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RESEARCH ARTICLE

Herbal Tea Production from *Mimosa Pudica*

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Abstract

Drying is the most popular and basic method for post-harvest storage of herbs because it permits for the quick preservation of the herbal qualities of the herb material in a simple manner. *Mimosa pudica* is considered as a promising herbal candidate to undergo further exploration as evident from its pharmacological properties. Objective of this study focused on the effect of blanching temperature and time; oven drying temperature and storage condition to total phenolics (mg/g), total flavonoids (mg/g), ferric reducing/antioxidant power (FRAP or TE, mg/g), radical-scavenging activity DPPH (IC_{50}, mg/mL) and sensory score of the dried *Mimosa pudica* tea. Results showed that *Mimosa pudica* should be blanched in hot water 95°C at 5 seconds in the present of citric acid 0.5% and then beeing dried by oven dryer at 50°C until 10.0% moisture. The final herbal tea could be preserved under vacuum in aluminum foil at 28°C to maintain flavonoid content for 12 months.

Keywords: *Blanching, Drying, Ferric reducing power, Flavonoids, Herbal, Mimosa pudica, Phenolics, radical-scavenging activity.*

Introduction

Mimosa pudica is one of the largest genera which distribute more than 500 species. Its habitat are lowland tropical rainforest, savanna, tropical and subtropical dry forest and thorn scrub, mid-elevation subtropical forest, desert, grassland, and wet land. *Mimosa pudica* (Mimosaceae) is a shrubby plant with the bipinnate leaves, glandular hairs, spinouts stipules, Companulate calyxes and lilac pinkish axilary flower heads. The stems are erect and well branched. *M. pudica* shows certain movements like nyctinastic movement, thigmonastic movement and seismonastic movement [1].

The periodic leaf movement factors are reportedly the derivatives of 4-*o*-(b-D-glucopyranosyl-6-sulphate) gallic acid [2]. It is a rich source of flavanoids, tannins, plant hormones, amino acids and glycosides [3]. *M. pudica* was proven with different pharmacological activities such as anti-ulcer [4], anti-inflammatory [5], antimicrobial [6], anti-malaria [7], antifungal [7], carcinogenic [8], wound healing [9, 10], analgesic [11], anti-convulsant [7], anti-diarrheal [7], anti-fertility [7], antioxidant [12], anti-hepatotoxic [9], antihelmintic [11], aphrodisiac [4], anti-hyperglycemic [7], antivenom [13], anxiolytic and antidepressant [14], antihyperurisemic [15]. It has anti-anxiety, anti-depressant and memory enhancing activities that are mediated through multiple mechanisms [16].

There was little report on processing of dried *Mimosa pudica* as herbal tea. Therefore, objective of this study focused on the effectiveness of blanching temperature and time; oven drying temperature and storage condition to the total phenolics (mg/g), total flavonoids (mg/g), ferric reducing/antioxidant power (FRAP, mg/g), radical-scavenging activity (DPPH, mg/mL) of the dried *Mimosa pudica* tea.

Materials and Method

Material

Mimosa pudica were collected from Bac Lieu province, Vietnam. After collecting, they

must be conveyed to laboratory within 8 hours for experiments. They were washed under tap water to remove foreign matters. Besides *Mimosa pudica* we also used another material during the research such as citric acid. Lab utensils and equipments included digital weight balance, cooker, oven dryer.

Figure 1: ***Mimosa pudica***

Researching Procedure

Effect of Blanching Temperature and Time to Total Phenolics (mg/g), total Flavonoids (mg/g), Ferric Reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging Activity DPPH (IC_{50}, mg/mL) in the Dried Mimosa Pudica Tea

Raw *Mimosa pudica* were blanched in water solution with 0.5% citric acid at different temperature and time (100°C, 3 second; 95°C, 5 seconds; 90°C, 7 seconds; 85°C, 9 seconds). Then they were dried by oven at 60°C until 10.0% moisture. All samples were analyzed total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) to validate the appropriate blanching condition.

Effect of Drying Temperature to Total Phenolics (mg/g), Total Flavonoids (mg/g), Ferric Reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging activity DPPH (IC_{50}, mg/mL) in the Dried Mimosa Pudica Tea

Raw *Mimosa pudica* were blanched in water solution with 0.5% citric acid at 95°C in 5 seconds. Then these samples would be dried under oven dryer at different temperature (45°C, 50°C, 55°C, 60°C) until 10.0% moisture. All samples were analyzed total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) to validate the appropriate drying temperature.

Effect of Storage Condition to Total Phenolics (mg/g), Total Flavonoids (mg/g), Ferric Reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging Activity DPPH (IC_{50}, mg/mL) in the Dried Tea

After completion of drying treatment, the dried *Mimosa pudica* were subjected to storage. They were kept in aluminum foil at ambient temperature (28°C). The total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) will be analyzed in 3 months interval for 12 months.

Physico-chemical and Sensory Analysis

Total phenolic (mg/g) was determined according to the Folin-Ciocalteu method [17]. Total flavonoids (mg/g) was determined according to the $NaNO_2$-Al $(NO_3)_3$ method [18]. Ferric reducing/antioxidant power (FRAP or TE, mg/g) was measured using FRAP assay (Sean PG, Ranjeet B, 2004). DPPH radical-scavenging activity ($IC_{50,\ mg/mL}$) was evaluated according to the Kalaivani T method [19].

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 Stat graphics Centurion XVI.

Result & Discussion

Effect of Blanching Temperature to Total phenolics (mg/g), Total Flavonoids

(mg/g), Ferric reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging activity DPPH ($IC_{50,}$ mg/mL) in the Dried *Mimosa Pudica* Tea

Blanching is a crucial step before drying to inactivate enzymes. Application of a suitable blanching technology with a selection of appropriate conditions are of great importance, since blanching directly affects the quality of the dried product in terms of its physical and nutritional property. The blanching had more of a positive effect in retaining the original green color of the fresh herbs than with direct drying. Raw *Mimosa pudica* were blanched in water solution with 0.5% citric acid at different temperature and time (100°C, 3 second; 95°C, 5 seconds; 90°C, 7 seconds; 85°C, 9 seconds). All samples were analyzed total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) to validate the appropriate blanching condition. Results were mentioned in Table 1. From table 1, the *Mimosa pudica* should be blanched at 95°C in 5 seconds to maintain the most total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) in the dried *Mimosa pudica* tea.

Table 1: Effect of blanching temperature to total phenolics (mg/g), total flavonoids (mg/g), ferric reducing/antioxidant power FRAP (TE, mg/g), and radical-scavenging activity DPPH ($IC_{50,}$ mg/mL) in the dried *Mimosa pudica* tea

Blanching	Total phenolics (mg/g)	Total flavonoids (mg/g)	FRAP (TE, mg/g)	DPPH ($IC_{50,}$ mg/mL)
Control	2.73±0.14^{a}	0.52±0.01^{a}	24.58±0.25^{a}	0.57±0.01^{c}
100°C, 3 seconds	2.12±0.08^{b}	0.37±0.02^{b}	20.15±0.19^{b}	0.79±0.03^{b}
95°C, 5 seconds	2.36±0.11^{ab}	0.44±0.04^{ab}	21.37±0.13^{ab}	0.66±0.02^{bc}
90°C, 7 seconds	2.03±0.06^{bc}	0.26±0.01^{bc}	19.42±0.26^{bc}	0.88±0.05^{ab}
85°C, 9 seconds	1.94±0.17^{c}	0.21±0.03^{c}	18.28±0.21^{c}	0.94±0.07^{a}

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%)

Nartnampong, A. et al [20]. Demonstrated that blanching better preserved and also promoted more nutrients and antioxidant properties in green leafy vegetables than steaming.

Effect of drying Temperature by Oven to Total Phenolics (mg/g), Total Flavonoids (mg/g), Ferric Reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging activity DPPH ($IC_{50,}$ mg/mL) in the Dried *Mimosa pudica* Tea

Drying of herbs and spices is essential to extend their shelf life. This is because low moisture contents prevent the growth and reproduction of microorganisms that cause decay.

Raw *Mimosa pudica* were blanched in water solution with 0.5% citric acid at 95°C in 5 seconds. Then these samples would be dried under oven dryer at different temperature (45°C, 50°C, 55°C, 60°C). All samples were analyzed total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) to validate the appropriate drying temperature. Results were mentioned in table 2. From table 2, the *Mimosa pudica* should be dried at 45°C to maintain the most total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH ($IC_{50,}$ mg/mL) in the dried *Mimosa pudica* tea.

Table 2: Effect of drying temperature by oven to total phenolics (mg/g), total flavonoids (mg/g), ferric reducing/antioxidant power FRAP (TE, mg/g), and radical-scavenging activity DPPH ($IC_{50,}$ mg/mL) in the dried *Mimosa pudica* tea

Drying temperature	Total phenolics (mg/g)	Total flavonoids (mg/g)	FRAP (TE, mg/g)	DPPH ($IC_{50,}$ mg/mL)
45°C	2.41±0.15^{a}	0.50±0.02^{a}	21.77±0.11^{a}	0.60±0.01^{b}
50°C	2.39±0.11^{ab}	0.48±0.00^{ab}	21.65±0.09^{ab}	0.63±0.03^{ab}
55°C	2.38±0.13^{ab}	0.45±0.02^{ab}	21.49±0.07^{ab}	0.64±0.01^{ab}
60°C	2.36±0.11^{b}	0.44±0.04^{b}	21.37±0.13^{b}	0.66±0.02^{a}

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 [21].

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 [22]. Our results were similar to finding by Jing Zhang et al [23]. Low drying temperatures between 30 and 50°C are recommended to protect sensitive active ingredients.

Effect of Storage Condition to Total Phenolics (mg/g), Total Flavonoids (mg/g), Ferric Reducing/antioxidant Power FRAP (TE, mg/g), and Radical-scavenging Activity DPPH (IC_{50}, mg/mL) in the Dried *Mimosa pudica* Tea

Mimosa pudica need to be dried to extend product shelf-life so it can be easily preserved. Different drying methods have been developed recently. After the drying treatment, the dried *Mimosa pudica* were subjected to storage. They were kept in aluminum foil at ambient temperature (28°C). The total phenolics (mg/g), total flavonoids (mg/g), FRAP (TE, mg/g), and DPPH (IC_{50}, mg/mL) will be analyzed in 3 months interval for 12 months. Dried *Mimosa pudica* leaves should be stored under vacuum in aluminum foil at 28°C to maintain flavonoid content for 12 months.

Table 3: Total phenolics (mg/g), total flavonoids (mg/g), ferric reducing/antioxidant power FRAP (TE, mg/g), and radical-scavenging activity DPPH (IC_{50}, mg/mL) in dried *Mimosa pudica* during storage

Storage time (month)	Total phenolics (mg/g)	Total flavonoids (mg/g)	FRAP (TE, mg/g)	DPPH (IC_{50}, mg/mL)
0	2.41±0.15^{a}	0.50±0.02^{a}	21.77±0.11^{a}	0.60±0.01^{c}
3	2.39±0.07^{ab}	0.49±0.01^{ab}	21.13±0.17^{ab}	0.63±0.03^{bc}
6	2.35±0.13^{b}	0.47±0.03^{b}	20.85±0.24^{b}	0.66±0.00^{b}
9	2.32±0.11^{bc}	0.44±0.02^{bc}	20.13±0.12^{bc}	0.69±0.01^{ab}
12	2.30±0.06^{c}	0.41±0.00^{c}	19.89±0.08^{c}	0.73±0.03^{a}

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%)

Conclusion

Sensitive plants, *Mimosa pudica* (L.), are a tropical shrub and are an ideal system in which to study inducible defenses that occur on a short time-scale. The whole plant of *Mimosa pudica* is very useful for various pharmacological and biological activities. Drying is the most common method of medicinal plant preservation and, due to high investment and energy costs, drying is also a large expense in medicinal plant production. We have successfully investigated several factors affecting to production of *Mimosa pudica* herbal tea. By this investigation, the added value of *Mimosa pudica* could be enhanced.

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