

The Effect of Distillation on Ethanol Content in Sageru and Sopi Samples from Enau Trees (*Arenga Pinnata*) Using UV-Vis Spectrophotometer

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Article history: received: 30-05-2024; revised: 12-06-2024; accepted: 28-06-2024; published: 28-06-2024

ABSTRACT

Sopi is a traditional Maluku alcoholic drink produced from the fermentation of sageru from tapping palm trees (*Arenga pinnata*), one of the ingredients of which is ethanol. The research aimed to determine the ethanol content of sageru and beef samples from traditional and steam distillation. This experimental research method uses the UV-Vis spectrophotometer method to determine the effect of distillation on ethanol levels in sageru and sopi samples from Enau trees (*Arengan pinnata*). Based on the results of the quantitative analysis carried out using the UV-Vis spectrophotometry method, it was found that the alcohol content in traditional drinks (sageru and sopi) from palm plants (*Arenga pinnata*) was (13%-29%), which falls within the provisions of BPOM RI No. 6 of 2018 states that drinks that have ethyl alcohol or ethanol levels of more than 20% to 50% are included in group C. So, it can be concluded that the ethanol content was obtained in the sageru sample resulting from distillation at a temperature of 50 °C to 78 °C (13% - 27%). Ethanol levels were found in samples of traditional distilled beef (24% - 29%).

Keywords: Ethanol, Sopi, Sageru, UV-Vis Spectrophotometer

1. INTRODUCTION

Based on the Global Status Report on Alcohol and Health, 2018, it is stated that alcohol users in Indonesia 0.8%, and the prevalence/amount of alcohol dependence in Indonesia is 0.7% for men and women. If you look at the presentation, this value is very small, but if it is related to the total number of Indonesian citizens, namely 261,100,000 residents, of whom 2,088,800 experience health problems due to alcohol use and as many as 1,827,700 experience alcohol dependence [1]. The World Health Organization (WHO) reports that in 2022, 3 million people will die every year in the world due to alcohol use, of which 5.3% are the cause of death. Alcohol consumption among people aged 20-39 years is approximately 13.5% of deaths caused by alcohol consumption [2].

Traditional alcoholic drinks are alcoholic drinks that are prepared traditionally and handed down from generation to generation, which are packaged simply and made at any time to be used for traditional needs or religious ceremonies. In the city of Ambon itself, the

type of drink that is most consumed is traditional drink, the average drink consumed is around 62.5%. Sopi is a traditional drink of the people in Ambon, where the level of consumers is quite high [3]. Sopi is a very popular type of traditional drink typical of Maluku which the people have produced for a long time by distilling sap. Before distilling sap, a fermentation process is first carried out [4]. It should be noted that alcoholic drinks are drinks that contain a type of addictive substance whose abuse has serious consequences for health, society, and social problems [5].

According to BPOM [6] states that alcoholic drinks as referred to can be classified based on the following groups, class A alcoholic drinks are drinks that contain ethyl alcohol or ethanol (C_2H_5OH) with levels of up to 5%, while class B alcoholic drinks are drinks that contain ethyl alcohol or ethanol (C_2H_5OH) with levels > 5% - 20%, while class C alcoholic drinks are drinks containing ethyl alcohol or ethanol (C_2H_5OH) with levels > 20% - 55%. However, often this drink itself is consumed without any restrictions so

that anyone who consumes it can end up feeling dizzy and unconscious because this drink contains alcohol, the alcohol content of which is the result of fermentation which has gone through traditional distillation so that the alcohol content is high. What's in this drink is not known for certain. The impact of this drink brings bad things to anyone who drinks it, where it can cause chaos and accidents because the drink influences it.

2. METHODS

2.1. Tools and materials

The tools used for this research were measuring flasks, a series of distillation tools, brown bottles, analytical scales, Erlenmeyer, test tubes, chemical glasses, measuring cups, water bath (Bante), vortex (Velp Scientifika), measuring pipettes, and UV-Vis spectrophotometer. (Cary 50 Variant). The materials used in this research were alcoholic drinks (Sopi and sageru), distilled water (H₂O) (waterone), potassium dichromate (K₂Cr₂O₇), sulfuric acid (H₂SO₄), ethanol (C₂H₅OH).

2.2. Procedures

1. Prepare Samples

Pipette a 50 mL sample of sageru then put it in a distillation flask and add 50 mL of distilled water, then distillation is carried out with varying temperatures of 50°C, 70°C, and 78°C, the distillation results are collected in a 60 mL sample bottle.

2. Making Reagents

Weighed 16.884 grams of potassium dichromate dissolved it in 500 mL of distilled water and homogenized using a stir stick until dissolved, then added 162.5 mL of concentrated sulfuric acid transferred it into a 500 mL measuring flask and added distilled water to the mark.

3. Making a Standard Curve

A standard curve was created from an absolute alcohol concentration of 100% with an alcohol concentration of 5%, 10%, 15%, 20%, and 25%, then a procedure was carried out such as determining the sample by replacing the sample with a standard alcohol solution.

4. Sample Analysis

Pipette a 0.5 mL sample then add 15 mL distilled water and 12.5 mL reagent into the Erlenmeyer then shake. Then 10 mL of the solution was taken and put into a test tube, then heated in a water bath at a temperature of 62.5 °C for 20 minutes. Next, it was cooled to room temperature, then the cooled solution was put back into the Erlenmeyer then pipetted again into a test tube as much as 5 mL and added 2.5 mL of distilled water. Homogenized using a vortex mixer. Before the sample is entered into the tool, the sample data is entered, where the sample data consists of samples (sageru 1 50°C, sageru 1 70°C and sageru 1 78°C), samples (sageru 2 50°C, sageru 2 70°C and sageru 2 78°C), samples (sageru 3 50°C, sageru 3 70°C and sageru 3 78°C) as well as samples (sopi 1, sopi 2, sopi 3), then test the samples with a Varian Cary 50 Conc UV-Vis spectrophotometer.

3. RESULTS AND DISCUSSION

In this study, the samples used were sageru and sopi samples which came from the Enau tree (*Arenga pinnat*) which is where this tree can produce sageru or commonly known as palm sap, but sopi itself comes from distilling sageru. The sample in this study came from Maluku Province, District West Seram (SBB) Kamal village. Processing the sopi drink uses sageru, people take sageru from the Mayang tree or what we know as enau, where the manufacturing process is first taken from the sap in the form of a white sweet liquid, this liquid is tapped from unopened fibers from the tree. The process of tapping sageru itself takes place from morning to evening, which is called tifar sageru, the results of this tapping are then stored in a closed container, which can undergo fermentation with wood roots. The results of this fermentation are then distilled to produce sopi.

In this research, quantitative analysis was carried out, this analysis was carried out using a UV-Vis spectrophotometer which aims to determine the ethanol content contained in samples of traditional alcoholic drinks (Sageru and Sopi). Sample preparation is carried out using the distillation method. Distillation is the process of separating or purifying a liquid based on boiling point. In this process the sample is distilled sageru 1, sageru 2, and sageru 3 at temperatures of 50 °C, 70 °C, and 78 °C (boiling point of alcohol). The distillation results were collected in an Erlenmeyer

flask and transferred to a white bottle which was closed using aluminum foil.

Before measuring the ethanol content, first determine the maximum wavelength in the acid dichromate solution, which is intended as a substance that can convert ethanol into acetate. In determining the maximum wavelength, absorption is measured in the wavelength range used, namely 595 nm-610 nm, this is by the analysis used, namely the color that will be absorbed is orange while the complementary or visible color is green-blue, which is obtained the optimum wavelength is 600 nm.

Next, determining a standard curve which aims to see the relationship between the concentration of the solution and its absorbance value, first, a standard series of 100% ethanol (p.a.) with concentrations of 5%, 10%, 15%, 20%, and 25% is created, using Pipette 2.5 mL, 5 mL, 7.5 mL, 10 mL, and 12.5 mL of 100% ethanol solution (p.a.) then put it into a 50 mL measuring flask and add distilled water until the mark, then the process of making a standard solution transferred into an Erlenmeyer flask to be reacted with reagents ($K_2Cr_2O_7$ and H_2SO_4) and distilled water, transferred into a test tube and homogenized using a vortex. Then preparation was carried out according to the sample analysis procedure by adding reagents. After the reaction was complete, a standard series test was carried out using a UV-Vis spectrophotometer at a wavelength of 600 nm.

In this research, ethanol is oxidized by potassium dichromate to become ethanoic acid/acetic acid, in an acidic atmosphere then another oxidation reaction occurs to produce the final product in the form of carboxylic acid. The heating process using a water bath with a temperature of 62.5°C functions to perfect the reaction. The higher the ethanol concentration, the more intense the color produced.

The results of distillation with 3 temperature variations (50°C, 70°C, 78°C) on sageru drink samples using a series of steam distillation equipment, can be seen in table 4.1.

Based on Table 4.1, the distillation results show that the sageru sample is controlled at a predetermined temperature. Based on Table 4.2, the results of traditional distillation of samples of sopi are not temperature controlled, but from the distillation results that have been taken, seen from the desired volume, according to research by [7], it is stated that the quality separation of sopi they observed was based on the volume of distillation results that they can, not control the boiling point temperature of a solution.

Based on table 4.3, the standard series of ethanol made are 5%, 10%, 15%, 20%, 25%. This ethanol

standard was made in 50 mL using distilled water as a solvent. The process of making this standard is carried out in a 50 mL measuring flask which is then transferred into a test tube.

Table 4.1. Results of distillation of sageru drink

No	Sample	Distillation temperature	Distillation results
1	Sageru I	50°C	12 mL
2	Sageru I	70°C	12 mL
3	Sageru I	78°C	10 mL
4	Sageru II	50°C	10 mL
5	Sageru II	70°C	11 mL
6	Sageru II	78°C	10 mL
7	Sageru III	50°C	11 mL
8	Sageru III	70°C	10 mL
9	Sageru III	78°C	10 mL

Table 4.2. Results of distillation of sopi drinks (traditionally)

No	Sample	Temperature variations
1	Sopi I (sopi kepala)	Uncertain
2	Sopi II	Uncertain
3	Sopi III	Uncertain

Table 4.3. Results of measuring the absorbance of standard solutions

No	Concentration (x)	Absorbance (y)
1	0	0
2	5	0,0649
3	10	0,1328
4	15	0,2104
5	20	0,2885
6	25	0,3471

After the process of adding distilled water and ethanol is complete, homogenization is carried out using a vortex. This vortex is not only used in making standard solutions but is also used for samples so that they are well homogenized. After the preparation is complete, a standard series test is carried out using a UV-Vis spectrophotometer at wavelengths. 600 nm. The data obtained is then presented in figure 4.1.

Based on Figure 4.1, we get a simple regression equation $y = 0.0142x - 0.0035$ and a regression correlation (R^2) of 0.9985, where there is a close correlation and good linearity between the concentration of the standard solution and its absorbance. Based on the Lambert-Beer law, the value

of a is 0.0142 which is the intercept, and the value of b is 0.0035 which is the slope.

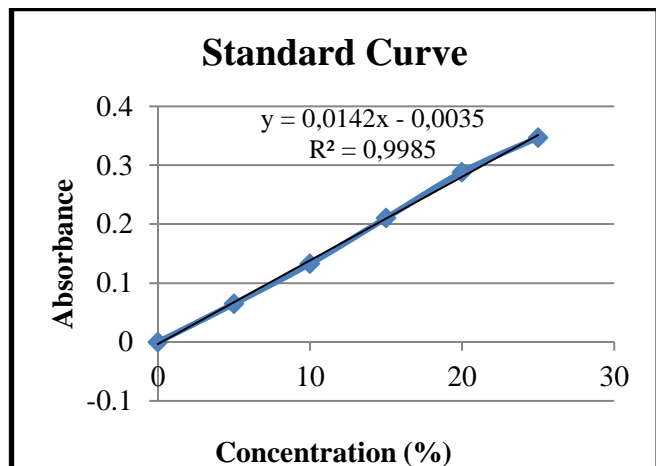


Figure 4.1. Determination of standard solution concentration

In the journal [8], it is stated that the linearity of a curve is said to meet the requirements if the regression correlation (R) value obtained is close to 1, then there is a linear relationship between the analyte concentration and the measured absorbance.

Table 4.5. Results of analysis of ethanol levels in Sageru and Sopi

No	Sample	Average absorbance (triple)	%
1	Sageru 1 (50°C)	0,2778	19,8099
2	Sageru 1 (70°C)	0,2975	21,1972
3	Sageru 1 (78°C)	0,2453	17,5211
4	Sageru 2 (50°C)	0,2254	16,1197
5	Sageru 2 (70°C)	0,3418	24,3169
6	Sageru 2 (78°C)	0,2294	16,4014
7	Sageru 3 (50°C)	0,194	13,9085
8	Sageru 3 (70°C)	0,3806	27,0493
9	Sageru 3 (78°C)	0,3844	27,3169
10	Sopi 1	0,3632	25,8239
11	Sopi 2	0,4148	29,4577
12	Sopi 3	0,3491	24,8310

Based on Table 4.5, the sample measurements were measured 3 times (in triplicate) with a wavelength of 600 nm. The results of measuring high ethanol levels obtained from three sageru were 70 °C and 78 °C. Likewise, the ethanol concentration of traditionally produced sopi is very high, namely sopi 2 because

when distillation is carried out the resulting temperature is not controlled. So, it can be concluded that distilled sageru should use an average temperature of 70 °C to produce ethanol concentration. Traditionally, the 3rd distillate should be taken from the distillate because the ethanol content can still be controlled. However, the results obtained by good ethanol levels in traditional drinks should be no more than 24% v/v. In the research of [9], on samples of traditional alcoholic drinks (arak) from the silawan plant, the alcohol content was 58%, where the content contained was contrary to the BPOM [6] provisions, where the quality standard for alcohol content in arak drinks is included in the category of fermented drinks. from the distillation of sap food ingredients, namely a distinctive odor, normal taste, ethanol content of not less than 30%, and methanol content of not more than 0.01%. From the research results obtained, it can be seen in Table 4.5 of several distillation results of good ethanol levels in traditional sopi-type drinks according to BPOM [6]. In this table of quality standards for alcoholic drinks, the ethanol content should be no less than 7% and no more than 24% v/v. This is included in the provisions of BPOM RI No. 6 of 2018 states that drinks that have ethyl alcohol or ethanol levels of more than 20% to 50% are included in group C.

From the results of the research above, it is known that the samples of traditional alcoholic drinks (sopi and sageru) analyzed have levels that fall within the standard regulations required by BPOM RI, in this case, people can still consume them, but if excessively this can cause health problems, such as symptoms severe ataxia, double or blurred vision, fainting and sometimes convulsions as well as a high risk of coronary heart disease and can cause death.

4. CONCLUSION

Based on the results of research that has been carried out, the ethanol content in traditional alcoholic drinks (sageru, and sopi) from palm trees (*Arenga pinnata*) was obtained in sageru samples resulting from distillation at temperatures of 50 °C to 78 °C, the ethanol content was 13% - 27%. In samples of sageru from traditional distillation, the ethanol content was found to be 24% - 29%, so it can be concluded that sageru from distillation should use an average temperature of 70 °C to produce ethanol concentration. Traditionally, the 3rd distillate should be taken from the distillate because the ethanol content can still be controlled.

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