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# Effect of particle size, extraction time and flow rate on the supercritical carbon dioxide extraction of oil yield from Citrus Microcarpa Pericarp

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**Abstract.** The purpose of this research is to determine the effect of particle size, extraction time and flow rate on the supercritical carbon dioxide extraction of oil yield from Citrus Microcarpa Pericarp using the supercritical carbon dioxide (SC-$CO_2$) method. The SC-$CO_2$ extraction was conducted at constant pressure and temperature, 30MPa and 40°C. The result indicates that 240 minutes was the optimal extraction duration for determining the flow rate. The trend and findings for extraction yield differed across all investigated factors. Results suggest that a low flow rate, 3 ml/min, 240 minutes of extraction time and specific particle size of 500-600 μm could increase the oil yield. Hence, SC-$CO_2$ extraction parameters can be adjusted to increase oil extraction from the overall extract.

## INTRODUCTION

It is generally accepted that the Citrus genus originated in Southeast Asia. One of the most common citruses uses in food processing is citrus macrocarpa. The main processing of fruits as citrus macrocarpa leads to the accumulation of waste by-products including leaves, peels, skins, rinds, and cores. Other examples of these by-products include pericarp. Due to their efficiency, affordability, and environmental friendliness, bioactive citrus leftovers have been employed as essential oil to produce innovative nutraceuticals [1]. This plant is not only consumed in the form of beverages, it is also utilized to treat medical conditions includes a fever, cough, and pharyngitis. Plus, citrus microcarpa's essential oil can be purchased to be used in products like perfumes, cosmetics, and cleaning products. Antiseptic, aromatherapeutic, and medicinal goods all use it. Reports indicated that citrus microcarpa peel essential oil contained a high concentration of limonene [2]. In addition, Phenolic acid major group which are four common hydroxycinnamic acids including caffeic, p-coumaric, ferulic and sinapic acids were discovered in citrus microcarpa peel [3]. There is a growing demand for essential oils around the world, and many researchers are focusing their efforts on developing methods that will encourage both industrial progress and environmental sustainability.

Consequently, essential oils can be extracted from plants using a wide variety of techniques, some of which include hydrodistillation [4], solvent extraction [5], steam distillation [6], microwave [7], steam explosion [8], sonication-assisted extraction [9] and supercritical fluid extraction [10]. Hydrodistillation is by far the most common and cost-effective process for extracting essential oils among all these other approaches. On the other hand, it has the potential to trigger chemical changes, including the oxidation of some components. During the process of hydroditilation, extensive hydrolysis and heat degradation can occur, both of which can lead to undesirable side effects, like the production of an unpleasant odour and the loss of important chemicals [11]. Supercritical carbon dioxide ($SCCO_2$) extraction has been widely investigated for the extraction of bioactive compound including polar