UNIVERSITI TEKNOLOGI MARA

SOLUBILITY OF *GARCINIA MANGOSTANA* OIL IN SUPERCRITICAL CARBON DIOXIDE

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of the requirements for the degree of
Master of Science

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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 result 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 other 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

Natural antioxidant as medical treatment nowadays has gained great attention in substituting the use of synthetic drugs. Mangosteen peel was proven containing abundant of potential compounds which were believed to exhibit antimicrobial, antibacterial and anticancer activity for cancer disease treatment. Conventional extraction method i.e. solvent extraction was used for years in extracting natural compounds. The method however contributed to the enormous increment of hazardous organic solvents emissions and caused generation of aqueous waste streams to the environment. Therefore, an alternative cleaner, safer and sustainable process that does not require the use of dangerous solvents is necessary. In this study, an environmental friendly solvent Carbon Dioxide (CO_2) under supercritical conditions has been chosen to extract the interest compounds from mangosteen peel. The extraction was conducted at constant flowrate of 24 mL/min within 40 minutes by varying temperature and pressure from 50 to 80 °C and from 34.5 to 55.1 MPa, respectively. The extracts obtained were identified using Gas Chromatography Mass Spectrometer (GCMS) to determine the oil compositions. The highest extraction yield of 1.85% (g oil/g sample) with 0.12 of Average Absolute Deviation (AAD) and highest solubility of mangosteen peel oil (0.575 mg oil/g CO_2) in Supercritical Carbon Dioxide (SC-CO_2) was obtained at temperature of 80 °C and pressure of 41.4 MPa. Experimental work for the whole range of temperature and pressure consumed more cost, time and energy. Therefore modeling of solubility data was required to obtain the relationship between the manipulated variable i.e. extraction temperature and pressure with the solubility of mangosteen peel oil in SC-CO_2. In this study, a multi-layer feed-forward back-propagation Artificial Neural Network (ANN) model was developed for the solubility prediction of mangosteen peel oil in SC-CO_2, where the input variables were temperature and pressure. An optimal ANN model consisted of one hidden layer and five neurons was obtained with minimum value of Mean Square Error (MSE) of 0.011 for 48 experimental data points used. The analysis showed that the ANN prediction model have a good agreement with the experimental data in which the value of correlation coefficient (R-value) for training, validating and testing obtained is 0.933, 0.982 and 0.927, respectively.

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