

UNIVERSITI TEKNOLOGI MARA

**EXTRACTION OF OIL FROM
HIBISCUS CANNABINUS L. SEEDS USING
SUPERCRITICAL CARBON DIOXIDE
EXTRACTION**

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ABSTRACT

Mass transfer coefficient determination is the main objectives of this study. The importance of finding the mass transfer coefficient specifically for *Hibiscus cannabinus L.* oil is for design and sizing of the extractor. Besides that, the role of mass transfer coefficient is essential to enhance the extraction rate. Other than that, the reason of choosing the *Hibiscus cannabinus L.* plant seeds as the raw material for this study is because of; currently this plant is in growing demand in Malaysia. Under the East Cost Economic Region (ECER) plan, about 10,000 hectares of land in Kelantan and Terengganu will be planted with *Hibiscus cannabinus L.* as an alternative plant for tobacco. In order to determine the mass transfer coefficient of the *Hibiscus cannabinus L.* seed oil, the oil is needed. Hence, Supercritical Carbon Dioxide (SC-CO₂) extraction is performed to obtain the oil. Current conventional method extracting *Hibiscus cannabinus L.* seed oil was by using solvent extraction. Several disadvantages of using this conventional method were the usage of organic solvent such as hexane which is toxic and hazardous to the environment and surroundings. Besides, oil that was extracted needs to undergo many processes to remove the trace of hexane and odour. In addition, separation process is needed to separate the oil and the solvent, hence increasing the cost and leading to higher energy consumption. Supercritical Carbon Dioxide (SC-CO₂) extraction method was chosen over the solvent extraction to extract oil from *Hibiscus cannabinus L.* seed because of its environmental and time consuming factor. Besides that, the oil from the *Hibiscus cannabinus L.* seeds is believed to be an excellent source of edible oil because of its high amount of polyunsaturated fatty acid (PUFA) which is essential to human growth. The oil can be used in salad and cooking oils. Since the oil contains linoleic acid, the oil can be used in the manufacture of soap and also other beauty products. In this study, SC-CO₂ extraction was used to extract oil from *Hibiscus cannabinus L.* seed at temperature ranges from 50°C to 80°C and pressure ranges from 5000 psi to 7000 psi for 40 minutes with constant CO₂ flow rate of 24 ml/min. From the experiments conducted, it was found that the highest percentage oil yield was obtained at temperature of 80 °C and pressure of 5000 psi with 8.66%. Maximum solubility of the oil in SC-CO₂ was found to be 0.047719 gm oil/ gm CO₂ at temperature of 80 °C and pressure of 5000 psi. The solubility of *Hibiscus cannabinus L.* oil in SC-CO₂ was estimated using three correlations i.e Chrastil (1982), Adachi-Lu (1983) and Del Valle-Aguilera (1988). The experimental data obtained showed a good agreements with the all three models with coefficient of correlation (R²) of all above 0.9. By using kinetic model by Andrich et al. (2001), it was found that the highest mass transfer coefficient k , of *Hibiscus cannabinus L.* was 0.0072 s⁻¹ at temperature of 80 °C and pressure of 7000 psi. Modeling of extraction curve was done using model of Sovova et al. (1994, 1996, 2005). It was found that the model has good agreement with experimental data with coefficient of correlation, R² is above 90 percent.

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