EFFECTS OF SPRAY DRYING TOWARDS PHENOLIC CONTENTS AND ANTIOXIDANT ACTIVITY IN ANANAS COMOSUS (JOSEPHINE)

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***Abstract*— Antioxidant was usually acts as human first line defend for any affected diseases. Antioxidant will avoid form of free radical that can cause cancer when the cell produces without limits. Examples of food and vegetables that contain antioxidant are broccoli, strawberries, potatoes, pineapples, sun flower seed and raw cabbage. In this experiment, Josephine Ananas Comosus will be chosen as sample. The objective of this research are to study the effect of spray dryer temperature and concentration of maltodextrin on antioxidant activity, and phenolic content then, to compare the antioxidant activity, and phenolic content, in pineapple powder at different parts of pineapple. Sample was prepared by blend to get pure juice before through spray drying for powder formation. 27% of maltodextrin concentration at temperature 140°C was set due to optimum parameter to form powder. Two different spray drying temperature and percentages of maltodextrin will be chosen for parameter comparison. Maltodextrin concentration at 17 % and 27% while, 140°C and 160°C for spray drying temperature. Different analysis such as 2.2-diphenyl-1-picrylhydrzyl (DPPH) free radical scavenging assay and total phenolic content (TPC) analysis was selected. During the analysis of TPC, all samples were changes from yellow to dark purple color due to present of phenolic content. For flesh sample, highest TPC was showed at temperature 140°C with 27% of maltodextrin concentration, 0.7395mg/20g fruit. While for lowest TPC flesh sample is 0.2359mg/20g fruit at 160°C with 27% maltodextrin concentration. Then, for peels sample, TPC reading highest at temperature 140°C with 27% concentration (0.5734mg/20g fruit), while lowest reading at 160°C, 27% (0.2252mg/20g fruit). Analysis using DPPH will changes colour from dark blue into yellow when presented of antioxidant contains in the sample. Flesh sample at temperature 140°C and 27% concentration contains highest reading of scavenging assay (% inhibiton), 35.21%. While for lowest reading of flesh sample, its shows temperature at 160°C and 27% maltodextrin concentration, 13.17%. For peels sample, the highest % inhibition at 140°C with 27% concentration (34.47%) and for lowest reading at 160°C at 27% (7.82%). Flesh contains higher % inhibition compared the peels due to the amount of fibre that contains by flesh with lot of component and nutrient such as phenolic, flavanoid and antioxidant compound. Compared with peels sample, antioxidant activity may be present in the sample but at low concentration.**

Keywords*—2.2-diphenyl-1-picrylhydrzyl (DPPH, Ananas Comosus, Josephine,maltodextrin, total phenolic content (TPC)

I. INTRODUCTION

Antioxidants are compounds in foods that neutralize chemicals also known as free radicals. These chemicals linked to heart, liver disease and cancer. Ascorbic acid will increase human immune system from any dangerous disease. Oxygen at high levels will generate oxidative stress, a deleterious process that can damage cell structures, including lipids, proteins, and DNA (Nafiu et. al., 2013). Ascorbic acid also known as L-ascorbic acid is one of water soluble Vitamin C that needed by human body. Plant and animals can synthesize ascorbic acid but different with human that lack of enzyme gulonolactone oxidase (Naidu K. A., 2003), which need to take supplement for of daily usage. It distributed in many fruits such as watermelon, papaya, pineapple, and raspberries.

Ananas Comosus is one of tropical fruits where it was originating from Southern Brazil and Paraguay, that also can found in Malaysia (Suzihaque et. al.,2015). Ananas Comosus contains lot of substances that give advantages to human body. From the stem and pineapple fruits, antioxidant can be extracted. Besides antioxidant, pineapple also contains compound that important for digesting enzymes in human body. It will help the digestion system in intestinal, also reduce the excessive inflammation, blood coagulation and stop tumor growth that can lead to cancer. Based on any nutritional sources, pineapple contains lot of compound that can give benefit to human body such as Vitamin C, bromelain, magnesium and potassium.

Antioxidant will avoid form of free radical that can cause cancer when the cell produces without limits. External factors such as cigarette smoke, air pollution and excessive alcohol consumption can all lead to production of free radicals and are therefore harmful

to the body. Antioxidants help to stop the damage done by free radicals and therefore may be effective in reducing risk of disease. Furthermore, uses of synthetic antioxidant rapidly in human body will affect human health later compared to natural antioxidants. Synthetic antioxidant such as Butylated hydroxytoluene (BHT) and Butylated hydroxyanisole (BHA) had significantly adverse effect on body weight and also had adverse effect on the process of fetus and baby development. Antioxidant such as Vitamin C had lack of ability to be produced by body. Human body must consume it from exogenous supplements in their diet. Human body can produced ascorbic acid but it is insufficient to neutralize free radical. To prevent formation of free radical, it must be supplied via fruits or supplement at correct dosage. Vitamin C is one of important vitamin needs by human other then, Vitamin E and Vitamin D

The objectives of this research are to study the effect of spray dryer temperature and concentration of maltodextrin on antioxidant activity, and phenolic content in pineapple powder and to compare the antioxidant activity, and phenolic content pineapple powder at different parts of pineapple. In this study, the scope of research is about to discover the important of antioxidant in human body system. Study was made to determine the ability of antioxidant to human health. Ananas Comosus contains lot of benefit compound such as bromelain, manganese, tight, and vitamins B1, B2, B3, B5, and B6.

II. METHODOLOGY

A. Materials and Chemicals

. The raw material used in this research is Josephine *Ananas Comosus*. To extract antioxidant from Josaphine, 50% concentration of methanol have been selected. It was found that good extraction can be held by using methanol or ethanol was used at 70% and 50%. The raw material was separated into flesh and peels to compare different part of antioxidant contents.

B. Raw material preparation

Ananas Comosus fruits were obtained from Nilai, Negeri Sembilan and Shah Alam, Selangor will firstly have washed with water to remove any sand or contamination. Josephine Ananas Comosus was carefully selected by their shape, colour and ripeness. To obtain juices from Ananas Comosus peels, cut into small pieces before boils in the hot water. While for flesh, cut before blend and mixed with distilled water in the blender. All two part of Ananas Comosus juices then was filtrate by sock sieve to avoid more fibrous formed during the process of drying in the spray dryer (Suzihaque et.al., 2015)

C. Spray drying process

Pure juice is kept in a refrigerator to avoid from microorganism contamination and antioxidant degradation. For preparation of 1000ml of mixture; 818.18ml juices and 181.82ml water will mix with 27%.maltodextrin. 27% maltodextrin in 1000ml mixture solution was weighted about 270g. Solution then mixed well with maltodextrin. Then the mixture was dry (Fig 1) at range of 130°C until 150°C of inlet temperature in spray dryer (Syafiza et. al., 2015). For this experiment, temperature that was suitable producing Ananas Comosus powder, was choose at 140°C and 160°C. From Fig 2 it shows the solution was turned into white powder form after the process of drying completed.

Fig 1 Drying process

Fig 2 Powder form

D. Extraction Process

Based on Lim et. al., (2007), method of extraction by using solvent used 20g of powder formation from drying process, then mixed with 200ml of 50% methanol. To extract highest ascorbic acid compound in the Ananas Comosus, 50% of methanol was used. Then, mixture was mixed about 45minutes at speed 150rpm in room temperature to promote antioxidant extraction by the solvent (Fig 3). Then, mixture will go through centrifuge process to separate suspension from the solvent for 15 minutes. Before to the analysis process, the sample was stored to avoid from contamination.

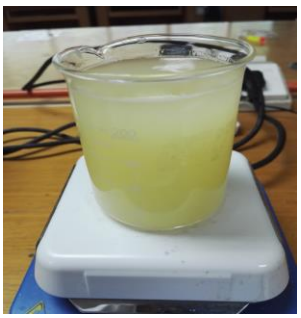

Fig 3 Solvent extraction process

E. Chemical analysis

Total phenolic contents (TPC) analysis

Folin-Ciocalteu's reagent was used to determine total phenolic content (Singleton & Rossi, 1965). Based on Anynda Yuris (2014), about 0.3ml of sample from solvent extraction was added with 1.5mL Folin Ciocalteu's reagent. Folin Ciocalteu's reagent before that diluted with deionized water 10 times. Then, 1.2ml of 7.5% w/v sodium carbonate was added. From Fig 4, wait until 30 minutes before reading the absorbance at 765 nm. Methanol was used as a

blank. Then, standard curve was prepared using different concentration of Gallic acid

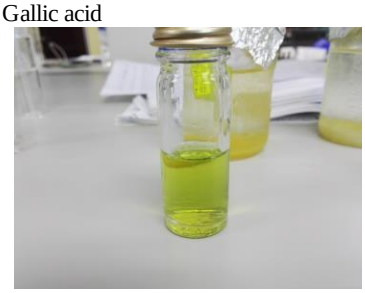

Fig 4 TPC analysis

2,2-diphenyl-1-picryhydrzyl (DPPH) free radical scavenging assay

Based on Krings and Berger (2001), free radical scavenger was used method of DPPH with some modification. 2 mL of 0.15 mM DPPH solution in methanol was mixed with sample that was been extracted. For preparation of 0.15mM DPPH solution, 59.1mg DPPH mixed well with 1000ml methanol. The sample extracted first mixed with water until reach 2ml.

Then by using UV-Visible Spectrophotometer (UV-Vis), the mixture was left for 30 minutes at absorbance 517nm before reading was taken (Fig 5). Methanol was used as the blank. Standard curve was prepared using ascorbic acid solution of different concentrations, with ascorbic acid as the blank. A percentage of inhibitor was calculated as formula shown below. A known as absorbance.

% inhibition = [(Acontrol – Asample)/Acontrol] x 100%

Ascorbic acid and the extract were then obtained by plotting the graph of percentage inhibition against the total phenol content of the extract. The result was then expressed as ascorbic acid equivalence antioxidant capacity.

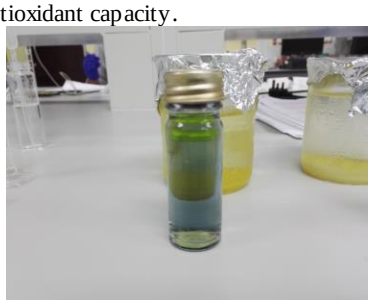

Fig 5 Antioxidant analysis

III. RESULTS AND DISCUSSION

A. Total Phenolic Content (TPC)

Average of absorbance reading, concentration of Gallic acid was calculated from the standard curve that shows at Fig 6. Then, total phenolic content can be calculated by using the formula;

T = C x V/M

C- Concentration of gallic acid from calibration curve (mg/mL)

V-volume of extract solution (mL) = 200mL

M-weight of extract (g) = 20g

From Fig 7, by using TPC procedure, the colour was change from yellow to purple or dark blue when the phenolic content exist in the Ananas Comosus.

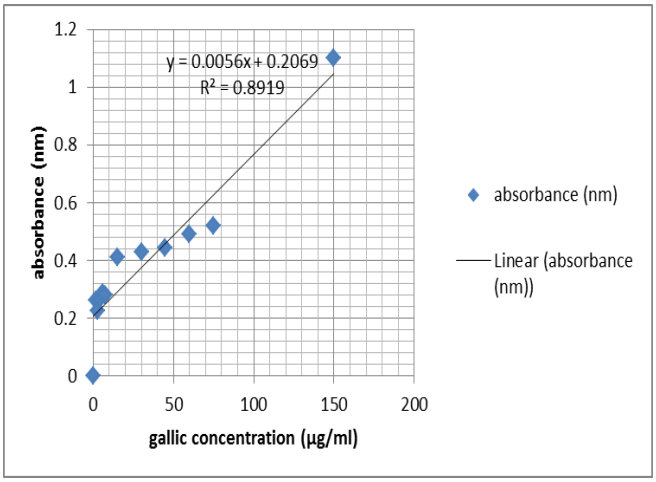

Fig 6 Graph of callibration curve

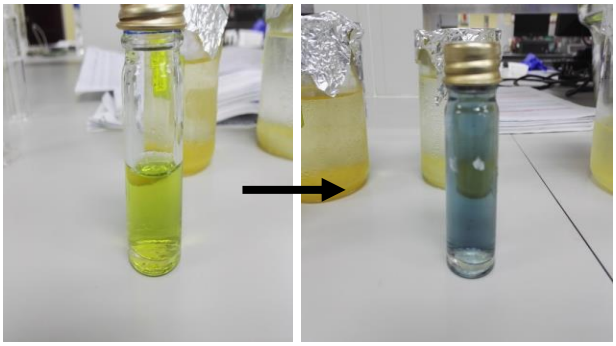

Fig 7 Color changes during the TPC analysis

From the experiment of Josephine Ananas Comosus extraction, the content of phenolic compound was discussed by result of Total Phenolic Content (TPC) from Table 1 or chart at Fig 8(flesh sample) and Fig 9(peels sample). By using 50% methanol, it was gave high efficiency of phenolic content. Extraction of phenolic contents of pineapples will give high extraction efficiency at 50% and 70 % of solvent (Alothman et al., 2009). Higher TPC give high efficiency at 50% methanolic extracts compared to other solvent

From Fig 8, highest TPC for flesh sample was showed at temperature 140°C with 27% of maltodextrin concentration, 0.7395mg/20g fruit. While for lowest TPC flesh sample is 0.2359mg/20g fruit at 160°C with 27% maltodextrin concentration. Then, for peels sample, TPC reading highest at temperature 140°C with 27% concentration (0.5734mg/20g fruit), while lowest reading at 160°C, 27% (0.2252mg/20g fruit) (Fig 9).

Based on Nguyen et al. (2015) total phenolic content (TPC) decreased with the increasing of inlet temperature used in spray drying. From the observation of flesh sample (Fig 8), highest TPC reading at 140°C compared to 160°C. The result of phenolic compound depends on temperature that used. Highly phenolic compounds were considered as antioxidants have been susceptible to heat (Mishra et al., 2008). When the process of spray drying reaches temperature 160°C, it will cause losing of natural antioxidants and these was proved on the TPC reading

Higher maltodextrin concentration increased the ability to capturing total phenolic contents in sample solution. Increasing of maltodextrin concentration at same inlet temperature will increasing ability to capturing total phenol (Amna & Sri, 2015). From the result obtains, 27% had highest TPC reading compared with 17%

For peels sample, the highest TPC reading recorded at

temperature 140°C and 27% of maltodextrin , 0.5734 mg/20g fruit. Then for the lowest TPC at 160°C (27%) is 0.2252 mg/20g fruit. From Fig 9, it shows that phenolic compound also exist in the peels of Josephine Ananas Comosus at optimum condition. Based on the result, at 27% of maltodextrin concentration, it was increasing the ability to capturing phenolic content based on the result obtained. This is because high concentration of maltodextrin will reduce moisture content, increase solubility characterisation and powder recovery for peel sample. While at temperature 160°C, concentration 17% had high phenolic compound compared with 27%. Due to high temperature used in spray drying, it was disturbing the formation of powder that leads to low solubility methanol solution with high moisture contains. Thus, caused TPC at concentration 17% higher than 27% .

Table1 Table of Total Phenolic Content (TPC) results

No	Sample	Temperature (°C)	Concentration maltodextrin (%)	Total Phenolic Content (mg/20g fruit)
1	Flesh	140.00	17.00	0.3948
2	Flesh	160.00	17.00	0.3734
3	Flesh	140.00	27.00	0.7395
4	Flesh	160.00	27.00	0.2359
5	Sample	140.00	17.00	0.4538
6	Sample	160.00	17.00	0.3168
7	Sample	140.00	27.00	0.5734
8	Sample	160.00	27.00	0.2252

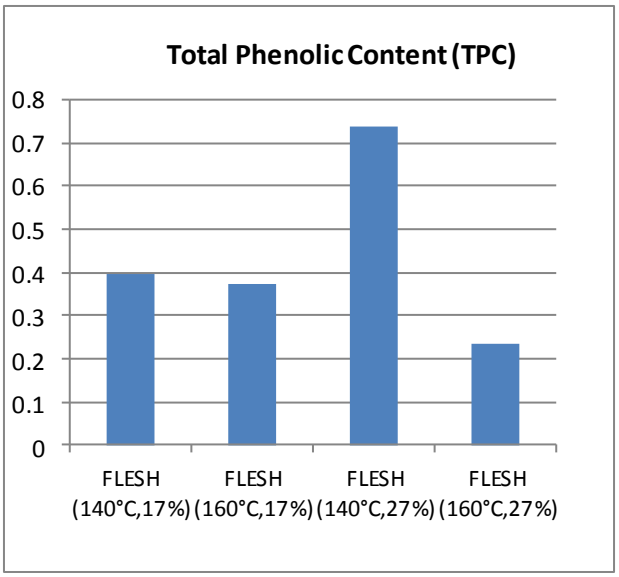

Fig 8 Chart of TPC result for flesh sample

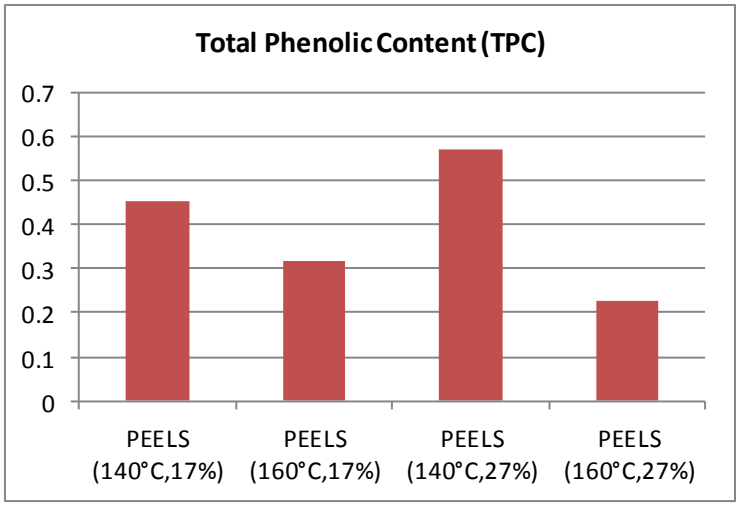

Fig 9 Chart of TPC result for peels sample

B. 2,2-diphenyl-1-picryhydrzyl (DPPH) free radical scavenging assay

Antioxidant compound contains in both flesh and peels sample can be determine by first observation through the colour changes in Fig 10. To compare inlet temperature used with different maltodextrin concentration for DPPH result in Table 2, scavenging assay (% inhibition) can be calculated by using formula;

% inhibition = [(Acontrol – Asample) / Acontrol] x 100%

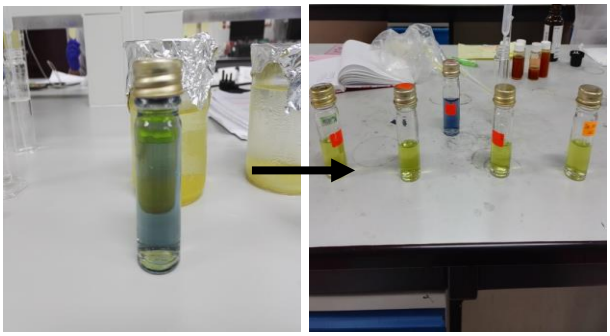

Fig 10 Colour changes during DPPH analysis

By referring Fig 11, flesh sample at temperature 140°C and 27% concentration contains highest reading of scavenging assay (% inhibiton), 35.21% . It was prove that Ananas Comosus had antioxidant compound at this range of temperature and maltodextrin concentration. High percentages of inhibition from 20g of sample proved that Ananas Comosus one of organic antioxidant source.

While for lowest reading of flesh sample, its shows temperature at 160°C and 27% maltodextrin concentration, 13.17%. As mention before, due to high temperature used in spray drying, it was disturbing the formation of powder that leads to low solubility with high moisture contains. Thus, it caused temperature at 160°C, 17% maltodextrin concentration had high % inhibition than 27%.

From Fig 12, For peels sample, the highest % inhibition at 140°C with 27% concentration (34.47%) and for lowest reading at 160°C at 27% (7.82%). By comparing flesh and peels sample, based on the result flesh contains more antioxidant compared with peels sample. This is due to the amount of fibre that contains by flesh with lot of component and nutrient such as

phenolic, flavanoid and antioxidant compound. Compared with peels sample, antioxidant activity may be present in the sample but at low concentration. This also comes from part of fibre that attach on surface of flesh during the cutting process.

Table2 Table of scavenging assay (%inhibition) results

No	Sample	Temperature (°C)	Concentration maltodextrin (%)	% Inhibition
1	Flesh	140.00	17.00	33.32
2	Flesh	160.00	17.00	30.95
3	Flesh	140.00	27.00	35.21
4	Flesh	160.00	27.00	13.17
5	Sample	140.00	17.00	30.81
6	Sample	160.00	17.00	22.08
7	Sample	140.00	27.00	34.47
8	Sample	160.00	27.00	7.82

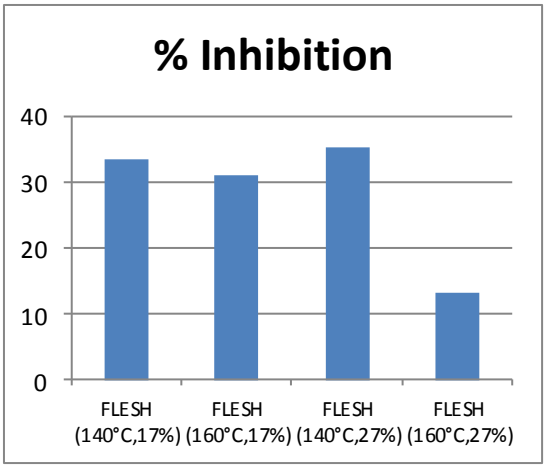

Fig 11 Chart of DPPH result for flesh sample

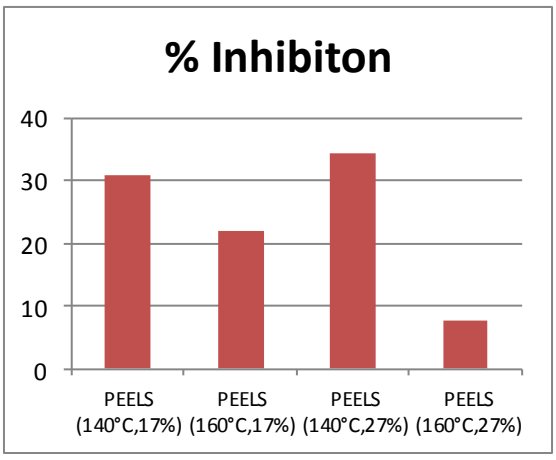

Fig 12 Chart of DPPH result for peels sample

IV. CONCLUSION

Highest TPC for flesh sample will show at temperature 140°C with 27% of maltodextrin concentration, 0.7395mg/20g fruit. While for lowest TPC flesh sample is 0.2359mg/20g fruit at 160°C with 27% maltodextrin concentration. For peels sample, TPC reading highest at temperature 140°C with 27% concentration (0.5734mg/20g fruit), while lowest reading at 160°C, 27% (0.2252mg/20g fruit).

Different reading of TPC was influencing by temperature used during the spray drying, concentration of maltodextrin and also during handling the analysis. Based on Nguyen et al. (2015) total phenolic content (TPC) decreased with the increasing of inlet temperature used in spray drying. Highly phenolic compounds were considered as antioxidants have been susceptible to heat (Mishra et al., 2008). When the process of spray drying reaches temperature 160°C, it will cause losing of natural antioxidants and these was proved on the TPC reading. Based on Suzihaque et. al.(2015), pineapples was dried best at below 160°C.

Then, by using different maltodextrin concentration also influences TPC result. Higher maltodextrin concentration should increase the ability to capturing total phenolic contents in sample solution. Increasing of maltodextrin concentration at same inlet temperature will increasing ability to capturing total phenol (Amna & Sri, 2015). From the result obtains 27% had highest TPC reading compared with 17%. Use high amount of maltodextrin concentration, will increasing solubility characteristics and powder recovery (Suzihaque et al, 2015).

Flesh sample at temperature 140°C and 27% concentration contains highest reading of scavenging assay (% inhibiton), 35.21% . It was prove that Ananas Comosus had antioxidant activity that benefit for consumer at this range of temperature and maltodextrin concentration. High percentages of inhibition from 20g of sample proved that Ananas Comosus one of organic antioxidant source.

While for lowest reading of flesh sample, its shows temperature at 160°C and 27% maltodextrin concentration, 13.17%. As mention before, due to high temperature used in spray drying, it was disturbing the formation of powder that leads to low solubility with high moisture contains. For peels sample, the highest % inhibition at 140°C with 27% concentration (34.47%) and for lowest reading at 160°C at 27% (7.82%).

By comparing flesh and peels sample, based on the result flesh contains more antioxidant compared with peels sample. This is due to the amount of fibre that contains by flesh with lot of component and nutrient such as phenolic, flavanoid and antioxidant compound. Compared with peels sample, antioxidant activity present in the sample but at low concentration. This also comes from part of fibre that attach on surface of flesh during the cutting process

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