**UNIVERSITI TEKNOLOGI MARA**

# CHARACTERIZATION AND SOLUBILITY STUDIES ON MICROENCAPSULATION OF *CLINACHANTUS NUTANS* (BELALAI GAJAH) BY FREEZE DRYING TECHNIQUE WITH SAGO STARCH AND GUM ARABIC AS WALL MATERIAL

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**MSc**

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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

*C.nutans* also known as Belalai Gajah have distributed widely in tropical Asia and have recognized as famous folklore medicinal properties. The poor aqueous solubility is a challenging property in the pharmaceutical industry. There is no scientific report regarding the solubilization of *C.nutans* extracted oil encapsulated with sago starch and gum arabic as wall material. Moreover, sole encapsulating agent as reported by other researchers do not provided unique features such as high solubility, low viscosity and good emulsifying agent. This study aims to characterize and determine the solubility of essential oil from *C.nutans* leaves encapsulated with sago starch and gum arabic. Encapsulating agent in encapsulation process of *C.nutans* oil using freeze drying method. While, the *C.nutans* oil was extracted using Soxhlet extraction method with ethanol as a solvent. The solubility parameter was determined using calculation of residual percentage of microparticle after and before drying process. Respectively, the encapsulation process is based on three different core-to-coating ratios that are SE1 (300 mg essential oil: 300 mg sago starch), SE2 (100 mg essential oil: 300 mg sago starch) and SE3 (60 mg essential oil: 300 mg sago starch). The finding indicates that the phenolic content was decreased from SE3 to SE2 and SE1 at 2.81 ± 0.18 mg of gallic acid equivalent (GAE/g) of the extract to 2.48 ± 0.10 mg of GAE/g of extract and 2.32 ± 0.29 mg of GAE/g of extract respectively. The highest encapsulation productivity was obtained at 61.49% for SE3. Based on the thermal profile, the endothermic transition was increased from SE1 to SE3 with the value of 67.8 °C, 72.6 ºC, and 77.3 °C. For particle size analysis, as the core to coating ratio changed from SE3 to SE1, the Sauter mean diameter (D42) values increased from 211.160 µm to 221.244 µm and 229.025 µm, respectively. The effect of gum arabic (G) to sago starch (S) ratio was evaluated at GSE1 (200 mg gum arabic: 100 mg sago starch), GSE2 (100 mg gum arabic: 200 mg sago starch), GSE3 (160 mg gum arabic: 140 mg sago starch), and GSE4 (140 mg gum arabic: 160 mg sago starch). The finding show that GSE1 gave the higher phenolic content at 3.76 ± 0.10 mg of GAE/g of extract than the control sample (sago starch), SE3 (2.81 ± 0.18 mg of GAE/g of extract). For particle size, the sample with gelatinized sago starch, SE3 has a bigger size (211.160 µm) than the combination of gum arabic and sago starch, GSE1 (53.736 µm). SE3 also shown the lower endothermic temperature, 77.3 ºC, than to the combination of wall material between sago starch and arabic. For the morphology analysis, when proportion of starch higher than gum arabic, the powder's surface was rougher, more dented surface, and 'shrinkage.' The higher (%w/w) gum arabic provides high emulsifying properties. For solubility studies, the combination of wall material gave the highest solubility (87.9%) as compared with single-wall material, SE3 (60.8 %). The research indicate that the combination of wall material between sago starch and gum arabic gave higher encapsulation efficiency, higher total phenolic content, increases endothermic transition, gave better protection and retention of *C.nutans* oils, smoother surface of microparticles and also increases solubility performance.

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