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Microencapsulation of orange peel oil and its qualitative antibacterial properties

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Essential oils (ESO) are natural compounds which demonstrate antibacterial properties that are beneficial for various industries. However, volatility and easy degradability limit their applications in the development of many products. For this purpose, a microencapsulation process, in which the active ESO as a core material is enveloped using a coat to give a small microcapsule, has been introduced. In pharmaceutical industry, target specificity, control releasing ability or the sustained release of drugs and easy administration can be achieved by microencapsulation techniques. Antibacterial activities are bacteriostatic or bactericidal. As far as ESO are concerned, the orange peel oil (OPO) is known to possess better antibacterial properties. In this study, coacervation phase separation technique was used to prepare microcapsules with OPO, under simple coacervation and complex coacervation. The microcapsules obtained from simple coacervation method were very small and difficult to recognize under optical microscope. Therefore, the most suitable method of preparing OPO microcapsules was the complex coacervation method based on the strength of optical microscopic images. Antibacterial activity of OPO and microcapsules loaded with OPO obtained from complex coacervation method were then tested with well diffusion assay against Gram-positive *Staphylococcus aureus* and gram-negative *Pseudomonas aeruginosa*. The presence of significant inhibition zones in agar plates against both bacteria indicated the antibacterial activity of OPO and developed OPO loaded microcapsules qualitatively. Furthermore, the antibacterial test results confirmed the encapsulation of OPO in the microcapsules. X-ray diffraction analysis confirmed that the used wall materials and prepared microcapsules are amorphous in nature. The delineated peak at 1645 cm^{-1} in the Fourier transform infrared spectrum of crushed microcapsules depicted complicated evidence for encapsulation of OPO or symmetrical stretching vibration of gum Arabic carboxylate groups.

Key Words: Antibacterial properties, coacervation, essential oils, microencapsulation, orange peel oil

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