Influence of Type and Concentration of Acids on Hydrolisis Starch of "Taro Tuber" Into Sugar Liquid

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Abstract

The objectives of this research are (1) to know the effect of acid type and concentration on the hydrolysis of Taro tuber starch into liquid sugar (2) to know the type and concentration of acid that can produce the best liquid sugar characteristic in the hydrolysis of Taro tuber starch. The study used a complete randomized design with two factorial patterns. There are the type and concentration of acid used for the hydrolysis of Taro tuber starch. The variables observed were sugar reduction and liquid sugar clarity. The results showed that the type and concentration of acids and their interactions significantly affected the Dextrose Equivalent of liquid sugar produced. The best treatment is hydrolysis using nitric acid (HNO3) with 6% concentration with Dextrosa Equivalent is 57,470 %.

Keywords: *Acid hydrolysis, liquid sugar, taro tuber starch.*

1. INTRODUCTION

The alternative sugar derived from starch perform in glucose syrup, fructose, maltose, mannitol and sorbitol, which have similar taste and sweetness level compared with cane sugar. Some are even sweeter. Among the starch sugars derived from potensiai tuber (minor) is Taro. The starch from Taro can be hydrolyzed into glucose syrup and fructose that prospect to substitute the cane sugar (Richana, 2010).

The starch Hydrolysis processed using enzyme and acid. Previous researches about Taro tuber starch (Hartiati and Yoga, 2014) hydrolyzed the tubers starch using enzyme α-amilase and amyloglucosidase shows results that have not been maximized. Beside the high price of enzyme used and also the liquid sugar produsedis still under the SNI standard (Low DE and the sugar color is browny yellow), more research is needed to get good results and easy to do.

The previous research about starch hydrolysis using acid done by Putri and Sukandar (2008). That is Ganyong (Canna) starch hydrolysis using HNO_3, H_2SO_4 and HCl 3–7% concentration at 120°C. The best treatment with highest DE in hydrolysis using HNO_3 7% concentration is 28,4. The other research is done by Minah (2010) of Canna starch with two acid comparison, HCL and HNO_3 in 1,5 –7,5 % concentration. The best treatment with highest glucose levels is using HNO_3 at 6 % is 87,20 %.

The starch hydrolysis using acid can be done perfectly by the low cost other than by using enzyme, and takes faster hydrolysis period. So it is easier to do. In this research, the hydrolysis processed using HNO_3, H_2SO_4 and HCl of Taro starch. The acid concentration used are 6%, 7% and 8% each at the temperature of 90°C for 1 hour (Dinarsari and Alfina, 2015)

2. MATERIALS AND METHODS

The laboratory where the research held is in Agricultural Product Analysis Laboratory, Agricultural Technology Faculty, Udayana University. The time of research start from March until June 2017.

The tools used in this research are Oven (Blue M), analytical balance (SHIMADZU), waterbath (nvc thermology), refractometer P-1 brix 0-32%, spectrophotometer (turner SP-870), Volumetric Flask (pyrex), blender (miyako), knife, filter cloth, Erlenmeyer (pyrex), measuring cup (pyrex), beaker glass (pyrex), volume dropper, drop pipette and filter paper.

The material used is Taro tuber obtained in the Tabanan area with 4 months of age calculated from flowering plants. The ingredients for analysis are water, aquades,

NaOH, reagen nelson, arsenomolibdat and PP solution. The bleach ingredient is Natrium metabisulfite 0,3% for producing Taro starch and NaCL for Gadung starch. The acid used for hydrolysis process is HNO_3 3Mol (nitric acid), HCl 3Mol (chloride acid), dan H2SO4 3Mol (sulfate acid)

The experimental design used was factorial randomized block design with 2 factors, they are acid type factor and concentration of the amount of acid used.

The first factor is Treatment, consisting 3 levels:

A1 = Starch Hydrolysis with HNO_3

A2 = Starch Hydrolysis with H_2SO_4

A3 = Starch Hydrolysis with HCl

Second factor is Concentrated Acid in 3 levels:

K1 = 6%

K2 = 7%

K3 = 8%

The treatment obtained from the two factors above are 9 combination treatments, and each treatment defined into two groups based on the treatment implementation time so that 18 research units obtained followed by Duncan test.

This research using Taro starch made from best treatment of previous research. The Taro starch were made of water and Taro tuber comparison (4:1) using Natrium Metabisulfite 0,3 % (Saputra, 2015).

The hydrolysis process start by measuring 0,5 g Taro tuber added with 25 ml aquades then the starch added with 20 ml acid wit the treatment of HNO_3 (6%, 7%, 8%), H_2SO_4 (6% ,7%, 8%), HCl (6%, 7%, 8%) the mixed well with the vortex. The mixture then hydrolyzed using Reflux tools equipped with back cooling and heated at 90°C for an hour. The hydrosylate drops in the form of liquid sugar replace into Erlenmeyer and added with 2 drops of PP 0,1% and neutralized using NaOH 50%, diluted to reach 100 ml then filtered and analyzed.

The variables observed are total sugar concentration, reducing sugar (Sudarmadji et al., 1997), Dextrose Equivalentt (Putri and Sukandar, 2008), and levels (Sudarmadji et al., 1997).

3. RESULTS

This study consists of several stages, namely: making starch, acid hydrolysis and data analysis. Taro starch were analyzed for water content. The results of hydrolysis of starch into liquid sugar were analyzed to include levels of DE (Eqivalent Dextrose).

3.1 Water Content

Taro tuber starch water content used in this study was 6,79%. The water content is still below 11% which is the maximum SNI threshold for starch.

3.1 DE (Dextrosa Equivalent)

Equivalent dextrose is the simplest result of hydrolysis derived from starch or starch which is a polysaccharide from carbohydrates. DE results from hydrolysis of Gadung starch can be seen in Table 1.

Table 1 .DE results from hydrolysis of Gadung starch

Treatment		Acid Concentration (%)		
		6	7	8
Acid type	HCl	15,588f	23,083e	23,182e
	HNO_3	**57,470a**	**57,296a**	37,351c
	H_2SO_4	30,154d	35,889c	40,139b

The highest DE results of acid type and concentration treatment were obtained at 8% H_2SO_4 usage which was not significantly different from HNO_3 treatment at concentrations of 5 and 6%. Hydrolysis using acids will break down the starch randomly and not specifically on both straight and branch chains. The thing that distinguishes DE results in the treatment of this study is the boiling point of each acid that is used differently, namely HCl has a boiling point of 110 °C, HNO_3 with a boiling point of 83 °C and H_2SO_4 has a boiling point of 270-340 °C. The acid hydrolysis temperature in this study is 90 °C and the most suitable for acid boiling is 83 °C boiling point for HNO_3.

The process of hydrolysis is the breakdown of complex compounds into simpler compounds using acids or enzymes. In this study using acid by breaking down Taro starch into simpler compounds, namely glucose, maltose and maltotriosa.

CONCLUSIONS

The type and concentration of acids and their interactions significantly affected the DE of liquid sugar from taro yam starch produced. The best treatment is hydrolysis using 6% HNO_3 acid to hydrolyze Taro starch with DE 57,470%

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