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HERBAL TEA PRODUCTION FROM *PEPEROMIA PELLUCIDA* LEAF

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Abstract

Peperomia pellucida is an annual herb from the Piperacea family. *P. Pellucida* is well known for its ethnomedical properties. The plant *P. pellucida* is a well-known medicinal plant being used ethnomedicinally for treatment of various diseases worldwide. Objective of this study focused on the effect of blanching temperature and time; heat pump drying temperature and storage condition to vitamin C (mg/100g), flavonoid (mg/g) and sensory score of the dried *Peperomia pellucida* leaf tea. Results showed that *Peperomia pellucida* leaves should be blanched in hot water 95^{o}C at 4 seconds in the present of $CaCl_2$ 2.5% and then beeing dried by heat pump dryer at 45^{o}C until 8.0% moisture. The final herbal tea could be preserved under vacuum in PET/AL/PE bag at 4^{o}C to maintain flavonoid content for 12 months.

Keywords: *Peperomia pellucida*, flavonoid, vitamin C, herbal, blanching, drying

Introduction

Peperomia pellucida is a herb belonging to the family Piperaceae. The plant is very common during rainy season and usually grows in clumps in loose and humid soils and is found in shaded, damp habitats. The plant occurs more or less throughout year in wet places. It is characterized by succulent stems, fleshy and heart shaped leaves, and tiny dot like seeds attached to fruiting spikes. The plant is known to be edible and is considered to possess cooling property (Melo *et al*., 2016; Termote *et al*., 2010). *P. pellucida* is a slender herb (reaching 30-50 cm in length) with straight and succulent stem and is cosmopolitan in distribution. Leaves are opposite and alternate, up to 2.5x2 cm, ovate-deltoid, obtuse to acute at apex. Leaves are thin, fleshy, smooth, membranous when dry, 5-7 nerved from the base. Petiole is up to 1.5 cm long. Spikes are terminal and leaf-opposed, up to 5 cm long. Flowering occurs more or less throughout year. Fruits are ribbed and reticulate, minute in size and almost dry (Melo *et al*., 2016). The plant *P. pellucida* is used ethno botanically as medicine, food and flavoring agent in various parts of the world. Aerial parts, young shoots, leaves and whole plant are used in the form of decoctions, juice, paste etc. to treat several diseases such as fever, cold, cough, viral diseases, rheumatic pain, asthma, vaginal infections and kidney infections. The plant is reported to exhibit several bioactivities such as hypotensive, immunostimulatory, antioxidant, antimicrobial, analgesic, anti-inflammatory, fracture healing, gastroprotective and antidiabetic activity. The presence of phytochemicals such as alkaloids, flavonoids, saponins, tannins and glycosides in the plant could be responsible for the pharmacological activities of the plant (Raghavendra *et al*., 2018). The plant is refrigerant, and its leaves are used in the treatment of headache, fever, eczema, abdominal pains and convulsions. *P. pellucida* leaves have dose dependent depressant effects (Khan *et al*., 2008).

There was little report on processing of dried *Peperomia pellucida* leaf as herbal tea. Effect of drying method on anti-microbial, anti-oxidant activities and isolation of bioactive compounds from *Peperomia pellucida* was examined (Habsah Mohamad *et al*., 2015). The cultivation and awareness of the numerous benefits of *Peperomia pellucida* is springing up in Vietnam and there arise the need to produce herbal tea. Therefore, objective of this study focused on the effect of blanching temperature and time; heat pump drying temperature and storage condition to vitamin C (mg/100g), flavonoid (mg/g) and sensory score of the dried *Peperomia pellucida* leaf tea.

Materials and Method

Material

Peperomia pellucida leaves were collected from Soc Trang province, Vietnam. After collecting, they must be conveyed to laboratory within 4 hours for experiments. They were washed under tap water to remove foreign matters. Besides *Peperomia pellucida* leaves we also used another material during the research such as $CaCl_2$. Lab utensils and equipments included digital weight balance, cooker, heat pump dryer.

Fig. 1 : *Peperomia pellucida* leaves

Researching procedure

(i) Effect of blanching temperature and time to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Raw *Peperomia pellucida* leaves were blanched in water solution with 2.5% $CaCl_2$ at different temperature and time (100^{o}C, 2 second; 95^{o}C, 4 seconds; 90^{o}C, 6 seconds; 85^{o}C 8 seconds). Then they were dried by heat pump at 55^{o}C until 8.0% moisture. All samples were analyzed vitamin C (mg/100g), flavonoid (mg/g), color (sensory score) to validate the appropriate blanching condition.

(ii) Effect of drying temperature to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Raw *Peperomia pellucida* leaves were blanched in water solution with 2.5% $CaCl_2$ at 95°C in 4 seconds. Then these samples would be dried under heat pump dryer at different temperature (40°C, 45°C, 50°C, 55°C) until 8.0% moisture. All samples were analyzed vitamin C (mg/100g), flavonoid (mg/g), color (sensory score) to validate the appropriate drying temperature.

(iii) Effect of storage condition to flavonoid (mg/g) in the dried leaf tea

After completion of drying treatment, the dried *Peperomia pellucida* leaves were subjected to storage. They were kept in PET/AL/PE (zipper top), PET/AL/PE (vaccum) bag at different 4°C, 28°C. The flavonoid content (mg/g) will be analyzed in 3 months interval for 12 months.

Physico-chemical and sensory analysis

The vitamin C (mg/100g) content of the *Peperomia pellucida* leaves was determined by redox titration using iodate solution. Flavonoid (mg/g) was determined with reference to the method of Shanmugapriya *et al*. (2017). Color (sensory score) of *Peperomia pellucida* leaves was assessed by a group of panelist. They were required to evaluate the odour, colour, taste, sweetness and overall acceptance using the 9-point hedonic scale (1 = dislike extremely, 9 = like extremely).

Statistical Analysis

The experiments were run in triplicate with three different lots of samples. Data were subjected to analysis of variance (ANOVA) and mean comparison was carried out using Duncan's multiple range test (DMRT) Statistical analysis was performed by the Startgraphics.

Result and Discussion

Effect of blanching temperature to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Raw *Peperomia pellucida* leaves were blanched in water solution with 2.5% $CaCl_2$ at different temperature and time (100°C, 2 second; 95°C, 4 seconds; 90°C, 6 seconds; 85°C, 8 seconds). All samples were analyzed vitamin C (mg/100g), flavonoid (mg/g), color (sensory score) to validate the appropriate blanching condition. Results were mentioned in table 1. From table 1, the *Peperomia pellucida* leaves should be blanched at 95°C in 4 seconds to maintain the most vitamin C (mg/100g), flavonoid (mg/g) and sensory score in the dried *Peperomia pellucida* leaf tea.

Table 1 : Effect of blanching temperature to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Blanching	Vitamin C (mg/100g)	Flavonoid (mg/g)	Sensory score
100°C, 2 seconds	24.53±0.01^{b}	0.76±0.01^{b}	6.43±0.0^{bc}
95°C, 4 seconds	28.89±0.03^{a}	0.85±0.00^{a}	7.85±0.00^{a}
90°C, 6 seconds	21.03±0.03^{c}	0.61±0.02^{bc}	7.11±0.02^{b}
85°C, 8 seconds	17.66±0.00^{d}	0.52±0.01^{c}	6.22±0.03^{c}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

High temperature has effects on vitamin C content of fruits, blanching in hot water can cause an appreciable loss in vitamin C that is thermally labile. Ascorbic acid oxidase needs to be inactivated; this prevents enzyme-catalyzed reaction during processing (Ayegba Clement *et al*., 2017).

Effect of drying temperature by heat pump to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Moisture content is among the most vital and mostly used measurement in the processing, preservation and storage of food. Drying food preserves nutrients and protects it by removing the moisture that bacteria, yeasts, and molds need to live. Raw, fresh food at the moment it is harvested contains the highest content of nutrients, but begins to decline post-harvest as it is exposed to light and air during handling. *Peperomia pellucida* is a succulent plant, thus the drying method is important to avoid any decay of the plant prior to extraction. Raw *Peperomia pellucida* leaves were blanched in water solution with 2.5% $CaCl_2$ at 95°C in 4 seconds. Then these samples would be dried under heat pump dryer at different temperature (40°C, 45°C, 50°C, 55°C). All samples were analyzed vitamin C (mg/100g), flavonoid (mg/g), color (sensory score) to validate the appropriate drying temperature. Results were mentioned in table 2. From table 2, the *Peperomia pellucida* leaves should be dried at 45°C to maintain the most vitamin C (mg/100g), flavonoid (mg/g) and sensory score in the dried *Peperomia pellucida* leaf tea.

Table 2: Effect of drying temperature by heat pump to vitamin C (mg/100g), flavonoid (mg/g) and color (sensory score) in the dried *Peperomia pellucida* leaf tea

Drying temperature	Vitamin C (mg/100g)	Flavonoid (mg/ml)	Sensory score
40°C	30.02±0.02^{a}	0.95±0.01^{a}	8.11±0.03^{ab}
45°C	29.79±0.00^{ab}	0.93±0.01^{ab}	8.25±0.01^{a}
50°C	29.11±0.01^{ab}	0.89±0.02^{ab}	8.04±0.02^{ab}
55°C	28.89±0.03^{b}	0.85±0.00^{b}	7.85±0.00^{b}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

Drying is one of the oldest and a very important unit operation, it involves the application of heat to a material which results in the transfer of moisture within the material to its surface and then water removal from the material to the atmosphere (Akpinar and Bicer, 2005). The drying features for pressure, air velocity, relative humidity, and product retention time vary according to the material and method of drying. During the drying operation physical, structural, chemical, nutritional changes in the vegetables may occur, and that can affect the quality attributes like texture, color, flavor and nutritional value (Di Scala and Crapiste, 2008). *Peperomia pellucida* was subjected to the determination of biological activity and isolation of chemical constituents. Two samples of this plant were used, which were the air-dried and freeze-dried (Habsah Mohamad *et al*., 2015). In one report, tray dryer method give the highest result on yield and antioxidant activities of dried *Peperomia pellucida*. Bioactive compounds in *Peperomia pellucida*, which have high antioxidant activity, were sensitive to high temperature thus drum dryer method give the lowest antioxidant activities. It suggested using solar or tray dryer method to

drying *Peperomia pellucida* (Siti Irma Rahmawati *et al*., 2017).

Effect of storage condition to flavonoid (mg/g) in the dried *Peperomia pellucida* leaf tea

Peperomia pellucida need to be dried to prolong self life so it can be easily to storage. Several drying methods have been develop recently, which have each advantages and disadvantages. After completion of drying treatment, the dried *Peperomia pellucida* leaves were subjected to storage. They were kept in PET/AL/PE (zipper top), PET/AL/PE (vaccum) bag at different 4°C, 28°C. The flavonoid (mg/g) will be analyzed in 3 months interval for 12 months. Dried *Peperomia pellucida* leaves should be stored under vacuum in PET/AL/PE bag at 4°C to maintain flavonoid content for 12 months.

Table 3 : Flavonoid content (mg/g) in dried *Peperomia pellucida* leaves by the effect of packaging material and storage temperature

Storage time (month)	Dried *Peperomia pellucida* leaves by the storage temperature (°C) kept in PET/AL/PE (zipper top)		Dried *Peperomia pellucida* leaves by the storage temperature (°C) kept in PET/AL/PE (vaccum)	
	4 °C	28 °C	4 °C	28 °C
0	0.93±0.01^{a}	0.93±0.01^{a}	0.93±0.01^{a}	0.93±0.01^{a}
3	0.85±0.00^{ab}	0.83±0.00^{b}	0.90±0.00^{a}	0.85±0.00^{ab}
6	0.77±0.01^{ab}	0.74±0.03^{b}	0.83±0.02^{a}	0.78±0.03^{ab}
9	0.73±0.02^{ab}	0.69±0.01^{b}	0.77±0.00^{a}	0.72±0.02^{ab}
12	0.69±0.00^{ab}	0.64±0.02^{b}	0.74±0.01^{a}	0.67±0.03^{ab}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

A study evaluated the effect of gamma irradiation (0; 2.5; 5; 7.5; and 10 kGy) on the ACE inhibitory activity (ACE Kit – WST test kit method), antioxidant activity (DPPH radical scavenging method), total phenolic content (colorimetric method using Folin-Ciocalteu reagent), total flavonoid content (colorimetric method using AlCl3 and sodium acetate), and TLC profiling (silica gel F254 as the stationary phase and dichlormethane: methanol [92:8] as the mobile phase) of suruhan herb powder. Results showed that the 2.5 kGy irradiation dose gave the smallest alteration in ACE inhibitory activity compared to others irradiated doses. Furthermore, the 5 and 7.5 kGy dose didn't cause significant change ($p>0.05$) on antioxidant activity, total phenolic content, and total flavonoid content. Antioxidant activity was found to correlate with the total phenolic content but not with the total flavonoid content (Mubarika *et al*., 2017).

Conclusion

The plant is used as medicine for treating various ailments or disorders such as asthma, rheumatism, wound, fever, stomach problems, kidney infection, hemorrhoid pain, joint pain, hypertension, diarrhea, snake bite and measles. The plant contains phytochemical groups such as alkaloids, flavonoids, saponins, terpenoids, steroids and glycosides. Compounds such as dill apiole, phytol, stigmasterol, sitosterol, secolignans, tetrahydrofuran lignans, highly methoxylated dihydronaphthalenone, peperomins, sesamin and isoswertisin have been identified in the plant. Studies have shown that the plant exhibited several pharmacological activities such as antimicrobial, antioxidant, anti-angiogenic, antiinflammatory, analgesic, antipyretic, neuropharmacological, antisickling, anticancer, enzyme inhibitory, antiulcer, hypotensive, immunostimulatory, fracture healing and antidiabetic activities which support the traditional use of the plant. Purified chemicals from the plant have also shown to exhibit certain pharmacological activities such as antiulcer, anticancer and antimicrobial activity. Drying the leaves assists to concentrate the nutrients, facilitate conservation and consumption, as such, it can be used during the time when source is scarce or can be transported to areas where it is not cultivated.

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