UNIVERSITI TEKNOLOGI MARA

CHARACTERISATION AND CONTROL RELEASE OF ENCAPSULATED CITRONELLA OIL BY COMPLEX COACERVATION IN SIMULATED CLEAN FLOOR SOLUTION

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Citronella oil is one of the essential oils that are recently known for its applicability in food and pharmaceutical industry. The main problems of essential oil are most of the component likely unstable and also very volatile. Microencapsulation is a method whereby one material or a mixture of the materials is coated by another material. This method is designed for protection, isolation and assist in storage. In the present study, the gelatine-chitosan microcapsules were prepared by complex coacervation. In this study, encapsulated citronella oil was placed in simulated floor cleaner stimulated (Tween 80 solution). The morphology of the microcapsules, mean particle size of microcapsules, thermal stability, release rate behaviour, and release mechanism of the microcapsules were investigated. On the optical microscope, the microcapsules were spherical in shape and of irregular size. This microcapsule is confirmed by analysis of IR spectra of release of citronella oil in simulated clean floor solution. The mean particle size of the volume for these microcapsules is 328.43 µm, which is within the acceptable range of particle size (1-500 µm) for the complex coacervation ranging between 1–500 µm. The span value is 1.5 indicating that the particle distribution is narrow and the lower value of span the better distribution of particle by the volumes. Analysis of thermogram for microencapsulation and citronella oil show that thermal decomposition of microcapsule is slightly high (32^{o}C-333^{o}C) compare to citronella oil (44^{o}C-168^{o}C). Release rate of the microcapsules (closed container) at different stirring rate at the beginning is slowly at 12 hours and begin burst and rapidly after 48 hours. When stirring increase from 300 rpm to 700 rpm the release rate increase to 80% in two weeks. Release rates of the microcapsules (closed container) at different temperature begin with a high rate in the first five days had become slow and stable after ten days. The microcapsules release rates were at 42%, 62% and 68% at 25°C, 50°C, and 75°C, respectively after 30 days. Release of microcapsule (open container) also indicates that release rate begins faster from the first hour at 20 % and after 96 hours the release rate achieved at 100%. Release properties of the yield percent of the microcapsules were considered at a range between 20% to 50% when gelatine was used as polymer. The average loading capacity and encapsulation efficiency is 60.10 % and 79.70% respectively. The release mechanism of the CO, based on Fick's law was classified as following the Korsmeyer-Peppas controlled release model of super case II, whereby the release is due to wall erosion. From the analysis of GCMS, the identification of the acetyl eugenol was present at retention time of 16.758 minutes and had an overall of 0.277% from the citronella oil. As conclusion the encapsulation of citronella oil by complex coacervation with gelatine and chitosan as core materials will improve the quality of the microcapsules. Release rates of the microcapsules at different conditions also indicate that the released rates were influenced by the stirring rate, temperature, and closed or open condition. Antibacterial agent in citronella oil such as eugenol was confirmed present by using both spectra analysis of FTIR and GCSM.

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