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RESEARCH ARTICLE

Analysis of Catechins in Gambir West Sumatra

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Abstract: Gambir contains functional compounds that are included in the class of polyphenol compounds. The polyphenol compounds in gambir are mainly catechins, a natural substance that has antioxidant properties. The purpose of this study was to obtain catechin compounds from Gambir extract, to determine the solvent concentration and the right extraction temperature to obtain catechin compounds in Gambir, and to increase the selling value of Gambir latex in the Farmer community. To get the results of catechins in Gambir, this research was carried out using the infundation method. The yield of the extract was mostly found at a solvent concentration of 45% ethanol, a temperature of 105°C and a time of 3 hours, namely 81%. Qualitative test using FeCl_3 reagent can be seen that in the filtrate extracted from gambir there are catechins which show a blackish green color when dropped with FeCl_3

Keywords: Gambir, Catechins, Polyphenol

1. Introduction

Gambir plants (*Uncaria gambir* Roxb) grow well in areas up to 900 m above sea level. This plant requires full sun and even rainfall throughout the year. The shape of the mold is usually cylindrical, resembling brown sugar. The color is dark brown. Other names are catechu, gutta gambir, catechu pallidum (pale catechu). India imports 68% of gambir from Indonesia, and uses it as a betel nut mixture.

Gambir contains functional compounds that are included in the polyphenolic compound group. The main polyphenolic compounds in gambir are catechins (Heyne, 1987), a natural substance with antioxidant properties. Commercial gambir is obtained by processing gambir leaves by boiling, pressing, and drying solids. In trade, one component of gambir quality is determined based on its catechin content. For quality I, II, and III gambir, the minimum catechin content, respectively, is 40 percent, 30 percent, and 20 percent (Risfaheri et al., 1993).

1.1. Literature review

The gambir plant (*Uncaria gambir* (Hunter) Roxb) is a location-specific commodity in West Sumatra. This means that this commodity grows and develops well in this area and is a basic livelihood that plays an important role in receiving community income as well as regional and state income, namely as an export commodity that is able to make a large contribution to the region's Gross Regional Domestic Product (GRDP) and foreign exchange for the state (Bapeda, 1997).





Figure 1: Gambir

Latin name : *Uncaria gambir* (Hunter) Roxb.
Region Name : Gambir (West Sumatra).
Habitat : Grows in the forest or planted in gardens and yards.

1.2. Gambir Benefits

Gambir, which is commonly used to eat betel, turns out to have other broader functions. Gambir is used as an adstringent, diarrhea medicine, dye and tanning agent (Jumin, 1988).

The aims and objectives of this research activity are to master local technology for the production of catechins from gambir and to produce catechin products from gambir which are worthy of sale with 80% purity. This research activity is an alternative in increasing the added value of one of Indonesia's natural resources, namely increasing the added value of gambir because the selling value of gambir as a catechin product is higher.

2. Gambir Content

Gambir (catechu) contains catechins, catechutanic acid, tannins, quercetin, fluorescein gambir, fat, wax (Soedibyo, 1998).

Sari Pati Gambir comes from leaf sap which is extracted by a compression process (Kampo Mahatnya). 1. Extracts of gambir sap content are:

catechin: is a substance that is contained in the sap of gambir as much as 7-33%, the chemical formula for catechin or also known as catechoic acid is $C_{15}H_{14}O_6$. This acid belongs to the flavonoid structure, this acid is colorless and in its pure state this substance is less soluble in cold water but very soluble in hot water, soluble in alcohol and ethyl acetate.

Catechu Tannic Acid: as much as 20 – 55% Is anhydrous of catechins with the chemical formula $C_{15}H_{12}O_5$. Catechu tannic acid is a reddish brown powder and is the largest mixture contained in gambir sap and amorphous substances that are soluble in cold water.

Pyrocatechol: Substances contained in gambir sap as much as 20-30, this acid has another name, namely 1,2 benzol; 1,2 dihydroxy benzene or pyrocatechoic acid with the molecular formula $C_6H_6O_2$

fluorescence: Is the content contained in the sap of gambir and is a small part of gambir which gives a green fluorescence.

Red catechu 3 – 5: the content contained in the sap of gambir which gives the red color to gambir.

Quercetin 2 – 4: Is a substance in the sap that gives gambir a yellow color and is a flavanol derivative with the chemical formula $C_{15}H_{10}O$.

Fixed oil 1 – 2: is a substance found in gambir sap in the form of volatile oil.

Wax Substance 1 -2: is a substance found in gambir sap and is a monoester of a fatty acid and alcohol

Alkaloids: Is a substance that is slightly found in gambir leaves.

The main components of gambir are catechins (catechin acid or catechu) and tannic catechin acid (anhydride catechins). Catechins are secondary metabolites derived from flavonoids. Catechins, when subjected to prolonged heating or heating with alkaline solutions, will easily become catechin tannate, because of their own condensation and become easily soluble in cold or hot water (Zeiljelstra, 1943).

3. Research Methods and Materials

This research uses the type of research. Comparative research is a research that is comparing. Here the variable is still the same as the independent variable but for more than one sample, or at different times.

Table 1: Table of Tools and Materials

Tool	Ingredients
<ul style="list-style-type: none"> - Hot plate Extractor Unit - Erlenmeyer - Glass beaker - Analytical balance - Measuring pipettes, volumetric pipettes and drip pipettes - Mortar - grinder - Measuring cup - Analytical balance 	<ul style="list-style-type: none"> - The raw material is gambir product (uncaria gambir roxb) from gambir farmers in Sumatra. - Solvent : Ethanol-Water - Water - Filter paper - Washing agent: Chloroform

3.1 Work Procedure

1. The gambir product/gambir sap is mashed using a mortar and then ground until smooth.
2. The material has been finely dried in the sun
3. Product material that has been dried, then put it into the hot plate extractor unit using a solvent While being extracted, it is heated with variations in temperature: 100°C, 105°C, 110°C
4. The extraction technique used is infundation extraction, namely extraction by boiling, where the solvent is water at a temperature of 96-98 °C for 14-20 minutes.
5. The extract solution is distilled to remove the solvent contained in the solution. Distillation is carried out at a temperature of 70-100° C
6. The residue is cooled and kept at room temperature.
7. The residue has been cooled to remove impurities, the solution is washed using chloroform.
8. To increase the content of catechin compounds, mix the same amount of caffeine into the solution, then stir until smooth until a cloudy layer is formed which indicates an association between catechin compounds and caffeine.

3.2 Research Flowchart

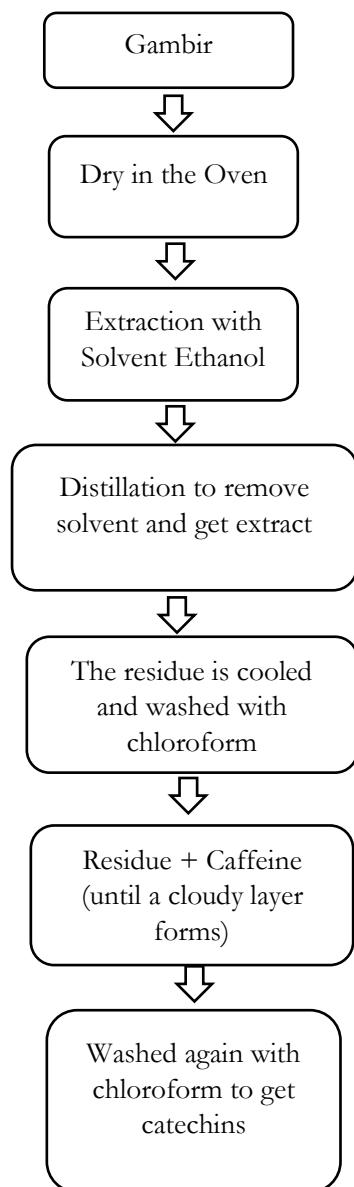


Figure 2: Research Process Flowchart

4. Results and Discussion

Based on the research that has been done on the solvent concentration variable and the extraction temperature variable, the results obtained are the levels of catechins in gambir

4.1 Catechin Obtaining in Gambir

The standard catechins were dried in an oven at a temperature of 105°C for 3 hours (SNI, 2000).

In this study, to produce gambir extract, the infundation extraction method was used with variations in the composition of ethanol solvent with a total solvent volume of 100 ml, the ratio of material to solvent was 45 grams of gambir powder with 100 ml of ethanol.

Variations in the composition of 70%, 80% and 90% ethanol solvents with 50 ml each added with 50 ml of water gave different extract yields from each solvent variation. This can be seen from the following table.

Table 2: The yield of gambir extract with a mixture of solvents (solvents) with different concentrations



Ethanol concentration	Temperature C	Gain of catechins (grams)
35%	100	20.36
	105	27.81
	110	12.30
40%	100	22.13
	105	30,18
	110	13.41
45%	100	27.93
	105	36.47
	110	16.27

The selection of solvent composition variations was carried out to obtain more gambir extract. With a total solvent volume of 100 ml, and 45 grams of gambir powder material, the largest extract yield was obtained at the ratio of ethanol solvent with a concentration of 45% at a temperature of 105°C was 36.47 grams.

4.2 Qualitative Testing of Catechins

The filtrate extracted from gambir was taken as much as 5 ml to be tested for the presence or absence of catechin content in the obtained gambir filtrate. The filtrate was dripped with FeCl_3 and then observed the change in color of the filtrate from brownish yellow to blackish green. In this case, it can be concluded that in the filtrate there are catechins. The addition of FeCl_3 is a compound that contains metals, so that when it reacts with catechins, Fe^{3+} will be reduced to Fe^{2+} and will form a complex chelate compound with catechins to produce color. The chemical nature of catechins will give a color reaction when reacted with FeCl_3 .

4.3 Discussion of Research Results

The blue picture shows the temperature of 100°C, the red temperature of 105°C, the green temperature of 110°C. Based on the graph above in terms of solvents, it can be concluded that the yield of catechins has different levels depending on the amount of ethanol solvent content, the greater the solvent content of ethanol, the higher the catechin produced.

The results of the acquisition of catechins in Gambir showed that the highest catechin content was obtained at a solvent concentration of 45% ethanol, a temperature of 105 oC and a time of 3 hours, namely 81% of the total mass of Gambir used. The data obtained from the catechins are presented in Table 2

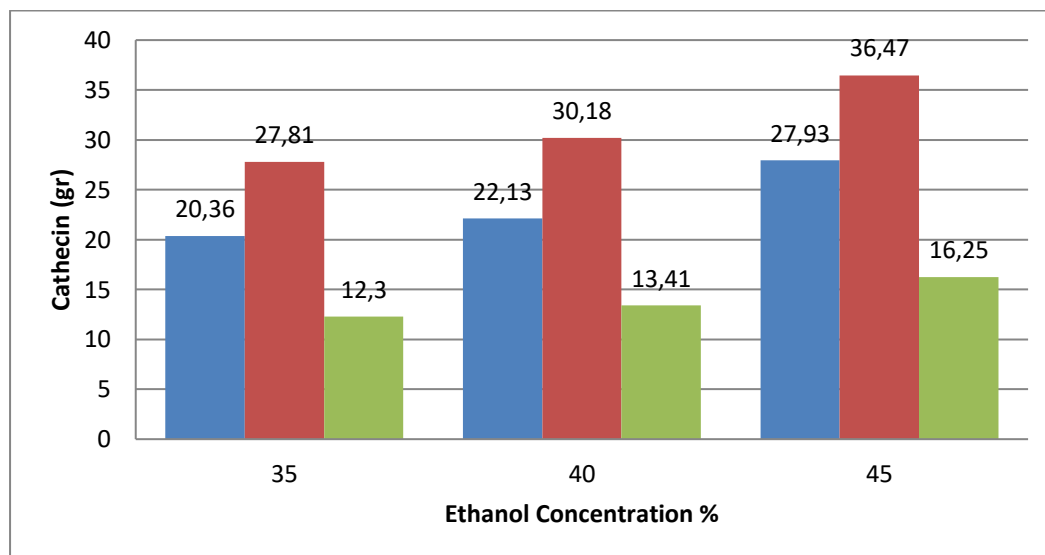


Figure 3: Obtaining Catechin Content in Ethanol Solvent

Table 3: Obtaining catechins with an ethanol concentration of 45%.

Ethanol concentration	Temperature °C	Gambir catechin yield (grams)	% gambir catechins
45%	100	27.93	62%
	105	36.47	81%
	110	16.25	36%

Based on the table data above in terms of heating time and temperature, it can be concluded that at a temperature of 100°C catechins are known to have catechins in the gambir by 62% at a temperature of 105°C by 81%, and at a temperature of 110°C by 36%. How to detect catechins by using the FeCl₃ indicator which if tested on these compounds will cause a reaction indicating that there are catechin compounds in gambir with a green color.

4.3.1 Effect of temperature on extraction

It can be seen in the previous table that the higher the temperature at the time of extraction, the less catechin content contained in gambir, because catechins in gambir will disappear at 110°C.

Extraction using 70%, 80%, and 90% ethanol solvents at various predetermined temperatures, namely 100°C, 105°C and 110°C. This is intended to be able to determine whether the catechin compounds contained in gambir are still visible or not, and it can be seen that at a temperature of 100°C and a temperature of 105°C in 70%, 80%, and 90% ethanol solvents with the same levels of catechin compounds are still present. found in gambir, but at a temperature of 110°C catechin compounds that have been given ethanol solvent at the same level are no longer visible in the gambir.

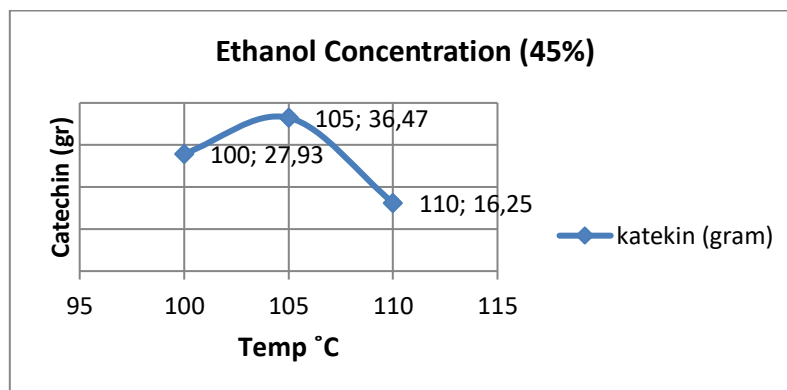


Figure 4: Effect of Temperature Variation on Extraction

At the time of extraction, the temperature was varied in order to know the difference between each temperature that will react to the results of the study, it can be seen in the research data that catechin compounds with a temperature of 110°C were not identified in the studied gambir, the substances contained in gambir are catechins or Catechu Tannic Acid is an anhydrous of catechins, with the chemical formula $C_{15}H_{12}O_5$. When catechins are heated at a temperature of 110°C or by heating in an alkaline carbonate solution, it will lose one molecule of water and turn into Catechu Tannic Acid which is a reddish-brown powder, quickly soluble in cold water, alcohol, colorless in solution. lead acetate. therefore at a temperature of 110°C catechins are no longer present in the gambir.

4.3.2. Effect of Solvent Level on Extraction

The solvent used at the time of extraction is ethanol solvent. The advantage of using 70% ethanol solvent is that it is non-toxic and harmless, ethanol is used because the antioxidants to be extracted are expected to be applied to foodstuffs.

The 70% ethanol solvent was chosen because the catechin compound is a compound containing 2 aromatic rings with more than one hydroxyl group. Robinson (2005) stated that a phenolic compound with a hydroxyl group has polar properties, so to extract phenolic compounds a polar solvent was chosen.

70% ethanol solvent is a polar solvent, so it is suitable for extracting phenolic compounds. Phenolic compounds are antioxidant compounds that can donate hydrogen atoms to free radicals. (Prakash, 2001).

From the various results of these studies, it is necessary to conduct research on the extraction of gambir using 70% ethanol as a solvent at various extraction temperatures to obtain high phenolic levels and anti-radical activity..

From the research data, it can be concluded that with the ethanol solvent with varying levels at a concentration of 70% to 90% at a temperature of 100°C and a temperature of 105°C there are still catechins.

Ethanol solvents used are solvents with varying concentrations of ethanol 70%, ethanol 80%, and ethanol 90%. With varying temperatures, namely 100°C, 105°C, and 110°C.

From the research data, it can be concluded that with ethanol solvents with varying levels at a concentration of 70% to 90% at a temperature of 100°C and a temperature of 105°C there are still catechins.

4.3.3 Discussion of Distillation Results

The technique carried out after the extraction process is distillation. Distillation is a technique to separate a solution into each of its components. The principle of distillation is based on the difference in the boiling points of the components of the substance.

Distillation can be used to purify compounds that have different boiling points so that compounds with high purity can be produced.

When the extraction process used is ethanol solvent, the possibility that occurs is that the ethanol contained in the extraction results is still there, then a distillation process is carried out to remove the remaining ethanol previously processed, to remove ethanol from this process distillation is carried out at high temperatures because the molecules Ethanol has hydrogen bonds between O atoms and H atoms, so breaking the hydrogen bonds requires more energy, thus causing a higher boiling point.

When the distillation temperature used is 70°C, the boiling point of ethanol is around 78°C, so distillation is carried out at this temperature to separate ethanol from water. After the distillation process, a washing process was carried out with chloroform to remove the caffeine compound contained in the research results. if it has been washed clean and then carried out an identification test of catechins with FeCl₃, the addition of FeCl₃ is a compound containing metal, so that when it reacts with catechins, Fe³⁺ will be reduced to Fe²⁺ and will form a complex chelate compound with catechins to produce a blackish green color.

5. Conclusion

The higher yield of the extract was found at a solvent concentration of 45% ethanol, a temperature of 105 oC and a time of 3 hours, namely 81%. Qualitative test using FeCl₃ reagent can be seen that in the filtrate extracted from gambir there are catechins which show a blackish green color when dropped with FeCl₃.

The solvent used at the time of extraction is ethanol solvent. The advantage of using 70% ethanol solvent is that it is non-toxic and harmless, ethanol is used because the antioxidants to be extracted are expected to be applied to foodstuffs. However, the best results for obtaining catechins were using 90% ethanol as solvent.

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