

## **OPTIMASI KONDISI PROSES PEMBUATAN NANOEMULSI MINYAK SERAI WANGI MENGGUNAKAN METODE TAGUCHI SEBAGAI ANTIJAMUR**

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### **INTISARI**

Optimasi kondisi proses pembuatan nanoemulsi minyak serai wangi menggunakan metode Taguchi sebagai antijamur telah dilakukan. Formulasi nanoemulsi minyak serai wangi dibuat menggunakan metode Energi Rendah Emulsifikasi Spontan. Campuran rasio komposisi minyak: Tween 80: PEG 400: akuades (v/v) yang digunakan sebesar (2,5:20:2,5:75)%; (5:17,5:2,5:75)%; dan (7,5:15:2,5:75)%. Formulasi nanoemulsi didesain dengan menerapkan metode statistik Taguchi menggunakan *software* Minitab 19. Nanoemulsi yang dihasilkan diuji stabilitas dan karakteristiknya, yaitu berupa pengamatan organoleptis, uji stabilitas termal pada suhu  $4\pm 2$  °C,  $25\pm 2$  °C dan  $40\pm 2$  °C, *freeze-thaw*, uji stabilitas mekanik menggunakan sentrifugasi 3800 rpm selama 30 menit, turbiditas, indeks polidispersitas (PdI), dan ukuran partikel. Pengujian antijamur dilakukan dengan mengaplikasikan nanoemulsi di skala laboratorium pada jamur *Aspergillus fumigatus* dan pada biakan alami dengan menyemprotkan secara langsung nanoemulsi pada *lichen* di batuan lepas Candi Borobudur.

Nanoemulsi minyak serai wangi berhasil diperoleh dengan ukuran tetesan 13,40-28,97 nm. Rasio SNES dan laju pengadukan berpengaruh terhadap nanoemulsi yang dihasilkan, sedangkan waktu pengadukan kurang berpengaruh secara signifikan. Berdasarkan metode statistik Taguchi, diperoleh kondisi optimum pembuatan nanoemulsi yang menghasilkan komposisi terbaik berupa ukuran tetesan terkecil (13,11 nm dengan nilai PdI 0,337) yaitu pada kondisi rasio SNES 1:8:1, waktu 5 menit dan kecepatan pengadukan sebesar 2800 rpm. Formula nanoemulsi berhasil menghambat pertumbuhan jamur *Aspergillus fumigatus* seiring dengan peningkatan konsentrasi minyak serai wangi yang digunakan. Penggunaan nanoemulsi dengan konsentrasi minyak serai wangi minimum 2,5% telah efektif dalam membunuh *lichen* dan menghambat pertumbuhan *lichen* baru.

Kata kunci: *Aspergillus fumigatus*, *lichen*, nanoemulsi, serai wangi, Taguchi

## OPTIMIZATION OF PROCESS CONDITIONS FOR MAKING LEMONGRASS ESSENTIAL OIL NANOEMULSION USING TAGUCHI METHOD AS AN ANTIFUNGAL

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### ABSTRACT

The optimization of process conditions for making lemongrass essential oil nanoemulsion using Taguchi method as an antifungal has been carried out. The formulation of nanoemulsion was made by using Spontaneous Emulsification of Low Energy method. The composition ratio mixture of oil: Tween 80: PEG 400: aquadest (v/v) used is (2.5:20:2.5:75)%; (5:17.5:2.5:75)%; and (7.5:15:2.5:75)%. The nanoemulsion formula was designed by applying Taguchi statistical method using Minitab 19 software. The nanoemulsion was analyzed for stability and its characteristic, namely in organoleptic observation, pH, thermal stability test at temperatures of  $4\pm 2$  °C,  $25\pm 2$  °C and  $40\pm 2$  °C, freeze-thaw cycle, mechanical stability test using 3800 rpm centrifugation for 30 minutes, turbidity, polydispersity index (PdI), and particle size test. The antifungal test was carried out by applying nanoemulsions at a laboratory scale to *Aspergillus fumigatus* and in natural cultures by spraying nanoemulsions directly at lichen in the Borobudur Temple rocks off.

Nanoemulsion was successfully obtained with droplet sizes of 13.40-28.97 nm. The SNES ratio and the stirring rate had an effect on the resulting nanoemulsion, while the stirring time had a less significant effect. Based on the Taguchi statistical method, the optimum conditions for making nanoemulsions were obtained which resulted in the best composition in a form of the smallest droplet size (13.11 nm with a PdI value of 0.337), namely at the SNES ratio 1:8:1, time of 5 minutes, and the stirring speed of 2800 rpm. This formulation of nanoemulsion resulted in minimum inhibitory concentration against *Aspergillus fumigatus* improvement as an estimate of the lemongrass essential oil. The use of nanoemulsion with a minimum concentration of lemongrass essential oil 2.5% has been effective in killing lichen and inhibiting the growth of new lichen.

Keywords: *Aspergillus fumigatus*, lemongrass, lichen, nanoemulsion, Taguchi