Technical Parameters Influencing to Production of *Polyscias Fruticosa* Tea

Nguyen Phuoc Minh¹, Van Thinh Pham², Dinh Thanh Duoc³, Tran Thanh Bien⁴, Truong Han Trung⁵, Nguyen Thanh Hoang⁶

¹Faculty of Chemical Engineering and Food Technology, Nguyen Tat Thanh University, Ho Chi Minh, Vietnam
²NTT Hi-Tech Institute, Nguyen Tat Thanh University, Ho Chi Minh City, Vietnam
³Can Tho University, Can Tho City, Vietnam
⁴Cuu Long University, Vinh Long Province, Vietnam
⁵Bac Lieu University, Bac Lieu Province, Vietnam
⁶An Giang University, An Giang Province, Vietnam

**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, Cacl₂ 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 seconds with 3% CaCl₂; heat pump drying at 40°C in dimension of 1.5cm; storage at 4°C in PET/AL/PE (vacuum) could maintain the saponin content in herbal tea for 6 weeks without any decomposition.

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

---

**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 Tran 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, CaCl₂ 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 CaCl₂, PET/AL/PE bag, iododate. Lab utensils and equipments included HPLC-ELSD, refractometer, thermometer, steaming oven, digital timer.

![Figure 1. Polyscias fruticosa leaf](image-url)
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% CaCl₂ 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.

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% CaCl₂ at 95°C in 4 seconds. Then these samples would be dried in 1.0 cm of size under heat pump at 60°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.

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 (vacuum) bag at different 4°C, 28°C. 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-ELS.D. 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Vitamin C (mg/100g)</th>
<th>Saponin (μg/g)</th>
<th>Total phenolic (TP, μg GAE/g fw)</th>
<th>Total soluble solid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>48.29±0.01</td>
<td>28.64±0.02</td>
<td>57.25±0.03</td>
<td>8.45±0.01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Blanching condition</th>
<th>Vitamin C (mg/100g)</th>
<th>Saponin (μg/g)</th>
<th>Color (sensory score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C, 2 seconds</td>
<td>35.16±0.02</td>
<td>17.59±0.01</td>
<td>5.23±0.01</td>
</tr>
<tr>
<td>95°C, 4 seconds</td>
<td>38.42±0.02</td>
<td>19.85±0.00</td>
<td>6.37±0.02</td>
</tr>
<tr>
<td>90°C, 6 seconds</td>
<td>34.50±0.00</td>
<td>16.32±0.03</td>
<td>4.16±0.00</td>
</tr>
<tr>
<td>85°C, 8 seconds</td>
<td>32.14±0.03</td>
<td>15.20±0.01</td>
<td>3.27±0.04</td>
</tr>
</tbody>
</table>

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 CaCl₂ concentration in blanching

<table>
<thead>
<tr>
<th>CaCl₂ concentration</th>
<th>Vitamin C (mg/100g)</th>
<th>Saponin (μg/g)</th>
<th>Color (sensory score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0%</td>
<td>35.21±0.01</td>
<td>17.22±0.02</td>
<td>6.13±0.00</td>
</tr>
<tr>
<td>2.0%</td>
<td>38.42±0.02</td>
<td>19.85±0.00</td>
<td>6.37±0.02</td>
</tr>
<tr>
<td>3.0%</td>
<td>40.21±0.03</td>
<td>21.44±0.01</td>
<td>6.45±0.03</td>
</tr>
<tr>
<td>4.0%</td>
<td>40.25±0.00</td>
<td>21.45±0.03</td>
<td>6.46±0.00</td>
</tr>
<tr>
<td>5.0%</td>
<td>40.28±0.01</td>
<td>21.47±0.01</td>
<td>6.46±0.01</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Polyscias fruticosa leaf size</th>
<th>Vitamin C (mg/100g)</th>
<th>Saponin (μg/g)</th>
<th>Color (sensory score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 cm</td>
<td>37.35±0.00</td>
<td>19.07±0.02</td>
<td>5.01±0.01</td>
</tr>
<tr>
<td>1.0 cm</td>
<td>40.21±0.03</td>
<td>21.44±0.01</td>
<td>6.45±0.03</td>
</tr>
<tr>
<td>1.5 cm</td>
<td>42.38±0.02</td>
<td>22.61±0.03</td>
<td>7.28±0.02</td>
</tr>
<tr>
<td>2.0 cm</td>
<td>42.40±0.01</td>
<td>22.63±0.02</td>
<td>7.30±0.01</td>
</tr>
<tr>
<td>2.5 cm</td>
<td>40.42±0.00</td>
<td>22.64±0.00</td>
<td>7.30±0.00</td>
</tr>
</tbody>
</table>

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% CaCl₂ 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 CaCl₂ 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 CaCl₂ 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 2. From table 3, the optimal CaCl₂ 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% CaCl₂ 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 Koffiour 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% CaCl₂ 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
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 (vacuum) 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 vacuum 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, CaCl₂ concentration in blanching; *Polyscias fruticosa* leaf size and temperature in drying; and storage condition to saponin (µg/g) content in the herbal tea.

REFERENCES


