E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

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BUTTERFLY PEA LEMON DRINK POWDER

Nor Aishah Ismail, Halimah Ab. Rahim, Siti Shafini Muhamad, Hasnoor Hafzan Baharum

Food Technology Department, Sultan Haji Ahmad Shah Polytechnic,
25350 Semambu, Kuantan, Pahang, Malaysia.

aishahjtm@polisas.edu.my
halimah@polisas.edu.my
shafini@polisas.edu.my
hafzan@polisas.edu.my

ABSTRACT

The present investigation aims to study the effect of different percentages of inulin and inlet temperatures on the physicochemical properties of butterfly pea lemon drink powder. Three different percentages of maltodextrin (15%, 20%, and 25%) were added (w/w) as the encapsulating agent prior to spray drying. Inlet temperatures were varied at 160 °C, 170 °C, and 180 °C, respectively and the outlet temperature (80 °C) and feed flow rate (8 mL/min) were kept constant. Moisture content, water activity, bulk and tapped density, flowability, solubility time, water absorption index, and vitamin C were analysed for the powder samples. The research data were statistically analysed by Analysis of variance (ANOVA) with Minitab version 17 at a confidence level of 95% and all tests were done in triplicates. The results indicated that at higher inlet temperatures and higher percentages of inulin, the moisture content and water activity decreased, showed a good powder stability. Moreover, powders produced at higher temperatures were more soluble and exhibited a lower cohesiveness. When the inlet temperatures of spray drying augmented from 160 °C to 180 °C, the bulk density and tapped density also decreased and thus increased the flowability of the powder from fair to excellent. The results also showed that a decrease in the percentage of inulin to 25% at a lower temperature range (160°C) led to the higher retention of ascorbic acid (vitamin C) in the *butterfly pea lemon* powder drink.

Keywords: butterfly pea; lemon; drink powder.

INTRODUCTION

Butterfly pea (*Clitoria ternatea L.*) is one of the wild plants that are often found in the yard of the house. The butterfly pea (*Clitoria ternatea L.*) has anthocyanin pigments that produce the blue colour in the butterfly pea. Based on Suebkhampet & Sotthibandhu (2011), the blue colour of the butterfly pea is due to the presence of anthocyanin pigments which can also be used as natural dyes in food. Butterfly pea (*Clitoria ternatea L.*) contains phenolic compounds that can act as antioxidants by donating hydrogen to stabilize the electron deficiency in free radicals (Andriani & Murtisiwi, 2020).

Antioxidants in butterfly pea flower are very beneficial for the body because they can be an antidote to free radicals so that they can reduce or even prevent the occurrence of cancer and degenerative diseases in the body. According to Saati et al. (2016), antioxidants are substances that are anti against other substances that work as oxidants. Antioxidants have an important role in helping prevent damage to healthy cells due to the presence of these free radicals. Making instant powder of butterfly pea lemon drinks can be carried out using the co-crystallization method. Fruit drinks powders have many benefits over their liquid counterparts such as reduced volume or weight, reduced packaging, easier handling, transportation, and longer shelf life Goula et al 2004 Spray drying is one of the most complex methods for fruit drink drying Fruit drink is very sensitive and is open to be affected by various drying parameters Among the main problems in fruit drink drying, is the stickiness from its composition It is a well-known

fact that foods, that contain large amounts of simple sugars (glucose, fructose), are difficult to spray dry in pure form due to stickiness problems (Rodriguez Hernandez et al, 2005.

The most common approach to deal with the problem of stickiness in spray drying of sugar rich foods is the addition of a drying aid agent, and in this study was used inulin which offers a good compromise between cost and effectiveness However, there are no reported studies on spray drying of butterfly pea lemon drinks into a powdered in order to retain the good physicochemical properties and quality of a product. Therefore, this study is focus on optimization of inulin percentage and spray drying inlet temperatures in the production of butterfly pea lemon powder drink and their physicochemical properties.

METHODOLOGY

2.1 Material

Butterfly Pea Flower, lemon, and lemongrass brought from a market. Butterfly Pea Flower and lemon juice weigh based on desired test percentages. The flower with lemongrass was boiled in 200ml of water at 100°C for 15 minutes, then add lemon juice according to the percentage.

2.2 Sample Preparation

The solution of Butterfly Pea Flowers with lemongrass, inulin, and lemon juice is homogenized to dissolve all ingredients equally for five minutes at 5000 rpm before entering the spray dryer.

2.3 Spray Dryer

The spray drying process takes place in a lab-scale spray dryer. The spray dryer is a plant-based spray dryer with a 0.5mm jet nozzle assembly and a hand-operated de-blocking needle. The dry mixture enters the main chamber through a peristaltic nozzle. The feed flow rate is controlled by the rotation speed of the pump. The drying air flow rate is 70 m3/h. The inlet air temperature is 180°C, and the feeding air flow rate is 8 ml/min.

2.4 Physicochemical analysis of Butterfly Pea Flower powder

Experimental Design of Butterfly Pea Lemon Drink Powder is conducted and the physicochemical analysis of butterfly pea lemon drink are determined.

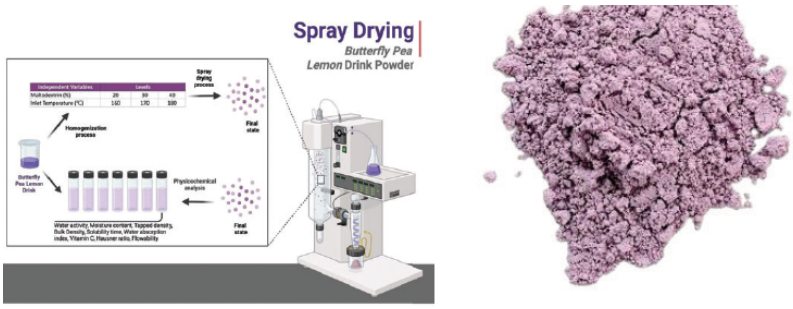

Figure 1 Experimental Design of Butterfly Pea Lemon Drink Powder

The moisture content is determined based on the technique used by Michalska & Lech (2018). Measurement of water activity is carried out using a water activity meter (Aqualab Series 4TE). The bulk density of powder is determined by the procedure by Goula et al. (2004). Tapped density, a higher value than bulk density, is achieved by mechanically tapping a container with the powder sample. In this case, the tapped density was obtained by tapping a graduated cylinder filled with Bunga Telang. The flowability of powder correlates with the parameter Hausner ratio. The compressibility of a powder

is correlated with Carr index. The detailed specifications for Carr's Index and Hausner's Ratio was referring from Lebrun et al. (2012). Water absorption index (WAI) and solubility time were conducted using Sabhadinde (2014) method with some modification. Estimation of vitamin C as ascorbic acid content are determined according to the proposed procedure (West & Mauer, 2013) with some modifications. Triplicate samples are analysed, and the mean are recorded.

FINDINGS

Table 1: Effect of percentage of inulin and inlet temperature on Bulk density, Tapped density, Car index, Hausner Ratio, and flow behavior of Butterfly pea lemon drink powder.

Sample	Inlet temp. (℃)	Bulk Density (g/cm^3)	Tapped Density (g/cm^3)	Car Index (%)	Hausner Ratio	Flowability
20%	160	0.57±0.00A[a]	0.80±0.00A[a]	28.75	1.40	Poor
	170	0.44 ±0.00A[b]	0.57±0.00A[b]	22.81	1.30	Possible
	180	0.31±0.00*A*[c]	0.39±0.00A[c]	20.51	1.26	Possible
30%	160	0.36±0.00B[a]	0.50±0.01B[a]	28.00	1.39	Poor
	170	0.35±0.00B[b]	0.44±0.01B[b]	20.45	1.26	Possible
	180	0.44±0.00B[c]	0.50±0.00B[c]	20.00	1.25	Fair
40%	160	0.44 ±0.00C[a]	0.56±0.00 C[a]	22.81	1.30	Possible
	170	0.33±0.00C[b]	0.40±0.00 C[b]	17.50	1.21	Fair
	180	0.29±0.00C[c]	0.33±0.00 C[c]	12.12	1.14	Good

Table 2: Effect of percentage of inulin and inlet temperature on Solubility time, Water absorption index and Vitamin C of Butterfly pea lemon drink powder.

Sample	Inlet temp. (℃)	Solubility (min)	Water Absorption Index (WAI)	Vitamin C
20%	160	88.03±0.01A[a]	83.73±0.23A[a]	72.00±0.00A[a]
	170	58.55±0.01A[b]	86.67±0.46A[b]	59.33±1.15A[b]
	180	37.54±0.01A[c]	89.87±0.23A[c]	40.00±0.00A[c]
30%	160	78.54±0.01B[a]	86.00±0.40B[a]	54.00±0.00B[a]
	170	55.81±0.01B[b]	88.27±0.23B[b]	36.00±0.00B[b]
	180	26.49±0.01B[c]	90.67±0.23B[c]	32.00±0.00B[c]
40%	160	67.50±0.01C[a]	87.73±0.23C[a]	44.00±0.00C[a]
	170	44.57±0.01C[b]	89.60±0.40C[b]	33.33±1.15C[b]
	180	14.54±0.01C[c]	92.13±0.23C[c]	16.00±0.00C[c]

CONCLUSION

Butterfly pea lemon drink powder represents a significant innovation which offering a product that is both natural and innovative meeting the dual demand for health and aesthetic.

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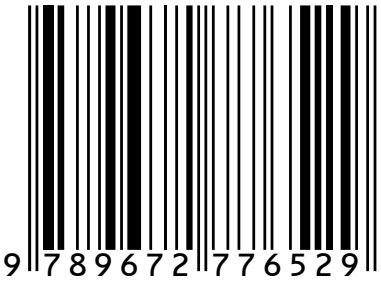

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