrak etanol 70% bunga ajeran berpotensi dikembangkan sebagai bahan aktif serum gel wajah anti-aging.

Kata kunci: *Bidens pilosa*, antioksidan, anti-elastase, anti-aging, serum gel.

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ABSTRACT

Skin aging is accelerated by oxidative stress and increased elastase activity, creating the need for natural compounds with antioxidant and anti-elastase properties. *Bidens pilosa* flowers contain various bioactive constituents with potential applications as anti-aging cosmetic ingredients. This study aimed to determine the most suitable extraction solvent, develop the optimum facial serum gel formulation, and evaluate its physical stability and biological activities.

Flower extracts were prepared by maceration using water, 70% ethanol, and ethyl acetate. Antioxidant activity was evaluated using DPPH and ABTS assays, while anti-elastase activity was determined *in vitro*. The most active extract was characterized using *Liquid Chromatography–High Resolution Mass Spectrometry* (LC-HRMS) and formulated into a facial serum gel. Formulation optimization was performed using a *D-optimal mixture design* based on pH, viscosity, and spreadability. The optimum formulation was further evaluated for physical characteristics, freeze–thaw stability, and biological activities after formulation.

The 70% ethanol extract showed the strongest activity, with DPPH and ABTS IC_{50} values of 87.28 ± 4.52 µg/mL and 54.09 ± 1.78 µg/mL, respectively, and anti-elastase inhibition of 52.64 ± 22.82% at 300 µg/mL. LC-HRMS identified 364 compounds, including 80 compounds with *best match confidence* above 90%, predominantly amino acids, phenolics, flavonoids, and phenolic acid derivatives. The optimum serum gel consisted of 0.8% hydroxyethyl cellulose, 0.4% glycerin, and 18.8% propylene glycol, meeting the required physical characteristics and stability while retaining antioxidant (57.85 ± 7.11%) and anti-elastase (54.17 ± 7.21%) activities. These findings indicate that the 70% ethanol extract of *Bidens pilosa* is a promising active ingredient for anti-aging facial serum gel formulations.

Kata kunci: *Bidens pilosa*, antioksidan, anti-elastase, anti-aging, serum gel.