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Characteristics Of Glucose Syrup From Various Sources Of Starch

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Abstract. Glucose syrup is a type of sugar that is widely used in the processed food industry, such as the confectionery industry, beverages, and in addition can also be used as raw materials of the pharmaceutical industry and chemical industry. The large use of glucose syrup in the industry demands to review glucose syrup from other sources of starch because each region has different agricultural potential. This research was conducted to see how the properties of other starch sources are then compared to the standard that is from cassava starch so that it can be suggested for the use of other sources of starch.

The program in this study was RAL 5 treatment 3 replays with one treatment as a control.

12 Observation of glucose syrup in accordance with the standard glucose syrup namely SNI (Indonesia's National Standards) No.01-2978- 1992 covers raw material starch content, water content, ash content, and reducing sugar content. Further tests are conducted by way of 3 Duncan's New Multiple Range Test (DNMRT) at a real rate of 5%. Based on the results of research that has been done sago starch is the best treatment with the following chemical characteristics: 82,35% raw material starch level, water content 13,20%, ash content 0,3% and glucose syrup content 50,51%.

Keywords: cassava, glucose syrup, starch

1. Introduction

The increase in the population in a country causes food needs to increase. 1 One of the main food needs is sugar. The price of sugar is now increasing, this is due to the

increasing need and is not accompanied by domestic production so that there is import from other countries. Glucose syrup is **one of the** alternatives to overcome this problem. **2** **Glucose syrup is a** type of sugar that is widely used in the processed food industry, usually used as the raw material of the confectionery, beverages, and jam industries. In addition glucose syrup **can also be used** as raw material of pharmaceutical industry and chemical industry. According to [1] glucose syrup has many advantages over granulated sugar among others more practical to use **1** **because it is** already in liquid condition and does not cost to dilute sugar if the industry uses granulated sugar. Glucose syrup is now commercially produced by starch sourced industries.

Starch is a group of carbohydrates that are widely found in food crops so it **is expected to be used as a** source other than tapioca to support the production **of glucose syrup**. Currently, glucose syrup produced commercially comes from cassava starch that is tapioca but does not close the possibility that it can come from other crops that have a high source of starch such as corn, sago, taro and fruit groups with high starch that is jicama. According to [2] glucose syrup can be made from starchy ingredients such as tuber starch and grains. Therefore with this research **1** **is expected to** be a solution to find other sources **of glucose syrup** other than tapioca.

13 **The process of making glucose syrup** is obtained through **the process of** starch hydrolysis, then neutralization and bending to some degree. The **20** **manufacture of glucose syrup consists of two** hydrolysis methods, namely the process of hydrolysis of starch enzymatically and non-enzymatically, but what many do and safer is hydrolysis enzymatically [3]. The **4** **process of glucose syrup production** through enzymatic hydrolysis consists of liquification, saccharification, bleaching, filtration, evaporation and storage. This research aims to find alternative sources **2** **of glucose syrup derived from other** food crops that are also a source of starch.

2. Material and Methods

2.1. Materials and tools

The materials needed for **21** **the making of glucose syrup** are cassava starch, corn starch,

sago starch, taro starch and jicama starch. Other materials are alpha amylase enzymes and alpha glucosidase, while the materials for analysis are luff, aquades, boiling stone, KI 20%, H₂SO₄ 4 N, Sodium Thiosulfat 0,1 N, amilum indicator 1%, HCl 3%, NaOH 25%, and filter paper.

The tools used for the process of making starch are pans, graters, scales, trays, heating glucose syrup making equipment, stirers, thermometers while equipment for analysis are burettes, aluminum cups, ovens, desicators, tank krus, furnaces, waring blenders, erlemeyer 500 ml, burets, condensers, test tubes, drop pipettes, beaker glasses, measuring glasses, back cooling, spatulas and volumetric glasses 250 ml.

2.2 Research implementation.

This research has been carried out as many as 3 stages starting with the making of starch by extraction for commodities whose starch is not sold freely on the market. The making ² of glucose syrup enzymatically uses alpha amylase enzymes and alpha glucosidase at various starch sources. The result of glucose syrup is then analyzed its chemical characteristics include : starch content of raw materials, moisture content, ash content and sugar content of reducing glucose syrup.

2.3. Program

The design of this study is a Complete Randomized Design with 5 treatments and three replays. Further tests were conducted with ³ Duncan's New Multiple Range Test (DNMRT) at a real rate of 5%. The treatment is as follows : cassava starch, corn starch, sago starch, taro starch and jicama starch.

3. Results and Discussion

3.1 Starch Content

The result of the variance analysis for the starch content of raw materials differs from the real level of 5%. The ⁶ data on the average starch content of raw materials can be seen in Table 1.

Table 1. Average starch levels of raw materials

Treatments

Average starch levels of glucose syrup (%)

A (cassava starch)

83,53a

B (corn starch)

83,32 b

C (sago starch)

82,35 c

D (taro starch)

81,28 d

E (jicama starch)

76,73 e

The numbers followed by the same lowercase letter in the same row and the same uppercase in the same column differ not real according to the DNMRT advanced test at a real level of 5%.

3 Based on the table above, the starch levels of raw materials are real different each others. This happens because it comes from a different source. Cassava, corn and sago are foodstuffs with a high source of starch while taro and jicama are low sources of starch. Jicama from the rendemen process of making starch is also lower than taro. According to [4] sago starch levels are higher than corn starch and cassava, but lower than rice starch which is 79.40-80.77%. Furthermore, according to [5] tubers that contain a lot of starch are the main groups of tubers such as 18 cassava and sweet potato (major root crops) and groups of minor tubers such as taro *Dioscorea hispida*, elephant foot yam, purple yam, lesser yam (minor root crops)

3.2 Water Content

3 The result of the variance analysis for different starch sources had no noticeable effect

on the water content of glucose syrup at a real rate of 5%. ¹⁹ The results of the analysis of water content from several treatments can be seen in Table 2.

Table 2. Average water ⁷ content of glucose syrup from various starch sources

Treatments

Average water content (%)

E (Jicama Starch)

26,92a

B (Corn Starch)

18,75a

A (Cassava Starch)

18,52a

D (Taro Starch)

16,45a

C (Sago Starch)

13,20a

The numbers followed by the same lowercase letter ⁹ in the same row and the same uppercase in the same column differ not real according to the DNMRT advanced test at a real level of 5%.

In Table 2 seen, the highest water content ⁴ in the syrup of jicama starch (E) while the lowest water content is found in the syrup of sago starch (C) treatment, but unreal different. The above syrup water content has met the syrup standard, INS 01-2978-1992 which is a maximum of 20%, except E treatment it has a water content of 26.92%. High or low water content in ² glucose syrup is associated with the length of heating during the liquification and saccharification process to achieve Dextrose Equivalent (DE) 33. According to [1] ⁴ the saccharification process is declared complete when it has been achieved the viscosity value of 30-35 Brix. Each treatment of glucose syrup has a different ability to achieve the

DE, causing the water levels between different treatments. According to [6] that the longer of cooking time the water content will decrease, causing more water evaporation so that the water content in the material gets smaller. The evaporation is also caused by the difference in steam pressure between water in the material and water vapor ¹⁹ in the air. The ⁸ pressure of water vapor in the material is generally greater than the pressure of water vapor in the air so that there is a transfer of water mass from the material to the air.

Furthermore, according to [7] ¹⁴ water content in a material will affect the quality because it is closely related to the durability of the material during storage. Different water content is also caused by the granular size of each different starch, large granules will take longer in liquification. According to [1] that on the modification of starch by using amylase enzymes, granular size is an important factor in hydrolysis due to differences in surface area.

3.3 Ash Content

The result of the variance analysis for ash content ⁴ of glucose syrup from various source of starch are unreal different at the level of 5 %. Average ash content of glucose syrup according to treatment can be seen in Table 3.

Table 3. ⁷ Average ash content of glucose syrup from various starch sources

Treatments

Average ash content (%)

D (taro starch)

0,6a

A (cassava starch)

0,4a

C (sago starch)

0,3a

B (corn starch)

0,2a

E (jicama starch)

0,08a

The numbers followed by the same lowercase letter **9** in the same row and the same uppercase **in the same** column differ not real according to the DNMRT advanced test at a real level of 5%.

The ash contents **2** of glucose syrup from all of the above treatments have met the standard INS 01-2978-1992 **which is a** maximum of 1% and between different treatments is not real each other. The value of different ash contents in each treatment is influenced by the raw materials used from various sources of **1** starch. In the table above seen that the highest ash contents are found in treatment D (taro starch). According to [8] the mineral content of taro tubers is higher when compared to other tubers such as **18** **cassava and sweet potato**. The chemical composition depends on several factors including variety type, age, maturity of tubers, climate and soil fertility. Furthermore, [9] said ash contents have something to do with minerals of a material, ash contents **14** in a food process indicate that the content of organic salt and unorganic salt on the cooking can decrease while fried foodstuffs experience an increase in ash contents.

4. **5** Sugar Content Reducer

The result of the variance analysis for **glucose syrup sugar content reducer** is real different at tlevel of 5%. Average value of sugar reducer for all treatments can be seen on Table 4.

Table 4. Average glucose syrup sugar content reducer from various starch sources

Treatments

Average sugar content reducer

C (Sago starch)

50,51a

A (Cassava starch)

46,46 b

B (Corn Starch)

42,52 c

D (Taro Starch)

40,51 d

E (Jicama Starch)

39,38 e

The numbers 3 followed by the same lowercase letter in the same row and the same uppercase in the same column differ not real according to the DN MRT advanced test at a real level of 5%.

Based on Table 4 above seen that the 5 sugar content reducer of all treatments are real different each other and the all value has met INS 01-2978-1992 which is at least 30%.

The sugar content reducer differs in each source of starch, this occurred 1 due to the difference in the amount of starch in the material. The starch value can be seen in Table 1 above. Sugar content reducer levels will be high if starch levels are high.

According to [10] high starch levels signify high glucose levels. The 4 increase in the value of sugar reducer and DE will reach the limit point, after that point is exceeded then there will be no change in the value of higher sugar reducer even though the concentration of enzymes is added and the time of saccharification is extended [11].

In the treatment of sago starch (E) the liquification process lasts longer than other treatments so it is very influential to the sugar content reducer of the syrup. According to

[12] DE glucose syrup increases along with the increased length of the liquification process at all levels of enzyme concentration treatment. 8 The higher the DE solution the higher the glucose level and the lower the dextrin level.

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