

**ANALISIS METABOLOMIK TIGA BELAS KACANG-KACANGAN  
(LEGUM) LOKAL MENGGUNAKAN INSTRUMEN FTIR**

**SKRIPSI**

Diajukan untuk memenuhi sebagian syarat memperoleh gelar Sarjana Sains  
Program Studi Kimia



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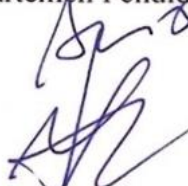
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## ABSTRAK

Kacang-kacangan (legum) merupakan salah satu bahan makanan yang banyak mengandung gizi. Penelitian ini berfokus pada analisis metabolit dari tiga belas jenis kacang (legum) lokal dengan pendekatan metabolomik. Serbuk kacang kering dicampur dengan pelet KBr dan dianalisis menggunakan FTIR. Hasil spektrum FTIR diekstrak menggunakan Excel, dilakukan normalisasi pada data bilangan gelombang, dan kemudian diolah menggunakan perangkat lunak *The Unscrambler*. Pengolahan data dilakukan dengan metode kemometrik berupa analisis data multivariat seperti *Principal Component Analysis* (PCA) untuk mendeteksi pencilan dan memperoleh profil metabolit berdasarkan identifikasi gugus fungsi pada daerah serapan  $4000-400\text{ cm}^{-1}$ , serta *Hierarchical Cluster Analysis* (HCA) untuk melihat hubungan kekerabatan dari tiga belas sampel kacang yang digunakan. Data hasil menunjukkan bilangan gelombang yang banyak terdeteksi pada sampel kacang yaitu pada daerah  $3828-3200\text{ cm}^{-1}$  (gugus OH) dan  $1074\text{ cm}^{-1}$  (C-O) yang mewakili senyawa fenolik; daerah  $1708-1525\text{ cm}^{-1}$  menunjukkan amida I dan II untuk protein; daerah  $2374-1616\text{ cm}^{-1}$  yang mewakili gugus C=O untuk ester pada lemak; daerah  $1024-1168\text{ cm}^{-1}$  (ikatan C-O-C) yang menunjukkan karbohidrat; daerah  $2382\text{ cm}^{-1}$  (P=O) yang mengindikasikan adanya senyawa asam organik; serta daerah  $1774-1514\text{ cm}^{-1}$  (C=C aromatik) yang merupakan khas dari senyawa turunan benzena. Berdasarkan PCA dari tiga belas sampel, kacang lurik dan kacang kecipir memiliki posisi yang paling memisah, sementara kacang lainnya memiliki posisi yang saling berdekatan. Pada dendrogram hasil HCA, kacang-kacang dari genus *Vigna* berdekatan dengan genus *Lablab*, dimana sebagian besar kacang *Vigna* memiliki senyawa protein sebagai pembeda, kemudian diikuti dengan genus *Phaseolus* yang mengandung senyawa turunan benzena sebagai pencirinya. Masing-masing spesies kacang yang berada dalam satu genus yang sama memiliki posisi yang berdampingan dan membentuk kluster berdasarkan nilai bilangan gelombangnya, hal ini mengindikasikan adanya kemiripan kandungan metabolit yang terkandung pada kacang-kacang tersebut.

**Kata kunci:** bilangan gelombang, FTIR, kacang-kacangan lokal, metabolomik.

## ABSTRACT

*Legumes are one of the most nutritious foods. This study focuses on the metabolite analysis of thirteen local legumes using a metabolomic approach. Dried legumes powder was mixed with KBr pellets and analyzed using FTIR. The results of the FTIR spectrum were extracted using Excel, normalized the wavenumber data, and then processed using The Unscrambler software. Data processing was carried out using chemometric methods in the form of multivariate data analysis such as Principal Component Analysis (PCA) to detect outliers and obtain metabolite profiles based on the identification of functional groups in the 4000-400  $\text{cm}^{-1}$  absorption area, and Hierarchical Cluster Analysis (HCA) to see the relationship between thirteen legume samples were used. The result data showed that the wave numbers that were detected in the legume samples were 3828-3200  $\text{cm}^{-1}$  (OH group) and 1074  $\text{cm}^{-1}$  (C-O) which represented phenolic compounds; the area 1708-1525  $\text{cm}^{-1}$  shows amides I and II for proteins; area 2374-1616  $\text{cm}^{-1}$  representing the C=O group for esters in fats; area 1024-1168  $\text{cm}^{-1}$  (C-O-C bond) indicating carbohydrates; area 2382  $\text{cm}^{-1}$  (P=O) which indicates the presence of organic acid compounds; and the area of 1774-1514  $\text{cm}^{-1}$  (C=C aromatic) which is typical of benzene derivatives. Based on PCA of thirteen samples, striated beans and winged beans had the most separated positions, while other legumes had positions that were close to each other. In the dendogram of HCA results, the legumes from the genus Vigna are close to the genus Lablab, where most of the Vigna legumes have protein compounds as differentiators, then followed by the genus Phaseolus which contains benzene derivative compounds as a marker. Each species of legumes that are in the same genus has a side-by-side position and forms a cluster based on the wavenumber value, this indicates that there is a similarity in the metabolite content contained in the legumes.*

**Keywords:** FTIR, local legumes, metabolomic, wavenumber.

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