

Modeling of free fatty acid content in the deodorization process of palm oil refinery using six sigma with response surface methodology

Abstract

The present study aims to minimize the free fatty acid (FFA) content in Refined Bleached Deodorized Palm Oil of FELDA Vegetable Oils Sdn. Bhd. and KUNAK Refinery Sdn. Bhd. (Sawit Kinabalu) by using Six Sigma with Response Surface Methodology. Process flow of the deodorizing section of the palm oil refinery have been studied. Unit operations from the process flow were identified and the parameters readings from 2011 till 2013 were tabulated. Only parameters' readings from year 2011 and 2012 were used. This data went through multiple regressions and the process parameters were narrowed down from 32 parameters to only six parameters. Then, few tests were conducted such Normality Test and so on. The R-Square value 94.65% correlated the actual and predicted value for validation data set. In the verify phase, it can be 95% confidence interval that the difference between the mean numbers is between -0.00514 and 0.00920 higher in actual value than the predicted value. To achieve 0.050% FFA, the optimal process variables were 340.1°C for boiler temperature (G760T), 64 BAR for boiler pressure (G760P), 270.1°C for heat exchanger (TE704), 68.6°C for pre-distillate fatty acid recycler (TE705), 43.1°C for hot well (TE750) and 12 BAR for steam header B (STEAMB). In this study, the equation model was developed to estimate the actual FFA content and predict the FFA content. Hence, this model can be directly used in the palm oil refinery to predict the FFA content and to optimize.