UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION OF OIL PALM DECANTER CAKE (OPDC) AND COMPARISON OF RESIDUAL CRUDE PALM OIL RECOVERY FROM OPDC USING D-LIMONENE AND N-HEXANE

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Thesis submitted in fulfilment of the requirements for the degree of Master of Science

Faculty of Chemical Engineering

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulation 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.

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ABSTRACT

Oil palm decanter cake (OPDC) is one of the abundance biomass wastes generated from oil palm industry. This research investigated the physicochemical properties of OPDC that contribute to the oil loss and the use of d-limonene as green solvent to recover the oil loss in the OPDC using conventional Soxhlet extraction and ultrasonic assisted extraction (UAE). In this study, the OPDC was characterized by having several key properties *i.e.* high moisture content, high biodegradability and rich in nutrient contents. The results also demonstrate that the OPDC exhibits amphiphilic properties, as it is both oleophilic and hydrophilic in nature *i.e.* low contact angle and has high affinity to oil and water. The contact angles were influenced by the surface area and porosity of OPDC. This characterization study has revealed the key factors that contribute to the high oil loss in the OPDC. From the microscopic observation, the majority of residual crude palm oil (RCPO) droplets were less than 50um, During typical palm oil mill processing, these small oil droplets are difficult to remove via mechanical extraction. Using solvent extraction, the residual oil content (10-16%, dry basis) in OPDC was fully recovered (100% recovery). This study also revealed the use of d-limonene for the RCPO recovery was comparable with n-hexane; in terms of solvent recovery (more than 90%), fatty acids composition, and quality of oils. Besides, the use of UAE was able to overcome the drawbacks of conventional Soxhlet extraction *i.e.* reduced the solvent consumption from 300 mL to 100 mL; gave shorter extraction time, from 8 hours to 44 minutes; and operated at lower temperature 49°C.

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