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The Comparison of Antioxidant and Bioactive Compound in Fresh Pineapple and Pineapple Powder

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Abstract— The aims of this study were to determined the antioxidant and bioactive compound of fresh pineapple between pineapple powder and to evaluate the antioxidant and bioactive compound of fresh pineapple. Ascorbic acid, total phenolic compound, total flavonoid and 2,2-diphenyl-1-picrylhydrazil (DPPH Assay) were analyzed using morris pineapple flesh. The ascorbic acids, total phenolic compound and total flavonoid in the morris pineapple flesh is higher rather than pineapple powder. The proximate and physiochemical properties showed good quality and increased solubility of pineapple powder compared to the fresh pineapple. Based on experiment, the highest antioxidant is obtained when 100% of extracted methanol in fresh pineapple was 65mg/L rather than pineapple powder was 53mg/L. So, overall the spray dried of pineapple may be a good source of natural antioxidants and profoundly increase the uses of pineapple in value added processing and dietary intake.

***Keywords*:** Antioxidant activity, ascorbic acid, Morris pineapple, total flavonoid, total phenolics.

I. INTRODUCTION

Pineapples were first recorded by Europeans in 1493 on the Caribbean Island. It is known botanically as Ananas Comosus. Pineapples have a wide cylindrical shape, yellow skin and a regal crown of spiny, and green leaves. The fibrous flesh of pineapple is yellow in colour and has a vibrant tropical flavor that balances the tastes of sweet and tart. The fruit has more sugar content and a sweeter taste. But, the fresh fruit can't be stored for long period because it will be bruises and darkened. One of the method to prevent from it happening, the spray drying is the best technique to apply of the pineapple so that the moisture content can be decreased.

Most commonly type of pineapple in Malaysia is Morris that contains antioxidant. Antioxidant have possibility to reduce the oxidative damage that caused by free radicals and chelating metals. There have three types of antioxidant that can be found in the fruit that is phytochemicals, vitamins, and enzymes [6]. Mostly, the enzymes come from the protein and minerals of fruit that can be synthesized in the human body for example iron, copper, selenium, magnesium and zinc [4]. Besides that, the vitamins that include in pineapple fruit such as A, C, E, folic acid, and beta-carotene that have main functionality which can also maintain immune body system [6]. Hence, the objectives of this experiment is to evaluate the antioxidant and bioactive compound of fresh pineapple between pineapple powder and to evaluate the antioxidant and bioactive compound of fresh pineapple.

II. METHODOLOGY

Materials: Ripened and freshly harvested pineapple were obtained from local market. Follin-Ciocalteau Reagent, methanol, quercetin, 2,2-diphenyl-1-picrylhydrazil, metaphosphoric acid, sulphuric acid, starch solution, iodine solution, sodium carbonate solution, gallic acid, aluminium chloride, potassium chloride, and pottasium acetate.

Methods:

A. Sample Extraction of fresh pineapple and pineapple powder

Sample extraction were determined for each fresh pineapple. The pineapple were skinned and cut into pieces and washed with distilled water. Then, the pieces of pineapple were blend together using a blender to produce paste. The paste was weight in a beaker at 25 grams and 20% methanol was added. The mixture was placed in an orbital shaker at a speed about 150rpm at room temperature for 10 min. The extraction was filtered by using sieve to get solid free extracted and then centrifuged with a speed 10,000 rpm for 15 min. The extracted solution was then stored at -20°C for not more than 3 days. After that, the procedure was repeated for Morris pineapple using 40%,60%,80% and 100% methanol concentrations.

B. Determination of Ascorbic Acid Content

5 g of pineapple varieties was extracted. 5 mL of each extracted was added with 5 mL of 4% metaphosphoric acid, 5 mL of 1M sulphuric acid, and 2 mL of 1% starch solution. The mixture was then titrated against 0.001 M iodine solution which was diluted from the standardization iodine solution.

C. Determination of Total Phenolic Content

Total phenolic compound was determined by using the Folin-Ciocalteu's reagent. 0.3 mL sample extraction was added into the

tubes that containing 1.5mL Folin Ciocalteu's reagent in water then it had been diluted 10 times. After 10 minutes, 1.2 mL of 7.5% w/v sodium carbonate solution was then added to the sample. The mixture was stand at room temperature for 30 minutes before reading the absorbance at 765 nm was measured. The solvent are been replaced as the blank of extraction. The TPC was expressed as gallic acid equivalents (GAE) in mg/100 mL of fruit juice to the different concentration of polyphenols in ranging from 0.2 to 4 mg/L.

D. Determination of Total Flavonoid

0.5mL of methanol extracts, 1.5 mL of methanol, 0.1 mL of aluminium chloride, 0.1 mL of pottasium chloride, 0.1 mL of pottasium acetate and 2.0 mL of distilled water was prepared and mixed after an incubation at room temperature for 30 min. Next, aluminium chloride was used as a sample blank. The absorbance was measured at 415 nm using a HITACHI spectrophotometer. Then, quercetin was used to make the calibration curve and the total estimation was carried out in triplicate an the results was calculated.

E. DPPH Free Radical Activity Scavenging Assay

Prepared ten grams of each of the pineapple varieties that was extracted and then sample extracts were diluted to a total of 2 mL. For each of the sample, 2 mL of 0.15 mM DPPH solution in methanol was added. The mixture was left to stand for 30 minutes before reading the absorbance at 517 nm and methanol was used as the blank of sample. Then, prepared 2 mL of solvent in the sample of extraction. The % inhibition of the extract was determined as equation shows below, where A is absorbance:

$$\%\ inhibition = \left[\frac{\text{Acontrol} - \text{Asample}}{\text{Acontrol}}\right] \text{x } 100\%$$

III. RESULTS AND DISCUSSION

A. Physiochemical Analysis

I. Ascorbic Acids

Results showed that the ascorbic acid content of the spray dried pineapple powder is highest than of the fresh pineapple due to the influenced of pineapple during the spray drying in the pineapple at constant temperature and pressure while spray drying. The spray drying is produced the powder of pineapple using 25% maltodextrin at 130°C at 3 rpm. It takes only 50 minutes to produced 48 grams of pineapple powder.

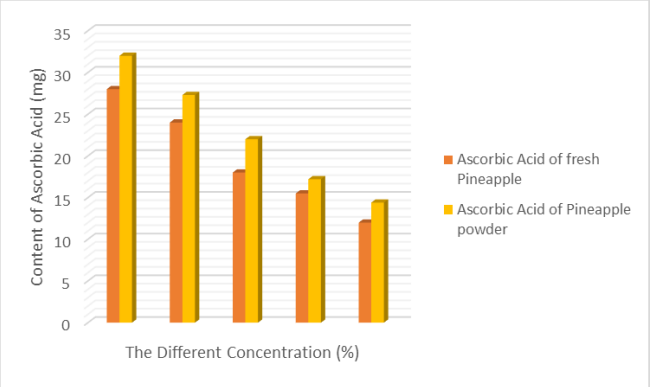

Figure 3.1: The Percentage of Titration Concentration Iodine Solution versus Ascorbic Acid Content of Fresh Pineapple between Pineapple Powder.

The trend of ascorbic acid content analysis of soluble fresh pineapple was extracted and pineapple powder are presented in figure 3.1. Morris pineapple showed the highest ascorbic acids than the Sarawak and Josaphine pineapple when applied the concentration at 20% of the methanolic solution in the titration of ascorbic acid. Pineapple powder is highest when applied the ascorbic acid in the 20% concentration was 32mL than ascorbic acid content in the fresh pineapple. Based on previous study, a higher ascorbic acid was observed in the 50% methanolic extracts compared to other extracts of the three pineapple varieties [9]. In another study, which also investigated the ascorbic acid content of Josephine and Sarawak that comparable to that of the 'Nanglae' (6.45mg AA/100g fruit) and 'Phulae' (18.88mg AA/100 g fruit) pineapples as reported by Kongsuwan et al. (2009).

II. Total Phenolic Content

Phenolic content in pineapple are present in both soluble forms and combined with cell wall complexes [6]. The TPC values in this experiment are in good agreement with previously published values of tropical fruits stating that the experiments conducted were fairly conducted [9]. The total phenol content (TPC) of spray dried pineapple powder when compared with pineapple soluble extract was found significant (Figure 3.2), this is due to the high concentration of pineapple powder after spray drying and the protective coating of maltodextrin which gave maximum retention of the total phenolic content in guava powder [2]. Results are presented per percent of inhibition soluble extract or spray-dried material, to demonstrate the concentration effects. Spray dried pineapple powder showed fair amount of total phenolics, when compared with soluble extract at five different concentrations.

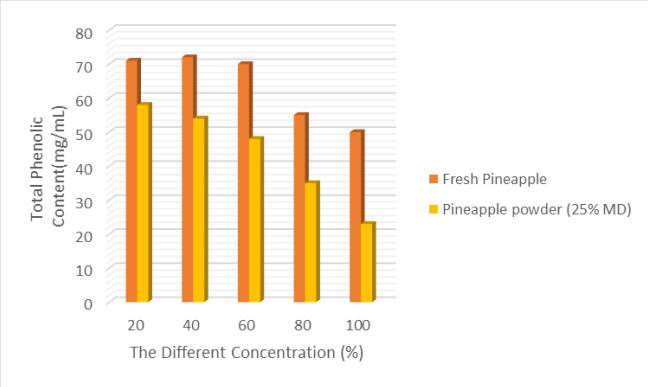

Figure 3.2: The Percentage of inhibition Total Phenolic Content of fresh pineapple are extracted and pineapple powder

The TPC of fresh pineapple extracted was highest than pineapple powder, respectively $(p < 0.05)$. These data indicated the differences in the TPCs of the tested pineapple extracts, which could strongly account for the distinct antioxidant activities of the samples. However, the total phenolics compound reacts with the folin-Ciocalteau reagent only under the basic condition at pH=10 due to the much higher reactivity of the phenolate anion with the molybdenum are presented in the reagents [18].

III. Total Flavonoid

The total flavonoid content decreased at the low concentration applied due to spray drying in pineapple powder (Figure 3.3), this must be due heat sensitivity of the pigment, during processing of fruits and vegetables boiling or heating at high temperature even for 5min causes reduction in total flavonoids content of the pineapple. While processing the fruits into powder form for the purpose of value addition, this factor should be given importance to reduce the loss of flavonoids as it has wide range of biological activities such as cell proliferation-inhibiting, apoptosis-inducing, enzyme-inhibiting, antibacterial, and antioxidant effects [7]. The reason of better retention of total phenol content during spray drying process at high temperature is encapsulation with carrier agent maltodextrin, since long duration of cooking at high temperatures had been observed as the main causes of loss of nutrients which causes disruption of cell wall and breakdown of biochemical compounds.

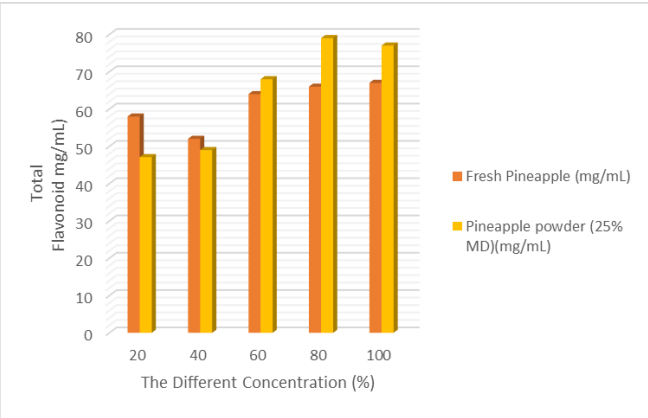

Figure 3.3: The Percentage of inhibition of Total Flavonoid in fresh pineapple are extracted and pineapple powder

Result shows the highest TFC in pineapple powder than fresh pineapple. In 20% concentration of methanolic solution, Morris pineapple flesh (67 mg QE/100 g FW), followed by the pineapple powder (77 mg QE/100 g FW). Meanwhile, the lowest TFC was determined in both fresh pineapple and pineapple powder at 58 and 47.1 mg QE/100 g FW respectively. In comparison to previous study, the TFC ranged between A. comosus (22.6 ± 0.06 mg QE/100 mL) and the lowest is A. muricata ('guyabano') fruit of 7.06 (± 0.01) mg QE/100g fw [8]. But then after the drying process the TFC ranged between (580.70 ± 20.46 µg of rutin 100 $g^{-}1$ sample) was at its highest level compare than fresh pineapple pulp (197.10 ± 2.60 µg of rutin 100 $g^{-}1$ sample, dry base) and skin (76.93 ± 11.85 µg of rutin 100 $g^{-}1$ sample) [3]. This is because, the harvest time might affect the TFC in pineapple fruit and pineapple powder.

B. DPPH Free Radical Scavenging Assay

In the figure 3.4 below, comparison made between both samples for DPPH activity showed significant variations. During this experiment, the antioxidant activity of pineapple soluble extract consistently ranked high at five different concentrations compared between the morris pineapple flesh. Other reports on the antioxidant capacity of methanolics extract of P. Guajava in terms of FRAP activity has been reported high [15]. The soluble extract morris pineapple flesh showed good retention of antioxidants when compared with pineapple powder through DPPH activity, which confirms that spray drying process are affect the antioxidant capacity of the fruit powder.

The fresh pineapple showed a good retention of antioxidants when compared with the pineapple powder through DPPH activity, which confirmed that spray drying process are affect the antioxidant capacity of the fruit powder used the 25% maltodextrin. DPPH free radical scavenging assay values of fresh pineapple were ranged from 41-65mg/100g FW and pineapple powder was ranged between 16-53mg/100g FW in five different concentration of methanolic solution.

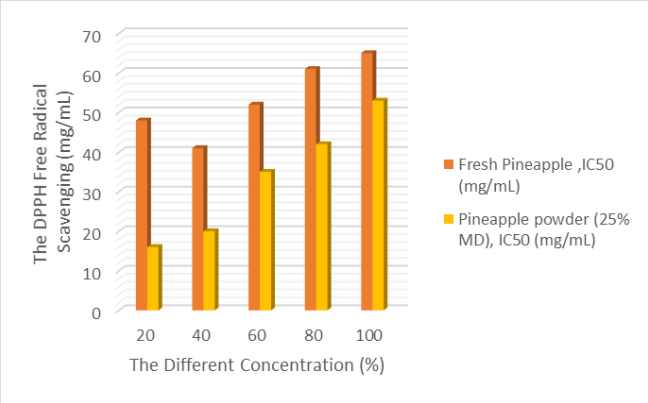

Figure 3.4: The percentage of inhibition of DPPH Free Radical Scavenging Assay (%) in fresh pineapple and pineapple powder.

IV. Conclusion

All the methanolic extracts obtained from residue in the fresh fruit and studied here, pineapple that showed the highest antioxidant capacity against different reactive of oxygen. During the experiments, the results showed that the spray dried pineapple powder was similar in physiochemical properties to fresh pineapple. The spray dried pineapple powder showed good antioxidant capacity. In conclusion, spray drying is potentially a useful process for large scale production of dried powders containing the natural products which may act as alternative way. Furthermore, the numerous applications of pineapple powder is not limited to commercial products likes jam, and jellies but can be used as health supplements, it is possible that the resulting powder could be used in a wide range of functional food applications, delivering antimicrobial properties in those foods.

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