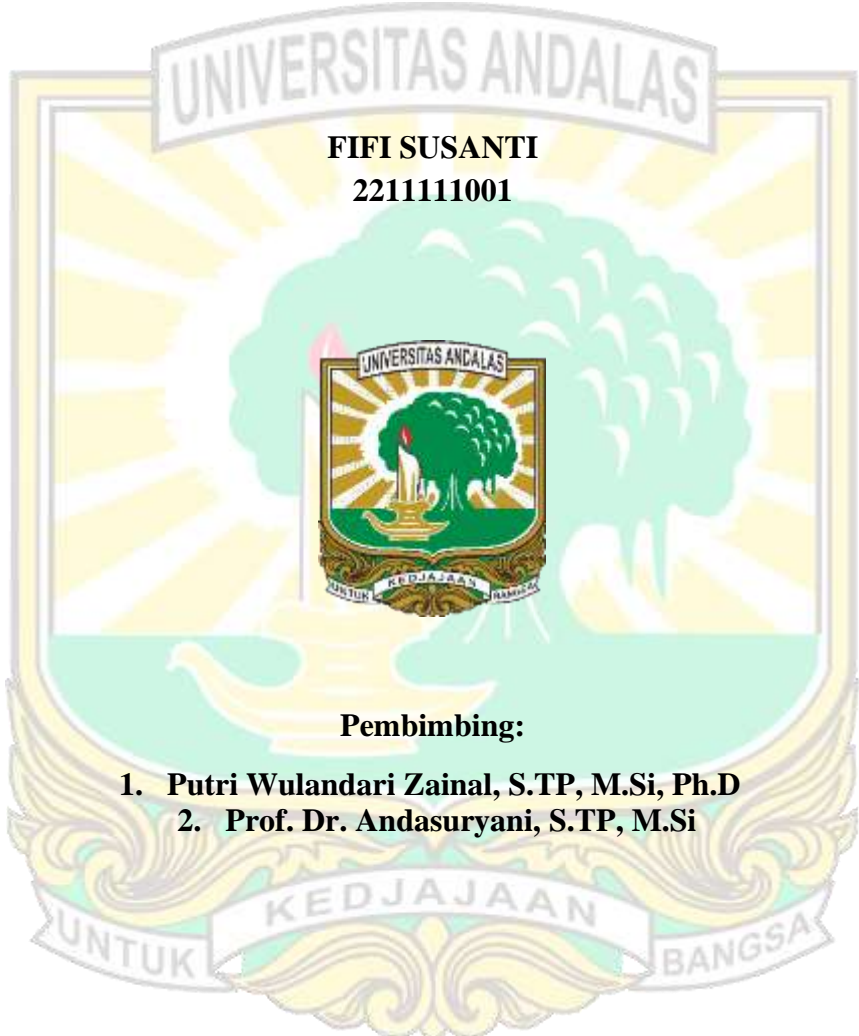


**IDENTIFIKASI KARAKTERISTIK *METABOLITE*
PROFILE BIJI KOPI ARABIKA (*Coffea arabica* L.)
BERDASARKAN VARIASI METODE
FERMENTASI DAN *ROASTING***



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ABSTRAK

Kopi arabika (*Coffea arabica* L.) merupakan komoditas unggulan yang kualitasnya dipengaruhi oleh proses pascapanen, khususnya fermentasi dan *roasting*. Tujuan dari penelitian ini adalah menganalisis karakteristik *metabolite profile* biji kopi arabika berdasarkan kombinasi variasi metode fermentasi dan *roasting*. Metode fermentasi yang digunakan terdiri dari tiga jenis (natural, *honey* dan *fully washed*) dan dua tingkat *roasting* (*light roast* dan *medium to dark roast*). Proses *roasting* dilakukan pada rentang suhu 190 °C –200 °C dengan penentuan tingkat *roasting* berdasarkan fase *first crack*. Metode penelitian yang digunakan adalah eksperimen dengan analisis data secara deskriptif dan pendekatan multivariat menggunakan *Principal Component Analysis* (PCA) dan *heatmap*. Hasil penelitian menunjukkan bahwa kombinasi metode fermentasi dan *roasting* berperan dalam membentuk karakteristik *metabolite profile* biji kopi arabika yang ditunjukkan oleh perbedaan yang signifikan pada protein. *Principal Component Analysis* (PCA) pada PC1 mampu menjelaskan sebesar 55,6% keragaman data dan PC2 menjelaskan sebesar 29,7%, sehingga secara keseluruhan kedua komponen tersebut mampu menjelaskan 85,3% keragaman data. Hasil PCA juga menunjukkan pola pengelompokan sampel kopi berdasarkan perlakuan fermentasi dan *roasting*. Visualisasi *heatmap* memperlihatkan hubungan antar parameter metabolit, dimana aktivitas antioksidan berkorelasi dengan kandungan polifenol, serta kafein berkaitan dengan protein. Dengan demikian,

kombinasi metode fermentasi dan *roasting* berperan dalam membentuk karakteristik kimia biji kopi arabika.

Kata Kunci : Kopi Arabika, Fermentasi, *Roasting*, *Metabolite Profile*, PCA, *Heatmap*



IDENTIFICATION OF THE METABOLITE PROFILE CHARACTERISTICS OF ARABICA COFFEE BEANS (*Coffea arabica* L.) BASED ON VARIATIONS IN FERMENTATION METHODS AND ROASTING

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ABSTRACT

Arabica coffee (*Coffea arabica* L.) is a leading commodity whose quality is influenced by post-harvest processes, particularly fermentation and roasting. This study aimed to analyze the metabolite profile characteristics of Arabica coffee beans based on the combination of fermentation methods and roasting levels. The fermentation methods used were natural, honey, and fully washed, with two roasting levels: light roast and medium to dark roast. The roasting process was carried out within a temperature range of 190°C–200°C, with roasting levels determined based on the first crack phase. The research employed an experimental method with data analysis conducted descriptively and using multivariate approaches, including Principal Component Analysis (PCA) and heatmap visualization. The results showed that the combination of fermentation methods and roasting levels influenced the metabolite profile characteristics of Arabica coffee beans, as indicated by differences in antioxidant activity, caffeine, and protein content. PCA results revealed that PC1 explained 55.6% of the data variability, while PC2 explained 29.7%, resulting in a cumulative variance of 85.3%. PCA also demonstrated clustering

patterns of coffee samples based on fermentation and roasting treatments. Heatmap visualization further illustrated the relationships among metabolite parameters, showing that antioxidant activity was correlated with polyphenol content, while caffeine was associated with protein. In conclusion, the combination of fermentation methods and roasting levels plays an important role in shaping the chemical characteristics of Arabica coffee beans.

Keywords: Arabica Coffee, Fermentation, Roasting, Metabolite Profile, PCA, Heatmap

