

Optimization of Cookies Formulation Using Kepok Banana Flour and Cowpea Flour through the D-Optimal Mixture Design Method

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ABSTRACT

*The optimization of Cookies formulated from kepok banana (*Musa paradisiaca* L.) flour and cowpea (*Vigna unguiculata* L.) flour was carried out using the D-Optimal Mixture Design method to determine the optimum formulation capable of producing the best product characteristics. The optimization focused on maximizing protein content, carbohydrate content, crude fiber content, and cookie texture. The experimental design was developed using Design Expert 13 software, resulting in 13 formulations based on the D-Optimal Mixture Design approach. The evaluated responses included protein content, carbohydrate content, crude fiber content, and texture. Data were analyzed using analysis of variance (ANOVA), mathematical modeling, numerical optimization based on the desirability function, and validation of the optimum formulation. The results showed that all response models were statistically significant ($p < 0,05$), with non-significant lack-of-fit values, indicating that the models were suitable for the optimization process. Cowpea flour had the greatest effect on increasing protein and crude fiber contents, whereas kepok banana flour contributed more to increasing carbohydrate content. The optimum formulation consisted of 25% kepok banana flour and 22,7% cowpea flour, with a desirability value of 0.953. The optimized formulation was predicted to produce a protein content of 11,53%, carbohydrate content of 73,89%, crude fiber content of 1,93%, and a texture value of 5,64N. The validation results showed that all responses exhibited very small prediction errors, ranging 0,10%-1,74%. Smaller error values indicate a higher level of agreement between the predicted and the actual experimental results, demonstrating that the model is capable of accurately representing the experimental conditions.*

Keywords: Cookies, kepok banana flour; cowpea flour; D-Optimal Mixture Design, formulation optimization.