

Analysis of Various Tea Samples

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Abstract

As adulteration is becoming common today and tea is the most widely consumed beverage all over the world so our objective was to determine various adulterants in tea, coffee samples from udupi district, Karnataka, India as well as estimation of tannin and polyphenols from black tea samples. Specified standard procedures and tests were followed to perform the study. Amount of tannin and polyphenol content was determined in samples and some adulterants were found to be present in the tea samples which are a matter of concern.

Key Words: Adulteration, Tannin, Polyphenol, Black tea.

1.Introduction

In India food adulteration is very common and involve both intentional and unintentional. Intentional adulteration is usually done by adulterator to make profit whereas unintentional may be due to ignorance, improper facilities and negligence. This leads to inferior food material which does not comply to food standards^{1,2}. Black tea which is the widely consumed beverage all over the world has also been found to be adulterated with other plants, starch, sand china clay, French chalk etc³. The present study was done to analyse various black tea samples consumed by people in Udupi district, Karnataka and region nearby.

2. Materials and methods

2.1 Drug and Chemicals

Black tea sample and coffee were collected from Udupi district and region nearby. All the reagents and chemicals were of analytical grade and purchased from Sigma chemicals, USA; S.D. Fine Chemical Ltd., Mumbai, India.

2.2 Procedure for determination of water soluble polyphenols from samples^{4,5}

1g of each sample is weighed and kept in tea bags. 20 ml of water is taken in different conical flasks and tea bags of various samples are kept in it. Tea bags are removed after 10 minutes and dried in oven. After drying tea bags are again reweighed.

2.3 Determination of adulteration^{6, 7, 8, 9}

Table 1. Various tests were performed to check the adulterants in tea and coffee samples

Tests	Procedure
Detection of colour	Tea is spread on the surface of clean glass containing water. If the colour of water changes immediately than the tea has been dyed with water soluble colours.
Iron fillings	Iron fillings get separated by moving a magnet through the sample.
Leather flakes	A paper is made and burnt. If a little amount of sample is placed on it the leather flakes if present emits an odour.
Coal tar	Sample is melted in a test tube and 5 ml of dilute sulphuric acid or concentrated Hydrochloric acid to it. Pink colour or crimson colour is produced due to coal tar dye.
Catechu	A porcelain dish is washed with dilute solution of ferric chloride and tea solution is added to it. A green ppt. is formed if catechu is present.
Sand	If any sediment is formed by shaking leaves with water means sand is present.
Cereal starch	A small quantity of tea sample is taken in a test tube and distilled water is added to it. The contents are heated to produce colour. Potassium permanganate solution and HCl (1:1) is added to it to decolourize the mixture. If blue colour is produced on addition of 1% aqueous solution of iodine indicates adulteration with starch.
Powder of scorched persimmon stone	Small quantity of sample is spread on the moistened blotting paper. 3 ml of 2% aqueous solution of sodium carbonate is poured on it. Appearance of red colour indicates the presence.
Azo colors	Sample is treated with strong alcohol and solution is evaporated to dryness further treating residue with water. The solution shows characteristic colour of the dye.
Chicory	Sample is boiled in test tube with 2 drops of concentrated hydrochloric acid; 15 drops of potassium ferrocyanide solution is added again and liquid is again boiled to become dark green. If chicory is present the liquid becomes brown and murky, otherwise a precipitate will settle at bottom leaving a supernatant solution of light yellow color.

2.4 Determination of Caffeine¹⁰

- Black Tea leaves were boiled in a beaker with one litre water and then filtered through a muslin cloth.
- A basic lead acetate solution was added to the filtrate when a precipitate was obtained. Addition of lead acetate was continued until no more precipitate was formed. Mixture was filtered while hot through a filter paper.
- Residue was washed with water. Filtrate was boiled and dilute sulphuric acid was added to precipitate lead sulphate, until no more precipitate appeared. Precipitates of lead sulphate were filtered off.
- Decolorizing carbon was added and filtrate was concentrated by evaporation to about 300-400 ml. Filtrate was filtered and shaken with about 75 ml of chloroform in a separating funnel and chloroform layer was separated. Extraction was repeated thrice.
- Chloroform layer was collected and solvent was distilled off. Residue obtained was then re-crystallized with ethanol.

2.4.1 Percent Yield of Isolated Compound

Firstly the percentage of isolated compound was calculated.

2.4.2 Identification Test of Isolated Compound

Murexide test¹¹: To the sample few drops of concentrated hydrochloric acid and concentrated nitric acid were added and evaporated to dryness on a sand bath. When the reddish brown residue was allowed to cool and when exposed to ammonia, a deep purple coloration was produced.

2.4.3 UV-Visual Spectrophotometer

Ultraviolet Spectra were recorded using Shimadzu UV-Vis Spectrometer, Model 1700S, and chloroform was used as solvent for the dilution of sample as well as blank. The λ_{\max} value of test sample and standard was recorded^{12,13}.

2.4.4 Thin Layer Chromatography (TLC)

Purity of isolated compound (caffeine) was checked using TLC method and compared with standard. The test sample and standard was dissolved in chloroform and applied to pre-coated TLC plates with Silica gel (Merck, 60F) using Chloroform: acetone: methanol (30:30:30 v/v/v) solvent system and detection was done by putting TLC plates in iodine chamber. Then R_f value was calculated^{14, 15, 16, 17}.

2.4.5 Melting Point determination of Caffeine

Melting point of isolated caffeine was determined by using open capillary and is uncorrected¹⁸.

3. Results and Discussion

Table 1. Determination of polyphenols (water soluble) in various tea samples

S.No.	Brand code	Initial weight (x g)	Final weight (y g)	Loss of weight	Percentage of water soluble component= $\frac{x}{y} * 100$
1.	1 KD	1g	0.84g	0.16g	119.048
2.	2 AVT	1g	0.86g	0.14g	116.279
3.	3 RL	1g	0.90g	0.10g	111.111
4.	4-A LP	1g	0.84g	0.16g	119.048
5.	6-B LP	1g	0.77g	0.23g	129.827

6-BLP contained maximum water soluble polyphenols and in 3 RL it was found to be least.

Table 2. Determination of adulteration in tea and coffee samples

Experiment	Observation					Inference
	1 KD	2 AVT	3 RL	4-A LP	5-B LP	
Detection of colour	NO	NO	NO	NO	NO	No water soluble colors present.
Iron fillings	NO	NO	NO	NO	NO	No iron fillings present.
Leather flakes	NO	NO	NO	NO	NO	No leather flakes present.
Coal tar	YES	YES	NO	NO	NO	Coal tar present in two brands and absent in others.
Catechu.	NO green color	Slight green color	Slight green color	Slight green color	Slight green color	Catechu found to be present in all brands except one.
Sand	NO	NO	NO	NO	NO	No sand present.

Few adulterants were found to be present in tea samples i.e. Coal tar in KD, AVT. Coal tar was found in all tea samples except KD.

Table 3. Determination of adulteration in coffee samples

Experiment	Observation	Inference
	Coffee	
Cereal starch	No formation of blue colour in mixture by addition of a drop of 1% aqueous solution of iodine indicated no adulteration with starch.	Cereal starch absent.
Powder of scorched persimmon stone	No red coloration.	Absent
Azo colors	No characteristic reaction	Azo colors absent
Chicory	Brown and murky liquid	Chicory present.

Coffee sample contained Chicory as an adulterant.

Table 4. Determination of caffeine content

S.NO	BRAND NAME AND CODE	QUANTITY	% YIELD	MELTING POINT	Rf	λ_{max} (in methanol) (nm)
1.	KANAN DEVAN (1 KD)	50g	0.22 %w/w	232 °C	0.524	272.00
2.	AVT PREMIUM (2 AVT)	80g	0.063%w/w	222-230 °C	0.589	271.50
3.	RED LABEL (3 RL)	80g	0.05%w/w	222-226 °C	0.600	271.50
4.	LOCAL-TEA POWDER, BOOSTON (4-A LP)	100g	0.02%w/w	230-236 °C	0.480	271.00
5.	SUNRISE NESCAFE COFFEE POWDER (5 COFFEE)	63g	0.048%w/w	200 °C	0.585	272.00
6.	LOCAL TEA POWDER (6-B LP)	100g	0.02%w/w	224 °C	0.659	271.50

Murexide test and nitrogen test were found to be positive for the isolated caffeine.

4. Conclusion

Polyphenol and caffeine content was determined for all the tea samples. The variation in their content may be due to difference in manufacturing process. Adulteration tests performed showed that some adulterants are mixed with the tea and coffee sample which is a matter of concern. Further elaborative studies are required in this respect.

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