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Phytochemical Screening, Spectrum Profile of Functional Groups, and Effervescent Formulation of Kepok Banana Peels Stem Extract

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Abstract. Kepok banana plants contain secondary metabolites such as tannins and flavonoids. Tannins and flavonoids have various properties for human health. Research has been carried out to identify secondary metabolite compounds (tannins, flavonoids, and saponins) by using the phytochemical screening method to see the functional group profile contained in the extract of kepok banana stem waste. Kepok banana stem waste was extracted in 96% ethanol, then evaporated and screened phytochemically. This extract was used to prepare effervescently. Screening results showed that tannin and flavonoids were identified by the appearance of the following color black-green and dark red, respectively. Meanwhile, saponins were negative because the foam formed had a height of 0.3 cm and did not meet the saponins' positive requirements (1-3 cm high foam and stable for 5 minutes). Identification of functional groups in the extract of kepok banana stem waste using Fourier-transform Infrared Spectroscopy (FTIR) showed that C-C stretching in the area 2927.24 cm^{-1}, O-H stretching in the 3423.87 cm^{-1} area, C=O stretching in the 1648.87 cm^{-1} area. Also appeared bending CH_2 in the region of 1421.45 cm^{-1}, and C-C in the area of 1149.98 cm^{-1}. The characteristics of three different formulas (A, B, and C) of effervescent have been investigated: the moisture content of 2.51%; 2.55%, and 2.52%, respectively. Then, flow rate of 8.81 g/s; 8.83 g/s; and 8.82 g/s, compressibility of 14.5%; 14.4%; and 14.5%, and a pH of 5.97; 5.98; and 5.97 respectively. All parameters are eligible.

Keywords: banana stems, effervescent, flavonoids, functional groups, and tannins

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Introduction

Banana is one of the plantation commodities in Indonesia. The utilization of banana plants had been done since ancient times, such as its weevils, leaves, and especially the banana itself. The banana stalk is one part of the banana plant that has not been used maximally and is usually just thrown away.

A study showed that banana plants have antibacterial materials, namely tannins, flavonoids, alkaloids, and steroids [1]. These compounds are included in secondary metabolites with many benefits, especially for human health [2].

Based on the research above, the researcher intends to use banana stem waste to be used as a product for health benefits by first looking at the content of secondary metabolite compounds that may still be in the banana stem waste. The compounds to be studied include tannins, flavonoids, and saponins and see the functional group profile in the extract.

Flavonoids are compounds found in plants as mixtures and very rarely in the single compound form [3]. Usually in the form of sugar, namely as a glycosal and flavonoid aglicon. Flavonoid contains a conjugated aromatic system.

Tannins are water-soluble phenolic compounds weighing 500–3000 mg equivalent of gallic acid, giving a general reaction to phenolic compounds [4]. Tannins form complexes not only with alkaloids and proteins but also with polysaccharides. Tannins are complex compounds. Usually, a mixture of polyphenols does not crystallize and only polyphenol polymerizations.

Saponins vary structure, physical properties and biological effects compounds in the form of glycons widely distributed in higher plants and some marine animals. Saponins are steroid glycons or triterpene compounds found in various plants. Saponins have a characteristic form of foam so that when it reacts with water, it will form foam that can last a long time. Saponins are readily soluble in water and insoluble in ether [5]–[7].

Then for the utilization of banana stem waste, the extract was formulated into an effervescent powder. The effervescent powder is coarse to a very coarse powder, and contains medicinal elements in a dry mixture, usually consisting of sodium bicarbonate, citric acid, and tartric acid. When water was added, the acid and base reacted to free carbon dioxide to produce foam [4].

Effervescent powder was chosen because, in addition to forming a dosage formulation that could be beneficial for health, effervescent also gives a fresh effect when consumed. The formulation was made with various uses of lactose to measure the level of sweetness.

Experimental

Tools and Materials

The equipment used includes erlenmeyer, stir rod, gloves, spatula, test tube, rotary evaporator, dropper pipette, petri cloud, autoclave, laminar airflow, spirit lamp, capillary pipette, IR spectrophotometer, oven, pH meter, and plate reader. While the materials used were Kepok banana stem, 96% ethanol, 10% NaOH, distilled water, n-hexane, ethyl acetate, methanol, reagent $FeCl_3$, 70% alcohol, lactose, fruit flavor, aspartame, citric acid, tartaric acid, sodium bicarbonate, α- glucosidase, DMSO, sodium carbonate, TLC plate, paper, filter, tissue, aluminum foil.

Kepok Banana Stem Extraction

The maceration method extract from the kepok banana stem [8]–[10]. Kepok banana stems were taken 10 cm, washed, cut into small pieces, dried at room temperature, then made into powder. The dry powder simplicia was macerated using ethanol solvent 96% to 1 cm above the kepok banana stem powder for 24 hours, then filtered and the precipitate was macerated again with 96% ethanol. This procedure was repeated until all of the metabolites have been extracted. All 96% ethanol extracts were combined and evaporated using a rotary vacuum evaporator until dry, then weighed, and the yield was calculated.

Phytochemical Test of Kepok Banana Stem Extract

The phytochemical test is a test conducted to identify the content of metabolite compounds in kepok banana stems, namely flavonoids, tannins, and saponins. Identification of flavonoids using 10% NaOH was added to the ethanol extract obtained using the maceration method, then added 2 drops of 10% NaOH [11]. A yellow-orange-red color change indicated the presence of flavonoids. Saponin identification (foam test) was carried out by simplicia banana stems added with distilled water so that all parts were immersed and boiled for 2 minutes. After that, it cooled and shook vigorously. The emergence of a stable foam indicated the presence of saponins. Identification of tannins was carried out by diluting the extract of the kepok banana stem (Musa paradisiacal L) in solvent (n-hexane, ethyl acetate, and methanol), then pipetting into drop plate porcelain and adding $FeCl_3$ reagent. The formation of a white precipitate indicated a positive result.

Analysis Using an IR Spectrophotometer

Peptide compound samples was pressed on KBr pellets with a sample ratio of 1: 100 KBr. The background used is pure KBr pellets. The spectrum was recorded in the transmittance mode at a wavenumber 4000–400 cm-1.

Effervescent Powder Preparation

Citric acid and tartric acid crystal were crushed to get powders and sieved using No. 16, then dried in the oven at ± 50°C for 30 minutes (mixture 1). The dried extract was sprayed with sufficient flavor, after that was stirred until homogeneous, then sieved with a No.16 sieve and stored in a container (mix 2). Other ingredients, namely: lactose, aspartame, and sodium bicarbonate, were mixed and stirred until homogeneous, then sieved with No. 16. The Powder obtained was dried in an oven at ± 50°C for 30 minutes (mix 3). The dried mixture of 1, 2, and 3 was stirred until homogeneous, sieved with a No.40 sieve, so that become an effervescent powder, then stored in a desiccator [1], [12].

Effervescent powder analysis

Physical and chemical properties test of the effervescent powder (test moisture content, flow rate, compressibility, dissolving time, and pH of the solution) had been investigated.

Results and Discussion

Results of Phytochemical Screening of Kepok Banana Stem Extract presented in **Table 1**. This research was conducted to determine the content of secondary metabolite compounds that may still be present in banana stem waste. Banana stem waste samples were obtained in the home industry yard in Punggur area, Central Lampung. The kepok banana stem used is a banana stem that has been harvested from the fruit.

Table 1. Phytochemical Screening of Kepok Banana Stem Extract

Phytochemical Test	Results	Conclusions
Saponins	Formed foam as high as 0.3 cm for 10 minutes	-
Tannins	Coloured greenish black	+
Flavonoids	Coloured dark red	+

The maceration method was used to extract Kepok banana stems, was classified as a cold extraction process so that the extraction results were good and prevent chemical damage to the sample due to heating [3], [13]. The principle of maceration is that chemical compounds with the same properties as the solvent will be attracted to and dissolved in the solvent so that certain chemical compounds can be separated. The solvent used in this method was 96% alcohol because its selectivity only attracts the desired nutritious substances, has good absorption, is not overgrown with fungus, volatile, and gets a viscous extract faster than 70% ethanol solvent [9].

Then samples were concentrated with a rotary evaporator until a thick extract was obtained.

After that, the effervescent powder preparation process was carried out with 3 formulations (see **Table 2**) and modified some of the additive components [11]. Formulation A was given more lactose and less sodium bicarbonate than formulation B and formulation C. The formulation modification's objective was to find the best formulation to produce an effervescent powder that conforms to the requirements of effervescent powder testing [14]. The testing parameters for effervescent powders such as physical and chemical properties of the powder (moisture content test, flow rate, compressibility, solubility time, and solution pH) [15]–[17].

Table 2. Formulation of effervescent powder

Material	Formula		
	A	B	C
Kapok banana stem extract	25 g	25 g	25 g
Lactose	24 g	19 g	14 g
Fruit Taste	Qs	Qs	Qs
Aspartame	1 g	1 g	1 g
Citric Acid	9,5 g	10,45 g	11,4 g
Tartric acid	13,5 g	14,85 g	16,2 g
Sodium bicarbonate	27 g	29,7 g	32,4 g

Organoleptic tests were carried out by observing the smell, consistency, and color of effervescent powder preparations (see **Table 3**) [2], [18]. Rrganoleptic test is a way of testing using the human senses as the main tool to assess the quality of powder. Good powder preparation is in the form of a solid crystal powder and does not become thick. Organoleptic test of color and odor of the effervescent powder formulation of Kepok banana stems has a distinctive banana odor and is also white. Meanwhile, the homogeneity test was used No.40 sieve to obtain a uniform powder size so that the powder became homogeneous [10], [12], [19].

Table 3. Organoleptic Test

Formulations	Organoleptic Test		
	Odor	Consistency	Color
A	Slightly flavorful typical of Kepok banana	Round powder, crystals	White
B	Slightly flavorful typical of Kepok banana	Round powder, crystals	White
C	Slightly flavorful typical of Kepok banana	Round powder, crystals	White
extract of the Kepok banana stem	Banana scented	Concentrated liquid	Chocolate

Based on the phytochemical screening results on an extract of the Kepok banana stem in Table 1, three compounds were 3 compounds identified: saponins, tannins, and flavonoids. From the test results, the extract showed positive results for tannins and flavonoids, which had greenish-black color and dark red color, respectively. Meanwhile, the results were negative for saponins because although foam was formed, the foam was only 0.3 mm high and under 1 cm [3].

The sample was identified containing functional groups of the C-C stretching in 2927.24 cm^{-1}, O-H stretching in the 3423.87 cm^{-1} area, C=O stretching appeared at 1648.87 cm^{-1}, bending CH_2 in the area of 1421.45 cm^{-1}, and C-C appeared at 1149.98 cm^{-1}.

Effervescent powder analysis showed that the moisture content obtained for formulations A, B, and C was 2.51%; 2.55%, and 2.52%, respectively. Moisture testing was performed using a measuring instrument of moisture meter. Meanwhile, the requirement for the water content of effervescent powder is less than 5%, so that all the moisture content of the three formulations meets the requirements [15].

Table 4. Mositure Content Test

Formulations	Mositure Content Test	
	Result	Standard
A	2.51%	< 5%
B	2.55%	
C	2.52%	

The flow rate of formulations A, B, and C was 8.81 g/s; 8.83 g/s; and 8.82 g/s. These results indicated that the flow properties of the three formulations' effervescent powders still meet the requirements where the flow rate requirements of effervescent powders are 4-10 g/s and fall into the easy-to-flow category [20].

Table 5. Flow Rate Test

Formulations	Flow Rate Test	
	Result	Standard
A	8.81 g/s	4 – 10 g/s
B	8.83 g/s	
C	8.82 g/s	

The three formulations' pH was 5.97; 5.98; and 5.97, which were still close to the requirements, namely between 6-7. The water holding capacity of the effervescent powder starting from formulations A, B, and C, among others, was 0.354; 0.362; and 0.358 g/g and still meet the requirements [4]–[8].

Table 6. pH Test

Formulations	pH Test	
	Result	Standard
A	5.97	6 – 7 g/s
B	5.98	

C	5.96

Table 7. Water Holding Capacity

Formulations	Water Holding Capacity
	Result
A	0.354 g/g
B	0.362 g/g
C	0.358 g/g

For the compressibility test, the effervescent powder produced from formulations A, B, and C, yielded 14.5%; 14.4%; and 14.5%, which met the granule compressibility requirements, namely less than 20% [5] [21].

Table 8. Compressibility Test

Formulations	Compressibility Test	
	Result	Standard
A	14.5 %	< 20 %
B	14.4 %	
C	14.5%	

Conclusion

It was concluded that the Kepok banana waste contained two secondary metabolites in the banana stem waste, namely tannins and flavonoids. Meanwhile, saponin compounds were not found in kepok banana stem waste. The sample was identified containing functional groups of the C-C stretching in 2927.24 cm^{-1}, O-H stretching in the 3423.87 cm^{-1} area, C=O stretching appeared at 1648.87 cm^{-1}, bending CH_2 in the area of 1421.45 cm^{-1}, and C-C appeared at 1149.98 cm^{-1}.

Furthermore, the effervescent powder characteristics met the requirements, so the effervescent powder dosage formulation made from the kepok banana stem waste's extract showed good results.

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