RESPONSE SURFACE OPTIMIZATION OF CURCUMA ZEDOARIA OIL YIELD BY SC-CO_2 EXTRACTION

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ABSTRACT

With the increasing of public interest in natural or herbal products, the Supercritical Fluid Extraction (SFE) of *Curcuma zedoaria* (Berg.) Rosc. (Zingiberaceae) was study. *Curcuma zedoaria* was selected to be extracted due to its great potential in pharmaceutical. SFE technique was safe and time effective in extraction process. Although SFE was viable alternative, there was major drawback on this application which was the high capital and operating cost due to requirement of extreme pressure on the process. Besides, the operating parameter in SFE also will be give different effect on the extraction yields as well as oil component properties. Therefore, it was crucial to determine the optimum parameter used in SFE. The parameters used in SFE were pressure and temperature. The optimum parameters were determined by employing the Response Surface Methodology (RSM) based on the Central Composite Design (CCD). The *Curcuma zedoaria* was extracted by SFE with the pressure and temperature range between 100 to 300 bar and 40^{o}C to 60^{o}C respectively. The extracts or oil yield was collected, weighed and analyzed by using gas chromatography mass spectrometer (GCMS) and gas chromatography flame ionization detector (GCFID). Based on the results, most of the extraction of SFE gave oil yield ranged from 0.6% to 1.8%. For the analysis, curzerene concentration was found high at SFE 11 and low at SFE 8. Hence, the optimum parameter of Supercritical Carbon Dioxide (SC-CO_2) of *Curcuma zedoaria* at best oil yield and curzerene concentration obtained was 138.65 bar and 40^{o}C. This optimum parameter gives the best predicted oil yield and curzerene concentration at 1.664 % and 3.696% respectively. In conclusion, the pressure and temperature significantly influence the oil yield as well as concentration of oil compounds.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

Curcuma zedoaria (Berg.) Rosc. (Zingiberaceae) oil can be obtained by using extraction method either conventional or novel method. For example, hydro distillation and solvent extraction are the conventional methods while Supercritical Fluid Extraction (SFE) is a novel extraction method. The oil obtained by using conventional method has been recognized as the most favorable for many decades among researchers. Conventional methods of extraction require much time for the process and also require relatively large amounts of solvent. Ouzzar et.al (2015) did an extraction of natural plant by using conventional method. He consumed almost 5 hour for the extraction and concluded that there is a solvent residue left behind in the products. In fact, the elevated temperature used in hydro distillation can degrade the quality of extracts as the temperature can cause chemical modifications to the oil component and loss of valuable volatile components.

In contrast, SFE is a safe and fast technique that has potential to gives high quality oil with solvent free products. This is because the solvent used in SFE is carbon dioxide (CO_2) and it is environmental friendly such as non-toxic, non-flammable, odorless and inert. SFE is an efficient in extraction process compared to conventional extraction method because of its high rate of extraction and the solvating power. Shih et.al (2015) did SFE of *Curcuma zedoaria* rhizome and consumed 1 and 2 hours for extraction time. He found that the extract oil is slightly higher compared to the hydro distillation. The extract oil acquired by SFE were 0.82% and 0.99% while for hydro distillation is 0.63%. This is because the highest throughput of SFE are often defined by the solubility maxima of solutes in a critical fluid (Ozkal, 2004). Solubility of solute in a supercritical fluid are depends on several factors such as solvent density, solute volatility (vapor pressure) as well as polarity. Increases in solvent density which depends on temperature and pressure makes the solubility increases.