OPTIMASI PEMBUATAN NANOEMULSI GIBERELIN-KITOSAN BERBANTUAN GELOMBANG MIKRO MENGGUNAKAN METODE PERMUKAAN RESPON

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INTISARI

Metode permukaan respon dilakukan untuk optimasi pembuatan nanoemulsi giberelin-kitosan dengan berbantuan gelombang mikro. Penelitian ini bertujuan untuk mengetahui pembuatan kitosan sebagai *wall material* yang digunakan untuk *slow released system* sediaan nanoemulsi. Sistem pelepasan lambat berfungsi untuk mengatur penggunaan giberelin agar lebih efektif saat diaplikasikan pada tumbuhan. Giberelin dan kitosan dikembangkan dalam bentuk nanoemulsi ganda air dalam minyak dalam air. Karakteristik dan kestabilan dari sediaan nanoemulsi yang telah terbentuk diindikasikan berdasarkan sifat fisik berupa homogen, jernih, dan tidak terjadi pemisahan fasa.

Nanoemulsi dilakukan pengukuran viskositas sebagai parameter respon. Penentuan kondisi respon optimum dilakukan menggunakan *software Design Expert-13* melalui pendekatan metode permukaan respon (RSM*)* menggunakan *Central Composite Design* (CCD). Desain eksperimen RSM dilakukan dengan variabel bebas seperti daya (Watt), waktu (detik), dan volume surfaktan (mL). Setelah diperoleh sediaan nanoemulsi pada kondisi optimum kemudian dilakukan uji ukuran droplet dan nilai indeks polidispersitas menggunakan *Particle Size Analyzer* (PSA).

Hasil penelitian menggunakan metode permukaan respon diperoleh formula nanoemulsi giberelin-kitosan pada kondisi optimum. Formula nanoemulsi giberelin-kitosan dilakukan dengan perlakuan gelombang mikro pada daya radiasi sebesar 181,31 Watt, waktu radiasi sebesar 139,80 detik, volume surfaktan sebesar 5,33 mL, dan nilai viskositas sebesar 10,78 cP. Berdasarkan uji *Partikel Size Analyzer* (PSA), nanoemulsi giberelin-kitosan diperoleh ukuran droplet sebesar 17,9 nm dan indeks polidispersitas sebesar 0,293.

Kata kunci : formula, gelombang mikro, kitosan, nanoemulsi, viskositas.

OPTIMIZATION OF GIBBERELLIN-CHITOSAN NANOEMULSION PREPARATION ASSISTED BY MICROWAVE USING RESPONSE SURFACE METHODOLOGY

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ABSTRACT

Response surface methodology was employed to optimize the preparation of gibberellin-chitosan nanoemulsion assisted by microwave irradiation. This study aimed to investigate the preparation of chitosan as a wall material used for a slow-release system in nanoemulsion formulations. The slow-release system functions to regulate the use of gibberellin to make it more effective when applied to plants. Gibberellin and chitosan were developed in the form of a double nanoemulsion (water-in-oil-in-water). The characteristics and stability of the resulting nanoemulsion formulation were indicated by physical properties such as being homogeneous, clear, and not exhibiting phase separation.

Viscosity measurement was performed on the nanoemulsion as a response parameter. The determination of optimal response conditions was carried out using Design Expert-13 software through the Response Surface Methodology (RSM) approach, employing a Central Composite Design (CCD). The RSM experimental design included independent variables such as power (Watt), time (seconds), and surfactant volume (mL). Once the nanoemulsion formulation under optimal conditions was obtained, droplet size and polydispersity index were tested using a Particle Size Analyzer (PSA).

The results of the study using the response surface methodology yielded an optimized formula for the gibberellin-chitosan nanoemulsion. The formulation was treated with microwave irradiation at a power of 181.31 Watts, radiation time of 139.80 seconds, surfactant volume of 5.33 mL, and a viscosity value of 10.78 cP. Based on the Particle Size Analyzer (PSA) test, the gibberellin-chitosan nanoemulsion had a droplet size of 17.9 nm and a polydispersity index of 0.293.

Keywords: formula, microwave, chitosan, nanoemulsion, viscosity.