

**OPTIMASI PEMBENTUKAN KONJUGAT ELEKTROSTATIK-
MAILLARD DARI KONSENTRAT PROTEIN BLONDO-PEKTIN
DALAM SISTEM EMULSI: PENGARUH RASIO, SUHU DAN pH**

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INTISARI

Interaksi elektrostatik atau reaksi Maillard umumnya digunakan dalam konjugat protein-polisakarida. Kelemahan interaksi elektrostatik yaitu sensitif terhadap perubahan pH karena kompleks hanya terbentuk di sekitar titik isoelektrik protein. Reaksi Maillard harus dikendalikan di tahap awal karena pada pemanasan lanjutan terbentuk senyawa melanoidin dan produk turunan glikasi yang tidak diinginkan. Dalam penelitian ini, konjugat dari protein blondo dan pektin dengan kombinasi elektrostatik-maillard digunakan untuk menstabilkan emulsi minyak dalam air. Tujuan penelitian ini yaitu untuk menentukan kondisi optimum dan karakteristik konjugat blondo-pektin optimum dengan kombinasi elektrostatik-maillard.

Konjugat dibuat dengan mencampurkan larutan konsentrat blondo dengan pektin dan mengeringkannya dalam *cabinet dryer*. Tahap *screening* menggunakan Rancangan Acak Lengkap (RAL) non-faktorial, dilanjutkan optimasi memakai *Response Surface Methodology* (RSM) *Box-Behnken Design* (BBD) dengan 3 faktor yaitu rasio blondo-pektin (1:3, 1:2, 1:1, 2:1, 3:1), suhu pemanasan (50, 60, 70, 80, 90 °C) dan pH (3; 3,5; 4; 4,5; 5). Indeks Stabilitas Emulsi (ISE) menjadi respon utama dan Indeks Aktivitas Emulsi (IAE) sebagai respon pendukung.

Kondisi optimum konjugat blondo-pektin yaitu pada rasio blondo-pektin 1:1,93 (w/w), suhu pemanasan 79,66 °C dan pH 4,09. Karakteristik konjugat optimum memiliki ISE 165,26 menit, IAE 72,31 m²/g, ukuran droplet 553,4 nm dan zeta potensial -45,5 mV. Droplet emulsi seragam dan terdispersi merata, namun terjadi flokulasi setelah pemanasan suhu 80 °C selama 30 menit. Sedangkan kompleks kontrol yang dikeringkan dengan *freeze dryer* memiliki nilai ISE 159,54 menit, IAE 80,83 m²/g, ukuran droplet 569,8 nm, dan zeta potensial -46,5 mV. Droplet emulsinya mengalami flokulasi, ukurannya beragam, tidak terdispersi merata, dan setelah perlakuan panas semakin banyak droplet terflokulasi dan *coalescence*.

Kata kunci: konjugat blondo-pektin, interaksi elektrostatik-maillard, emulsi minyak dalam air, optimasi *Box-Behnken Design*

**OPTIMIZATION OF ELECTROSTATIC-MAILLARD CONJUGATE
FORMATION FROM COCONUT PROTEIN CONCENTRATE (CPC)-
PECTIN IN OIL-IN-WATER EMULSION: EFFECTS OF RATIO,
TEMPERATURE, AND pH**

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ABSTRACT

Electrostatic interactions or Maillard reactions are commonly used in polysaccharide-protein conjugates. Electrostatic interactions have the disadvantage of being sensitive to pH variations since complexes can only form around the protein's isoelectric point. Meanwhile, the Maillard reaction must be kept under control until the earliest stages, because continued heating, unwanted melanoidins and glycation derivatives can be formed. In this study, conjugates of coconut protein concentrate (CPC) and pectin with an electrostatic-maillard combination were used to stabilize oil-in-water emulsions. The objective of this study was to find the optimum conditions and optimum characteristics of the CPC-pectin conjugate with the electrostatic-maillard combination.

The conjugate was prepared by mixing CPC and pectin solution and dried it in a cabinet dryer. Screening stage used a non-factorial completely randomized design, then optimization used Response Surface Methodology (RSM) Box-Behnken Design (BBD) with three factors: CPC-pectin ratio (1:3, 1:2, 1:1, 2:1, 3:1), heating temperature (50, 60, 70, 80, 90 °C), and pH (3; 3,5; 4; 4,5; 5). At this point, the Emulsion Stability Index (ESI) was the primary response, while the Emulsion Activity Index (EAI) was the secondary response.

At CPC-pectin ratio 1:1,93 (w/w), heating temperature 79,66 °C, and pH 4,09, the optimum CPC-pectin conjugate was found. The optimum conjugate characteristics had ISE of 165,26 min; IAE of 72,31 m²/g; the droplet size was 553,4 nm with zeta potential of -45,5 mV. The emulsion droplets were uniform in size and equally dispersed, yet they slightly flocculated after heat treatment 80 °C for 30 min. The control complex which was dried with freeze dryer, had following characteristics: ISE 159,54 min, IAE 80,83 m²/g, droplet size 569,8 nm, and zeta potential -46,5 mV. The droplets were flocculated, varied in size, and were not evenly distributed. After heat treatment, ever more droplets flocculated and coalesced.

Keywords: Blondo-Pectin Conjugate; Electrostatic-Maillard Reaction, Oil-in-Water Emulsion, Box-Behnken Design Optimization