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STABILITY AND STORAGE BEHAVIOUR OF NATURAL FOOD COLOURFROM BASELLA ALBA L FRUITS

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ABSTRACT

The Basella alba fruit is a rich source of betalains and has value-added potential for use in the development of food colourants and nutraceuticals. Mature Basella alba L. fruit, with dark blue skin and deep red-violet flesh, is a potential source of natural colourants. The natural colourants may be nutritionally important antioxidants and their presence in the diet may reduce the risk of cardiovascular disease, cancer and other diseases associated with aging. The Colour stability was better at pH4 when compare to pH7 & pH9.Higher concentration of sodium benzoate preservative (1000ppm) had a detrimental effect on stability of the powder. The BACP degradation was higher at elevated temperature.

KEYWORDS: *Basella Alba Fruits, Basella Alba Colourant Powder (BACP) Stability, P^H, Preservative and Temperature*

Article History

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INTRODUCTION

Colour is the main feature of any food item as it enhances the appeal and acceptability of food. During processing, substantial amount of colour is lost, and make any food commodity attractive to the consumers, synthetic or natural colours are added. Several types of dyes are available in the market as colouring agents to food commodities but biocolourants are now gaining popularity and considerable significance due to consumer awareness because synthetic dyes cause severe health problems. Biocolourants are prepared from renewable sources and majority are of plant origin.

The main food biocolourants are carotenoids, flavonoids, anthocyanidins,chlorophyll,betalain and crocin, which are extracted from several horticultural plants. In addition to food colouring, biocolourants also act as antimicrobials, antioxygens and thereby prevent several diseases and disorders in human beings.(Rymbai et al.,2011).

Basella alba is good source of vitamin A, vitamin C, vitamin B9 (folic acid), calcium, magnesium, iron and several vital anti-oxidants in the plant; also has proteins, fats, carbohydrates, fibre, ash, calcium, vitamins, thiamine, riboflavin and niacin. The plant contains the essential amino acids such as arginine, isoleucine, leucine, lysine, threonine and tryptophan along with several vitamins, minerals and a low percentage of soluble oxalates.

Natural food colours are less stable, less bright and not uniform in terms of utilization in processed food products. Industrial application requires protecting the natural pigments in the environment, due to their instability in the presence of light, air, humidity, high pH and temperatures. So there is pressure to find ways to increase stability, brightness and

uniformity in utilization of processed food products. Betalain and anthocyanin are the most important natural food colours and are emerging food colours of commercial importance for its dye and medicinal properties. The maximum stability of Basella alba betacyanin extract was more stable at pH 4.1 and 6.0, temperature at 10° C, 20° C and 30° C both in the presence and absence of light(Reshmiet al., 2014).

MATERIALS AND METHODS

Sample Preparation

Sound and disease-free Basella alba fruits were collected and washed with tap water thoroughly. Mixie was used to crush the fruits and extraction of the colour using filters.

Extraction of Bicolour

One gram of the pulp (Basella alba fruits) was mixed with 5 ml of water solvent and filtered through Whatman No1 filter paper and kept for 30 minutes, and the colour was read in the UV-Spectrophotometerat 535 nm.

Natural Food Colour from BasellaAlba by Spray Drier

The edible portion of the Basella alba fruits were crushed into pulp by adding 5 per cent water in the proportion of 1:5 (Basella alba: water). The pulp was kept at room temperature for 30 minutes to dissolve the pigments in the solvent. After 30 minutes, the pulp was filtered by using muslin cloth and the filtrate was kept ready for spray drying. The TSS of the extracted Basella alba fruits extract was (1 °brix) noted by using hand refractometer.

Table 1 shows Maltodextrin is a very long chain of repeating glucose molecules connected together. Because of this particular structure, maltodextrin can be classified as a complex carbohydrate, as opposed to a simple carbohydrate like glucose (Guzman-maldonado et al., 1995; Chronakis, 1998; Tharanathan, 2002).

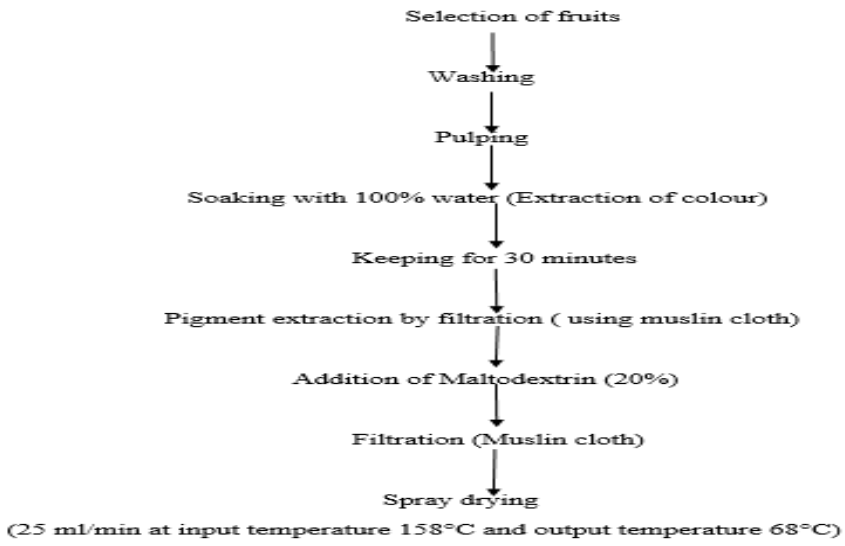

Figure 1: Production of Natural Food Colour from Basella Alba Fruits.

Table 1: Parameters for the Production of Natural Food Colour Powder from the Extraction of Basella Alba Fruits

Parameters	Levels
Maltodextrin (MD)	20 %
Drying air temperature	Input temperature 158°and output temperature 68°C
Feed rate	25 ml/min

Table 2: Effect of Drying Air Temperature, Feed Rate and Maltodextrin (MD) on Spray Dried Powder Recovery

S. No	Drying Temperature	Feed Rate (ml/min)	Powder Recovery (g/100ml)
1	Input-158°C &output-68°C	25ml/min	10.9

STABILITY STUDIES

Effect of pH, Temperature and Preservative on the Stability of Spray Dried BACP

Preparation of Aliquot Sample:

One gram of spray dried BACP was dissolved in 100 ml of distilled water.

Effect on pH:

Stability of pigments at different pH (4-9) was measured by mixing 2 ml of aliquot BACP in 10 ml of buffer pH (4-9). These samples were stored in room temperature for a period of seven days and absorbance was measured at 24 hours interval. Basella alba betacyanin extract was more stable at pH 4.1 and 6.0, temperature at 10° C, 20° C and 30° C both in the presence and absence of light.

Effect on Preservative:

Effect of sodium benzoate was studied by mixing an aqueous solution of sodium benzoate (concentration 200 ppm - 1000 ppm) with 2ml aliquot samples. These samples were stored in room temperature for a period of seven days and absorbance was measured 24 hours' interval (Rekha et al., 2007).

Effect on temperature:

The degradation of pigment was studied by exposing the mixture of 2 ml aliquot sample with 10 ml of distilled water at 40, 50, 75, 100, 125 and150ºC and the degradation was measured for a period of 20 Minutes(Rekha et al., 2007).

STORAGE STUDY

Determination of Moisture

The moisture content of spray dried BACP were estimated using the hot air oven. Three gram of the sample was accurately weighed and dried in an oven at 105 ºC until constant weight was obtained. The moisture content was expressed in percentage.

Determination of pH

The pH of the sample was estimated by using pH meter.

Determination of Total Soluble Solids

The Total Soluble Solids (TSS) was estimated by refractometer.

Sedimentation and Solubility

The sedimentation rate of the sample was noted till a constant value was obtained and the solubility of the powder in water was estimated.

RESULTS AND DISCUSSIONS

Spray Dried BasellaAlba Fruits Powder

The spray dried Basella alba fruits powder was prepared by spray drying method. 108.6 grams of powders was derived from one litre of Basella alba fruit juice. The powder recovery was obtained from input temperature 158°C and output temperature 68°C with the feed rate of 25 ml / min and 20 per cent maltodextrin. Hence, these parameters were selected for drying Basella alba fruits extract in spray drying. Fernado Diaz Sanchez (2004) reported extraction of betalains can be done easily by water. The water extract is then blended in ethyl alcohol: water (1:1) mixture. Ethanol in the mixture reduces the enzymatic action which otherwise causes degradation of pigments.

Figure 2: Spray Dried Basella Alba Colourant Powder.

STABILITY OF SPRAY DRIED BASELLA ALBA FRUITS POWDER

Effect of pH on the Stability of BACP During Storage

The steady degradation of Basella alba fruit colour was observed at varying ionic strength (pH 4, pH 7 and pH 9) throughout the storage period of one week at room temperature based on the optical density (O.D) using UV-Spectrophotometer at 535 nm and the observed data are given in Table 1. The experimental results showed that the colour stability at pH 4 was higher compared to pH 7 and pH 9 in the samples during storage in room temperature and pH 7 showed a satisfactory stability in the sample during storage in room temperature when compared with pH 9.Pattnaik et al. (1997) reported that the betalain was fairly stable at pH range between 3.5 and 7.0 and had maximum stability in the range of pH 4.0 to 5.0.

Table.3: Effect of pH on the Stability of BACP During Storage

Spray Dried Powder	Storage Period in Days (S)	Optical Density at 535 nm		
		pH4	pH7	pH9
		RT	RT	RT
BACP	Initial	0.223	0.212	0.203
	1	0.209	0.203	0.186
	2	0.199	0.138	0.128
	3	0.192	0.122	0.108
	4	0.186	0.102	0.099
	5	0.178	0.097	0.088
	6	0.173	0.086	0.078
	7	0.164	0.082	0.073

RT-Room Temperature: **S**-Storage Periods

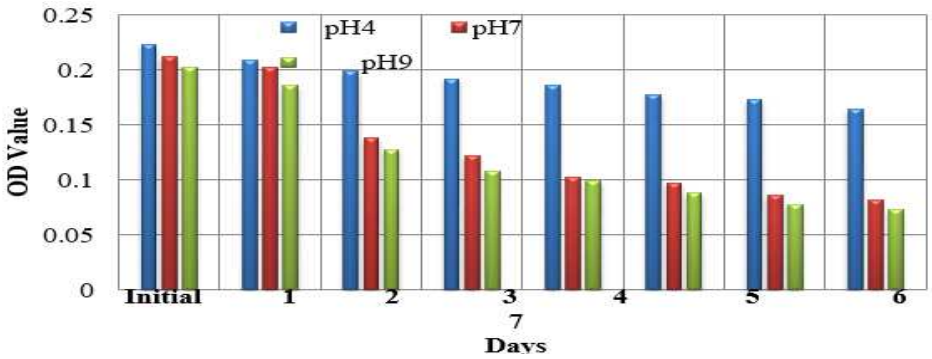

Figure 3: Effect of pH on the Stability of BACP During Storage.

Effect of Preservative on the Stability of BACP during Storage

A gradual degradation of BACP was observed at different concentration of preservative (sodium benzoate) throughout the storage period of one week at room temperature based on the optical density (O.D) value using UV-Spectrophotometer at 535 nm. The observed data is given in Table 2. The experimental results showed that increasing concentration of preservative in sample, resulted in increasing degradation of colour during storage in room temperature So drastic reduction was observed at higher concentrations (800 ppm and 1000 ppm) for the sample.Rekha et al. (2007) studied the stability of pigment (betalain) at various concentration levels (100 ppm - 500 ppm) of sodium benzoate and they found that the stability of the betalain pigment was above 80 per cent at 200 ppm concentration and it was gradually decreased as the concentration of preservative increased.

Table 4: Effect of Preservative on the Stability of BACP During Storage

Spray Dried Powder	Storage Period inDays (S)	Optical Density at 535 nm				
		200ppm	400ppm	600ppm	800ppm	1000ppm
		RT	RT	RT	RT	RT
ACP	Initial	1.332	1.316	1.158	1.124	1.117
	1	1.095	1.091	1.029	1.018	0.997
	2	1.060	1.004	1.002	0.923	0.914
	3	1.037	0.974	0.964	0.896	0.851
	4	1.021	0.951	0.946	0.879	0.832
	5	1.018	0.946	0.938	0.859	0.794
	6	1.003	0.914	0.912	0.852	0.783
	7	1.001	0.908	0.906	0.844	0.771

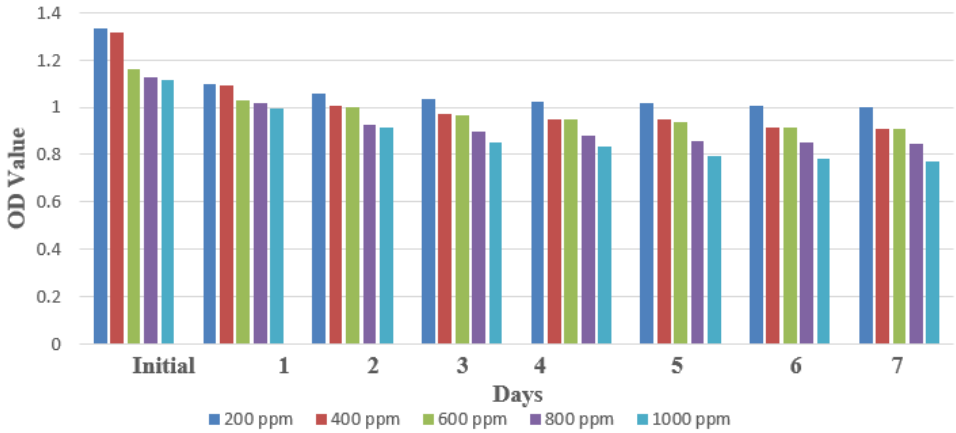

Figure 4: Effect of Preservative on the Stability on BACP During Storage.

Effect of Temperature on the Stability of BACP

The initial absorbance values were 0.304 respectively, which was decreased 0.298 respectively at a temperature of 40ºC for a period of 20 minutes. At 75ºC, the absorbance value was decreased to 0.276 respectively. At higher temperature (100ºC,125ºC and 150ºC), the colour retention was poor. (AdiyamanP., 2009).

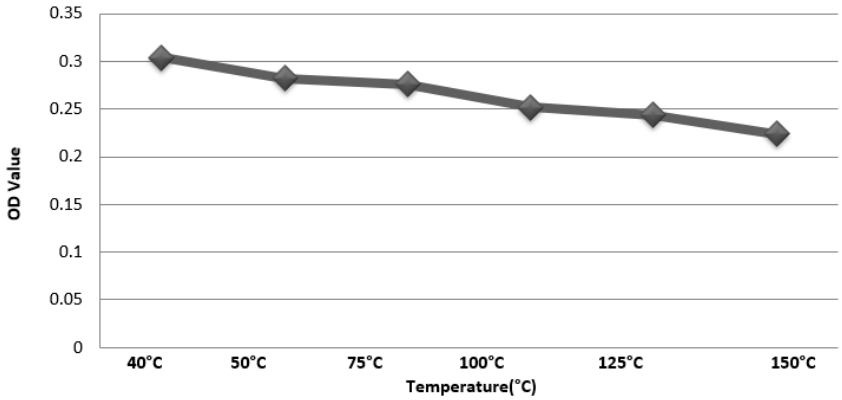

Figure 5: Effect of Temperature of Stability of BACP.

Storage Behaviourof Spray Dried BACP

Moisture Content

Changes in the moisture content (%) during storage of spray dried BACP gradual increase in moisture content was observed in refrigeration temperature. The initial moisture content of BACP in 3.2 which increased to 3.5 in refrigeration temperature

P^H

A gradual reduction in pH was observed in the refrigeration temperature. The initial pH of was 4.7, which was decreased to 4.3 in storage period.

TSS

A decreasing trend in TSS was observed in during storage. Initially the spray dried BACP contained 20° brix of TSS During storage TSS was reduced to 3ºbrix.

Sedimentation and Solubility Ratio

The Basella alba colourant powder had 100 per cent solubility. There is no sedimentation was occurred .The BACP was completely dissolved in 100 per cent of water.

Table 5 showed that aluminium foil packed spray dried BACP 100 per cent solubility was observed.

Table5:Sedimentation and Solubility Ratio of Spray Dried BACP During Storage

Amount Taken (g)	Packaging Material	Storage Periods	Sedimentation		Solubility		Sedimentation and Solubility Ratio
			Gram	Percentage	Gram	Percentage	
2	Aluminium foil pouch	Initial	-	-	-	100	-
		Final	-	-	-	100	-

CONCLUSIONS

The BACP colour recorded good stability at pH 4 than at pH7 and pH9. The different concentration of preservative and different range of temperature is directly proportion with colour degradation so that when increase the preservative and temperature the spray dried natural food colour degradation also increase. The powders stability and colour intensity was found to decrease as the storage period increased. Moisture content increased on storage in spray dried Basella alba colourant powder. Decreasing trend in pH and TSS was observed spray dried Basella alba colourant powder.

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