PENGARUH KONSENTRASI PROTEIN DAN KONDISI HOMOGENISASI TERHADAP KARAKTERISTIK EMULSI YANG DISTABILKAN
OLEH EKSTRAK PROTEIN KORO PEDANG (Canavalia ensiformis (L.) DC.)
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INTISARI

Oleh:

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Penelitian ini bertujuan untuk mengevaluasi pengaruh konsentrasi protein koro pedang putih (*Canavalia ensiformis* (L.) DC.) (0,1%; 0,5%; dan 0,9%) terhadap aktivitas dan stabilitas emulsi, serta mengarakterisasi emulsi yang dihasilkan oleh metode homogenisasi Ultra-Turrax (UT 2, 4, dan 10 menit) dan kombinasi Ultra-Turrax 4 menit + *High Pressure Homogenizer* (HPH). Protein diekstrak melalui *ultrasound-assisted alkaline extraction–isoelectric precipitation–spray drying*, menghasilkan konsentrat protein dengan kadar protein 71,38 ± 0,74% (db) dan serat pangan total 29,60 ± 0,03% (wb). Emulsi *oil-in-water* (O/W) dievaluasi pada konsentrasi protein 0,1%; 0,5%; dan 0,9% melalui parameter *adsorbed protein* (AP%), *Emulsifying Activity Index* (EAI), evaluasi Optilab, *creaming index* (CI), dan viskositas.

Hasil menunjukkan bahwa metode homogenisasi merupakan faktor dominan yang menentukan kualitas emulsi (η^2 EAI = 0,994; η^2 viskositas = 0,987). HPH secara konsisten menghasilkan EAI (153–674 m²/g), viskositas (6,05–7,95 mPa.s), dan CI 2 hari (45–81%) yang lebih unggul dibandingkan Ultra-Turrax (EAI 55–128 m²/g; viskositas 3,74–3,95 mPa.s; CI 56–94%) melalui mekanisme pembentukan droplet submikrometer dan modifikasi protein. Konsentrasi protein memberikan pengaruh yang berlawanan arah: EAI menurun seiring peningkatan konsentrasi karena protein yang tersedia lebih sedikit, sementara kestabilan emulsi (CI dan viskositas) meningkat akibat lapisan film antarmuka yang lebih tebal. Konsentrasi protein 0,1% terbukti berada di bawah *minimum surface saturation concentration,* sehingga menyebabkan pemisahan fase hampir seketika pada perlakuan Ultra-Turrax (CI menit ke-0: 83,67–90,33%), sedangkan konsentrasi 0,5% merupakan ambang batas kritis, di mana pemisahan fase relatif lebih stabil (CI awal: 1,98–3,92%). Kondisi yang paling stabil pada konsentrasi 0,9% (CI awal: 0-2,03%). AP% yang seragam tinggi (94-99%) pada semua perlakuan membuktikan afinitas tinggi fraksi globulin (vicilin 7S) terhadap antarmuka minyak-air. Kombinasi Ultra-Turrax 4 menit + HPH dengan konsentrasi protein 0,9% merupakan perlakuan optimal dengan EAI sebesar 170,02 ± 3,56 m²/g, CI setelah 2 hari sebesar 45,32%, dan viskositas sebesar 7,95 ± 0,12 mPa·s, yang mengonfirmasi potensi kompetitif protein koro pedang sebagai *emulsifier* nabati.

Kata kunci: *emulsifier* nabati, emulsi *oil-in-water*, koro pedang putih, konsentrasi protein, metode homogenisasi

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THE EFFECT OF PROTEIN CONCENTRATION AND HOMOGENIZATION CONDITIONS ON THE CHARACTERISTICS OF EMULSIONS STABILIZED BY JACK BEAN (*Canavalia ensiformis* (L.) DC.) PROTEIN EXTRACT

ABSTRACT

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This study aimed to evaluate the effect of white jack bean (*Canavalia ensiformis* (L.) DC.) protein concentration (0.1%; 0.5%; and 0.9%) on emulsion activity and stability, and to characterize the emulsions produced by the Ultra-Turrax homogenization method (UT 2, 4, and 10 minutes) and the combination of Ultra-Turrax 4 minutes + High Pressure Homogenizer (HPH). Protein was extracted through ultrasound-assisted alkaline extraction–isoelectric precipitation–spray drying, producing a protein concentrate with a protein content of 71.38 ± 0.74% (db) and total dietary fiber of 29.60 ± 0.03% (wb). Oil-in-water (O/W) emulsions were evaluated at protein concentrations of 0.1%, 0.5%, and 0.9% through adsorbed protein (AP%), Emulsifying Activity Index (EAI), Optilab evaluation, creaming index (CI), and viscosity.

The results showed that the homogenization method was the dominant factor determining emulsion quality (η^2 EAI = 0.994; η^2 viscosity = 0.987). HPH consistently produced superior EAI (153–674 m^2/g), viscosity (6.05–7.95 mPa · s), and 2-day CI (45–81%) compared to Ultra-Turrax (EAI 55–128 m^2/g; viscosity 3.74–3.95 mPa · s; CI 56–94%) through submicrometer droplet formation and protein modification mechanisms. Protein concentrations had opposite effects: EAI decreases with increasing concentration due to less available protein, while emulsion stability (CI and viscosity) increases due to a thicker interfacial film. A protein concentration of 0.1% was shown to be below the minimum surface saturation concentration. A protein concentration of 0.1% was shown to be below the minimum surface saturation concentration, causing almost instantaneous phase separation in the Ultra-Turrax treatment (CI at 0 min: 83.67–90.33%), while a concentration of 0.5% was the critical threshold at which phase separation was relatively more stable (initial CI: 1.98–3.92%). The most stable condition was at a concentration of 0.9% (initial CI: 0–2.03%). The uniformly high AP% (94–99%) in all treatments attests to the high affinity of the globulin fractions (vicilin 7S) to the oil-water interface. The combination of Ultra-Turrax 4 minutes + HPH with a protein concentration of 0.9% was the optimal treatment with an EAI of 170.02 ± 3.56 m^2/g, CI after 2 days of 45.32%, and viscosity of 7.95 ± 0.12 mPa·s, confirming the competitive potential of sword bean protein as a vegetable emulsifier.

Keywords: plant-based emulsifier, oil-in-water emulsion, jack bean, protein concentration, homogenization method