Metal Content Of Midrib Sap Flour Salak Tree (Tgps) As A Thickening Agent

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Abstract.
The food processing industry, whether related to livestock, agriculture, or fishery products, often requires thickening additives to improve product quality. Salak trees are found around the Southern Tapanuli area of North Sumatra, Indonesia. Previous research showed the Midrib Sap Flour Salak Tree (TGPS) has fairly good quality content as a natural thickening agent but has not reported the quality of TGPS in terms of heavy metal content. Here, a study was carried out to determine the heavy metal content of TGPS. This research was conducted in January-March 2022 in Southern Tapanuli. The analysis showed that the metal content in TGPS does not exceed the threshold required in Indonesian Standard SNI 7387-2009.

Keywords: *midrib sap flour salak tree (TGPS), natural thickener and metal content.*

I. INTRODUCTION

The processing of various types of food, whether originating from livestock, agriculture, or fisheries, often requires additive materials to increase the elasticity of the final product. Natural additive materials are often preferred both by business actors to maintain food safety, as well as for consumer preference. A potential source for high quality thickening agent, is the sap from salak as it has been observed in the field that zalacca, in addition to the main production of salak fruit, also produces quite a lot of sap. Sap production occurs particularly when salak farmers practice the 'embroidering' of salak stalks, where the bark/midrib that is cut and releases large volumes of sap with a clear and thick texture. Physically, this sap looks like rubbery glue. There have been many studies carried out on various potentials of salak, starting from the fruit, midrib, leaves, and stems, including the latex of the midrib. In line with the opinion of Mazumdar, Purabi Pratama, Howgen Lau, et al., [1] Snake fruit, consisting of several untapped varieties and cultivars, are a rich reservoir of antioxidants and phytochemicals. There is no doubt that this genus produces fruit with high nutrient value and obvious benefits for consumer health.

In addition to its consumption as a fresh and processed food, snake fruit has enormous potential for use in therapeutics, cosmetics, renewable energy production as well as in heavy metal remediation.Then Is, Fatimah et al., [2] researching the potential of Biogenic Silica Extracted from Salacca Leaf Ash successfully extracted biogenic silica samples and showed these to be effective adsorbents for salicylic acid from an aqueous solution. The increasing specific surface area and the increasing temperature were reected by the varying sintering temperatures, which affected the increasing adsorption capacity. The homogeneous surface of silica was exhibited, as suggested by the fitness of the adsorption kinetics to the Langmuir isotherm model. The results of this research represented that Salacca leaf ash is potential resource for biogenic silica production.Than the plant parts can be used for other purposes in different industries in addition to their medicinal effects. Likewise, the salak fruit has been reported to be used in the food industry to isolate yeast meant for bread leavening agent. It relatively showed better quality than the commercial baker’s yeast by means of desired leavening ability and colour development of the bread crust and crumb, Ma'Aruf, A. G. Asyikeen, Z. Noroul Sahilah et al. [3] According to Harahap, M.F. Lubis, R.A. Syawaluddin, et al. [4], based on the results of testing on the midrib sap flour salak tree (TGPS) it has a fairly good quality and has the potential to be used as a food thickener.

The following are the test results obtained:

Table.11. Test Results of Midrib Sap Flour Salak Tree (TGPS)

No.	Testing	Test Results	Information
1.	Water Content	9,2358	%
2.	Ash	26,9914	%
3.	Protein	7,2983	%
4.	Crude Fiber	6,2058	%
5.	Fat	1,0232	%
6.	Carbohydrate	16,0997	%
7.	Carragenan	4,2769	cp
8.	Gel Strength	177,45	gr/cm^2

Source : Harahap, M.F. Lubis, R.A. Syawaluddin et al. [4]

The results of these studies have not been able to show the quality of TGPS in terms of heavy metal content. Because heavy metal is one of the chemicals whose presence in food products to a certain extent can endanger human health. For this reason, further research is carried out to determine whether or not TGPS from metal materials is used as a food thickener that can support community food safety. Based on the explanation above, it is necessary to study the metal content of TGPS if it is to be used as a thickening agent in the production of safe and healthy processed foods.

II. MATERIALS AND METHODS

The research method was experimental in the field and laboratory on TGPS samples. Testing in the laboratory by analyzing the content of heavy metals, namely 1). Arsenic : test method according to Badan Standarisasi Nasional [5]; 2). Cd, Hg, Sn, Pb : test method according to SNI 01-2896-1998. This test method includes testing for metal contamination of cadmium (Cd), lead (Pb), tin (Sn), mercury (Hg), and arsenic (As). The sample was ashed using a microwave digester method and then read using an Atomic Absorption Spectrophotometer (AAS).Destruction of the sample by means of pressure digestion using microwave destruction followed by dissolving in an acid solution. The dissolved metal was calculated using an atomic absorption spectrophotometer (AAS) with wavelengths of 228.8 nm for Cd, 283.3 nm for Pb, 235.5 nm for Sn, 253.7 nm for Hg and 193.7 nm for As.

The equipment are : 1. Atomic Absorption Spectrophotometer (SSA) and its accessories (cathode lamps Cd, Pb, Sn, Hg, As) calibrated and equipped with flame, graphite furnace, steam hydride generator (HVG); 2. Microwave digester; 3. Destruction tube; 4. Calibrated analytical balance with 0.1mg . accuracy; 5. Micropipette 100ul and 1000ul; 6. Burette 10 ml; 7. Erlenmeyer 250 ml; 8. Calibrated 50 ml, 100 ml and 1000 ml volumetric flasks; 9. Calibrated 10 ml, 25 ml and 50 ml measuring cups; 10. 250ml and 500 ml beakers; 11. Polypropylene bottles.The results of the analysis of the metal content of TGPS will be compared with the standard metal content in foodstuffs. The working steps in making the TGPS test sample are as follows: Salak tree sap is taken by cutting the midrib of the stem. After the sap comes out, it is accommodated in a certain container. The weight of the sap produced is calculated to determine the amount of sap potential. Then, the sap obtained was tested in the laboratory.

The following is a research flow chart for salak tree sap:

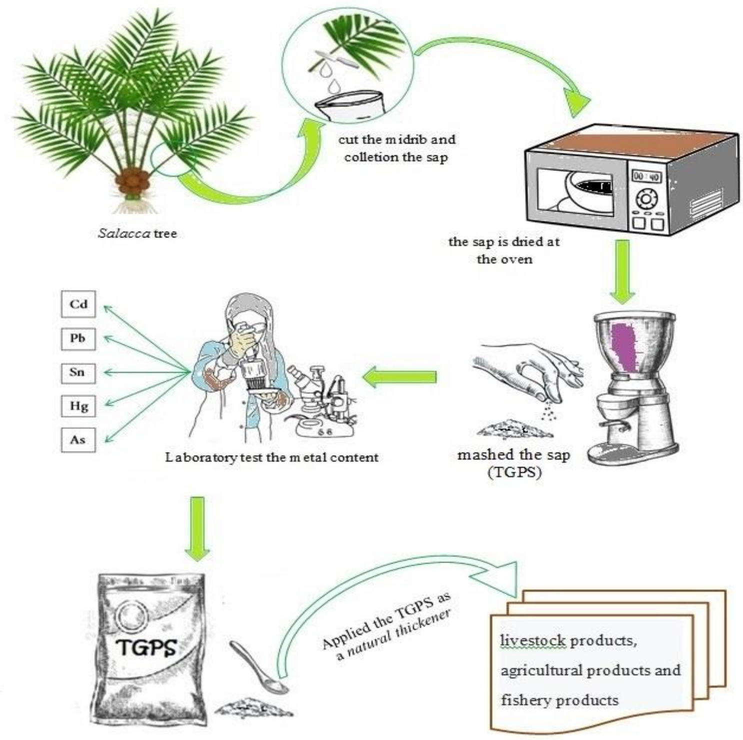

Fig 1. Research flow chart

III. RESULTS AND DISCUSSION

Taking the sap from the bark of the salak tree directly to the garden in order to obtain fresh sap as needed. The fresh sap is then dried using a microwave oven which is then subjected to a flouring process. After becoming a TGPS, the metal content was tested in the laboratory. The test results can be seen in the table below:

Table 2. Results of TGPS Metal Content Testing

No.	Parameter	Result Test	Information
1.	Lead (Pb)	0,0241	mg/kg
2.	Cadmium (Cd)	0,0843	mg/kg
3.	Tin (Sn)	0,2320	mg/kg
4.	Mercury (Hg)	<LOD*	mg/kg
5.	Arsenic (As)	<LOD**	mg/kg

Description :

LOD : *Limit of Detection*

LOD* : 0,0081 mg/kg

LOD** : 0,0903 mg/kg

3.1. Lead (Pb)

Lead is one of the heavy metals whose presence is too high in foodstuffs or food can endanger human health. In line with the opinion of Li, Xiang Zhang, Baoyue Li [6] that lead (Pb) has been identified as a toxic metal at elevated concentrations, and extensive use of Pb is reported to result in widespread environmental contamination and health problems globally. Than R. Nag and E. Cummins [7] that 'several metals andmetalloids (elementswhose properties are intermediate between metals and non-metals) (metalloids) are essential for living organisms, with particular roles in cell division and metabolism while also facilitating endocrine signals between organs. Excessive concentrations of certain metalloids may lead to serious health issues. Being a cumulative toxicant, Pb can influence the neurologic system, kidneys, and blood circulation, especially in children, infants, and foetuses [8]. Pb is distributed in the brain, liver, kidney and bones [9]. Pb may accumulate over time in teeth and bones, reflecting a cumulative human exposure. Pb may also affect brain and intellectual development in children, inducing apoptosis in organ tissues [10].The table above shows that the metal content of Lead (Pd) in TGPS is 0.0241 mg/kg. Based on SNI Number 7387 of 2009 [11] stipulates that the metal content of Lead (Pd) for this type of flour is a maximum of 1 mg/kg. For this reason, from the results of this study, it is known that the metal content of Lead (Pb) in TGPS has met the standards that have been set.

3.2. Cadmium (Cd)

Cadmium does not break down in the environment. Atmospheric cadmium compounds are transported (sometimes for long distances) and deposited (onto surface soils and water) with minimal transformation in the atmosphere [12]. Kidneys and liver are the main organs especially sensitive to Cd toxicity [13]. In the human body, Cd most often causes damage to both of these organs, as well as the testicles, lungs and bones. In addition, it causes a carcinogenic effect, initiating cancers of the prostate, kidneys, pancreas and testicles [14].The table above shows that the metal content of Cadmium (Cd) in TGPS is 0.043 mg/kg. Based on SNI Number 7387 of 2009 [11] stipulates that the metal content of Cadmium (Cd) for this type of flour is a maximum of 0.4 mg/kg. Therefore, from the results of this study, it is known that the metal content of Cadmium (Cd) in TGPS has met the standards that have been set for food.

3.3. Tin (Sn)

Tin (Sn) is a naturally occurring heavy metal in the earths' crust, at an average concentration of 2 mg/kg. It is therefore also a component of many soils due to the natural weathering of bedrock. Normal concentrations of Sn in unpolluted soils range from less than 1 mg/kg to 200 mg/kg and is found in two oxidative states, stannous (+2) and stannic (+4) [15]. The concentration of Sn in the environment is however highly variable, and is dep endent on the use and release of Sn containing products by both natural sources such as the weathering of rocks and volcanic eruptions, and anthropogenic activities such as industrial processes, agriculture and mining [16].The table above shows that the metal content of Tin (Sn) in TGPS is 0.2320 mg/kg. Based on SNI Number 7387 of 2009 [11] stipulates that the metal content of Tin (Sn) for all types of food is in the range of 40-200 mg/kg. Therefore, from the results of this study, it is known that the metal content of Tin (Sn) in TGPS has met the standards that have been set for food.

3.4. Mercury (Hg)

Mercury is a heavy metal that is dangerous and can occur naturally in the environment, as a result of mineral degradation in nature through weather/climate processes, from wind and water. Mercury compounds can be found in the air, soil and water near dirty and dangerous places. Mercury can combine with other compounds such as chlorine, sulfur or oxygen to form inorganic mercury compounds or salts. Most inorganic mercury compounds are white powders or solutions except for mercury sulfide (known as cinnabar) which is red and turns black when exposed to light. Generally, mercury is found in nature in the form of metallic mercury, mercury sulfide, mercury chloride and methyl mercury [11].Mercury occurs naturally in the environment and exists in several forms.

These forms can be organized under three headings: metallic mercury (also known as elemental mercury), inorganic mercury, and organic mercury. The nervous system is very sensitive to mercury. In poisoning incidents that occurred in other countries, some people who ate fish contaminated with large amounts of methylmercury or seed grains treated with methylmercury or other organic mercury compounds developed permanent damage to the brain and kidneys. Permanent damage to the brain has also been shown to occur from exposure to sufficiently high levels of metallic mercury. Whether exposure to inorganic mercury results in brain or nerve damage is not as certain, since it does not easily pass from the blood into the brain [17].The table above shows metal content of Mercury (Hg) in TGPS is <LOD* mg/kg (Limit of Detection: 0.0081 mg/kg). Based on SNI Number 7387 of 2009 [11] stipulates that the metal content of Mercury (Hg) for flour-type foods is in the range of 0.5-1.0 mg/kg. Therefore, from the results of this study, it is known that the metal content of Mercury (Hg) in TGPS has met the standards that have been set for food.

3.5. Arsenic (As)

Arsenic is one of the most important heavy metals causing disquiet from both ecological and individual health standpoints [18]. It has a semimetallic property, is prominently toxic and carcinogenic, and is extensively available in the form of oxides or sulfides or as a salt of iron, sodium, calcium, copper, etc.

[19]. Arsenic is the twentieth most abundant element on earth and its inorganic forms such as arsenite and arsenate compounds are lethal to the environment and living creatures. Humans may encounter arsenic by natural means, industrial source, or from unintended sources. Drinking water may get contaminated by use of arsenical pesticides, natural mineral deposits or inappropriate disposal of arsenical chemicals. Deliberate consumption of arsenic in case of suicidal attempts or accidental consumption by children may also result in cases of acute poisoning [1].The table above shows that the metal content of Arsenic (As) in TGPS is <LOD** mg/kg (Limit of Detection: 0.0903 mg/kg). Based on SNI Number 7387 of 2009 [11] stipulates that the metal content of Arsenic (As) for flour and processed foods is 0.5 mg/kg. Therefore, from the results of this study, it is known that the metal content of Arsenic (As) in TGPS has met the standards that have been set for food.

IV. CONCLUSION

Based on the results of testing for metal content, TGPS has complied with SNI Number 7387 of 2009 [11] and has shown that TGPS is safe to use as a food thickener. Further research is needed on the application of TGPS as a thickener in the processing of food products.

V. ACKNOWLEDGEMENTS

The authors are grateful for the research funding provided by the Universitas Muhammadiyah Tapanuli Selatan, and Majelis Pendidikan Tinggi Penelitian dan Pengembangan Pimpinan Pusat Muhammadiyah Indonesia.

VI. AUTHOR CONTRIBUTIONS

Muharram Fajrin Harahap and Rafiqah Amanda Lubis assisted in conducting the experiments, performed the statistical analysis and data visualization and wrote the manuscript. Muharram Fajrin Harahap and Aisyah Nurmi designed and conducted all of the experiments and wrote the manuscript. All authors have read and approved of the final manuscript.

VII. CONFLICT OF INTEREST

The authors declare that they hold no competing interests.

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