

STANDARDIZATION OF SPECIFIC AND NON-SPECIFIC PARAMETERS, PHYTOCHEMICAL ANALYSIS, AND KLT PROFILE OF JACKFRUIT SEED EXTRACT (*ARTOCARPUS HETEROPHYLLUS* LAM)

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<p>Info Article</p> <p>Received : 01 Oktober 2025</p> <p>Revised : 02 November 2025</p> <p>Accepted : 02 Desember 2025</p> <p>Publication : 30 Desember 2025</p>	<p>Abstract <i>This study aimed to determine the specific parameters, non-specific parameters, phytochemical screening results, and TLC profile of jackfruit seed extract. The evaluations included organoleptic assessment, moisture content, total ash content, microbial contamination, phytochemical identification, and TLC analysis using n-hexane: ethyl acetate eluents. The results showed that the extract was viscous, yellow-brown, and had a characteristic aroma; the moisture content was 6% and the total ash content was 2.85%, both meeting the quality requirements. Microbial contamination indicated acceptable values with total plate count at dilutions 10^{-2}–10^{-3} and yeast-mold count at dilutions 10^{-1}–10^{-2}, remaining below the maximum limits. Phytochemical screening identified the presence of alkaloids and steroids/terpenoids, while flavonoids, tannins, and saponins were not detected. TLC profiling produced several Rf values indicating the dominance of non-polar to semi-polar compounds. These findings demonstrate that jack fruit seed extract meets physical, chemical, and microbiological quality standards and presents a consistent chemical profile, supporting its potential for use as a raw material in herbal product development.</i></p> <p>Abstrak: Penelitian ini bertujuan untuk mengetahui parameter spesifik, parameter non-spesifik, hasil skrining fitokimia, dan profil TLC ekstrak biji nangka. Evaluasi meliputi penilaian organoleptik, kadar air, kadar abu total, mikroba kontaminasi, identifikasi fitokimia, dan analisis TLC menggunakan n-heksana: eluen etil asetat. Hasil menunjukkan bahwa ekstrak tersebut kental, kuning-coklat, dan memiliki aroma yang khas; Kadar air adalah 6% dan kadar abu total adalah 2,85%, keduanya memenuhi persyaratan kualitas. Kontaminasi mikroba menunjukkan nilai yang dapat diterima dengan jumlah total pelat pada pengenceran 10^{-2}–10^{-3} dan jumlah jamur ragi pada 10^{-1}–10^{-2}, tetap di bawah batas maksimum. Skrining fitokimia mengidentifikasi keberadaan alkaloid dan steroid/terpenoid, sedangkan flavonoid, tanin, dan saponin tidak terdeteksi. Profil TLC menghasilkan beberapa nilai Rf yang menunjukkan dominasi senyawa non-polar hingga semi-polar. Temuan ini menunjukkan bahwa ekstrak biji nangka memenuhi standar kualitas fisik, kimia, dan mikrobiologi serta menghadirkan profil kimia yang konsisten, mendukung potensinya untuk digunakan sebagai bahan baku dalam pengembangan produk herbal.</p>
<p>Keywords: Jackfruit Seed, Extract Standardization, Phytochemical Screening, Tlc, Extract Quality</p> <p>Kata Kunci: Biji Nangka, Standarisasi Ekstrak, Filtrasi Fitokimia, Tlc, Kualitas Ekstrak</p>	
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INTRODUCTION

Jackfruit seeds are one of the parts of the jackfruit plant that has great potential as a source of secondary metabolites, but its use is still very limited. In daily practice, jackfruit seeds are generally considered household waste and fruit processing industry waste, so their economic value is relatively low. In fact, various studies report that jackfruit seeds contain bioactive compounds such as alkaloids, terpenoids, phenolics, as well as other secondary metabolite components that have the potential to provide pharmacological activity, including antioxidant, antimicrobial, antidiabetic, and anti-inflammatory activities. These findings show that jackfruit seeds have the potential to be developed as raw materials for herbal preparations as well as as candidates for phytopharmaceuticals.

As public interest in the use of herbal medicines increases that are safer and have minimal side effects, the need for standardized plant ingredients is also increasingly important. Natural materials have a chemical composition that is greatly influenced by environmental conditions, harvesting techniques, drying processes, storage, and extraction methods. These variations can lead to differences in quality and secondary metabolite content between production batches. Therefore, standardization of jackfruit seed extract is necessary to ensure the quality, safety, and consistency of the extracts produced. Standardization includes specific parameters such as organoleptic, phytochemical profile, and chromatographic patterns, as well as non-specific parameters such as moisture content, total ash content, and microbial contamination.

In addition, the determination of Thin Layer Chromatography (KLT) profiles is one of the important parts of the standardization process because it produces chemical fingerprints that can be used to identify the stability and peculiarities of extracts. The KLT profile provides an overview of the composition of the compound based on the Rf value so that it can be used as a reference in quality control. Phytochemical screening tests are also required to identify the main secondary metabolite compound clusters present in the extract. Meanwhile, microbiological parameters such as Total Plate Count (ALT) and Khir Mold Number (AKK) are needed to ensure the extract is safe from microbial contamination.

Although the potential of jackfruit seeds is huge, research examining the standardization of its extracts as a whole is still limited. Most previous studies have only highlighted its nutritional content or pharmacological activity without evaluating the complete quality parameters needed for the development of herbal raw materials.

This leads to a lack of basic data regarding the quality and characteristics of jackfruit seed extracts that are valid and can be used as a reference. Based on this background, this study was conducted to determine specific and non-specific parameters, conduct phytochemical screening, and determine the KLT profile of jackfruit seed extract. The results of the research are expected to provide comprehensive information as a scientific basis in the development of jackfruit seeds into safe, quality, and consistent raw materials for the herbal industry and advanced pharmaceutical research.

METHOD

The tools used in this study are, Stirring Rod, Bunsen, Caulk, Petri Dish, Chamber, Funnel, Crucible, Desiccator, Disposable, Enkas, Erlenmeyer, Becup Cup, Measuring Cup, Incubator, Analytical Balance, Oven, Ruler, Cooler, Stainless Container, Pencil, Capillary Pipe, Drip Pipette, Drip Plate, Tube Rack, Rotary Evaporator, Spatula, Test Tube, Drill, UV 254 and UV 366. Materials The materials used in this study are 70% Alcohol, Aquades, Aluminum Foil, Dragendorff, Jackfruit Seed Extract, Ethyl Acetate, FeCl₃, HCl, Chromatography Paper, Parchment Paper, Cotton, Label, Lieberman-Burchard, Magnesium, Mayer, Methanol, N-Hexane, 96% NaCl, Sodium Agar (NA), Plastic Wrap, Potato Dextrose Agar (PDA), and Tissues.

Specific standardization is carried out through organoleptic examination by observing the shape, color, and smell of jackfruit seeds (Rahayu *et al.*, 2023). Phytochemical screening was carried out by preparing eight test tubes containing extracts that have been dissolved with methanol along with one control tube. The flavonoid test was carried out with the addition of magnesium and HCl and then the color change was observed. Alkaloid tests were performed using Dragendorff reagents. The tannin test uses FeCl₃, the saponin test uses heating and then the addition of HCl and shake, while the steroid or terpenoid test uses ethyl acetate and Liebermann–Burchard reagents (Rahayu *et al.*, 2023). The KLT stage is carried out by dissolving the sample in ethanol dan menotol pada lempeng sesuai variasi eluen 4:1, 3:2, dan 3.5:1.5, then elusive to the limit, observed at UV 254 and 366 nm, and calculated RF values.

Non-specific standardization includes determining the moisture content by baking the sample at 105°C to a constant weight (Rahayu *et al.*, 2023). The total ash content is determined by sprinkling the sample in a kiln at 700°C for 3–6 hours and then calculating the percentage. The examination of ALT and AKK microbial contamination was carried out through 10⁻¹ to 10⁻⁶ multi-stage dilution, then 1 ml of samples were

each planted in the petri dish of ALT and AKK according to the dilution level for the calculation of the number of colonies (Rakhmawati *et al.*, 2019).

RESULTS AND DISCUSSION

Results

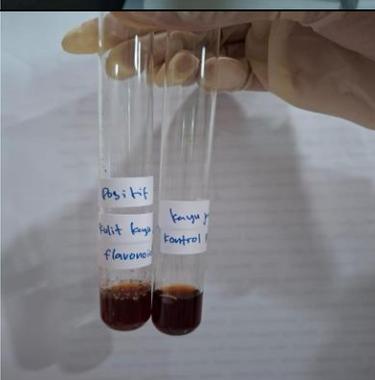
Table 1. Organoleptic Tests

Sample	Shape	Color	Construction
			
Biji nangka (<i>Artocarpus heterophyllus Lam.</i>)	Thick Extract	Brownish Yellow	Distinctive Smell

The results of standardization show that jackfruit seed extract meets acceptable quality characteristics based on specific and non-specific parameters. Organoleptically, the extract has a yellowish-brown color, a thick consistency, and a distinctive smell of jackfruit seeds. This characteristic is consistent with the report of Selvianti *et al.* (2024) which states that jackfruit seed extract is generally brown due to the browning reaction during the extraction process and has a distinctive aroma derived from natural volatile components (Selvianti *et al.*, 2024). The organoleptic findings indicate that the extract is in a stable physical condition and does not undergo sensory degradation.

Table 2. Phytochemical Screening

Sample	Compound Test	Observation Results	Reagents	Serenity
	Alkaloid		Mayer	(+) Positive Brown cloudiness

Biji nangka (<i>Artocarpus heterophyllus Lam.</i>)	Steroid/ Terpenoid		Liebermann Burchard	(+) Positive is purple
	Flavonoid		mg+ powder HCl	(-) Negatives Color- Blind
Biji nangka (<i>Artocarpus heterophyllus Lam.</i>)	Tanin		HCl + Air Panas	(-) Negative Does Not Change color
	Saponin		FeCl3 + Air Panas	(-) Negative Does Not Change color

Phytochemical screening showed the presence of alkaloids (positive with the Dragendorff reactant) and steroids/triterpenoids (positive with the Liebermann–Burchard react). Meanwhile, flavonoids, tannins, and saponins were not detected. The presence of alkaloids reflects the presence of organic nitrogen groups that are often associated with specific biological activities, while positive steroid/triterpenoid reactions indicate the predominance of nonpolar compounds in the extract (Rahayu et

al., 2023). The undetectability of flavonoids and tannins is in line with information that jackfruit seeds have a lower polyphenol content than the skin or leaves, and are richer in lipid and starch components (Kanti & Leliqia, 2023). Thus, the screening results confirm that jackfruit seed extract has a chemical profile that tends to be nonpolar.

Table 3. Thin-Layer Chromatography

Sample	Eluen	Observation Results		Rf
		254 nm	366 nm	
Ekstrak Biji Nangka (<i>Artocarpus heterophyllus lam.</i>)	N-Hexane: Ethyl Acetate (3:2)			0.25 0.35 0.425 0.575
Ekstrak Biji Nangka (<i>Artocarpus heterophyllus lam.</i>)	N-Hexane: Ethyl Acetate (3,5:1,5)			Rfn1 = 0.125 Rfn2 = 0.2 Rfn3 = 0.4 Rfn4 = 0.5 Rfn5 = 0.5
Ekstrak Biji Nangka (<i>Artocarpus heterophyllus lam.</i>)	N-Hexane: Ethyl Acetate (4:1)			Rfn1 = 0.15 Rfn2 = 0.225 Rfn3 = 0.35 Rfn4 = 0.925

Thin-layer chromatography (KLT) profiles with three eluent variations (4:1, 3:2, and 3.5:1.5 n-hexane–ethyl acetate) produced 4–5 spots on each system, with an Rf value range of 0.125–0.925. Low Rf values (0.125–0.25) indicate the presence of polar compounds such as carbohydrate fragments or protein components, while moderate Rf (0.35–0.5) indicates semipolar compounds such as modified fatty acids. High Rf values (≥ 0.9) are thought to be highly nonpolar compounds such as oils, lipids or triterpenoids (FHI, 2017). The consistency of the spotting pattern throughout the elution system emphasizes the chemical complexity of the extract and the dominance of the nonpolar component, according to the results of phytochemical screening. In addition, the stable patching pattern on various eluents suggests that chromatographic profiles can be used as identity parameters for jackfruit seed extract.

Table 4. Non-specific standardization

a. Up Air

Sample	Up to % air
Seed (<i>Artocarpus heterophyllus Lam.</i>)	6%

b. Until Abu Total

Sample	% up to Abu Total
Seed <i>Artocarpus heterophyllus Lam.</i>)	2,85%

Non-specific parameters indicate good physical-chemical quality of the extract. The moisture content of 6% is below the maximum limit of dry extracts ($<10\%$), so it is safe against the risk of microorganism growth and stable during storage (Prasetyo et al., 2019). The total ash content of 2.85% is also within the standard range of 2–5% for *simplysia*, indicating that the content of inorganic and mineral residues is still within normal limits and does not indicate excessive contamination (Kadar et al., 2023). Thus, these two parameters confirm the physical purity and quality of the extract. In microbiological parameters, the valid Khamir Mold Number (AKK) values came from dilution of 10^{-1} and 10^{-2} with 22 and 28 colonies, respectively, so that the final values were 2.2×10^2 CFU/mL and 2.8×10^3 CFU/mL, still far below the maximum limit of $\leq 10^4$ colonies/g (Nur et al., 2020). Meanwhile, the Total Plate Count (ALT) at valid dilution of 10^{-2} and 10^{-3} showed values of 8.1×10^3 CFU/mL and 6.8×10^4 CFU/mL, also still below the $\leq 10^5$ colony/g limit. Other dilutions that do not follow the serial pattern are not used in the analysis because they are not representative. Overall, the microbiological parameters show that jackfruit seed extract is safe from microbial contamination and meets the standards of quality requirements. In general, all the

results of specific and non-specific parameters show that jackfruit seed extract has a clear identity quality, good physical stability, low microbiological contamination, and a secondary metabolite profile that can be accounted for. The presence of alkaloids and steroids/triterpenoids supported by consistent KLT patterns demonstrates the potential of jackfruit seed extract to be further developed in pharmacognosy research, marker compound standardization, and herbal product applications.

CONCLUSION

Based on the results of standardization of specific and non-specific parameters, jackfruit seed extract meets acceptable quality criteria. Organoleptically, the extract exhibits characteristic yellowish-brown color, thick consistency, and distinctive smell of jackfruit seeds, which signifies physical stability and the absence of sensory degradation. Phytochemical screening results confirmed the presence of alkaloids as well as steroids/triterpenoids, while flavonoids, tannins, and saponins were not detected, indicating that the chemical profile of the extract was dominated by nonpolar compounds. KLT profiles with various eluent systems produce a consistent spotting pattern with an R_f value range of 0.125–0.925, which reflects the complexity of the chemical components and can be used as an extract identity parameter. Non-specific parameters, including moisture content and total ash content, are within the set standard limits, indicating good physical purity and stability of the extract. In addition, the results of microbiological tests (ALT and AKK) are still below the maximum permissible limit, so the extract is declared safe from microbial contamination. Overall, the results of standardization prove that jackfruit seed extract has good quality, safety, and identity and has the potential to be further developed in pharmacognosy research, determination of marker compounds, and application of herbal preparations.

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