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# Technical Parameters Influencing to Production of *Polyscias Fruticosa* Tea

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**Abstract.**

There has been an increase of awareness and interest in medicinal *Polyscias fruticosa* plant in recent times. The present study focused on the effect of blanching time and temperature, $Cacl_2$ concentration in blanching; *Polyscias fruticosa* leaf size and temperature in drying; and storage condition to saponin (µg/g) content in the herbal tea. The optimal results demonstrated that blanching at 95°C, 4 sesonds with 3% $CaCl_2$; heat pump drying at 40°C in dimension of 1.5cm; storage at 4°C in PET/AL/PE (vaccum) could maintain the saponin content in herbal tea for 6 weeks without any decomposition.

***Keywords:*** *Polyscias fruticosa, herbal, blanching, drying, storage, vaccum*

## I. INTRODUCTION

*Polyscias fruticosa* belongs to Araliaceae family and distributes widely in Vietnam. It is a shrub to small tree to 4 m tall. Leaves alternate, petiolate, irregularly pinnately compound, the leaflets with conspicuous toothed margins, blades often yellowish in color and fragrant if crushed. Flowers are relatively small, yellowish-green, borne in umbels. Fruit is a small dry drupe with a single seed. The roots smell and taste like parsley (R. Varadharajan and D. Rajalingam, 2011). The leaves are used as atonic, anti-inflammatory, antitoxin, and antibacterial (M.B. Bensita et al., 1999). The root is used as a diuretic, febrifuge, antidysentery, and for treatment of neuralgia, rheumatic pain, asthma (R. Varadharajan and D. Rajalingam, 2011; George Asumeng Koffuor et al., 2014; Nguyen Thi Thu Tram et al., 2017). Amino acids, polysaccharides, steroids, sesquiterpenoids, triterpenoid saponins, and polyacetylenes are among the components of *P. fruticosa* (Brophy et al., 1990; Chaboud, A. et al., 1995; Huan et al., 1998, Mahesh, 2008; Tran Van Thai et al., 2016). Tran Thi Huong Hanh et al. (2016) suggested the use of *P. fruticosa* and its major saponin for the prevention and treatment of diabetes. Nguyen Thi Luyen et al. (2018) evaluated the inhibitory effect of 3-*O*-[β-d-glucopyranosyl-(1→4)-β-d-glucuronopyranosyl] oleanolic acid 28-*O*-β-d-glucopyranosyl ester (PFS), a major saponin isolated from *Polyscias fruticosa* leaves, on α-amylase and α-glucosidase. The present study focused on the effect of blanching time and temperature, $Cacl_2$ concentration in blanching; *Polyscias fruticosa* leaf size and temperature in drying; and storage condition to saponin (µg/g) content in the herbal tea.

## II. MATERIALS AND METHOD

### 2.1 Material

We collected *Polyscias fruticosa* in Mekong river delta, Vietnam. They must be cultivated following VietGAP to ensure food safety. After harvesting, they must be conveyed to laboratory within 8 hours for experiments. They were washed thoroughly under turbulent washing to remove dirt, dust and adhered unwanted material. Besides *Polyscias fruticosa* we also used other materials during the research such as $CaCl_2$, PET/AL/PE bag**,** idodate. Lab utensils and equipments included HPLC-ELSD, refractometer, thermometer, steaming oven, digital timer.

**Figure 1.** *Polyscias fruticosa* leaf

### 2.2 Researching procedure

***2.2.1 Effect of blanching temperature and time to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried Polyscias fruticosa leaf tea***

Raw *Polyscias fruticosa* leaves were blanched in water solution with 2% $CaCl_2$ at different temperature and time (100°C, 2 second; 95°C, 4 seconds; 90°C, 6 seconds; 85°C 8 seconds). Then they were dried by heat pump at 60°C until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition.

***2.2.2 Effect of $CaCl_2$ concentration in blanching to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried Polyscias fruticosa leaf tea***

Raw *Polyscias fruticosa* leaves were blanched in water solution with different $CaCl_2$ concentration (1.0%, 2.0%, 3.0%, 4.0%, 5.0%) at 95°C, 4 seconds. Then they were dried by heat pump at 60°C until 6.5% moisture. All

samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition.

***2.2.3 Effect of Polyscias fruticosa leaf size during drying to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried Polyscias fruticosa leaf tea***

Raw *Polyscias fruticosa* leaves were blanched in water solution with 4% $CaCl_2$ at 95$^oC$, 4 seconds. Then they were dried at different size (0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, 2.5 cm) by heat pump at 60$^oC$ until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition.

***2.2.4 Effect of drying temperature to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried Polyscias fruticosa leaf tea***

Raw *Polyscias fruticosa* leaves were blanched in water solution with 4% $CaCl_2$ at 95$^oC$ in 4 seconds. Then these samples would be dried in 1.0 cm of size under heat pump dryer at different temperature (10$^oC$, 20$^oC$, 30$^oC$, 40$^oC$, 50$^oC$, 60$^oC$) until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate drying temperature.

***2.2.5 Effect of storage condition to saponin (µg/g) in the dried leaf tea***

After completion of drying treatment, the dried *Polyscias fruticosa* leaves were subjected to storage. They were kept in PET/AL/PE (vaccum) bag at different 4$^oC$, 28$^oC$. The saponin (µg/g) will be analyzed in 1 week interval for 6 weeks.

**2.3 Physico-chemical and biological analysis**

The vitamin C (mg/100g) content of the *Polyscias fruticosa* leaves was determined by redox titration using iodate solution. Saponin (µg/g) was determined by HPLC-ELSD. Total phenolic (TP, µg GAE/g fw) contents were measured according to the method of Singleton and Rossi (1965) with slight modifications. Total soluble solids (TSS, %) were measured by refractometry method. Color (sensory score) of *Polyscias fruticosa* 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).

**2.4 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 Statgraphics Centurion XVI.

## III. RESULT & DISCUSSION

**3.1 Phytochemical composition in *Polyscias fruticosa* leaves**

Phytochemical composition in *Polyscias fruticosa* leaves was primarily analyzed. Results were depicted in table 1.

From table 1, we clearly noticed that *Polyscias fruticosa* leaves had high amount of saponin which was suitable for herbal tea production.

**Table 1. Phytochemical composition in *Polyscias fruticosa* leaves**

| Parameter | Vitamin C (mg/100g) | Saponin (µg/g) | Total phenolic (TP, µg GAE/g fw) | Total soluble soid (%) |
|---|---|---|---|---|
| **Value** | 48.29±0.01 | 28.64±0.02 | 57.25±0.03 | 8.45±0.01 |

*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%).*

**Table 2. Effect of blanching temperature and time**

| Blanching condition | Vitamin C (mg/100g) | Saponin (µg/g) | Color (sensory score) |
|---|---|---|---|
| 100$^oC$, 2 seconds | 35.16±0.02$^b$ | 17.59±0.01$^b$ | 5.23±0.01$^b$ |
| **95$^oC$, 4 seconds** | **38.42±0.02$^a$** | **19.85±0.00$^a$** | **6.37±0.02$^a$** |
| 90$^oC$, 6 seconds | 34.50±0.00$^c$ | 16.32±0.03$^c$ | 4.16±0.00$^c$ |
| 85$^oC$ 8 seconds | 32.14±0.03$^d$ | 15.20±0.01$^d$ | 3.27±0.04$^d$ |

*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%).*

**Table 3. Effect of $CaCl_2$ concentration in blanching**

| $CaCl_2$ concentration | Vitamin C (mg/100g) | Saponin (µg/g) | Color (sensory score) |
|---|---|---|---|
| 1.0% | 35.21±0.01$^c$ | 17.22±0.02$^c$ | 6.13±0.00$^c$ |
| 2.0% | 38.42±0.02$^b$ | 19.85±0.00$^b$ | 6.37±0.02$^b$ |
| **3.0%** | **40.21±0.03$^a$** | **21.44±0.01$^a$** | **6.45±0.03$^a$** |
| 4.0% | 40.25±0.00$^a$ | 21.45±0.03$^a$ | 6.46±0.00$^a$ |
| 5.0% | 40.28±0.01$^a$ | 21.47±0.01$^a$ | 6.46±0.01$^a$ |

*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%).*

**Table 4. Effect of *Polyscias fruticosa* leaf size during drying**

| *Polyscias fruticosa* leaf size | Vitamin C (mg/100g) | Saponin (µg/g) | Color (sensory score) |
|---|---|---|---|
| 0.5 cm | 37.35±0.00$^c$ | 19.07±0.02$^c$ | 5.01±0.01$^c$ |
| 1.0 cm | 40.21±0.03$^b$ | 21.44±0.01$^b$ | 6.45±0.03$^b$ |
| **1.5 cm** | **42.38±0.02$^a$** | **22.61±0.03$^a$** | **7.28±0.02$^a$** |
| 2.0 cm | 42.40±0.01$^a$ | 22.63±0.02$^a$ | 7.30±0.01$^a$ |
| 2.5 cm | 40.42±0.00$^a$ | 22.64±0.00$^a$ | 7.30±0.00$^a$ |

*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%).*

**Table 5. Effect of drying temperature**

| Drying temperature | Vitamin C (mg/100g) | Saponin (µg/g) | Color (sensory score) |
|---|---|---|---|
| 10°C | 44.08±0.00[a] | 24.31±0.02[a] | 7.27±0.01[c] |
| 20°C | 44.05±0.01[a] | 24.31±0.01[a] | 7.55±0.03[bc] |
| 30°C | 44.05±0.04[a] | 24.31±0.02[a] | 7.94±0.00[ab] |
| **40°C** | **44.02±0.03[a]** | **24.27±0.01[a]** | **8.13±0.00[a]** |
| 50°C | 43.61±0.01[b] | 23.15±0.02[b] | 7.64±0.01[b] |
| 60°C | 42.38±0.02[c] | 22.61±0.03[c] | 7.28±0.02[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%).*

**Table 6. Effect of storage condition**

| Storage duration (week) | Saponin (µg/g) | |
|---|---|---|
| | Storage temperature 4°C | Storage temperature 28°C |
| 0 | 24.27±0.01[a] | 24.27±0.01[a] |
| 1 | 24.20±0.03[ab] | 24.13±0.03[ab] |
| 2 | 24.16±0.04[b] | 24.05±0.02[b] |
| 3 | 24.11±0.02[bc] | 24.01±0.00[bc] |
| 4 | 24.08±0.00[c] | 23.97±0.01[c] |
| 5 | 24.03±0.03[cd] | 23.91±0.03[cd] |
| 6 | 24.00±0.02[d] | 23.87±0.02[d] |

*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%).*

### 3.2 Effect of blanching temperature and time to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried *Polyscias fruticosa* leaf tea

Raw *Polyscias fruticosa* leaves were blanched in water solution with 2% $CaCl_2$ at different temperature and time (100°C, 2 seconds; 95°C, 4 seconds; 90°C, 6 seconds; 85°C 8 seconds). Then they were dried by heat pump at 60°C until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition. Results were depicted in table 2. From table 2, the best blanching condition was noted at 95°C, 4 seconds.

Oluwaseun P. Bamidele et al., (2017) concluded that blanching time for vegetables should range between 1 to 5 min to prevent the loss of health benefiting compound present in them.

### 3.3 Effect of $CaCl_2$ concentration in blanching to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried *Polyscias fruticosa* leaf tea

Raw *Polyscias fruticosa* leaves were blanched in water solution with different $CaCl_2$ concentration (1.0%, 2.0%, 3.0%, 4.0%, 5.0%) at 95°C, 4 seconds. Then they were dried by heat pump at 60°C until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition. Results were depicted in table 3. From table 3, the optimal $CaCl_2$ concentration in blanching should be 3.0%.

Dominika Guzek et al., (2012) proved that soaking in 1% calcium chloride solution prior to low-temperature blanching resulted in obtaining a colour more attractive for consumers, compared to the use of conventional technology. Meanwhile, Agiriga A. N. et al., (2015) showed that carrot slices blanched at 80°C with 5% salt was the most preferred of all the samples.

### 3.4 Effect of *Polyscias fruticosa* leaf size during drying to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried *Polyscias fruticosa* leaf tea

Raw *Polyscias fruticosa* leaves were blanched in water solution with 4% $CaCl_2$ at 95°C, 4 seconds. Then they were dried at different size (0.5 cm, 1.0 cm, 1.5 cm, 2.0 cm, 2.5 cm) by heat pump at 60°C until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate blanching condition. Results were depicted in table 4. From table 4, the optimal *Polyscias fruticosa* leaf size should be 1.5 cm.

The Polyscias fruticosa leaves were washed, shade-dried (26- 30°C) and pulverized into fine powder using a mechanical blender (George Asumeng Koffuor et al., 2014). Sang SY et al., (2014) investigated the antioxidant capacities of four common forage legume leaves. Freeze-dried extract showed the highest antioxidant activities compared to oven drying.

### 3.5 Effect of drying temperature to vitamin C (mg/100g), saponin (µg/g) and color (sensory score) in the dried *Polyscias fruticosa* leaf tea

Raw *Polyscias fruticosa* leaves were blanched in water solution with 4% $CaCl_2$ at 95°C in 4 seconds. Then these samples would be dried in 1.0 cm of size under heat pump dryer at different temperature (10°C, 20°C, 30°C, 40°C, 50°C, 60°C) until 6.5% moisture. All samples were analyzed vitamin C (mg/100g), saponin (µg/g), color (sensory score) to validate the appropriate drying temperature. Results were depicted in table 5. From table 5, the optimal drying temperature should be 40°C.

Sahar Roshanak et al., (2012) evaluated the effect of seven drying treatments (sun, shade, oven 60 °C, oven 80 °C, oven 100 °C, microwave and freeze-drying) with respect total flavonoid (TFC), phenolic (TPC), antioxidant activity, vitamin C and color characteristics of green tea. In general, drying increased antioxidant activity, TPC, TFC and

chlorophyll content, while it led to a decrease in vitamin C. The highest TPC (209.17 mg Gallic acid/gdw) and TFC (38.18 mg Quercitin/gdw) were obtained in oven drying at 60 and 100 °C, respectively. Among methods, oven drying at 60 °C revealed the highest radical scavenging activity ($IC_{50}$ = 167.166 µg/ml), while microwave showed the lowest one ($IC_{50}$ = 505.5 µg/ml). Similar trend was also observed in reducing power assay. The highest vitamin C (16.36 mg/100gDM) and Chlorophyll a (17.35 mg/l) were obtained in freeze drying. Finally, sun and freeze drying methods were considered as the least and the most desirable drying methods, respectively the final color of green tea leaves

### 3.6 Effect of storage condition to saponin (µg/g) in the dried leaf tea

After completion of drying treatment, the dried *Polyscias fruticosa* leaves were subjected to storage. They were kept in PET/AL/PE (vaccum) bag at different 4°C, 28°C. The saponin (µg/g) will be analyzed in 1 week interval for 6 weeks. Results were depicted in table 6. From table 6, the *Polyscias fruticosa* dried leaf tea was still stable under the vaccum at 4°C for 6 weeks.

Storage environment is vital to preserve antioxidant capacity of herbal tea (Naithani et al., 2006).

## IV. CONCLUSION

Herbs are valued for its specific aroma, taste, phytochemical effect which appeal to sense of taste, smell, and sight and therefore promote continuous development of functional food. We have successfully optimized the effect of blanching time and temperature, $Cacl_2$ concentration in blanching; *Polyscias fruticosa* leaf size and temperature in drying; and storage condition to saponin (µg/g) content in the herbal tea.

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