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The effect of maltodextrin and additive added towards pitaya juice powder total phenolic content and antioxidant activity

Chemah Tamby Chik [1], Aminah Abdullah [2], Noriham Abdullah [3] and Wan Aida Wan Mustapha [2]

[1] Department of Foodservice, Faculty of Hotel & Tourism Management, UiTM Shah Alam, Sel. Malaysia

[2] School of Chemical Science and Food Technology, Faculty of Science & Technology, UKM Bangi, Sel.

[3] Department of Food Technology, Faculty of Applied Science, UiTM Shah Alam, Sel.

Abstract. Consumption of natural juice with additional benefits was highly appreciated by consumers. Pitaya juice was spray dried using maltodextrin at 10 dextrose equivalent (DE), 15DE and 20DE and ascorbic acid and citric acid as additive to preserve the red colour. The powder content for total phenolic and antioxidant activity was evaluated using Folin-Chiocalteu, 2,2-diphenyl-1-picryldrazil (DPPH) and ferric reducing power (FRAP) antioxidant assay. The results showed that maltodextrin at different degree of dextrose equivalent did not show any significant difference ($p>0.05$) in total phenolic content, DPPH and FRAP assay. Ascorbic acid at 0.1, 0.5 and 1.0% showed that the highest percentage of ascorbic acid content exhibited higher ($p<0.05$) total phenolic acid value of 350.4 mg gallic acid equivalent/100 g sample. DPPH and FRAP assay showed similar trend with 46.3% and 9.7 mg catechin equivalent/100 g sample. Pitaya juice powder with ascorbic acid has potential as functional drink with attractive natural pigment of red colour

Keywords: pitaya juice, powder, functional ingredient, beverages.

1. Introduction

Consumption of natural juice with additional benefits was highly appreciated by consumers. Natural pigment found in fruit juices has some added value for its colour and functional properties. However, juices had shorter shelf life and proper storage was costly. Therefore dried juice was able to maintain the fruits pytochemicals properties for longer period thus helps in reducing handling and storage cost.

Furthermore, research now focused on maintaining pytochemicals contents in food [1]. As an example, food processing was found to increase the flavonol content in food [2], [3]. And these flavonoids are absorbs in the small intestine without changes [4].

Pitaya is a fruit recently planted commercially in several states in Malaysia. It is a climbing cactus originated from Latin America with medium-large fruit bearing green or red scales [5]. Pitaya has gained popularity for its red-ultra violet betalain colour which contained antioxidant properties [6], [7]. Betalain is a water soluble nitrogenous pigment consisted of red-ultra violet betacyanin and yellowish betaxanthin [8]. Betalain found in pitaya fuits are better than beet roots betalain because of it lacks of "earthy" taste due to geosmine and pyrazine [9], [10]. There are many studies on the drying of fruit juice, among them are cactus pear [9], roselle [11], black carrot [12] and carotenoid [13]. Most of the research focused on fruits with anthocyanin content. However the usage of anthocyanin as colouring are limited due to its instability. Therefore pitaya served as another source of red pigment with antioxidant content and stable over a wide pH ratio.

Spray drying is a process widely used to produce fruit juice powders [14], [15], [16]. This method helps in producing powders with good quality, low water activity and easier transport and storage [17]. It is useful in drying material which is heat sensitive, increased flowability and solubility [18]. Reference [19] reported spray dried extracts had higher antioxidant activity and flavonoid content as compared to the extract which is vacuum dried. Reference [20] stated that food properties such as nutrients, colour and flavour are a function

of maltodextrin DE. Thus it is the objective of this study to dry pitaya juice using maltodextrin at different degree of polymerization as carrier and adding ascorbic acid and citric acid at 0.1, 0.5 and 1.0% to maintain the pigment phytochemical content of the spray dried powder.

2. Methodology

2.1. Total phenolic content

Total phenolic content was determined using Folin-Ciocalteu reagent, modification method by [21]. Gallic acid was used as standard and the concentration of total phenolic compounds in the extracts were calculated by standard curve interpolation. Results were reported as mg gallic acid equivalent/100 g dried sample.

2.2. DPPH Assay

Free radical scavenging activity was measured by the 2,2- diphenyl-1-picrylhydrazil (DPPH) according to a modified method by [6]. Sample extracts (100ul) added into 3.9ml of DPPH reagent (prepared with 24mg of DPPH/L of methanol). The percentage of DPPH scavenging activity is expressed by the following formula,

$$\text{DPPH inhibition} = \left[\frac{(\text{Initial absorbance} - \text{sample absorbance})}{\text{Initial absorbance}} \times 100\right]$$

2.3. FRAP assay

FRAP method was according to [22] which measures the ferric reducing ability of plasma (FRAP). The method is based on the reduction of a ferric 2,4,6-tripyridyl-s-triazine complex (Fe3+-TPTZ) to the ferrous form (Fe^{2+}-TPTZ). The stock solutions included 300mM acetate buffer (3.1 g C2H3NaO2.3H2O) and 16mL C2H4O2), pH 3.6, 10mM TPTZ (2, 4, 6-tripyridyl-s-triazine) solution in 40mM HCl, and 20mM FeCl3.6H2O solution. The fresh working solution was prepared by mixing 25mL acetate buffer, 2.5mL TPTZ solution, and 2.5mL FeCl3.6H2O solution and then warmed at 37°C before use. The reagent was added into 100ul sample extracts. The reduced form of blue colour read at 93nm after 30 minutes. Trolox used as standard and ferric reducing power of the extracts was calculated by standard curve interpolation. Results expressed as mg Trolox equivalent/100 g dry weight.

2.4. Powder preparation

Pitaya juice added with water at ratio of 1:1 and maltodextrin at 25% before spray dried (SD06 LabPlant, UK). The powder sample was collected and kept sealed in a plastic bag until further analysis.

2.5. Research design

Powder prepared with 3 types of maltodextrin at dextrose equivalent of 10, 15 and 20 was added with ascorbic acid and citric acid at three level of concentration 0.1, 0.5 and 1.0% before spray dried. Factorial analysis using SAS statistical package version 9.1 (2002) were used. ANOVA test was used to determine significant difference ($p<0.05$) while DUNCAN was used to determine the significant sample. Each parameter and test was replicated.

3. Results and discussion

The result in Table 1 showed polyphenolic content, DPPH % and FRAP assay result for pitaya powder with maltodextrin DE10, 15 and 20. Maltodextrin was incorporated into the pitaya juice acting as carrier. Pitaya juice is high in sugars and acids and thus not suitable to be spray dried without carrier. Maltodextrin was chosen due to its low cost [23], [24]; bland taste [25]; has low viscosity as compared to its high volume [14] and are available in different size molecules [26]. During spray drying, the powder colour changed due to high temperature used (data not showed). However, in this study, the different degree of polymerization in maltodextrin did not show any significant difference ($p>0.05$) in the content of polyphenol, DPPH test and FRAP assay for pitaya powder. Our result differs from [25] maybe due to the maltodextrin DE which are in closer range.

Table 1: Mean (n=2) for the Polyphenolic Content, DPPH test and FRAP assay for pitaya powder with maltodextrin DE10, 15 and 20.

Maltodextrin	TP (mg gallic acid/ 100 g powder	DPPH (%)	FRAP (mg catechin/ 100 g powder)
MDE 10	252.5[a]	41.5[a]	5.7[a]
MDE 15	210.6[a]	28.7[b]	4.8[a]
MDE 20	222.5[a]	38.8[a]	5.4[a]

Different letter in the same column showed significant difference ($p<0.05$)

In Table 2, results showed mean for polyphenolic content, DPPH % and FRAP assay for pitaya powder with ascorbic and citric acid. These acid was added into the pitaya juice prior to spray drying to stabilize the red-ultra violet colour. According to [27], use of additive into juice can stabilize betacyanin pigment. The result in this study showed that pitaya powder with ascorbic acid higher has higher ($p<0.05$) total phenolic content and better antioxidant capacity. Citric acid did not show significant function in maintaining total phenolic and antioxidant capacity in the pitaya powder. Reference [28] and [29] indicated citric acid showed no antioxidant activity when tested with ORAC assay however, ascorbic acid and gluthatione showed good results.

TABLE 2: Mean (n=2) for the polyphenolic content, DPPH test and FRAP assay for pitaya powder with ascorbic and citric acid.

Maltodextrin	TP (mg gallic acid/ 100 g powder	DPPH (%)	FRAP (mg catechin/ 100 g powder)
Ascorbic acid	383.63[a]	53.86[a]	10.01[a]
Citric acid	73.38[b]	18.83[b]	0.55[b]

Different letter in the same column showed significant difference ($p<0.05$)

The result in Table 3 showed the polyphenolic, DPPH test and FRAP assay for pitaya powder with ascorbic acid at 0.1, 0.5 and 1.0%. The more ascorbic acid added into pitaya juice the higher ($p<0.05$) polyphenol, DPPH and FRAP result. Ascorbic acid was added to preserved the betalain pigment [20]. But the results showed that it also can enhance the antioxidant activity and total phenolic content of the pitaya powder.

TABLE 3: Mean (n=2) result for polyphenolic content, DPPH test and FRAP assay for pitaya powder with ascorbic acid at 0.1, 0.5 and 1.0%.

Ascorbic acid (%)	TP (mg gallic acid/ 100 g powder)	DPPH (%)	FRAP (mg catechin/ 100 g powder)
0.1	127.5[c]	20.1[b]	1.3[c]
0.5	207.6[b]	42.6[a]	4.9[b]
1.0	350.4[a]	46.3[a]	9.7[a]

Different letter in the same column showed significant difference ($p<0.05$)

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