The Effect of Inlet Temperature towards Spray Drying of Pineapple Flesh, Pulp and Peels

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***Abstract*—This research addresses to study the effect of 130ºC, 140ºC and 150ºC of inlet temperature towards pineapple flesh, pulp and peels powder. The carrier agents that been used was maltodextrin with concentration of 15%, 20% and 25%. The powder was obtained by using spray drying with speed pump 3 was keep constant. The inlet temperature give major impact on the product yield and its flow rate. As inlet temperature increase, the product yield and the flow rate was also increase. After that, the moisture content, titratable acidity and total soluble solids was analyse. The moisture content seem to reduce as the inlet temperature increase. The concentration of maltodextrin found to give effect to the acidity content in the powder. The highest titratable acidity % was found in 15% maltodextrin of pineapple powder. The total soluble solids content in powder found to decrease as the inlet temperature was increase.**

***Keywords*— inlet temperature; maltodextrin; pineapple; spray drying**

I. INTRODUCTION

The pineapple (Ananas comosus) is a tropical plant with edible multiple fruit consisting of coalesced berries, also called pineapples, and the most economically significant plant in the Bromeliaceae family. Pineapples can be cultivated from a cutting crown of fruit, perhaps in 20-24 months flowering and fruiting the following six months. Pineapple is one of the tropical fruit that can be found in Malaysia. To prevent from blacken or too ripe, the pineapple juice is transform to become a powder by using drying technique. In powder, the moisture content is lower than in fresh pineapple. While, the size is easy to stored, packaging and transport with a longer shelf life. One of the drying technique is spray drying. Spray drying is a technique to separate the solute and change the solvent into vapor. The liquid is channel into a hot vapor stream to be vaporized. Usually air is being used as the hot media to dry the liquid. But if the liquid is flammable, the air was replace with nitrogen gas. Spray drying was chosen in this study because of the time to produce powder was shorter compare to other drying method such as freeze drying, vacuum chamber dryer and Vibro-fluidized bed.In spite of that, because of high sugar content in pineapple juice, the powder produce from spray drying is stickiness. Moreover, the powder also have high hygroscopicity that can contribute to thermoplasticity at high temperature and humidity.

In this context, the end product of this study is to produce powder from mixed of pineapple flesh, and peels using spray drying method with addition of maltodextrin at different inlet temperature.

II. METHODOLOGY

A. Materials

Samples of ripe pineapples (Ananas comosus) of the Morris variety were obtained at the local market and stored at the refrigerator. A batch of pineapple flesh, pulp and peels was separated and prepared in a laboratory and sieved through a mesh to get the juice.

B. Pineapple Juice preparation

The pineapple juice is pour into beaker at 600ml before mixing with the maltodextrin powder in ratios of 15%, 20% and 25% (wt/wt).

Weight of maltodextrin powder = ratio x volume pineapple juice

As an example, to obtain a sample of pineapple fruit juice with 15% Maltodextrin concentration, 90g of the powder was added into 600ml of the pineapple fruit juice.

Weight of maltodextrin powder = 0.15 x 600 ml
= 90g

The mixture was continuously stirred to ensure the juice mixture is perfectly mixed and smooth.

C. Spray drying

The spray dryer is equipped with a spraying nozzle. The pump speed setting is a range of setting from 1-11. The pump speed chosen for every spray dryer run was at optimum speed that is at speed 3. Drying conditions for the spray drying process was set at three different temperatures: 130ºC, 140ºC, and 150ºC. A cyclone separator system was used to separate powders from the hot air, and the dried powders are collected at the base of the cyclone. The

powder yield was considered only from the base of the cyclone, and no product was retrieved from any part of the equipment walls or chambers.

D. Powder analysis

Moisture content

Moisture analysis was carried out by using Moisture Analyser. Moisture analysis was carried out to show moisture content in the samples. The empty dish is weight before analyse. The powder samples is add to the dish to the tune of 5g. The samples were analysing with Moisture Analyser at temperature 105˚C for 10 minute.

Powder recovery

Powder recovery of spray dried pineapple powder was computed by taking after equation:(Suhag et al. 2016)

$$\%Powder\ recovery = \frac{Total\ weight\ of\ resulting\ powder\ on\ dry\ basis}{Total\ solid\ content\ in\ feed} \times 100$$

E. Titratable acidity analysis

Titratable acidity (TA) is a measure of the value of corrosive present in the solution. It is presented as grams/liter (g/L) and is gotten by multiplying with percent TA by 10. Along these lines, a TA of 0.60% is expressed as 6g/L. pH is characterized as the measure of the quality of corrosive in an answer.
The diluted sample was titrated with 0.1 M sodium hydroxide to the end point. The phenolphthalein indicator was used to decide the end point. Percent TA equal to volume of 0.1 M sodium hydroxide used times with 0.064.

F. Total soluble solids analysis

Soluble solids were resolved utilizing a refractometer (Advanced ABBE Refrectometer, Kruss Optronic) (AOAC 932.12; 1995). A drop of the arrangement was squinted on the crystal of refractometer. The rate of TSS was acquired from direct perusing of the instrument. (Hajar et al. 2012)

III. RESULTS AND DISCUSSION

A. Moisture Content

The effect of inlet temperature and different maltodextrin concentration towards moisture content of pineapple are illustrated in figure 1. As shown in figure 1, the increase in inlet temperature make the moisture content in spray dried powder decline. This is due to rapid heat transfer as the inlet temperature increase to produce lower moisture content.

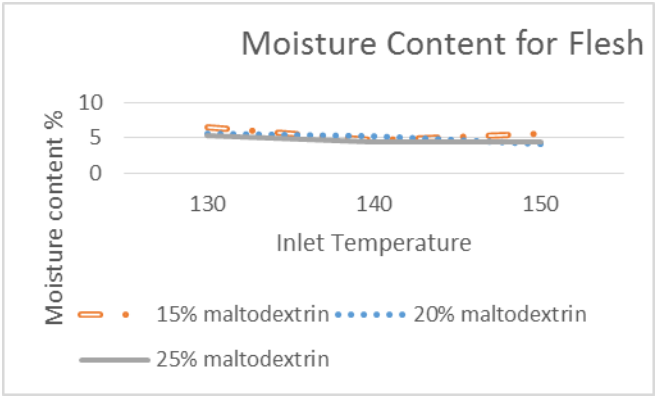

Figure 1: moisture content for flesh pineapple

B. Titratable acidity analysis

Based in figure 2, TA was decreasing from flesh, pulp and skin. This show that acid content was highest in flesh pineapple and lowest in skin. TA was calculated to finding the content of citric acid in pineapple flesh, pulp and skin.

The concentration of maltodextrin does not give huge effect in content of acid in pineapple.

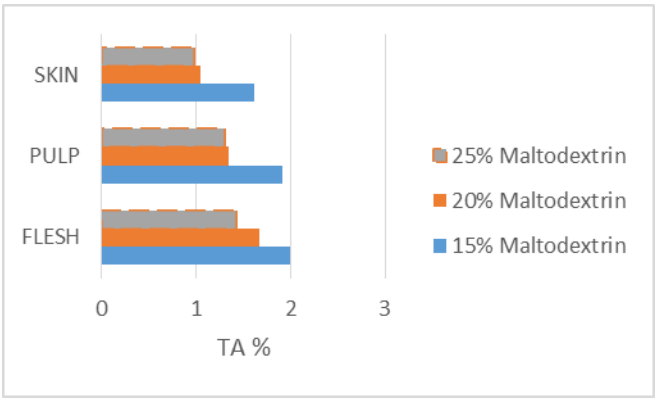

Figure 2: Titratable acidity %

C. Total soluble solids analysis.

Based on figure 3, the inlet temperature does not give major impact towards total soluble solids. This is because as inlet temperature increase, the solids content such as sugar does not reduce.

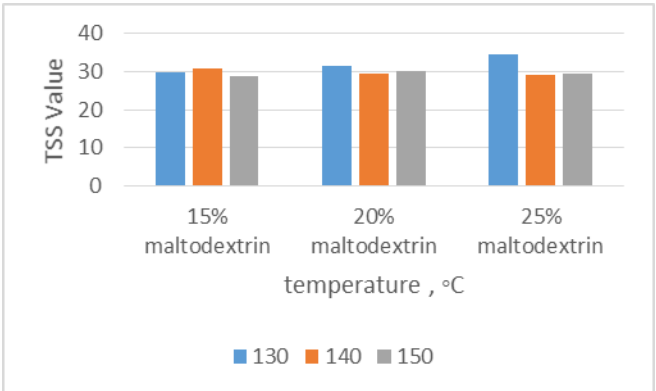

Figure 3: TSS vs Temperature

IV. CONCLUSION

The inlet temperature give major effect towards flowrate of powder produce and product yield. As inlet temperature increase, the flowrate and product yield also increase. The finest powder produce in term of product yield was found in flesh pineapple at 150^{o}C with 25% maltodextrin that produce highest powder yield and high flowrate. At 150^{o}C with 25% maltodextrin seems to produce lower moisture content. At this temperature, moisture content found in flesh, pulp and peels was 4.43 %, 4.12 % and 4.68 % respectively. Meanwhile, titratable acidity was influence by concentration of maltodextrin. As the concentration of maltodextrin reduce, the TA % was increased. Next, the total soluble solids was decreased as the inlet temperature of spray dryer increased.

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