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Microwave Extraction of Various Commercially Available Types of *Camellia sinensis* (Tea)

Sikandar Khan Sherwani [1*], Rehman Ullah Khan [2], Shaista Urooj [1], Muhammad Ajmal Shah [3], Shahana Urooj Kazmi[4]

1. Department of Microbiology, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan. [E-mail: sikander_biology@hotmail.com]
2. Department of Botany, University of Science and Technology, Bannu, Pakistan
3. Department of Pharmacognosy, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan.
4. Department of Microbiology, University of Karachi, Karachi, Pakistan

Utilizing microwave for extraction purpose of valuable constituents from plant and other natural sources has been in practice as a modern technology. In this study, eight different tea types which were locally and commercially available in Pakistan were subjected to both conventional and microwave techniques. The color and consistency of all eight types were found almost same. The yield via microwave assisted extraction was more than conventional extraction. Microwave extraction was performed at three different intensities via 140 W, 210 W and 245 W. The yield was dependent on the intensity of radiation. The minimum yield was achieved at 140W in case of Nepal tea i.e. 21.8% and maximum at 245 W in case of green tea at 245 W i.e. 34.1%.

Keyword: *Camellia sinensis*, extraction, tea, extraction yield.

1. Introduction

With the advent in the progress in science and technology, microwave heating and its use has been considered to be convenient sand productive source of energy for domestic work in home kitchen as well as in laboratories for research and other purposes [1,2]. The microwave assisted extraction method (MAE) was first reported by Ganzler, 1998 [3]. It was done on solid matrices for the extraction of organic pollutants [4]. Such approach has been applied in many researches and found quite successful in terms of efficacy [5]. The traditional methodologies of solvent extraction from plant and other natural resources are mostly based on solvents or via heating and agitation for the release of the bioactive compounds [6]. However; it is a common belief of researchers that these techniques are quite cumbersome, time consuming and sometimes are also associated with risk to the lost and degradation of the important substances due to thermal instability in natural products [7]. Microwave-assisted extraction is a bit new extraction method, which works on the principle that microwave energy basically heats the solvent and the sample to enhance the mass transfer rate of the solutes from the substance of the sample into the solvent [8]. Tea is produced by the leaves of *Camellia sinensis* L. (Kuntz) and consumed as one of the most popular beverages. Tea is cultivated in more than 30 countries all over the world [9]. Globally, 78% produced tea is black,

20% is green, and 2% is oolong [10]. In the current study, two extractions procedures were compared for various types of tea in terms of % yield.

2. Materials and Methods

2.1 Collection of Tea samples:

After first extensive survey from literature and from experts, 6 types of various tea that are easily available in the local market and popular among the people were purchased in retail price from on famous market for selling tea in Pakistan. They were brought to the laboratory in the Department of Microbiology, Federal Urdu University of Arts, Science and Technology (FUUAST)-Karachi-Pakistan for the sake of making extracts by conventional and micro wave assisted methods. Some of the teas were purchased as open from the market and some types of tea were purchased from shops and utility stores of certain companies (the names of the manufacturers and companies were kept confidential for the proprietary rights).

2.2 Conventional Method for Extract Preparation:

For conventional method, 5% concentration of each of the tea was prepared i.e. 25 gm of each tea was boiled with 100 ml of distilled water for 15-20 min with constant agitation. The extracts were subjected to filtration first by passing through strainer and later via 0.22 um filter and then stored in small vials [11].

2.3 Microwave Method for Extract Preparation:

Each of the tea product was prepared again in 5 % concentration i.e. 5 gm were added into the flask separately and then 100 ml of distilled water was added in all of them. Microwave assisted extraction was done at three different intensities i.e. 140 W, 210 W and 245 W. The extraction was done for 15 min constantly without any disturbance in order to avoid any bumping or accident [1].

Table 1: Colour of *Camellia sinensis* various tea extracts:

S No.	Various Tea extracts	Colour
1	Black tea	dark Brown
2	Green tea	light brown
3	Nepal tea	Brownish
4	Red tea	deep red
5	Grey tea	light yellow
6	Lemon grass tea	light yellow
7	Sri Lankan tea	Dark black
8	Chinese tea	Light yellow

Table 2: Consistency of *Camellia sinensis* various tea extracts:

S No	Various Tea extracts	Consistency
1	Black tea	Thick semisolid
2	Green tea	Paste like semisolid
3	Nepal tea	Watery semisolid
4	Red tea	Paste like semisolid
5	Grey tea	Watery semisolid
6	Lemon grass tea	Watery semisolid
7	Chinese tea	Paste like semisolid
8	Sri Lankan tea	Thick semisolid

Table 3: Percentage yield of *Camellia sinensis* various tea extracts by Conventional and microwave extracted method:

Conventional Method					Microwave assisted extraction	
				140 W	210 W	245 W
S. No.	No Tea extracts	%yield (w/w)		%Yield (w/w)	%yield (w/w)	%yield (w/w)
1	Black tea	19.0		23.8	26.9	29.5
2	Green tea	20.3		23.4	29.5	34.1
3	Nepal tea	17.6		21.8	24.4	26.4
4	Red tea	17.8		25.3	29.5	33.5
5	Grey tea	18.8		27.9	32.2	32.6
6	Lemon grass	20.1		22.3	28.4	32.1
7	Sri Lankan tea	21.2		29.3	33.3	34.1
8	Chinese tea	19.2		24.3	24.2	26.3

3. Results and Discussion:

The tea is the most popular beverage prepared from of flavorful leaves and has immense medicinal value [12-13]. The phytochemical screening of tea revealed the presence of tannins, saponins, alkaloids, catechins and polyphenols [14]. The usage of microwave technology for the sake of extraction of compounds from natural sources like foods, soil, seeds and feeds was studied as totally new approach of sample preparation for chromatography [3]. The microwave assisted extraction is no doubt a useful alternative to conventional technique, especially in plant material extraction research work [15]. Studies from the literature highlighted that extraction processes of crude preparations can be carried out by numerous ways depending on the physical and chemical properties of the constituents present in it [8]. A number of various traditional methods have been employed for the extractions of drugs include digestion, infusion, decoction, percolation and maceration [16]. Most of the pharmacopoeias selectively point out maceration and percolation for the extraction of crude drugs. In our study, the color and consistency of all 8 types of commercially obtained in both conventional and microwave assisted methods of extractions were almost same. The results clearly reflect that the extraction procedure does not affect seemingly on the color and the consistency feature of tea as mentioned in Table 1 and 2. The yield was

calculated also in terms of percentage. The yield in case of microwave assisted extraction was more than conventional extraction. Microwave extraction was performed at three different intensities i.e. 140 W, 210 W and 245 W. The greater the intensity the greater yield was achieved in all types of tea. The minimum yield was achieved at 140 W in case of Nepal tea i.e. 21.8 and maximum at 245 W in case of green tea at 245 W i.e. 34.1 %. The other types indicate variable percentages as mentioned in Table 3. Past studies also indicate microwave-assisted extraction has numerous benefits [3] like less solvent consumption, short time duration and high yield [17]. In comparison to Soxhlet technique that usually needs a few hours, even more than 20 h, on the other hand, microwave-assisted extraction just requires a few minutes [18-19]. Moreover, microwave based technique is fairly simpler and cheaper [20] and can easily be used to more substances with even less of the polarity of different extractants [21].

4. Conclusions

From the findings of the current research work in which comparison has been made in conventional and microwave assisted extraction method of eight different types of tea being consumed in Karachi-Pakistan. It has been noticed that % yield by microwave assisted extraction was fairly better as compared to conventional technique. So apart from routine extraction in the laboratory from natural sources, if one is interested in good yield, microwave based method is preferable.

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