Mango Seeds as Raw Materials for Dextrin

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Abstract

Wasted seeds are sometimes scattered all over the place during the mango season to spoil the beauty and pollute the environment. Mango seeds can be processed into dextrin, so efforts must be made to process them in order for them to be useful. Specifically, by hydrolyzing mango seed flour with an HCl catalyst. The mango seed flour is 20 grams in weight; 10 milliliters of HCl are added, and water is added until the volume reaches 200 milliliters. Additionally, heat at the temperature of heating: 70 o C; 80oC; _90°C; 100°C; 110°C, and the concentration of HCl: 0.1N; 0.15N; 0.20N; 0.25N; Hydrolysis time was used to produce 0.3N: 15 seconds; 20 seconds; 25, 30, and 35 minutes, respectively. As a result, it is anticipated that a lot of dextrin yields will be obtained. The treatment that was used in the previous study yielded the best results, with a dextrin yield of 8.16 percent at a hydrolysis temperature of 100 degrees Celsius, a concentration of 0.25 N HCl, and a hydrolysis time of 35 minutes.

***Keywords**: Hydrolysis, HCl, Mango Seed Powder.*

A. INTRODUCTION

In Indonesia there are loads of materials that can be handled into potential and valuable materials however are simply discarded as waste without anybody exploiting them. Indonesia is a country with a tropical climate (Islami et al., 2021). Many plants, especially fruits, are grown here (Pade & Bulotio, 2019). One of these fruit plants is the mango fruit plant. Several regions in Indonesia are producers of this plant. The variants also vary (Metusala et al., 2020).

Indonesia is the fifth largest producer of mangoes in the world with a total production of more than 2 million tons (Fitranto et al., 2020). Mango fruit itself is widely used for various food ingredients including juice (Kumalasari et al., 2021), beer (Gasiński et al., 2020), ice, yogurt, cake and bread additional ingredients (Rasmikayati et al., 2020), *dodol* (Rahmah, 2021) and also crakers (Rahmah (2021) and Fitriana and Setiawan (2021).

Currently the mango seed has not been used. Despite the fact that these mango seeds can deliver items that are extremely helpful as food (Bangar et al., (2021), Choudhary et al., (2023), and Kaur et al., (2022) or other uses such as for biosorbent (Wang et al., 2022), biodiesel (Reddy et al., 2021), and also electrochemical energy (Wickramaarachchi et al., 2021).

Dextrin, is useful as an adhesive for cardboard, paper, adhesive on labels on glass, adhesive for envelopes, and adhesive for stamps (Juma, (2022) and Sharma et al., (2021)). It is also used as a thickener or stabilizer in confectionery, drinks, ice cream, and baked goods (Egharevba, 2019). Mango seeds that are processed into flour (starch) and then hydrolyzed with the addition of acid after a certain amount of time and heating can also produced dextrin (Abdullah et al., 2022). Beside that it also can be produced food ingredients like: making jelly as a solids source to stabilize the candy's texture.

Dextrins are sugars produced when starch is hydrolyzed into sugars by heat, acids, or enzymes (Mihajlovski, 2020). The flesh of the mango seed is the source of starch and flour; the image below depicts the flesh of the mango seed.

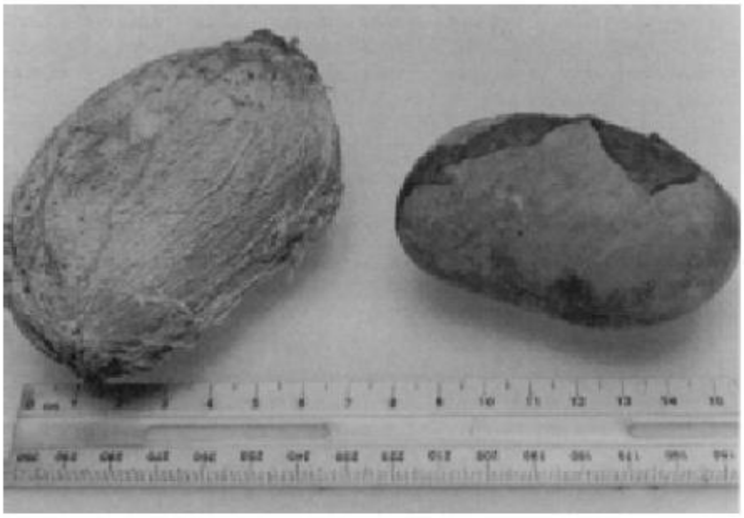

Figure 1. The Shape of the Mango Seeds and Flesh

On the right side of the Bambangan Mango (Mangifera Indica), the mango flesh contains the following: water, 41.38 percent, total carbohydrates, 38.68 percent, fat, 9.85 percent, crude fiber, 4.79 percent, protein, 3.08 percent, and total ash, 2.23 percent (Rahayu, 2019). The kernels contain very few antinutrients like cyanogen glycosides and tannins (Yadav & Paudel, 2022).

B. METHOD

First, make mango seed flour by weighing 20 grams of the flour and mixing it with an HCL solution with a concentration of: 0.1N; 0.15N; 0.20N; 0.25N; 0.3N, which has been measured to 10 ml. After the flour and HCl solution have been thoroughly combined, add water to the mixture until the volume reaches 200 milliliters, then transfer the mixture to the three-neck flask (hydrolysis apparatus) in accordance with the treatment. Stir the mixture while heating it to a temperature that has been predetermined, such as 150 rpm: 70 °C; 80°C; 90 °C; 100 °C; 110 °C. If the time for stirring and heating has passed, such as: 15 seconds; 20 seconds; after 25 minutes, 30 minutes, and 35 minutes, use NaOH to neutralize the mixture in the hydrolysis tool. Additionally, the examination of the dextrin content that was produced.

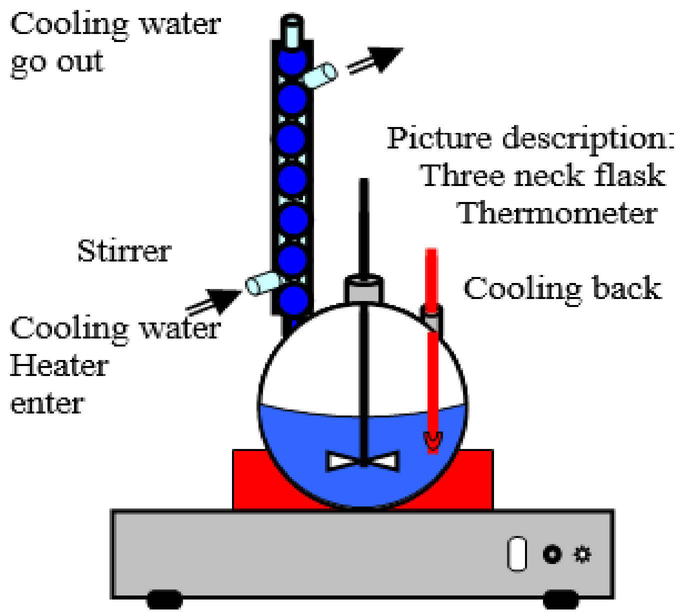

Figure 2. Series of Hydrolysis Tools

C. RESULT AND DISCUSSION

The hydrolysis process with an experimental weight of 20 grams of mango seed flour at different temperatures, times and concentrations of HCl obtained results which can be seen in table 1. below:

Table 1. Yields of Dextrin by Hydrolysis Process at Various Temperatures, Times and Concentrations of HCl

Hydrolysis Temperature	HCl concentration	Hydrolysis time (minutes)				
(°C)	(N)	15	20	25	30	35
		Dextrin yield (%)				
70	0.1	0.65	1.9	2.36	2.8	2.98
80	0.1	0.88	2.26	2.83	3.05	3.1
90	0.1	1.26	2.5	3.01	3.1	3.14
100	0.1	1.38	2.96	3.18	3.3	3.26
110	0.1	1.4	3.2	3.2	3.32	3.35
70	0.15	1.02	2.34	2.55	2.94	3.02
80	0.15	1.46	2.48	2.98	3.2	3.25
90	0.15	1.98	2.6	3.2	3.36	3.35
100	0.15	2.34	2.74	3.35	3.44	3.45
110	0.15	2.35	2.75	3.36	3.45	3.5
70	0.2	1.48	2.54	3,18	4.06	4,1
80	0.2	1.67	2.96	3.52	4,22	4,25
90	0.2	2,18	3,2	3.76	4.62	4.66
100	0.2	2.25	3,62	4.02	4,8	4.82
110	0.2	2,5	3,6	4,1	4,8	4,8
70	0.25	2.34	3,8	5,32	6,25	6,3

80	0.25	2,9	4,15	6,44	7,6	7.65
90	0.25	3.82	4,42	6.96	7.98	7,9
100	0.25	4,3	4.98	7,36	8,14	8,16
110	0.25	4.35	4.95	7.35	8,15	8,15
70	0.3	2.35	3.82	5,36	6,3	6,3
80	0.3	3.04	4,18	6,45	7.65	7,6
90	0.3	3,8	4.95	6.96	7,9	7.86
100	0.3	4,32	5,8	7,36	8,15	8,1
110	0.3	4,3	6,15	7.35	8,1	8,1

From the figure below it can be seen the effect of time, temperature and HCl concentration on the yield of dextrin.

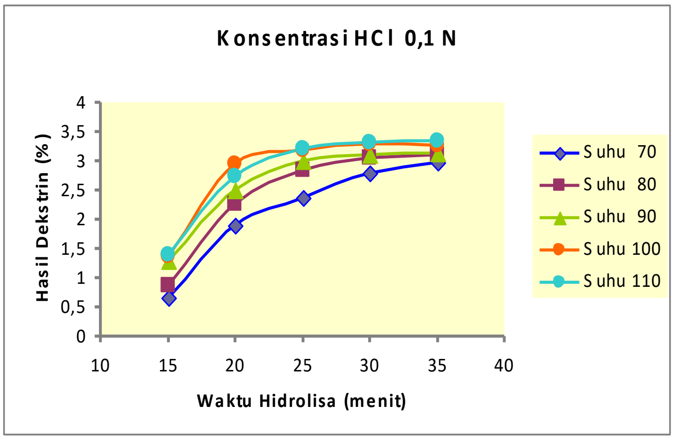

Figure 3. Effect of Time and Temperature at 0.1 N HCL Concentration on Dextrin Yield

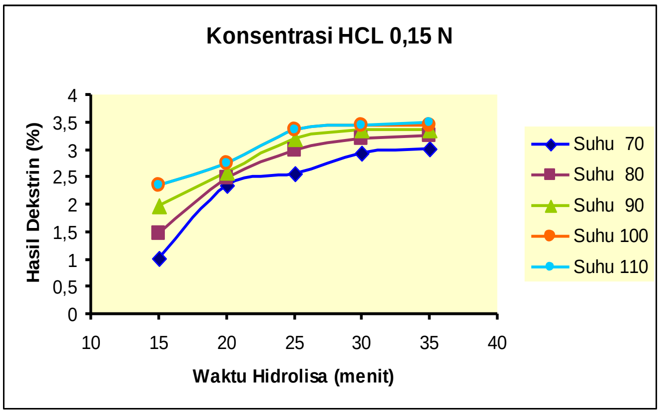

Figure 4. Effect of Time and Temperature at 0.15 N HCL Concentration on Dextrin Yield

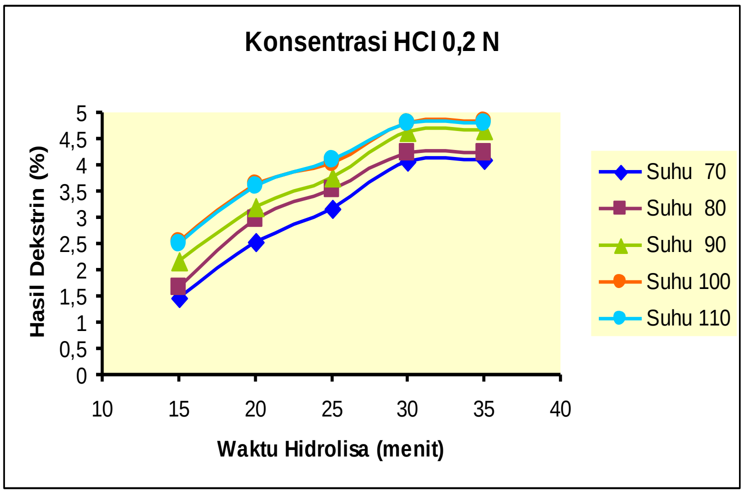

Figure 5. Effect of Time and Temperature at 0.2 N HCL Concentration on Dextrin Yield

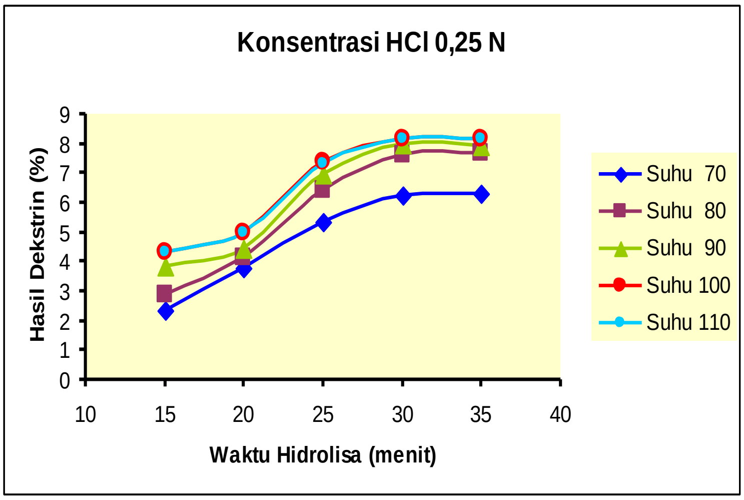

Figure 6. Effect of Time and Temperature at 0.25 N HCL Concentration on Dextrin Yield

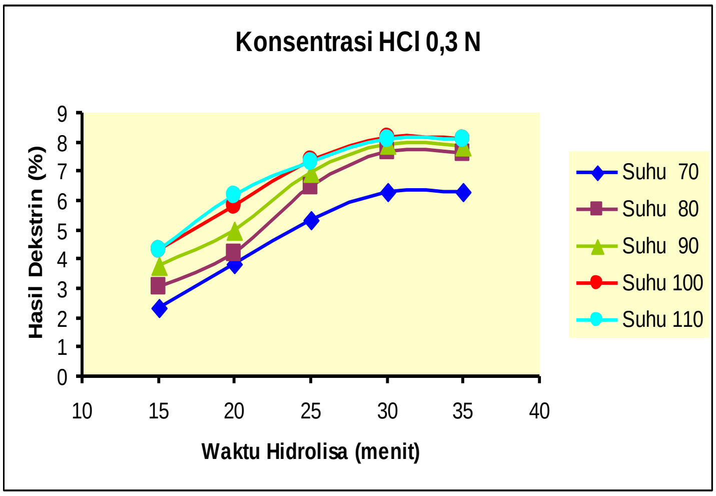

Figure 7. Effect of Time and Temperature at 0.3 N HCL Concentration on Dextrin Yield

Figure 3 shows 4; 5; 6 and 7 show that as the hydrolysis time and temperature increase, so does the yield of dextrins. This is because the starch (mango seed flour) chain bonds will break down into smaller bonds as the temperature and time increase. The yield of dextrin did not increase or even tend to remain constant or even decrease for an excessive amount of time at temperatures of 100 °C and 110 °C. This was on the grounds that at high temperatures starch was immediately framed into dextrin. so that the formed dextrin will again decompose into maltose or glucose if the time is too long.

D. CONCLUSION

According to the findings of this study, the hydrolysis of 20 grams of mango seed flour into dextrin with the addition of 10 milliliters of HCl catalyst yielded the best results, producing dextrin with a concentration of 8.16 percent at a temperature of 100 degrees Celsius and a hydrolysis time of 35 minutes.

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