Effect of Spray Drying Temperature and Maltodextrin Concentration towards Physical Properties and Antioxidant Activity in Pineapple Powder

Saliana Binti Jusoh,Ummi Kalthum Ibrahim, and Syafiza Abd Hashib,

Faculty of Chemical Engineering, Universiti Teknologi Mara

Abstract— **This research are done to study the effect of spray drying temperature and maltodextrin concentration towards physical properties and antioxidant activity in pineapple powder.The chosen pineapple is Josephine type. Flesh and peels of pineaaple are used to be spray dried and analyze. There are four sample of flesh and four sample of peels.The parameters that are set for this eight samples are the temperature of spray dried which are 140°C and 160°C. Another parameter is the concentration of maltodextrin which are 14% and 27%.All these eight samples was run in the spray dried with these different parameters and centrifuge before ready to be analyzed. The analysis are including the antioxidant activity, pH, pulp content, moisture content, absorbance, titratable acidity and total soluble solid (TSS). For the pH analysis, the result shows that the flesh samples had higher pH in acidity compared to the peels with the highest value is 4.08 for the sample with parameters 140°C and 27% maltodextrin. While, for the pulp content analysis, the pineapple peels shows more weight of pulp contents with highest value is 14.24g for parameters 140°C and 17% maltodextrin. The moisture content had the highest value for sample 140°C and 27% maltodextrin with 8.30%M. The total soluble solids(TSS) shows that sample with parameters 160°C and 27% maltodextrin had the highest value with 1.35642 n.D. While for the antioxidant analysis, the DPPH test shows that the flesh sample had highest value at 35.21% in sample 140°C and 27% maltodextrin. Absorbance analysis recorded that flesh sample had highest value in sample 160°C and 22% maltodextrin with average 1.233%. Lastly is the titratable acidity test which flesh sample at 160°C and 27% maltodextrin had highest value of acidity percentage with 0.1920%. The results are following the expectation for the research.**

Keywords— ***pH, total soluble solid, maltodextrin, moisture content, titratable acidity, pulp content***

I. INTRODUCTION

Spray Drying is a method that can turn liquid food into a powder form. This method are using spray dryer to convert liquid product into powder by fast drying with hot gas that are widely used for commercial production of fruit, milk and vegetables(Suzihaque, Hashib, & Ibrahim, 2015). Other than rapid drying, this equipment also can convert a solution into powder in a single step, that can useful for maximizing the profit and minimize the process (Phisut, 2012).Usually, it is applied in the pharmaceutical and food manufacturing process. Spray drying the fruit juice has a great potential in economical because when the juice is dried, the volume of product produced is lower and the shelf life also increase. However, this method can cause the product to become sticky because fruit juice powders are easy to absorb moisture from the surrounding air. Spray drying only use low temperature and short time for production. However, when the different temperature are applied on the food sample, the physical and antioxidant activity will have changes. Other than the different of spray dry temperature, the concentration of maltodextrin also give different effect on each sample. In this research, the range of spray dry temperature that are used is 140°C to 160°C. While, the range for concentration of maltodextrin is 17% to 27%.

Pineapple contains many useful ingredients that are useful for human body. One of it is antioxidants which are function as medium to protect body from oxidation that cause by smoking habit, alcohol and depression. Antioxidant can be defined as “any substance that, when present in low concentration compared to that of an oxidisable delays, substrate or inhibit the oxidation of the substrate” (Sivanandham, 2014). In order to reduce oxidation, human needs to consume fruit that are rich in antioxidant by eating raw or as supplements. Pineapple need to be extracted to get the chemical compound such as ascorbic acid. Ascorbic acid is an example of

antioxidant that are important for human body. This ascorbic acid is one of the important water soluble vitamins and required for carnitione, collagen and neurotransmitters biosynthesis (Naidu, 2003) . By consuming ascorbic acid or known as vitamin c, some disease that can give harm to body can be prevented..There are many industries that show interest to get natural antioxidants since the already existing sythethic food antioxidants is not too favored. Antioxidants are widely used in pharmaceutical, cosmetics and plastics to prevent deterioration. Example of antioxidants is vitamin C that can be found in fruits and vegetables. This antioxidants can help in protecting against oxidative damage in living system. Other than vitamin C, antioxidants such as vitamin E and carotenoids can act as dietary constituents. Fruit is the best option as the antioxidants supplier because fruit like berries contain strong antioxidants compounds. Another example are citrus, cherries, prunes and kiwi that are also tasty when eaten raw.

Nowadays, there are many technique to improve food sample. Pineapple is one of the fruit that contain high antioxidants and when undergoes spry dry and addition of maltodextrin, there might changes to the antioxidants activity and other physical properties. Thus, many experiment are done to provide suitable temperature and concentration of maltodextrin in order to retain the best condition of the food sample.

II. METHODOLOGY

A. Materials

The materials that are used in this experiment are josaphine pineapple, maltodextrin, methanol, distilled water, phenolphthalein indicator, sodium hydroxide, deionised water

B. Method

i. Sample preparation

The first step in preparing the sample was cutting the pineapple into small size. The pineapple was separated by flesh and peels. The flesh is then grinded by using electric blender. However, for the peels, it was boiled first with hot water before grinding. This is because of the texture of peels that are hard to be blended.
The liquid that are produce after grinding will be mixed with different concentration of maltodextrin which are ranging from 17% to 27%. Then, the pineapple-maltodextrin solution was put in spray dryer that are operated at different temperature which are 140°C to 160°C at 3rpm.

ii. Antioxidant Analysis

The first step was preparing the DPPH solution. 10ml DPPH was mixed with 100 ml of 80% methanol. Then, the control is prepared with mixing 1ml of DPPH with 4ml 80% methanol. To prepare for the analysis, 10g of sample was mixed with 100ml of 5% methanol and 100 ml distilled water. The solution is then kept on the hot plate for 45 minutes at 65°C. After 45 minutes, 1ml of the sample was mixed 4ml of 80% methanol and DPPH solution. The mixture was shake and kept in dark place for 30 minutes. Then, by using spectrophotometer, the absorbance was read at 517nm.

iii. Physical Properties Analysis

1. pH

10 ml of sample was taken out and the pH was determined by using pH meter(Hajar et al., 2012).

2. Pulp Content

To determine the pulp content, 5ml of sample was taken out and undergoes centrifugation for 10 minutes. The pulp content that are formed was then weight(Hajar et al., 2012)

3. Moisture Content

3 gram of sample was place on the moisture analyzer at the 130°C for 10 minutes. The result was then read.

4. Total soluble solid

3ml of sample was taken out and squinted on the prism of refractometer. After the reading are shown, the result was tabulated(Hajar et al., 2012)

5. Absorbance

10 ml of water was used as the blank. 10ml of sample was taken out and measured by using refractometer that was set at 600nm of wavelength. The reading shown was then taken as the result in abs(Hajar et al., 2012)

6. Titratable acidity

For this analysis, 0.1N sodium hydroxide which are strong bases was used because the sample are rich in organic acid. Firstly, 10ml of sample was taken out and weighted using weighting balance. Then the sample was put into 500ml conical flask. The sample was diluted with 250ml deionised water. Phenolphthalein indicator was used in order to determine the end point of titration. 1ml of phenolphthalein indicator was added to the sample. Then, the titration was started until the mixture form faded pink color. The step was repeated around three times. Below expression was used to calculate the percentage of citric acid(Hajar et al., 2012)..

%Acid (as anhydrous citric acid) = volume of NaOH (ml) x 0.64/10

I. RESULTS AND DISCUSSION

A. Physical Properties Analysis

Table 1

TYPE OF SAMPLE	FACTOR 1 TEMPERATURE (°C)	FACTOR 2 CONCENTRATION MALTODEXTRIN (%)	pH	Pulp Content (g)	Moisture Content (M)	Total soluble Solid (n.D)	Absorbance (%)	Titratable acidity (%)
FLESH 1	140	17	4.55	11.53	7.96	1.35130	0.226	0.0533
FLESH 2	160	17	4.16	10.96	6.52	1.35178	0.320	0.1792
FLESH 3	140	27	4.08	9.98	7.76	1.35125	0.794	0.1920
FLESH 4	160	27	4.09	9.60	3.63	1.35186	1.233	0.1237
PEELS 1	140	17	4.99	14.24	7.99	1.35162	0.042	0.1621
PEELS 2	160	17	4.63	12.75	6.82	1.35194	0.023	0.0896
PEELS 3	140	27	4.59	12.47	8.30	1.35165	0.053	0.0640
PEELS 4	160	27	4.41	10.25	5.36	1.35642	0.013	0.0853

i. pH

From the result tabulated, it is shown that for the flesh sample, the most acidic sample is at temperature 140°C and 27% maltodextrin with value of 4.08. While, the least acidic sample is at temperature 140°C and 17% maltodextrin with value of 4.55. This is because, when the temperature of spry dry is set at low value, the pH of sample is high thus showing that the sample are acidic. For the peels sample, the most acidic is sample at temperature 160°C and 27% maltodextrin with value of 4.41. While, the least acidic sample is at 140°C and 17% maltodextrin with value 4.99. This is prove that the above theory also applied for the peels samples where the higher the temperature apply in spray dry, the lower the value of pH.

ii. Pulp Content

From the result tabulated, it is shown that for the flesh sample, the highest pulp content is at temperature 140°C and 17% maltodextrin with value of 11.53g. While, the least pulp content sample is at temperature 160°C and 27% maltodextrin with value of 9.60g. For the peels sample, the highest pulp content is sample at temperature 140°C and 17% maltodextrin with value of 14.24g. While, the lowest pulp content is at 160°C and 27% maltodextrin with value 10.25g. This is prove that high temperature and low concentration of maltodextrin can gives low pulp content value to the sample.

iii. Moisture Content

For flesh samples, the moisture content are lowest at temperature 160 °C and 27% maltodextrin with value of 3.63%M. While, the highest value of moisture content are recorded at temperature 140°C and 17% maltodextrin with value of 7.96%M. For the peels samples, the highest value of moisture content are recorded at temperature 140°C and 27% maltodextrin with value 8.30%M. While, the lowest moisture content is at temperature 160°C and 27% maltodextrin with 5.36%M. All these result for these two type sample are following the theory where the increasing of air drying temperature leads to decreasing of moisture content (Jittanit, Niti-Att, & Techanuntachaikul, 2010). This is because the heat and rates of moisture transfer are enhance when the temperature is raised.

iv. *Total Soluble Solid (TSS)*

For flesh samples, the total soluble solid are lowest at temperature 140 °C and 27% maltodextrin with value of 1.35125 n.D. While, the highest value of total soluble solid are recorded at temperature 160°C and 27% maltodextrin with value of 1.35186 n.D. For the peels samples, the highest value of total soluble solid are recorded at temperature 160°C and 27% maltodextrin with value 1.35642 n.D. While, the lowest total soluble solid is at temperature 140°C and 17% maltodextrin with 1.35162 n.D. These result are follow the expected result where the concentration of maltodextrin give effect to the sample as the maltodextrin is high, the total soluble solid also give high value. However, for the temperature, there is no constant trend of decreasing and increasing total soluble solid when the temperature is increase, thus the total soluble solid does not depend on the temperature value.

v. *Absorbance*

From the table, it is shown that the highest value of absorbance for flesh samples are at temperature 160°C and 27% maltodextrin with value 1.233%. While, the lowest value are recorded at temperature 140°C and 17% maltodextrin with value of 0.226%. For the peels samples, the highest value of absorbance are recorded at temperature 140°C and 27% maltodextrin with value 0.053%. While, the lowest absorbance is at temperature 160°C and 27% maltodextrin with 0.013%. These result are following the theory as the absorbance are recorded high when the temperature is high.

vi. *Titratable acidity*

From the table, it is shown that the highest value of titratable acidity for flesh samples are at temperature 140°C and 27% maltodextrin with value 0.1920%. While, the

lowest value are recorded at temperature 140°C and 17% maltodextrin with value of 0.0533%. For the peels samples, the highest value of titratable acidity are recorded at temperature 140°C and 17% maltodextrin with value 0.1621%. While, the lowest titratable acidity is at temperature 140°C and 27% maltodextrin with 0.0640%. All these result for these two type sample are following the theory where the high value of maltodextrin and temperature leads to the lowest titratable acidity.

A. Antioxidant activity (DPPH test)

Table 2

NO.	TYPE OF SAMPLE	FACTOR 1 TEMPERATURE (°C)	FACTOR 2 CONCENTRATION MALTODEXTRIN (%)	ANTIOXIDANT ACTIVITY
1	FLESH	140	17	33.22
2	FLESH	160	17	30.95
3	FLESH	140	27	35.21
4	FLESH	160	27	13.17
5	PEELS	140	17	30.81
6	PEELS	160	17	22.08
7	PEELS	140	27	34.47
8	PEELS	160	27	7.82

From the table, it is shown that the highest value of antioxidant activity for flesh samples are at temperature 140°C and 27% maltodextrin with value 35.21%. While, the lowest value are recorded at temperature 160°C and 27% maltodextrin with value of 13.17%. For the peels samples, the highest value of antioxidant activity are recorded at temperature 140°C and 27% maltodextrin with value 34.47%. While, the lowest antioxidant activity is at temperature 160°C and 77% maltodextrin with 22.08%. All these result for these two type sample are following the theory where the high temperature can reduce the antioxidant activity in the sample.

I. CONCLUSION

The effect of spray dry temperature and concentration of maltodextrin are important factors on physical properties and antioxidant activity of pineapple powders. From the result obtained, it is shown that when the temperature of spry dry is increasing, the moisture content, titratable acidity, absorbance and antioxidant activity are decreasing. While, high concentration of maltodextrin leads to high pH level, total soluble solids and pulp contents. It is shown that flesh samples are having more absorbance, titratable acidity and acidic level (pH) compared to the peels. After the experiment and the result are tabulated, it is prove that all these result are following the expected result and give the desired outcome.

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> SALIANA BINTI JUSOH (CHEMICAL ENGINEERING AND BIOPROCESS) <