iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8173

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Estimation of REEs in Some Selected Green /Organic/ Herbal Tea Available in Indian Market

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Abstract: ***Tea is one of the most consuming and cheap beverages after water all over the world. Tea is a potent stimulant of gastric acid excessive intake cause more acidity in stomach. Most of the population of India is switching from black tea to other herbal products that are marketed in India with name of Green /Organic/ Herbal tea. Studies in the past have shown that Oxides, Nitride and Chloride forms of Rare Earth Elements have adverse effect on human health. Aim of our study is to determine qualitatively as well as quantitatively REEs that present in the Green /Organic/ Herbal tea. To provide an overview of exposure to REEs people are getting by consuming such type of tea. For present work eleven Green /Organic/ Herbal tea samples were procured form local store brew was made and analysis was done on Perkin Elmer NexIon-300x Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Ce was the most abundant element its concentration varied from highest 964.764 µg/L to lowest 73 ng/L. second most abundant elements were Nd, La and Y for some samples. Concentrations of Gd and Dy were found almost similar same was true for Tm and Lu. Lu was found to be least abundant highest 9.336 µg/L and lowest 1 ng/L. Results were observed different from the Black tea in which Ce was found most abundant and La was second most abundant.***
Keywords: Rare Earth Elements; ICPMS; Herbal tea; Green tea; Organic tea.

I. INTRODUCTION

Tea is one of the most consuming and cheap beverages after water all over the world [1, 2]. It has huge demand and keeps on increasing as the world population is increasing. It is widely accepted that it has several health benefits [1]. Since, tea contains caffeine so the person who drinks tea hot or iced observers refreshing and relaxing effect immediately. That may be the reason that makes it most consuming non-alcoholic beverage. Traditionally, in India tea is served as welcome drink on the arrival of the guests and also it is an essential part of the diet of Indian population. Recent studies have shown that excessive intake of tea due to its high flavonoid contents may cause inhibition of some enzymes involved in hormone metabolism [3]. High and regular caffeine intake makes person addicted of it causes craving for tea this induces restlessness and anxiety, withdrawal is also find difficult. Tea is a potent stimulant of gastric acid excessive intake cause more acidity in stomach [4]. Probably due to these main reasons most of the population of India is switching from black tea to other herbal products that are marketed in India with name of Green /Organic/ Herbal tea. They can be prepared in the same manner the black tea/ Chai (Boiling half tea spoon of leaves in one cup of water two or three times rigorously adding refined sugar according to taste) is prepared. Companies are marketing their products with the name and ingredient of popular ayurvedic herbs that are traditionally known as beneficial to health they are doing so to make profit and to increase their sales. Numerous studies in the past have shown that Oxides, Nitride and Chloride forms of Rare Earth Elements have adverse effect on human health [5-7]. Inflammation endpoints, oxidative stress, and damage to lungs liver and kidney have been reported [8-9]. Aim of our study is to determine qualitatively as well as quantitatively REEs the present in the Green /Organic/ Herbal tea. To provide an overview of exposure to REEs people are getting by consuming such type of tea. For present work eleven tea samples were procured form local store brew was made and analysis was done on Perkin Elmer NexIon-300x Inductively Coupled Plasma Mass Spectrometer (ICP-MS).

II. EXPERIMENTAL

A. Materials

Total eleven types of Green /Organic/ Herbal tea of different companies and different brands were procured from a local market store. Out of total eleven types of tea seven teas were certified green tea; one was containing green tea along with lemon and ginger; second was containing green tea along with honey and lime; third was containing green tea and jasmine; fourth was containing green tea along with tulsi (holi Basil) and ginger. Procured teas were in different packages of different weight ranging 100 gm. and 250 gm.

All glassware and plasticware were soaked in 2% HNO_3 solution for 24 h and boiled for 1 h and washed with 2% HNO_3 solution prior to experiment.

B. Sample Preparation

Samples were prepared by traditional Indian method of tea making that is boiling rigorously 2, 3 times the half tea spoon of tea leaves in one cup of water so that the prepared brew remain same as the real brew that Indian population consumes this will give a chance to assess the actual amount of REEs reach in body of consumer. Tea packets were opened just before making the tea brew. Tea brew were prepared by boiling rigorously 500 mg of tea leaves from each packet in 50 ml of 5% HNO_3 solution, taken in platinum coated stain less steel vessel for five minutes on induction cooking plate operating at 1000W power, the solution reduced to 15 ml (approx). HNO_3 used was of LOBACHEMIE, Mumbai, India, Nitric Acid AR and water was distilled deionized Millipore water (18.2 MΩ). The reduced solution is then allowed to cool at room temperature and directly filtered into 15 ml centrifuge tubes made up of high density polyethylene (HDPE) with the help of funnels of same HDPE material and filter paper (Watman No. 42). Solution is then diluted in 2% HNO_3 in the ratio of 10:1 and analyzed in Perkin Elmer NexIon-300x Inductively Coupled Plasma Mass Spectrometer (ICP-MS).

II. INSTRUMENT AND METHOD

Instrument used was Perkin Elmer NexIon-300x Inductively Coupled Plasma Mass Spectrometer (ICP-MS). The Instrument operating conditions were as follows:

RF Power/ W	1500 W
Plasma gas flow	18 L/min
Auxiliary gas flow	1.2 L/min
Integral Time	15 s
Sweeps	20
Reading	1
Replicates	3
Scanning Mode	Peak hopping
Method	TotalQuant
Calibration Type	External
Measurement Time per sample	15 min (approx.)

All the tea samples were diluted in 2 % HNO_3 solution made by ultrapure Millipore water. 1 ml of each sample is mixed in 10 ml of 2% HNO_3. Instrument was calibrated using certified external standard PerkinElmer Pure 200 µg/L mix of 13 elements in 2% HNO_3. Three replicates of measurement were done for each sample and average of readings is presented in results.

Semiquantitative method (TotalQuant) of analysis is chosen because it is easy, rapid and accurate. Its accuracy has been reported as it has relative percentage error within 10% and reproducibility (relative standard deviation lower than 5%) at concentrations equal to or greater than 10 times the detection limit (DL) [10].

III. RESULTS AND DISCUSSION

Results of measurement are represented in Table 1. Sample names are coded to avoid the conflicts Measurements have shown that; the samples S1 and S2 were most soluble during sample preparation color of the obtained brew was the darker; all the samples have shown the presence of all measured RREs except sample S1 and S2 the Tb was not detected in them ; Ce was the most abundant element its concentration varied from highest 964.764 µg/L in sample S1 to lowest 73 ng/L in sample S7; second most abundant element was Nd in samples S1,S2,S4,S5,S8 and S10 with concentration 543.396 µg/L, 148.411 µg/L, 155 ng/L, 167 ng/L, 166 ng/L and 138 ng/L respectively; second most abundant element was La in samples S6,S9 and S11 with concentration 139 ng/L, 220 ng/L and 347 ng/L respectively; second most abundant element was Y in only two samples S3 and S7 with concentration 71 ng/L and 54 ng/L respectively; for all samples the concentrations of Gd and Dy were found almost similar; similarly for Tm and Lu concentration were found almost similar; Lu was found to be least abundant highest 9.336 µg/L in sample S1 and lowest 1 ng/L in sample S7 .Results were observed different from the Black tea in which Ce was found most abundant and La was second most

abundant [11]. But for Lu results were found true. Four samples S5, S6, S9 and S11 were of same company but different brand names and ingredients showed similarities in abundant elements.

There can be many sources of accumulation of REEs in samples such as soil in which they cultivated, processing technology employed, packaging and handling of products and environment pollution [12-14].

The difference in the solubility of samples arises due to the compounds they contain and their degree of binding force. Previous studies have shown that the analyte elements may be highly extractable, moderately extractable and poorly extractable element [15].

IV. CONCLUSION

From our study it has been found that the all the Green /Organic/ Herbal tea samples were containing various REEs in trace amount. Fortunately their concentration found with current brewing method is very low. Green tea is a rich source of different beneficial organic constituents as well as inorganic elements, REEs are one of them. REEs found have their different role in biological system role of each element needs to be evaluated so that the maximum allowable and safe daily intake of each of the element can be determined.

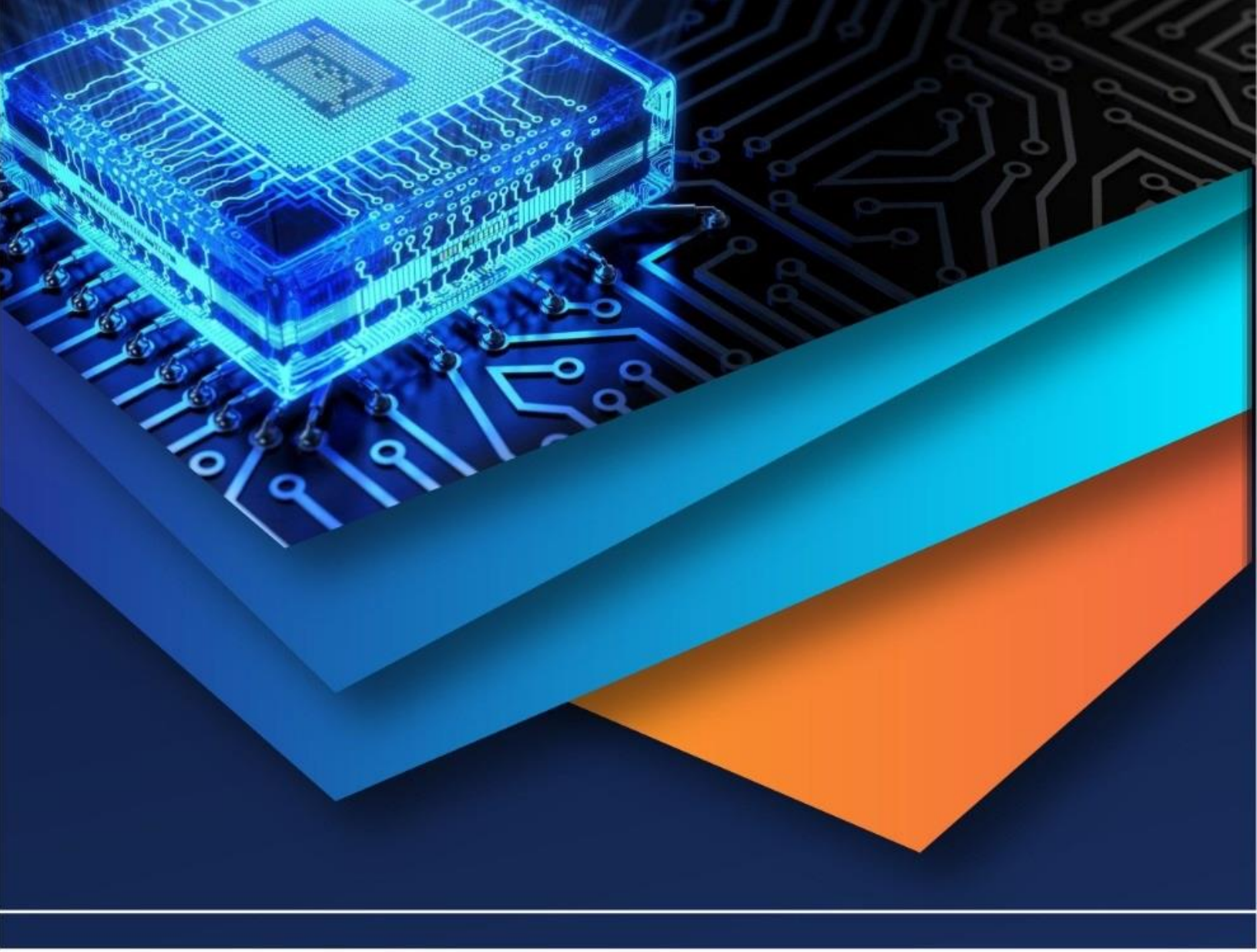
RFERENCES

[1] Cheng TO (2004). Will green tea be even better than black tea to increase coronary flow velocity reserve? Am J Cardiol 2004; 94:1223.
[2] Vinson JA.(2000) Black and green tea and heart disease: a review. Biofactors 2000; 13:127–32.
[3] Christine F , Skibola, Martyn T Smith.(2000)Potential health impacts of excessive flavonoid intake. Free Radical Biology and Medicine Volume 29, Issues 3–4, August 2000, Pages 375-383.
[4] Dubey P, Sundram KR, Nundy S.(1984) Effect of tea on gastric acid secretion. Dig Dis Sci. 1984 Mar;29(3):202-6.
[5] www.lenntech.com/periodic/elements/ce.htm.
[6] Filip Pošćić, HenkSchat, Luca Marchiol (2017): Cerium negatively impacts the nutritional status in rapeseed. Science of the Total Environment 593–594 (2017) 735–744.
[7] Zhengyi Hu, Herfried Richter, Gerd Sparovek & Ewald Schnug (2004): Physiological and Biochemical Effects of Rare Earth Elements on Plants and Their Agricultural Significance: A Review, Journal of Plant Nutrition, 27:1, 183-220.
[8] Pagano, G., Tommasi, F., Guida, M. (2012). Comparative toxicity of cerium and of other rare earth elements (REEs) in plant and invertebrate test systems. In: Izyumov, A., Plaksin, G. (Eds.), Cerium: Molecular Structure, Technological Applications and Health Effects. Nova Science Publishers, Hauppauge, NY, USA,pp. 107–124.
[9] THOMAS J. HALEY, N. KOMESU, M. EFROS, L. ROSTE, AND H. C. UPHAM (1964); Pharmacology and Toxicology of Praseodymium and Neodymium Chlorides, Toxico.& App. Pharma.6, 614-620.
[10] Heidi Chen, Ewa Dabek-Zlotorzynska, Pat E. Rasmussen, Nouri Hassan, Monique Lanouette (2008). Evaluation of semiquantitative analysis mode in ICP-MS. Talanta 74, 1547–1555.
[11] Zhanglin Ni, Chuanyi Ren, Jun yong Chengb and Fubin Tang (2017). Determination of Rare Earth Elements in Some Flower Herb Teas and their Infusions; J. Braz. Chem. Soc., Vol. 00, No.00,1-6,2017.
[12] Fernandez PL, Pablos F, Martin MJ, Gonzalez AG (2002) Multi-element analysis of tea beverages by Inductively coupled plasma atomic emission spectrometry. Food Chem 76:483–48.
[13] Özcan M (2005) Determination of mineral contents of Turkish herbal tea (Salvia aucheri var. canescens)at different infusion periods. J Med Food 8:110–112.
[14] Powell JJ, Burden TJ, Thompson RP (1998) In vitro mineral availability from digested tea: a rich dietary source of manganese. Analyst 123:1721–1724.
[15] Natesan S, Ranganathan V (1990) Content of various elements in different parts of the tea plant and in infusion of black tea from South India. J Agric Food Chem 51:125–13.

Element	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
Y	189 ng/L	49 ng/L	71 ng/L	168 ng/L	127 ng/L	98 ng/L	54 ng/L	122 ng/L	134 ng/L	97 ng/L	201 ng/L
La	307 ng/L	74 ng/L	58 ng/L	134 ng/L	164 ng/L	139 ng/L	48 ng/L	142 ng/L	22 ng/L	119 ng/L	347 ng/L
Ce	964.764 µg/L	151.278 µg/L	101 ng/L	277 ng/L	303 ng/L	232 ng/L	73 ng/L	285 ng/L	407 ng/L	243 ng/L	628 ng/L
Pr	147.321 µg/L			40 ng/L		32 ng/L	12 ng/L	40 ng/L	52 ng/L	35 ng/L	83 ng/L
Nd	543.396 µg/L	148.411 µg/L	14 ng/L	155 ng/L	42 ng/L	122 ng/L	44 ng/L	166 ng/L	211 ng/L	138 ng/L	323 ng/L
Sm	92.314 µg/L		54 ng/L	32 ng/L		25 ng/L	7 ng/L	31 ng/L	54 ng/L	32 ng/L	70 ng/L
Eu	34.735	27.683 µg/L	10 ng/L	11	40 ng/L	11 ng/L	9 ng/L	5	12	13	12	20

	µg/L			ng/L			ng/L	ng/L	ng/L	ng/L	ng/L
	121.464			49		34	13	46	55	39	91
Gd	µg/L	27.902 µg/L	14 ng/L	ng/L	50 ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
							2				15
Tb	N.D.	N.D.	3 ng/L	9 ng/L	9 ng/L	6 ng/L	ng/L	8 ng/L	8 ng/L	6 ng/L	ng/L
	122.419			58		34	14	47	52	37	
Dy	µg/L	29.677 µg/L	18 ng/L	ng/L	49 ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	9 ng/L
				12			3		10		17
Ho	26.7 µg/L	6.605 µg/L	4 ng/L	ng/L	10 ng/L	6 ng/L	ng/L	9 ng/L	ng/L	8 ng/L	ng/L
				34			8	25	25	19	41
Er	69.87 µg/L	13.331 µg/L	11 ng/L	ng/L	24 ng/L	8 ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
	10.062						1				
Tm	µg/L	3.757 µg/L	2 ng/L	5 ng/L	4 ng/L	2 ng/L	ng/L	3 ng/L	4 ng/L	3 ng/L	5 ng/L
	62.335			27		13	7	19	23	16	34
Yb	µg/L	26.437 µg/L	10 ng/L	ng/L	21 ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
							1				
Lu	9.336 µg/L	1.852 µg/L	2 ng/L	5 ng/L	3 ng/L	2 ng/L	ng/L	3 ng/L	3 ng/L	3 ng/L	5 ng/L

Table 1: Concentration of elements in samples.



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