OPTIMIZATION OF THE PROCESSING PARAMETER ON MICROWAVE ASSISTED EXTRACTION CUM STERILIZATION BY USING BOX BEHKEN DESIGN

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ABSTRACT

In this study, the optimization of free fatty acid and energy efficiency of palm fruit using microwave assisted extraction was conducted. The objective of this study are to obtain optimum condition for percentage of energy efficient and percentage of free fatty acid by manipulating three process variable which are mass, time , power and effects of the variables towards both response. A set of experiments was design by using Box Behken Design was used to achieve the objectives. The experimental data then fitted to second-order polynomial and analyzed by analysis of variance (ANOVA) using design expert software. Based on ANOVA, R^2 was 0.9585 for percentage of energy efficiency and 0.9284 for percentage of free fatty acid and percentage of energy efficiency was depend on mass as compared to time and power. The three dimensional (3d) response surface plots demonstrate the effect of independent variables on two different generated response .The higher percentage of ffa and percentage of energy efficiency was depend on mass as compared to time and power. An experimental test had been conducted to compare the optimum value predicted by the software. The error for the percentage of ffa and percentage of energy efficiency were 0.0016 and 0.2618.

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Chapter 1

Introduction

1.1 Background Study

Malaysia is one of the biggest country that exported palm oil in the world. Malaysia Palm Oil Industry (MPOB) had reported that Malaysia cover 12% and 27% of total export in the world for palm oil and fats. As a key player in palm oil industry, Malaysia play important role to fulfill global demand for oil and fats. The process of palm oil production consist of few important phase in order to produce high quality of crude palm oil. Palm oil process involve of bunch reception from the plantation, bunch sterilization and threshing, digesting and pulp pressing out of crude palm oil. The crude palm oil is then purify and dry before transport to refinery.

Bunch sterilization is one of the crucial process in palm oil extraction. . Sterilization process is a process of heat treatment to protect the quality of palm oil by deactivate lipase on producing free fatty acid(FFA)(Sarah and Taib 2013) Sterilization process also help to loosening and separate palm fruit from the bunch. Fresh fruit bunches (FFB) are sterilized using steam at temperature range 140°C to 150°C for period 75-90 minute.

Conventional drying method such as hot air drying still can be categorized as preservation technique but it affects final quality of dried product in term of nutrient, color and shrinkage. Microwave radiation is a new alternative method in drying application whereby heat is provide to the whole material volume in lesser time as compared to conventional drying method. Microwave energy directly transferred to the material in contact with molecular interaction and electromagnetic field (Thostenson and Chou 1999). There are two important parameter in microwave heating whereby power absorbed (P) and depth (D).