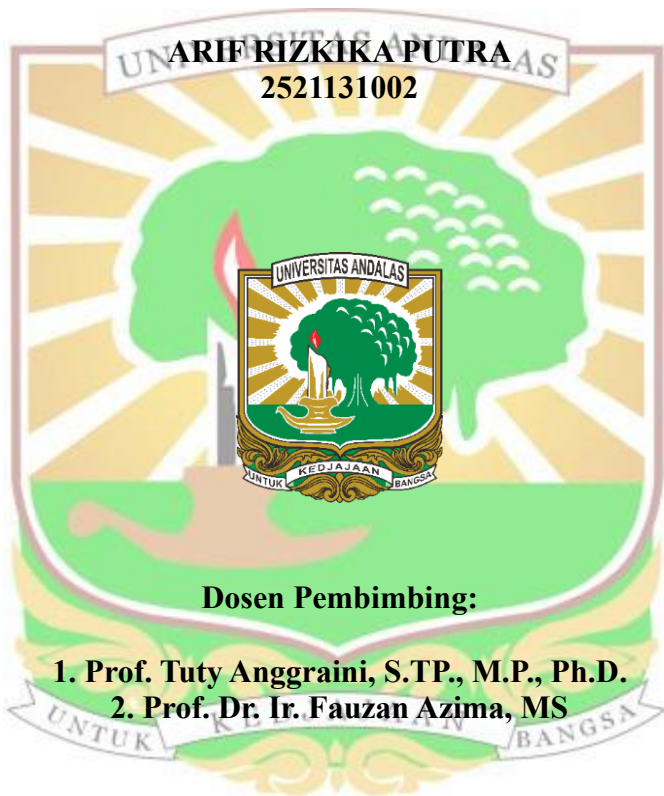


**PROFIL METABOLIT, KARAKTERISTIK KIMIA,
DAN SIFAT FUNGSIONAL GULA AREN CAIR,
CETAK, DAN SEMUT (*Arenga pinnata* Merr.)**



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Profil Metabolit, Karakteristik Kimia, dan Sifat Fungsional Gula Aren Cair, Cetak, dan Semut (*Arenga pinnata* Merr.)

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ABSTRAK

Gula aren (*Arenga pinnata* Merr.) tersedia dalam bentuk cair, cetak, dan semut yang dihasilkan melalui tahapan pengolahan dengan intensitas berbeda. Perbedaan proses tersebut diduga menyebabkan perubahan karakteristik kimia, profil metabolit, senyawa volatil, sifat fungsional, dan karakteristik sensori. Penelitian ini bertujuan mengkaji perubahan karakteristik tersebut pada gula aren cair, cetak, dan semut yang dihasilkan secara bertahap dari nira aren yang sama. Penelitian menggunakan pendekatan deskriptif komparatif dengan analisis karakteristik kimia, *untargeted liquid chromatography-mass spectrometry* (LC-MS/MS), *headspace gas chromatography-mass spectrometry* (GC-MS), total komponen fenolik, aktivitas antioksidan DPPH, indeks glikemik *in vitro*, dan analisis sensori. Peningkatan intensitas pengolahan menyebabkan penurunan kadar air dari 32,32% menjadi 5,78%, aktivitas air dari 0,777 menjadi 0,594, dan kecerahan (L^*) dari 30,76 menjadi 12,95, disertai peningkatan konsentrasi komponen padatan. Profil metabolit menunjukkan pergeseran dari dominasi metabolit primer, terutama gula dan asam amino, pada gula cair menuju metabolit hasil transformasi termal, termasuk 5-HMF dan senyawa heterosiklik, pada gula cetak dan semut. Profil volatil menunjukkan terbentuknya senyawa pirazina, furan, pirol, dan piranon yang berkaitan dengan aroma manis, karamel, sangrai, dan nutty. Total komponen fenolik meningkat dari 8,94 menjadi 11,87 mg GAE/g dan aktivitas antioksidan DPPH dari 39,23% menjadi 63,76%, sedangkan indeks glikemik *in vitro* menurun dari 39,79 menjadi 35,40; seluruh produk tergolong rendah. Gula aren cetak menunjukkan skor aroma khas aren tertinggi (4,47). Hasil menunjukkan bahwa peningkatan intensitas pengolahan menghasilkan transformasi kimia dan metabolit yang menentukan perbedaan sifat fungsional serta karakteristik sensori gula aren.

Kata Kunci: *Arenga pinnata*, gula aren, profil metabolit, senyawa volatil, pengolahan termal.

Metabolite Profile, Chemical Characteristics, and Functional Properties of Liquid, Molded, and Granulated Palm Sugar (*Arenga Pinnata* Merr.)

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ABSTRACT

Palm sugar (*Arenga pinnata* Merr.) is available in liquid, molded, and granulated forms produced through processing stages of different intensities. Differences in processing are expected to cause changes in chemical characteristics, metabolite profiles, volatile compounds, functional properties, and sensory characteristics. This study aimed to investigate these changes in liquid, molded, and granulated palm sugars produced sequentially from the same palm sap. A descriptive comparative approach was employed, including analyses of chemical characteristics, untargeted liquid chromatography–mass spectrometry (LC-MS/MS), headspace gas chromatography–mass spectrometry (GC-MS), total phenolic content, DPPH antioxidant activity, in vitro glycemic index, and sensory characteristics. Increasing processing intensity decreased moisture content from 32.32% to 5.78%, water activity from 0.777 to 0.594, and lightness (L^*) from 30.76 to 12.95, accompanied by an increase in the concentration of solid components. The metabolite profile shifted from a predominance of primary metabolites, particularly sugars and amino acids, in liquid palm sugar toward thermally transformed metabolites, including 5-HMF and heterocyclic compounds, in molded and granulated palm sugars. The volatile profile showed the formation of pyrazines, furans, pyrroles, and pyranones associated with sweet, caramel, roasted, and nutty aromas. Total phenolic content increased from 8.94 to 11.87 mg GAE/g and DPPH antioxidant activity from 39.23% to 63.76%, whereas the in vitro glycemic index decreased from 39.79 to 35.40, with all products classified as having a low glycemic index. Molded palm sugar exhibited the highest characteristic palm sugar aroma score (4.47). These findings demonstrate that increasing processing intensity drives chemical and metabolic transformations that contribute to differences in the functional and sensory characteristics of palm sugar.

Keywords: *Arenga pinnata* Merr.; carrier agents; foam-mat drying; instant beverage powder; Palm sap;