OPEN ACCESS
International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

Determination of Keeping Quality of Tea using Silica Desiccant

N. Manigandan, N. Dilipkumar, B. Radhakrishnan

Abstract: ***A study was carried out to find out the effect of silica gel on keeping quality of tea. CTC-SRD grade teas each at 250 g were packed in low density poly ethylene pouches with a small pouch containing silica gel (10 g). Another set of samples were packed in low density poly ethylene packing material without silica gel. From sealed pouches, every month one pouch was taken and analysed for their moisture and quality parameters such as theaflavin, thearubigin, high polymerised substance, total liquor colour and biochemical parameters such as total polyphenol, total catechin, water extract and amino acid. Studies conducted after fourteen month indicated that the moisture content increased in teas packed in LDPE alone and it was less in teas packed in LDPE with silica gel. The level of theaflavin content decreased by 24.01% in teas packed LDPE alone and 17.92 % in LDPE with silica gel respectively. Bio chemical parameters decreased in teas packed in LDPE when compared to LDPE with silica gel. The study reveals that silica gel is useful in maintaining the keeping quality of tea.***

Key words: Theaflavin, water extract, silica gel, Quality and Tea

I. INTRODUCTION

Tea is the most ancient and widely consumed beverage in world wide. Tea is manufactured from the young leaves of *Camellia sinensis.* Tea leaves can be processed differently to give white tea (unoxidized) green tea (unoxidized), oolong tea (partially oxidized) and black tea (fully oxidized). Black teas can be further divided into two categories viz orthodox and CTC (Crush Tear and Curl). The quality of tea is determined by the presence or absence of chemical compounds, which impart to colour, briskness, brightness, strength, flavor and infusion. Majority of chemical compounds imparting quality are produced during the processing of the tea leaves. For the quality in black tea, theaflavin (TF) and thearubigin (TR) are the compounds formed from Catechin are responsible during fermentation. The most important and quality components of tea leaves are the polyphenols compounds.

Manuscript published on 30 September 2019
* Correspondence Author
N.Manigandan*, Tea Technologist, UPASI Tea Research Foundation, Regional Centre, Coonoor, India. nagulmani@gmail.com
N.Dilipkumar, ITC, Bengaluru, India. dilipnanjan@gmail.com
B.Radhakrishnan, Director, UPASI Tea Research Foundation, Tea Research Institute, Coimbatore, India. dr.radhaupasi@gmail.com

They are mainly responsible for the unique character of processed teas (Roberts, 1962).During maceration process, Polyphenols present in tea leaves are oxidized by the enzyme polyphenol oxidase and theaflavin and thearubigins are formed (Robertson,1992). Flavanols are oxidized by polyphenol oxidase during tea processing and they change the colour of tea leaves. The individual polyphenols have been easily noted and measured.

Polyphenol oxidase generates hydrogen peroxide during oxidation of catechins and lesser availability of hydrogen peroxide under lower pH leads to increase in theaflavin content in tea (Subramanian et al., 1999). Creamy formation in tea depends on the chemical composition. Most of the research to date has been dealing with the biochemical aspect of finished tea. However, there are more factors affecting the biochemical parameters during storage conditions and it leads to affect the shelf life of the tea. This study proved the keeping quality of CTC teas in normal low density polyethylene pouches compared with normal low density polyethylene pouches containing silica gel pouches and the quality and biochemical constituents of teas in silica gel.

II. MATERIALS AND METHODS

Super Red Dust (SRD) grade under CTC black tea category was collected from one of the factories situated at an elevation of 1600 m from mean sea level. The teas were procured during south west monsoon season where the moisture content is more and the moisture absorption by tea is also more during that period. The bulk tea was further packed in fourteen packets each with two different packing materials such as low density polyethylene pouches and low density polyethylene pouches with silica gel pack (10 g). Each packet contains 250 g tea. The packed samples were stored in a carton boxes. From the sealed pouches, every month one pouch was taken and analysed for the quality and biochemical parameters such as theaflavin, thearubigin, high polymerised substance, total liquor colour, total polyphenol, total catechin, water extract and amino acid.

A. Theaflavin, Thearubigin, Highly polymerised substance and Total liquor colour

Theaflavin, thearubigin, highly polymerised substance and total liquor colour analysis were carried out by the method developed by Thanaraj, S.N.S., & Seshadri, R., (1990).

B. Total polyphenol and total catechins

Total polyphenols in tea were estimated using Folin phenol Ciocalteu reagent in the presence of sodium carbonate. The absorbance of blue colour developed was measured at 765nm (ISO 14501- 2005). Gallic acid was used as standard. Total catechin was estimated using acidified vanillin reagent and the absorbance was measured at 500 nm. (+) Catechin was used as standard (ISO 14502-2005). Total polyphenols and catechins were expressed as % on dry matter basis.

C. Amino acid

1ml of the methanolic extract was diluted and mixed with Ninhydrin reagent and boiled in water bath. The absorbance of purple colour developed was measured at 570 nm. Leucine was used as standard. Amino acid was expressed as % on dry matter basis.

D. Water extract

Water extract or total soluble solids was analysed in tea by the method developed by IS 13862: 1999 and the amount of water extract was calculated and expressed as % on dry matter basis.

III. RESULTS AND DISCUSSION

Fourteen month of the study results indicated that the moisture content increased by 55.95 % in teas packed in low density polyethylene packets (LDPE) alone and it increased by 43.22% in teas packed in LDPE with silica gel from the moisture content of initial month. This study also revealed that the moisture absorption was less by 11 % in teas packed in LDPE with silica gel pack when compared to the teas packed in Low density polyethylene packets alone. The level of theaflavin content decreased by 24.01% in teas packed in LDPE alone and 17.92 % in LDPE with silica gel respectively. The theaflavins (TF) and thearubigins (TR), are main characteristic quality attributes for black tea which are highly responsible for the briskness, brightness, strength and colour of the infusion (Biswas and Sarkar 1973; Yang and Liu 2013). It indicated that the teas packed in LDPE with silica gel retain the briskness, brightness and strength of the tea than the teas packed in LDPE alone. The total polyphenol and total catechin content decreased in teas packed in LDPE when compared to LDPE with silica gel by 19.96%, 15.51% and 19.26%, 14.23% respectively. The amino acid content is decreased by 21.23% and 19.57% respectively. The total soluble solids were also decreased by 9.80 % in teas packed in LDPE alone while it was decreased by 7.99 % in LDPE with silica gel respectively. A high content of total soluble solids in tea brew is also an indication of good quality tea (Wood et al.1964). The study reveals that silica gel playing a major role in keeping quality of tea. We observed the reduction in quality and biochemical parameters are less in teas packed in LDPE with silica gel when compared to the teas packed in LDPE alone. The results also shows that overall quality of teas packed in low density polyethylene with silica gel is better than the teas packed in low density polyethylene alone. The results are presented in table-I.

Table- I Keeping quality of teas packed in LDPE vs LDPE with silica gel

Parameters	Packing Material	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Moisture %	LDPE	8.04	8.88	8.84	9.05	9.10	9.88	10.08	10.34	10.48	10.54	10.77	11.09	11.95	12.54
	LDPE with Silica Gel	8.10	8.82	8.80	8.84	8.85	9.65	9.71	10.17	10.19	10.23	10.32	10.55	11.47	11.60
TF %	LDPE	0.70	0.68	0.68	0.67	0.67	0.60	0.59	0.58	0.56	0.55	0.56	0.54	0.54	0.53
	LDPE with Silica Gel	0.71	0.71	0.70	0.70	0.69	0.62	0.61	0.60	0.59	0.58	0.58	0.59	0.58	0.58
TR %	LDPE	9.72	9.43	9.32	9.31	9.29	9.28	8.94	8.88	8.73	8.70	8.67	8.67	8.52	8.63
	LDPE with Silica Gel	10.09	9.56	9.20	9.22	9.38	9.39	9.03	8.97	8.93	8.86	8.79	8.78	8.66	8.67
HPS %	LDPE	10.80	10.30	10.17	10.14	10.04	10.00	8.62	8.59	8.43	8.50	8.46	8.44	8.40	8.31
	LDPE with Silica Gel	10.58	10.44	10.29	10.20	10.11	10.13	8.81	8.75	8.70	8.57	8.54	8.53	8.54	8.48
TLC	LDPE	3.60	3.63	3.61	3.60	3.58	3.58	3.49	3.47	3.43	3.40	3.41	3.43	3.41	3.37
	LDPE with Silica Gel	3.60	3.66	3.60	3.60	3.62	3.61	3.63	3.58	3.56	3.50	3.47	3.47	3.47	3.49
TP %	LDPE	14.43	14.36	13.81	13.69	13.49	13.18	12.65	12.46	12.18	11.95	11.90	11.79	11.58	11.55
	LDPE with Silica Gel	14.65	14.46	14.02	13.98	13.93	13.53	13.29	13.04	12.99	12.78	12.70	12.71	12.56	12.38
TC %	LDPE	8.93	8.97	8.58	8.53	8.32	8.23	8.04	7.81	7.54	7.47	7.38	7.30	7.29	7.21
	LDPE with Silica Gel	9.08	8.94	8.86	8.82	8.78	8.60	8.40	8.30	8.19	7.96	7.89	7.92	7.88	7.75
AA %	LDPE	1.95	1.95	1.73	1.74	1.76	1.72	1.72	1.69	1.63	1.58	1.60	1.58	1.57	1.54
	LDPE with Silica Gel	1.96	1.96	1.78	1.79	1.78	1.78	1.79	1.76	1.67	1.61	1.61	1.62	1.60	1.57
WE %	LDPE	42.48	41.13	41.06	40.32	40.24	40.12	41.03	39.70	39.52	39.33	39.07	39.10	38.98	38.31
	LDPE with Silica Gel	42.82	40.89	41.48	41.55	41.02	40.98	40.85	40.38	40.48	40.16	40.07	40.09	39.77	39.40

TF- Theaflavin; TR- Thearubigin; HPS- High polymerised substances; TLC- Total liquor colour; TP- Total polyphenol; TC- Total catechin; AA- Amino acid; WE- Water extract.

Retrieval Number C4247098319/2019©BEIESP
DOI: 10.35940/ijrte.C4247.098319
Journal Website: www.ijrte.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

REFERENCES

1. Conrad Astill, Mark. R. Brich, Clive Dacombe, Philip G. Humphrey and Philip T. Martin. (2001) Factors affecting the caffeine and polyphenol contents of black and green tea infusion. J. Agric. Food Chem. 49. 5340-5347
2. I.S. Bhatia. (1961) Application of chemical tests in manufacturing departments. Tea Trade and Industry. vol.10. No. 4 155- 159
3. Kanji Kumazava and Hideki Masude. (2001) Change in flavor of black tea drink during heat processing. J. Agric. Food Chem. 49. 3304-3309
4. P. Okinda Owuor, Martin obanda, Hastings E, Nyienda, Wilson L. Mandala. (2008) Influence of region of production on clonal black tea. Food Chemistry 108 263-271
5. Robertson, A. (1992) The chemistry and biochemistry of black tea production – the non volatiles. in Tea: Cultivation to consumption: Wilson, K. C., Clifford, M. N., Eds.: Chapman and Hall; London, U. K.,: pp 555-601.
6. Roberts, E. A. H. (1963). The phenolic substance of manufactured tea. X. the creaming down of tea liquors. J.Science of food and agriculture. 14, 700 – 705.
7. Ramaswamy Ravichandran. (2004) The impact of pruning and time from pruning on quality and aroma constituents of black tea. Food Chemistry. 84 7-11
8. Ramaswamy Ravichandran, Ramaswamy Parthiban. (2007) Lipid occurrence, distribution and degradation to flavor volatiles during tea processing. Food Chemistry. 68 7-13
9. Ramaswamy Ravichandran, Ramaswamy Parthiban. (1998) The impact of processing techniques on tea volatiles. Food Chemistry. Vol 62. No.3 pp. 347-353
10. N. Subramanian, Purna Venkatesh, ShoVan Ganguli and Vilas P. Sinkar. (1999) Role of polyphenol oxidase and peroxidase in the generation of black tea theaflavins. J. Agric. Food Chem. 47, 2571-2578.
11. Takashi Tanaka, Kyoko Inoue, Yayoi Betsumiya, Chie Mine and Isao kouno. (2001) Two types of oxidative Dimerization of the black tea polyphenol theaflavin. J. Agric. Food Chem., 49, 5785- 5789.
12. Thanaraj. S. N. S and Seshadri. R. (1990). Influence of polyphenols oxidase activity and polyphenols content of tea shoot on quality of black tea. J.Science of food and agriculture. 51:57-69.
13. Thomas Muthumani, R.S. Senthil kumar. (2007) Studies on freeze withering in black tea manufacturing. Food Chemistry 101 103- 106.
14. Yuerong Liang. Yuerong xu. (2001) Effect of $_{P}$H on cream particle formation and solids extraction yield of black tea. Food Chemistry 74 155-160.
15. Wood. D. J. and Roberts. E. A.H. (1964) Chemical basis of quality in tea. J. Science of food and agriculture. 15:19-25.

AUTHORS PROFILE

Mr. N. Manigandan is working as Tea Technologist in UPASI Tea Research Foundation. He Completed his Masters Degree in Industrial Chemistry from Bharathidasan University. He is doing Ph.D in Chemical Technology in Tea. He served as Assistant Advisory Officer and Analytical Chemist in Regional Centre Coonoor. His area of research includes process optimization of various types of tea manufacture, quality evaluation of tea, flavor profile of black teas, FSSAI requirements and tea byproducts. He has published fifteen research papers in National and International journals on various aspects of tea processing and its quality. He handled three external projects funded by different funding agencies and currently running one project.

Mr. N.Dilipkumar, is working as a Junior Associate in Indian Tobacco Company limited, Flavor division, Bengaluru. He completed his Post Graduate in M.Sc Chemistry from Bharathiar University. After his post graduate he joined in UPASI Tea Research Institute as a Senior Research Fellow in the project Aging Chemistry of Tea Infusion. he also worked as a project Assistant in the project entitled Studies on keeping quality of different types of tea and their anti oxidant properties. He has published three research articles in National journal.

Dr. B. Radhakrishnan is the Director of UPASI TEA Research Institute. He has Masters Degree in Entomology from University of Madras. He is the first Ph.D from UPASI Tea Research Foundation affiliated to the Bharathiar University. He has over 36 years of research and advisory experience in UPASI Tea Research Institute. He has published more than 280 research papers in National and International journals on various aspects of tea culture. He is a member of the editorial board of Indian Society for Plantation Crops. Specialized in Entomology, his areas of research are organic farming, sustainable agriculture and IPM. He is a fellow of the Indian Society of Plantation Crops. He has been instrumental in getting GI certification for Nilgiri Orthodox tea.