BIO ACCENT

International Journal of Environment & Agricultural Sciences

An Open Access Journal

Int J Environ Agric Sci
Research Article
Volume 2

Determination of polyphenol contents and developed the production process of guava leaves bagged tea (*Psidium guajava* L.)

Tran Thi Minh*; Nguyen Ngoc Tanh

Faculty of Applied Technology, School of Engineering and Technology, Van Lang University, Vietnam.

***Corresponding Author: Tran Thi Minh**

Van Lang University, 68/69 Dang Thuy Tram Street, Binh Thanh District, Ho Chi Minh 700000, Vietnam.

Email: minh.tt@vlu.edu.vn

Received: Sep 27, 2022

Accepted: Nov 10, 2022

Published: Nov 18, 2022

Keywords:
Guava leaves;
Biphasic release systems;
Bagged tea.

Abstract

Many studies have proved that the Guava leaves (Psidium guajava) have many nutritional values such as vitamin C, vitamin B and many other minerals. In particular, Guava leaves also contain very high polyphenol content, which have antioxidant, anti-cancer, anti-diabetic, antibacterial, lipid-lowering and liver-protective effects. This study determined that the polyphenol content in young Guava leaves was 20.75% and developed the production process of Guava leaves bagged tea. Tea products have been evaluated and met for sensory, physico-chemical, and microbiological criteria of TCVN 7975: 2008 standard. At the same time, tea has a polyphenol content of up to 7.94%, vitamin C is 0.08%.

Introduction

Guava tree is also known as pomegranate phantom, scientific name *Psidium guajava* L., belongs to the Sim family Myrtaceae. Guava is native to tropical America, first described scientifically by Carl Linnaeus in 1753, then popularized and grown throughout tropical Africa and Asia [1]. According to Kakuo S. et al (2018), Guava leaves contain nutrients such as Fat (0.62%), Glucose (33.79%), Carbohydrate (48.13%), Sulfate polysaccharide (66.71%), Protein (16.8%), mg), Vitamin C (142.55 mg), Phenolic (1717 mgGAE/g), Essential Oil (0.36%), Tannin (7 – 10%) [2]. Through research by Shabbir H. et al (2020), guava leaves contain many healthful polyphenol compounds such as quercetin, avicularin, apigenin, guaijaverin, kaempferol, hyperin, myricetin, gallic acid, catechin, epicatechin, chlorogenic acid, epigallocatechin gallate and caffeic acid [3].

In addition, a lot of studies on the use of Guava leaves have been published such as: Takahashi Y. et al (2015) studied guava leaf extract with the main components quercetin and ethyl gallate that inhibited the 12-lipoxygenase enzyme activity, thereby reducing and preventing atherosclerosis disease in rats [4];

Citation: Minh TT, Tanh NN. Determination of polyphenol contents and developed the production process of Guava leaves bagged tea (*Psidium guajava* L.). Int J Environ Agric Sci. 2022; 2(1): 1003.

Díaz-de-Cerio E. et al (2017) demonstrated the antibacterial ability, inhibiting the proliferation of *Staphylococcus aureus*, *E. coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis* bacteria of Guava leaf extract [5]; Akila B et al (2018) studied that tea production from guava leaves could block the absorption of sucrose and mantose sugar [6]; Mamun M. A. A. et al (2019) showed the effect of Guava leaf powder to significantly reduce fat accumulation in obese mice, improve glucose intolerance, and reduce inflammation in the rat liver [7]; Lok B. et al (2020) demonstrated that guava leaf extract was rich in flavonoids and β-caryophyllene and was able to inhibit proliferation against human colon carcinoma cell lines such as Caco-2, HT-29 and SW480 [8]. At the same time, the toxicity of guava leaves has been studied and tested by Etuk E. U et al. (2003) on white mice, the results show that guava leaf juice extract (5 g/500 mL) is safe at all dosages 10, 20, 30, 40 and 50 mg/100 g. At the maximum dose of 50 mg/100 g no deaths were reported [9].

From the above studies, we conducted to determine the polyphenol content in Guava leaves (*Psidium guajava* L.) grown in Vietnam and built the production process of Guava leaf tea bags to provide consumers with products Guava leaf filter tea bags are convenient, quality and contain high levels of nutrients that can support health protection.

Materials and methods

Guava leaves were purchased at Tan Phat Herbal Company in Hamlet 5a, Ea Kly Commune, Krong Pac District, Dak Lak Province. Filter bags were purchased from Alikata Technical Service and Trading Co., Ltd.

Investigation of total polyphenol content in guava leaf raw materials

Classify and choose 1 of 3 types of Guava leaf materials: young leaves, mature leaves, and old leaves (remove damaged, decayed, crushed leaves). The polyphenol content in Guava leaves was extracted with methanol and quantified according to the method of TCVN 9745-1:2013 [10]. Select the leaves with the highest polyphenol content to use as raw materials for producing Guava leaf tea bags.

Investigate factors affecting the production process of Guava leaf tea bags

Research on drying temperature: The drying temperature affects the polyphenol content, nutrition, and sensory quality of the product. Guava leaves are dried at temperatures of 40°C, 50°C, and 60°C. The product after drying was determined the total polyphenol content, vitamin C content (Nguyen Van Mui, 2007) and sensory evaluation according to TCVN 3218:2012 on the color of the product after drying to select the optimal drying temperature [11,12].

Research on drying time: The drying time affects the moisture content of the raw materials and the shelf life of the product. Choose drying time from 6 hours, 8 hours and 10 hours to conduct moisture surveys, ensure the creation of good quality products and save production costs.

Evaluation of the quality of Guava leaf bagged tea products

Evaluation of the quality of Guava leaf tea bags: tea bags weighing 2 g were evaluated for physico-chemical, microbiological, and heavy metal content according to TCVN 7975:2008 [13].

Evaluation of tea water quality: The study investigated the amount of water for making tea in the volumes of 100 ml, 150 ml, 200 ml, 250 ml, brewing time for 1, 3, 5, and 7 minutes at the brewing temperature of 85°C (Dao Van Thanh, 2020), sensory evaluation according to TCVN 3218:2012 and the content of polyphenols and vitamin C in tea according to TCVN 9740:2013 [14,15].

Results and discussion

Polyphenol content in Guava leaf material

The analysis results showed that the polyphenol content in young leaves was 17.9%, the highest in old leaves, 16.18%, and the lowest in mature leaves was 9.43% (Figure 1).

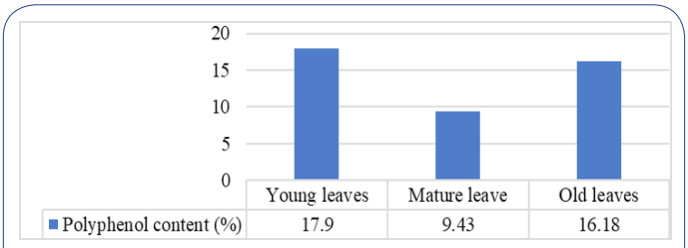

Figure 1: Polyphenol content in guava leaves.

Total polyphenol content varies depending on the age of the raw materials, the younger the raw materials, the higher their polyphenol content. This result is consistent with the study on polyphenol content in Shan tea leaves by Giang Trung Khoa et al., 2017 [16].

Survey results on factors affecting the production process of Guava leaf bagged tea

The results of the drying temperature survey: At the drying temperature of 40°C, the polyphenol content was at the lowest level of 13.6%, at the drying temperature of 50°C, the highest polyphenol content was 20.75%, when the drying temperature increased to 60°C, the polyphenol content decreased to 16.51% (Figure 2).

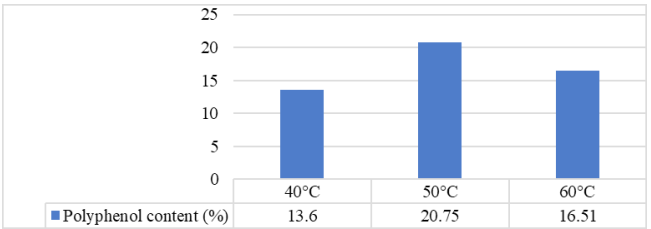

Figure 2: Effect of drying temperature on polyphenol content in raw materials.

The measured vitamin C content in raw materials when drying at 40°C reached 0.2%, then increased 0.23% at 50°C. However, when increasing the temperature to 60°C, the vitamin C content decreased to 0.13% (Figure 3).

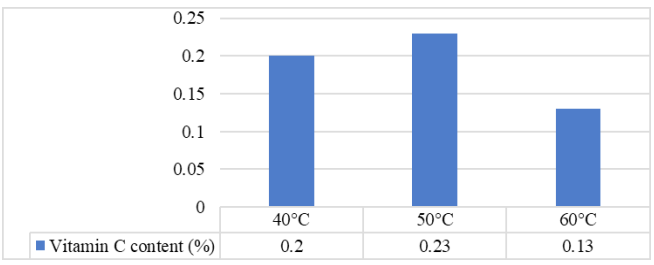

Figure 3: Effect of drying temperature on vitamin C content in raw materials.

Sensory evaluation results show that when drying at 40°C, the material is still green and unattractive, so it has the lowest sensory score of 2.7. At a drying temperature of 60°C with a sensory score of 3.51, the material has an uneven color, the tea leaves are dry, and they cannot keep the necessary curls. When drying at a temperature of 50°C, the material has a uniform color, which is typical for the product, so it has the highest sensory score of 4.53 (Figure 4).

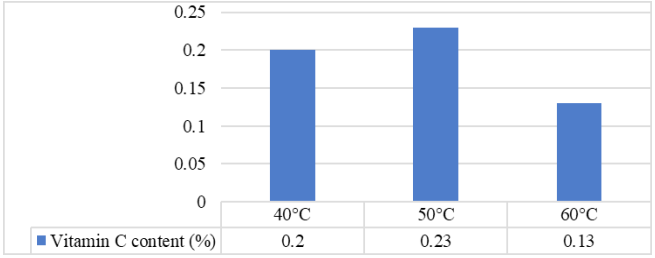

Figure 4: Sensory evaluation results of product quality at different drying temperatures.

From the above 3 research results, it was found that the polyphenol content, vitamin C content and sensory quality score were highest at the drying temperature of 50°C, which is the optimal temperature to put into the guava leaf bagged tea production process.

The results of the drying time survey: The drying results show that the longer the drying time, the more moisture is reduced. Specifically, after 6 hours of drying, the moisture content of the raw materials is still quite high at 12.65%, increasing the drying time to 8 hours gives the moisture content of 9.62% and with the drying time increasing to 10 hours, the moisture content of the raw materials remains at 7.91% (Figure 5). It can be seen that at the drying time of 8 hours and 10 hours, the moisture content decreases rapidly from 77.95% of the starting material to less than 10%, meeting the requirements for safe moisture for tea products according to TCVN 7975:2008. However, at the drying time of 10 hours, the moisture content drops to low, affecting the color of the tea leaves and taking a long time to produce. Therefore, we decided to choose a drying time of 8 hours in the production process of Guava leaf tea.

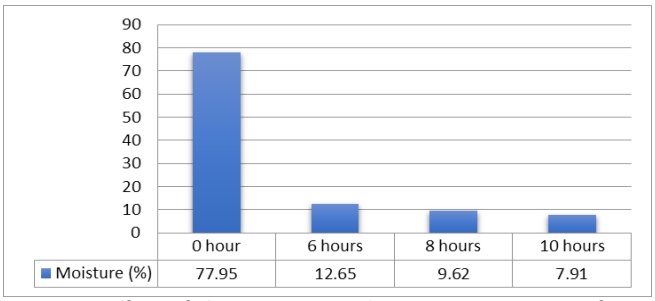

Figure 5: Effect of drying time on the moisture content of raw materials.

Based on the analysis results of total polyphenol, vitamin C content and moisture of tea products, it was found that the optimal production process with the drying temperature is 50°C and the drying time is 8 hours.

Results of tea product quality assessment

Results of quality evaluation of Guava leaf tea bags: Analytical results The physicochemical parameters of Guava leaf tea powder showed that the moisture content was 9.62% and the total ash content was 7.94% (Table 1). This result meets the quality standard TCVN 7975:2008 on herbal tea bags.

Table 1: Result of product physicochemical parameters

Index	Moisture	Total ash content
Content (%)	9.62	7.94

The results of evaluation of microbiological criteria in Guava leaf tea bags met the requirements compared with the provisions of the standard TCVN 7975:2008 on herbal tea bags (Table 2).

Table 2: Result of microbiological index of the products.

Number	Indicators	Unit	Test method	Result	Maximum levels
1	Total aerobic microorganisms	CFU/g	TCVN 4884-1:2015	2,35 x 10^4	10^6
2	*Coliforma*	CFU/g	TCVN 6848:2007	2,6 x 10^2	10^3
3	*Salmonella spp.*	/25g	TCVN 1078-1:2017	0	0
4	Total number of yeast spores – mold	CFU/g	TCVN 8275-2: 2010	0	10^4

Metal analysis results showed that guava leaf tea bags did not contain Pb, cadmium content (Table 3). Thus, the product meets the requirements of metal content according to the standard TCVN 7975:2008 on herbal tea bags.

Table 3: The result of the product's heavy metal indicator.

Number	Indicators	Unit	Test method	Result	Maximum levels
1	Plumbum (Pb)	mg/g	TCVN 8126: 2009	0	2
2	Cadimi (Cd)	mg/g	TCVN 8126: 2009	0	1

Results of evaluation of water quality of Guava leaf tea bags

The amount of water used to make tea has an influence on the sensory quality of the product. Specifically, at a water volume of 100mL, tea water was red-brown, dense, without the necessary clarity, so it had the lowest sensory score of 4.38. Then, at the water volume of 200mL and 250mL, the sensory scores were 5.84 and 5.15, respectively, the tea water had a slightly light yellow color, the tea water was clear and not cloudy. And at 150mL water volume has the highest sensory score on state and water color, characteristic yellow color for the product, clear tea water, no turbidity, the highest total sensory score of 6.36 (Figure 6).

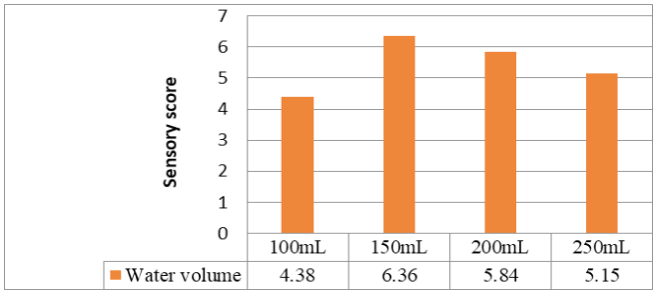

Figure 6: Sensory evaluation results for the water volume to make tea.

Tea brewing time also affects the sensory quality of the product. Specifically, at the tea-making time of 1 minute, the sensory score was 4.61, at the time of 3 minutes it was 5.82 and 4.82 at 7 minutes, and at 5 minutes the highest sensory score was 6.33 (Figure 7).

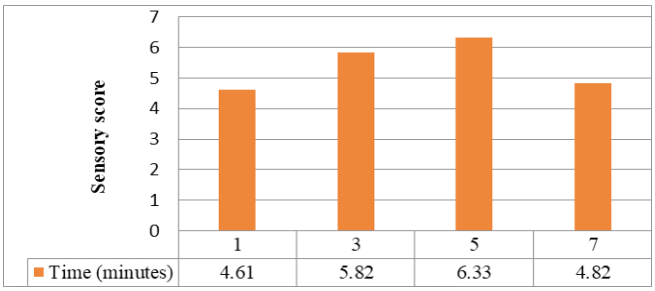

Figure 7: Sensory evaluation results of tea brewing time.

From the above results, the optimal tea preparation method for each Guava leaf tea bag (2 grams) is: the amount of water used is 150 mL, the brewing time is 5 minutes. This result is consistent with the study on the extraction time of antioxidants from plant materials through boiling water for 5 minutes, which is enough to extract most of the antioxidant active ingredients of Giao MariaS et al in 2009 [17].

Sensory evaluation results for tea water quality according to TCVN 3218: 2012 standard showed that the average score in the indicators of state, water color, smell and taste was 3.71, 2.83, 5.14 and 4.46, respectively. The total score of guava leaf tea products evaluated according to TCVN 3218: 2012 is 15.28, equivalent to good quality (table 4).

Table 4: Sensory results of tea water quality.

Indicators	Total score	Medium score	Important coefficients	Weighted average score
Status	26	3.71	1	3.71
Water color	33	4.71	0.6	2.83
The smell	30	4.29	1.2	5.14
The taste	26	3.71	1.2	4.46
Total Score			**4**	**15.28**

The average content of nutrients in the finished tea was determined to be quite high, the polyphenol content was 7.94%, the vitamin C content was 0.08% (table 5), meet the regulations according to the quality standard of herbal tea TCVN 9740: 2013.

Table 5: Average nutritional content in tea water.

Number	Content (%)	
	Polyphenol	Vitamin C
1	7.95	0.08
2	7.94	0.08
3	7.93	0.07
Average	**7.94**	**0.08**
Stdev.S	0.010	0.006

Conclusion

Through research, Guava leaves have quite high total polyphenol content, especially the highest polyphenol content in young Guava leaves is 20.75%. A process of producing tea bags with Guava leaves has been built with the parameters determined such as the drying temperature of 50^{0}C, the drying time of 8 hours with the raw material being young Guava leaves. Guava leaf filter tea bags meet the requirements of sensory, physical, chemical and microbiological criteria according to TCVN 7975:2008. Tea water has a sensory score of good quality with a total score of 15.28 and has a polyphenol content of 7.94%, vitamin C of 0.08%.

Declarations

Funding: This study was supported by VLU_Grant 2022 of Van Lang University, Vietnam.

Acknowledgments: The authors thank Van Lang University, Vietnam for funding this work.

References

1. Do Tat Loi. Medicinal plants and herbs of Vietnam, Thoi Dai publisher. 2006.
2. Kakuo S, Fushimi T, Kawasaki K., Nakamura J, Ota N. Effects of Psidium guajava Linn. leaf extract in Japanese subjects with knee pain: a randomized, double-blind, placebo-controlled, parallel pilot study, Aging Clinical and Experimental Research.2018; 30: 1391-1398.
3. Shabbir H, Kausar T, Noreen S, Hussain A, Huang Q, Gani A, et al. In vivo screening and antidiabetic potential of polyphenol extracts from guava pulp, seeds and leaves, Animals., 2020; 10: 1714.
4. Takahashi Y, Otsuki A, Mori Y, Kawakami Y, Ito H. Inhibition of leukocyte-type 12-lipoxygenase by guava tea leaves prevents development of atherosclerosis, Food Chemistry., 2015; 186: 2-5.
5. Díaz-de-Cerio E, Verardo V, Gómez-Caravaca A, Fernández-Gutiérrez A, Segura-Carretero A. Health Effects of Psidium guajava L. Leaves: An Overview of the Last Decade, International Journal of Molecular Sciences. 2017; 18: 897.
6. Akila B, Vijayalakshmi R, Hemalatha G, Arunkumar R. Development and evaluation of functional property of guava leaf based herbal tea, Journal of Pharmacognosy and Phytochemistry. 2018; 7: 3036-3039.
7. Mamun MAA, Faruk M, Rahman MM, Nahar K, Kabir F, et al. High carbohydrate high fat diet induced hepatic steatosis and dyslipidemia were ameliorated by Psidium guajava leaf powder supplementation in rats, Evidence-Based Complementary and Alternative Medicine. 2019.
8. Lok B, Sandai D, Baharetha H, Nazari V, Asif M, et al. Anticancer effect of Psidium guajava (guava) leaf extracts against colorectal cancer through inhibition of angiogenesis, Asian Pacific Journal of Tropical Biomedicine. 2020; 7: 293-307.
9. Etuk EU, Francis UU. Acute Toxicity and Efficacy of Psidium guajava Leaves Water Extract on Salmonella Typhi Infected Wistar Rats, Pakistan Journal of Biological Sciences, 2003; 6: 195-197.
10. TCVN 9745-1:2013, Tea - Determination of characteristic substances of green and black tea - Part 1: Total polyphenol content in tea - Colorimetric method using reagent folin-ciocalteu, National Standard.
11. Nguyen Van Mui. Biochemistry Practice, Hanoi National University publisher. 2007.
12. TCVN 3218. Tea - Determination of sensory criteria by scoring method, National Standard. 2012.
13. TCVN 7975. Herbal tea filter bag, National Standard. 2008
14. Dao Van Thanh. Effect of extraction and pasteurization methods on biological compounds of Guava leaf beverage, Industry and Trade Journal. 2020.
15. TCVN 9740. Green tea – Definition and basic requirements, National Standard. 2013.

16. Giang Trung Khoa, Bui Quang Thuat, Ngo Xuan Manh, P.Deuz. Polyphenol composition and antioxidant activity of Shan tea variety (Camellia sinensis var. Shan), Vietnamese Agricultural and Science Journal. 2017; 15: 509-518.

17. Giao MS, Pereira CI, Fonseca SC, Pintado ME, Malcata FX. Effect of particle size upon the extent of extraction of antioxidant power from the plants Agrimonia eupatoria, Salvia sp. and Satureja montana, Food Chemistry. 2009; 117: 412-416.