

Production of Instant Tea Powder by Spray Drying

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Abstract

The spray drying of dried Black tea (*Camellia sinensis*) extract was observed. Tea extract was prepared from milled dried tea, dissolved in hot water at temperature 65°C, 75°C, 85°C, 95°C and ratio of dried tea to water 1: 10 (w / v).

The time of extraction used was 10, 20, 30, 40, minutes, and pH value was 5.0 and Total solid is 4°C Brix. Then, tea extract was concentrated by using low temperature until reached 10-12° Brix of TSS, and dried with spray drier with condition inlet air temperatures were 180°C, 200°C, 220°C, 240°C, outlet air temperatures was controlled 95°C, blower speed was adjusted in 2500 rpm.

The physical analysis, bulk density, color, solubility, hygroscopicity, and chemical analysis, moisture content, total polyphenols content, antioxidant activity (DPPH assay), were determined. Results showed that different solid moisture content in feed and inlet air temperatures affected the variation of physical and chemical properties of black tea powder. An increase inlet air temperature, resulted in a significant decrease ($p < 0.05$) in bulk density, hygroscopicity, total polyphenols and antioxidant activity. An increase of solid concentration in feed gave an increase in tea powder solubility, L, a, b value, and antioxidant activity. However, the total polyphenols contents were not affected by the increase Inlet temperature. The feed flow at 20 ml/min and inlet temperature at 200°C was evaluated with the highest yields of physical, chemical results and the highest of kg water removal/hour by spray dryer.

So it is recommended to brew black tea at 65°C for 50 min. for maximum yields the caffeine content and Total polyphenol content (TPC) should be 38.09 mg/100 gm and 13.19 mg/100 gm.

Keywords: Black tea, tea powder, spray dryer.

1. Introduction

ea was originally only consumed by Anglicized Indians, and it was not until the 1950s that tea grew widely popular in India through a successful advertising campaign by the India Tea Board. Prior to the British, the plant may have been used for medicinal purposes. Some cite the Sanjeevani tea plant first recorded reference of tea use in India. However, studies have shown that Sanjeevani plant was likely a plant unrelated to the tea plant (*Camellia sinensis*) and more likely refers to either *Selaginella bryopteris* or *Desmotrichum fimbriatum*.

According to the different ways of processing, especially the extent of fermentation, tea is usually divided into three basic types: green tea (non-fermented), oolong tea (semi-fermented) and black tea (fully fermented). Alternatively, with the combination of the ways of processing and the characteristic quality of manufactured tea, tea is classified into six types: green tea, yellow tea, dark tea (containing brick tea and pu-erh tea), white tea, oolong tea and black tea. The so called fermentation in tea processing is not the anaerobic breakdown of energy-rich compound (as a carbohydrate to carbon dioxide and alcohol or to an organic acid), but in essence is mainly the oxidative polymerization and condensation of catechins catalyzed by endogenous polyphenol oxidase and peroxidase. The oxidation products such as theaflavins and thearubigins contribute to tea color and taste of the black tea. Moreover, tea quality is also determined by the processing techniques employed. The three basic types of tea; green, oolong and black have different quality characteristics, including aroma, taste and color, and appearance. Of the total amount of tea produced and consumed in the world, 78% is black, 20% is green, and < 2% is oolong tea. Black tea is consumed primarily in Western countries and in some Asian countries, whereas green tea is consumed primarily in China, Japan, India, and a few countries in North Africa and the Middle East. Oolong tea production and consumption are confined to southeastern China and Taiwan (Katiyar et al., 1996). Kukicha (twig tea) is also harvested from *C. sinensis*, but uses twigs and stems rather than leaves.

Instant tea is of great interest to the general public, medicinal and nutritional experts, and health and food science researchers to know the antioxidant capacity and constituents in the food we consume (Bonoli, Verardo, Marconi and Caboni, 2004). Health advantages of diets rich in antioxidants include lowering the risk of cardiovascular diseases, certain cancers and natural degeneration of the body associated with the aging process (Miyachi, 1995). Bush tea (*Athrixia phylicoides* DC.) and black tea (*Camellia sinensis*) are beverages rich in antioxidants, which make them excellent sources for increased health benefits (Turkmen, Velioglu, Sari and Polat, 2007; Mudau, Hitsa, Araya, Du Toit, Soundy, and Olivier, 2007). Black tea is one of the most commonly consumed beverages in the world for its desirable aroma, taste and putative positive physiological functions. It is the most widely used tea in making iced tea and English tea. New taste and flavors have been created by blending black tea with chrysanthemums, plums, ginger, hibiscus or lemon (Gupta, Saha and Giri, 2002)

1.1 Scope of the Study

The goal of project is to optimize the brewing and spray drying process parameter to produce instant tea powder which adds delicacy to various tea premixes.

Instant tea powder is extensively used in large quantity in various tea premixes. The main objective to produce instant tea powder is to save time & effort of mankind in preparation of tea and feel the people the actual taste of tea as & when they want to have a cup of tea.

The area of preparation & consumption of tea and hope that it will certainly change the method of preparation of tea in Indian society and abroad and therefore the good quality of tea will be easily available to the people who are away from home. This product will also help the housewives to prepare instant tea at home itself. It will save the time & effort of mankind in preparation of tea.

Almost each and every person of our society is accustomed to prepare and consume tea, but, the method of preparation of tea has not been changed since its introduction in Indian society. Many of people who are used to spend a considerable time of his life into offices, classrooms, traveling etc. are feelings a great thrust of tea, but they are helpless to have a good quality of tea for their consumption at that time.

2. Materials and Methodology

The study was conducted at Food Process Engineering Department, School of Bioengineering, SRM University, Kattankulathur, Chennai, and Tamilnadu. The raw material used for this study was processed tea dust CD grade, variety rubby black tea from ARYA TEA ESTATES dargilling west Bengal.

2.1 Equipment used

Digital balance (Range 0-300 gm., Model No. IN300EC, Mfd by Infra Instrumentation Pvt. Ltd. Chennai) was used for weighing purpose, Heating mantle (Temperature Range 0-100 C. Mfd by Guna Enterprise Chennai-15) was used for heating purpose, Thermometer (Range 10-110 C. Brannan, Mfd in UK) was used for temperature measurement, Refractometer (Range 0-30 Model No. REF103, Mfd by MV Krishnarao, Chennai) was used for TSS measurement, Beaker (borosil of various capacity 100,200,300,400,500 ml. of Brand Schott Duran, Made in Germany) was used for extraction of Tea extract, Muslin cloth was used for filtration of tea extract, Petri dish (Borosil of Brand Schott Duran, Made in Germany) was used for moisture content determination, Measuring cylinder (Borosil of Capacity 50 ml. of Brand Schott Duran, Made in Germany) was used for bulk density measurement, Hot air oven (Mfd by Hitech Equipments Chennai) was used for moisture content, Tall Type Spray dryer (Model No. IGO12X120, Mfd by SM Scientech Kolkata-29) PH determination was carried out by using digital PH meter (Model No. 335, Mfd by Systranics Ahmadabad.)

2.2 Experiment Design for Extraction of tea extract

The experimental design of 2- level factorial was used to frame the design of experiment and was used to optimize the factor like temperature and time. And check and measure the value of PH and TSS of extract.

2.3 Design Factor

Design Expert 2008 was used for design the experiments.

Temperature: 55, 65, 75, 85, 95 (°C.)

Time: 20, 30, 40, 50, 60 (min.)

Table No. 2.1 Experiment Design for Extraction of tea extract

Trail	Block	Temp.	Time	Brix	PH	Brix	PH
1	Day 1	65	30	4.0	5.23	4.0	5.23
2	Day 1	75	40	6.0	5.18	6.0	5.18
3	Day 1	85	50	7.0	5.24	7.0	5.24
4	Day 1	65	50	5.5	5.21	5.5	5.21
5	Day 1	75	40	6.0	5.18	6.0	5.18
6	Day 1	85	30	5.5	5.26	5.5	5.26
7	Day 1	75	40	6.0	5.16	6.0	5.16
8	Day 2	89	40	7.0	5.30	7.0	5.30
9	Day 2	75	40	6.0	5.16	6.0	5.16
10	Day 2	75	40	6.0	5.16	6.0	5.16
11	Day 2	75	40	6.0	5.16	6.0	5.16
12	Day 2	61	75	7.0	5.14	7.0	5.14
13	Day 2	75	54	6.5	5.15	6.5	5.15
14	Day 2	75	26	5.0	5.11	5.0	5.11

3. Result and Discussion

The experimental design of 2- level factorial was used to frame the design of experiment and was used to optimize the factor like temperature and time. And check and measure the value of PH and TSS of extract. Selection of trail no. which was maximum brix, According to table no. 3.1

3.1 Spray drying process parameters design

The experimental design of 2- level factorial was used to frame the design of experiment and was used to optimize the factor like Yields, Bulk Density, Moisture Content, Color, Total Polyphenol Content (TPC), and Caffeine Content.

3.2 Design Factor

Inlet Temperature:-180,200,220(°C.)

Feed Flow rate:-10, 15, 20 (rpm)

Air Flow Rate:-2300, 2400, 2500 (rpm)

Table No. 3.1- Optimization of factor and responses

Run	Block	F 1	F 2	F 3	R 1	R 2	R 3	R 4	R 5	R 6
1	Day 1	220	20	2300	12.18	0.672	4.50	66.05	11.68	35.98
2	Day 1	220	20	2500	14.79	0.622	4.33	62.63	11.17	35.99
3	Day 1	180	10	2500	4.42	0.668	4.72	61.58	9.64	34.39
4	Day 1	180	10	2300	4.61	0.647	4.27	64.01	12.18	35.99
5	Day 1	180	20	2500	13.07	0.664	4.19	63.53	12.18	37.03
6	Day 1	220	10	2500	6.14	0.648	4.53	62.99	8.63	33.33

7	Day 1	220	10	2300	5.14	0.662	4.17	64.15	12.69	37.57
8	Day 1	180	20	2300	11.34	0.651	4.50	66.11	10.65	34.92
9	Day 2	180	20	2300	12.84	0.650	4.89	65.79	11.68	35.45
10	Day 2	180	10	2500	5.19	0.646	4.53	65.14	9.64	34.39
11	Day 2	220	20	2500	15.89	0.681	4.02	66.89	13.19	38.09
12	Day 2	220	10	2300	5.45	0.676	4.49	64.19	8.12	33.33
13	Day 2	220	20	2300	11.40	0.642	4.44	66.44	12.18	36.51
14	Day 2	180	20	2500	4.18	0.668	4.74	60.48	10.15	34.92
15	Day 2	220	10	2500	11.76	0.665	4.39	64.62	10.68	33.33
16	Day 2	180	10	2300	4.63	0.637	4.91	66.79	7.11	32.28

5. Conclusions

In conclusion, a novel technique for the production of instant tea has been established in this investigation. The Instant Tea produced by this method is of good color, pungency and other liquoring characteristics. Polyphenols, and caffeine contents are also in the acceptable range. The IT produced is soluble even in cold water. Thus, there is considerable savings in the economy since both the juice as well as the residue is converted into value added products.

- For maximum yields:-
- Optimum Process Parameter, According to table no. 5.1

Table no. 5.1

Run	Block	F 1 (°C)	F 2(rpm)	F 3 (rpm)	R 1 (%)	R 2 (gm/cm 3)	R 3 (%)	R 4 (dE Value)	R 5 (mg/100 gm)	R 6 (mg/100 gm)
11	Day2	220	20	2500	15.89	0.681	4.02	66.89	13.19	38.09

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