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Optimasi proses nanoenkapsulasi ekstrak minyak cengkeh dengan misel kasein dan uji toksisitas untuk sediaan pestisida nabati = Optimization of nanoencapsulation process of clove oil extract using casein micelle and cytotoxicity assay as plant based pesticide

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Abstrak

[ABSTRAK
Pestisida nabati berbasis minyak atsiri (essential oils) dapat dijadikan alternatif sebagai protektan tanaman terhadap serangan hama. Senyawa eugenol dalam minyak atsiri cengkeh menunjukkan beberapa aktivitas sebagai insektisida, anti jamur dan anti bakteri, namun bersifat sensitif terhadap degradasi oleh cahaya, panas, oksigen dan masa simpan yang pendek jika disimpan dalam kondisi tidak tepat. Enkapsulasi senyawa eugenol dirasa sangat penting untuk melindungi senyawa yang sensitif dari degradasi, menutupi sifat yang tidak diinginkan dari suatu senyawa, mengurangi kerugian akibat penguapan, mencegah terjadinya ikatan atau interaksi dengan komponen matriks lainnya dan memfasilitasi pelepasan yang terkontrol pada kondisi yang diiinginkan sehingga sesuai untuk dijadikan formula pestisida nabati. Proses optimasi nano enkapsulasi minyak cengkeh menggunakan Response Surface Methodology (RSM). Central Composite Design (CCD) digunakan untuk mempelajari pengaruh konsentrasi cengkeh, buffer fosfat dan kalsium klorida terhadap loading capacity dan efisiensi enkapsulasi produk nano-cengkeh. Persamaan kuadratik terhadap respon loading capacity didapatkan Y= 60,46+ 7,06A + 6,81B - 0,088 C ?2,26AB + 1,75AC + 2,49BC ? 4,99A2 ? 2,39B2 -2,36C2 , dan terhadap respon efisiensi enkapsulasi Y= 57,65 - 20,67A ? 1,13B + 10,68 C ?5,32AB + 13,59AC + 0,65BC ? 1,00A2 + 11,85B2 -0,50C2. Optimasi variabel bebas untuk mendapatkan kondisi optimal respon loading capacity dan efisiensi enkapsulasi berturut-turut sebesar 64,67% dan 79,64% dengan volume cengkeh , fosfat dan kalsium masing-masing sebesar 9,82 ; 75 dan 18 ml. Diameter rata-rata nanocengkeh terbaik yang didapatkan 179,83 nm. Dari uji sitotoksisitas dengan Brine Shrimp Lethality Test (BSLT) didapatkan data LC50 minyak cengkeh tanpa enkapsulasi sebesar 7,35 ppm (konsentrasi eugenol 4,445 μg/ml) sedangkan sediaan nanocengkeh sebesar 11,50 ppm (konsentrasi eugenol 0,264 μg/ml) menunjukkan secara statistik efek enkapsulasi berbeda sangat signifikan terhadap kematian larva Artemia salina Sp. dibandingkan tanpa enkapsulasi dengan tingkat kepercayaan 95%.
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ABSTRACT
Essential oils based pesticides can be used as an alternative as crop protectant against pests. Eugenol in clove essential oil showed some activity as insecticides, anti-fungal and antibacterial but it is sensitive to degradation by light, heat, oxygen and short shelf life when stored in improper conditions. Encapsulation of eugenol was considered very important to protect sensitive compound from degradation, covering undesirable properties, reducing

losses due to evaporation, prevent bonding or interaction with other matrix components, and facilitate the controlled release conditions, so meet the requirement of a plant based pesticides. Optimization process of nano encapsulation of clove oil extract using Response Surface Methodology (RSM). Central Composite Design (CCD) employed to study the effect concentration of clove oil, phospat buffer and calcium chloride on the loading capacity and encapsulation efficiency of nano-clove product. Quadratic equation of the loading capacity response was obtained Y= 60,46+ 7,06A + 6,81B - 0,088 C ?2,26AB + 1,75AC + 2,49BC ? 4,99A2 ? 2,39B2 -2,36C2, dan encapsulation efficiency response was obtained Y= 57,65 - 20,67A ? 1,13B + 10,68 C ?5,32AB + 13,59AC + 0,65BC ? 1,00A2 + 11,85B2 -0,50C2. Optimization of independent variables to obtain optimum conditions loading capacity and encapsulation efficiency response respectively for 64.67% and 79.64% by volume clove oil, phospat buffer and calcium chloride respectively 9.82; 75 and 18 ml. The average diameter of the obtained nano-clove was 179.83 nm. The cytotoxicity assay using Brine Shrimp Lethality Test (BSLT) LC50 data obtained, clove oil without encapsulation was 7.35 ppm (eugenol concentration 4.445 μg/ml), while preparations nano-clove was 11.50 ppm (eugenol concentration 0.264 μg/ml) showed that a statistically encapsulation effects different very significantly on mortality of larvae Artemia salina Sp. compared without encapsulation with a confidence level of 95%., Essential oils based pesticides can be used as an alternative as crop protectant against pests.

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