

**OPTIMASI PENGARUH VARIASI PROSES PERENDAMAN TERHADAP
KADAR LOGAM NI, AS, CD DAN PB PADA SORGUM WARNA ASAL
GUNUNG KIDUL MENGGUNAKAN *RESPONSE SURFACE
METHODOLOGY* (RSM)**

Rizqa Irma Widayati
21/477390/PA/20656

INTISARI

Sorgum warna (*Sorghum bicolor L.*) sebagai komoditas sereal global berpotensi mendukung diversifikasi dan ketahanan pangan, tetapi akumulasi logam non-esensial mengancam keamanan konsumsinya. Penelitian ini bertujuan menganalisis perubahan kadar logam non-esensial nikel (Ni), arsenik (As), kadmium (Cd), dan timbal (Pb) pada tepung sorgum warna sebelum dan setelah proses perendaman dengan variasi waktu, suhu, dan kecepatan pengadukan. Selain itu, penelitian ini mengkaji kadar logam non-esensial dalam air hasil rendaman serta menentukan parameter optimal proses perendaman menggunakan *Response Surface Methodology* (RSM) untuk memaksimalkan pelepasan logam.

Penelitian dilakukan dengan merendam sorgum warna dalam akuades dengan variasi waktu (12, 24, 36 jam), suhu (25, 35, 45 °C), dan kecepatan pengadukan (0, 250, 500 rpm). Sampel tepung sorgum dan air rendaman didestruksi dengan larutan HNO₃ 65% pada *microwave digester* dan dianalisis dengan ICP-MS. Data dianalisis menggunakan RSM metode *Box-Behnken Design* dengan 3 faktor dan 5 *center point per block* menghasilkan 17 kombinasi eksperimen. Model regresi divalidasi melalui uji *lack of fit*, *sum of square*, dan *summary statistics*.

Hasil penelitian proses perendaman secara signifikan menurunkan kadar logam non-esensial Ni (89,05%), As (65,79%), Cd (62,8%), dan Pb (63,27%). Kadar logam non-esensial dalam air rendaman sorgum warna tertinggi Ni ($42,67 \pm 0,56 \mu\text{g/kg}$) dan As ($7,83 \pm 0,08 \mu\text{g/kg}$) pada kondisi 36 jam, 25 °C, dan 250 rpm serta untuk Cd ($1,21 \pm 0,07 \mu\text{g/kg}$) dan Pb ($53,49 \pm 0,16 \mu\text{g/kg}$) pada kondisi 24 jam, 35 °C, dan 250 rpm. Metode RSM berhasil mengoptimalkan proses perendaman pada kondisi waktu 28,50 jam, suhu 30,39 °C, dan kecepatan pengadukan 152,04 rpm untuk memaksimalkan pelepasan logam non-esensial dari sorgum warna ke air rendaman sehingga meningkatkan keamanan pangan.

Kata kunci: *box-behnken design*, logam non-esensial, *response surface methodology* (RSM), sorgum warna

OPTIMIZATION THE EFFECT OF SOAKING PROCESS VARIATION ON THE METAL CONTENTS OF NI, AS, CD, AND PB IN COLORED SORGHUM FROM GUNUNG KIDUL USING RESPONSE SURFACE METHODOLOGY (RSM)

Rizqa Irma Widayati
21/477390/PA/20656

ABSTRACT

Color sorghum (*Sorghum bicolor L.*), as a global cereal commodity has the potential to support food diversification and security, but the accumulation of non-essential metals threatens its consumption safety. This study aims to analyze changes in the levels of non-essential metals nickel (Ni), arsenic (As), cadmium (Cd), and lead (Pb) in colored sorghum flour before and after the soaking process with variations in time, temperature, and stirring speed. In addition, this study examines the levels of non-essential metals in the soaking water and determines the optimal parameters of the soaking process using Response Surface Methodology (RSM) to maximize metal release.

The experiment involved soaking colored sorghum grains in distilled water with variations in soaking time (12, 24, 36 hours), temperature (25, 35, 45 °C), and stirring speed (0, 250, 500 rpm). Sorghum flour and soaking water samples were digested with 65% HNO₃ solution in a microwave digester and analyzed by ICP-MS. Data were analyzed using the RSM Box-Behnken Design method with 3 factors and 5 center points per block, resulting in 17 experimental combinations. The regression model was validated through lack of fit tests, sum of squares, and summary statistics.

The results of the soaking process significantly reduced the levels of non-essential metals Ni (89.05%), As (65.79%), Cd (62.8%), and Pb (63.27%). The highest levels of non-essential metals in the soaked water of colored sorghum were Ni ($42.67 \pm 0.56 \mu\text{g/kg}$) and As ($7.83 \pm 0.08 \mu\text{g/kg}$) under conditions of 36 hours, 25 °C, and 250 rpm, for Cd ($1.21 \pm 0.07 \mu\text{g/kg}$) and Pb ($53.49 \pm 0.16 \mu\text{g/kg}$) under conditions of 24 hours, 35 °C, and 250 rpm. The RSM method successfully optimized the soaking process at 28.50 hours, 30.39 °C, and a stirring speed of 152.04 rpm to maximize the release of non-essential metals from colored sorghum into the soaking water, thereby enhancing food safety.

Keywords: box-behnken design, colored sorghum, non-essential metals, response surface methodology (RSM)