The Influence of Different Processing Methods on Component Content of Sophora japonica

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Abstract. The purpose of this experiment is to understand the effect of different processing methods on the content of active ingredients in Sophora japonica, and to determine the content of rutin and quercetin in Sophora japonica under different processing methods by UV spectrophotometry of the content determination. So as to compare the effect of different processing methods on the active ingredient content of Sophora japonica. Experiments can be seen in the rutin content: Fried Sophora japonica>Vinegar sunburn Sophora> Health products Sophora japonica> Charred sophora flower, Vinegar sunburn Sophora and Fried Sophora japonica difference is not obvious; Quercetin content: Charred sophora flower> Fried Sophora japonica> Vinegar sunburn Sophora>Health products Sophora japonica. It is proved that there are some differences in the content of active ingredients in Sophora japonica in different processing methods. The content of rutin increased with the increase of the processing temperature, but the content decreased after a certain temperature; Quercetin content will increase gradually with time.

1. Introduction

Sophora japonica, ”Chinese Pharmacopoeia” stipulates that it is a dried flower and bud of the leguminous plant sophorajaponical. Foreign imports from China imported a large number of Sophora japonica for health products such as food research and development, etc. At present, the research value of Sophora japonica is great. Sophora japonica was first recorded in the late Tang Dynasty, ”Japan and China Materia Medica” [1], in our study later. Sophora japonica is slightly bitter, Medicinal slightly cold, can use for cooling blood to stop bleeding [2]. According to the literature, Sophora japonica processed products with a variety of efficacy. Raw products is better than the heat for cooling blood, mostly for blood heat Wang Xing, Treat headache dizziness [3]. Fried products can alleviate the bitter cold nature of Sophora japonica. Charred sophora flower has the strongest hemostatic effect, and Health products Sophora japonica hemostatic effect is stronger than Fried Sophora japonica [4]. Sophora japonica produced in all parts of the country, its variety comes from many places, the early 20th century, the world began to study the active ingredients of Sophora japonica, Sophora japonica content mainly contains rutin 10% -28% Betulin, sophoradiol [5-7] , and Soph-orinA, B, C and quercetin [8,9]. The Rutin is its main active ingredient, Rutin hydrolyzed into quercetin under the action of enzymes or acids [10], rutin, also known as rutin, vitamin P, Has the function of reducing capillary fragility, improve the role of microcirculation, in clinical Mainly used for diabetes, high blood pressure, hyperglycemia and other adjuvant therapy [11]. Modern pharmacological studies suggest that Quercetin has a good expectorant, stop the cough effect, and has a certain role in asthma [12]. In recent
years, Sophora japonica contains a variety of ingredients have been found. It has been found that it contains 22% protein and contains 17 kinds of amino acids with high content. Calcium, Phosphorus, Magnesium, Potassium, Ferrum, Manganese, Zinc, Copper and so on. And a variety of trace elements [13,14]. Recently, it has been found that Sophora japonica contains fatty acids such as lauric acid, dodecenoic acid and myristic acid, and β-sitosterol, D-glucose, glucuronotetraolic acid and so on[15].

2. The main instruments and reagents

2.1 The main instrument
SHZ-95B circulating water vacuum pump (Gongyi City Kerui Instrument Co., Ltd.); Electric sets (Tianjin Tai Site Instrument Co., Ltd.); HH-2 digital constant temperature water bath (Jintan City, Jiangsu Province, Yinghua Instrument Manufacturing Co., Ltd.); UV spectrophotometer (Shanghai Precision Instrument Co., Ltd.); BS124S electronic balance (Beijing Odolius Instrument Systems Co., Ltd.)

2.2 Reagents and samples
Sophora japonica was purchased from Hebei Anguo Zhenyu Pharmaceutical Co., Ltd., identified by the teacher of Li Xin as a dry flower and bud for leguminous plant Huai. {95% ethanol (medical) Tianjin Tianli Chemical Reagent Company}; {distilled water (analysis of pure) Harbin Wenjing Distillation Water Plant}; {Methanol (analytical grade) Tianjin Tianli Chemical Reagent Company}; {75% concentrated hydrochloric acid (analytically pure) 75% concentrated hydrochloric acid (analytical grade)}; {Ether (analytical pure) Tianjin days of chemical reagents company}; {60% sodium hydroxide (analytical grade) Tianjin Tianli Chemical Reagent Company}; {Vinegar (60%) Shanxi water tower old vinegar Co., Ltd.}; Rutin reference substance (China Pharmaceutical and Biological Products Institute); Quercetin reference substance (China Pharmaceutical and Biological Products Institute); Gallic acid (China Pharmaceutical and Biological Products Institute); {Phosphomolybdotungstic acid (analytical grade) Tianjin days of chemical reagents company}.

3. Experimental method

3.1 processing of Sophora japonica
(1) Health products Sophora japonica: take the original herbs, remove impurities and branches, sieve to debris.
(2) Fried Sophora japonica: take the net Sophora japonica, stir fry the container, with the slow fire, fry until dark yellow, remove the cool.
(3) Charred sophora flower: take the net Sophora japonica, stir fry the container, with the fire in the fire, fry until the coke brown, spray a little water, destroy the Mars, fried dry, remove the cool.
(4) Vinegar sunburn Sophora: The first vinegar will add the net Sophora japonica to add a certain amount of rice vinegar mix well, slightly drowsy infiltration, until the vinegar was exhausted, stir fry the container, with a slow fire to a certain extent, remove the cool or dry, sieve Debris

3.2 Determination of rutin content

3.2.1 Preparation of sample solution. Respectively, Respectively, four kinds of Huaihua processed products 50g into powder, Put in a beaker, add 300ml of water, boil for 30 minutes (the experiment should pay attention to add appropriate amount of water, add evaporation loss), Take advantage of heat for filter, Filter residue and then extract twice (every time use water 250ml, boil for 15 minutes), filter, Combine the filtrate, placed 24 hours, So that the precipitate can be completely precipitated. Filter ,and the crude product was washed with a small amount of water to obtain the crude
product of rutin. Take rutin powder 0.100g, with 60% ethanol dissolved and set in 100ml volumetric flask, as the sample solution.

3.2.2 Preparation of rutin reference substance solution. Accurately weighed rutin reference substance about 5.00mg, placed in 50ml volumetric flask, add 40ml of methanol, set the water bath on the micro-heating, cooling to room temperature. Learn 10ml, set 100ml volumetric flask, add water set the volume, prepared into 0.1mg / ml reference solution, shake that is.

3.2.3 Drawing of standard curves. Precise amount of the reference solution is divided into 0,1,2,3,4,5,6ml, placed in the volume of each bottle plus 60% ethanol diluted 5 ml, 5 ml 60% ethanol solution is blank. Shake evenly, put it aside for 5 minutes, add 0.3ml 10% aluminum nitrate solution shaking evenly, then add 10% aluminum nitrate solution 0.3ml, put 5 minutes, add sodium hydroxide reagent 0.4ml, add water set the standard, place 30 minutes, UV spectrophotometer at 510nm measured absorbance, calculate the regression equation.

3.2.4 precision experiment. Take rutin Reference substance experiment, add 60% ethanol diluted to 5ml, add 5% sodium nitrite 0.3ml, shake, put it static aside for 10 minutes, then add 10% aluminum nitrate 0.3ml, shake, put it static 10 minutes, add 4% Sodium hydroxide 4ml, add 0.4ml 60% ethanol, shake, put it static aside for 15 minutes. The absorbance value was measured at a wavelength of 510 nm, Calculate its RSD.

3.2.5 stability experiment. Using the "3.2.3" experiment, In 10min, 20min, 30min, 40min, 50min measuring absorbance.

3.2.6 Repetitive experiment. Repeat the experiment with the solution made of Sophora japonica, Determination by "3.2.3" method, measuring its absorbance at its maximum absorption wavelength, Measured 6 times.

3.2.7 sample recovery rate of the experiment. The sample solution prepared by the extraction of Sophora japonica, Rutin was prepared as the sample solution. Accurate measurement of known rutin content of the sample solution for 105ml,110ml,200ml,220ml, placed in the volumetric flask, add rutin reference substance solution 110ml, after mixing, according to "3.2.3" method for determination.

3.3 Determination of quercetin content

3.3.1 Preparation of sample solution. Take each Sophora japonica processed products 50g, crushed. Accurately weighed Sophora japonica processed products of the powder, and then add 3-4 times the amount of solvent Water bath to extract pure matter, filter to leave the crude extract, add ethyl acetate, And crude extract ratio of 2: 1,40 °C water bath insulation 30min, quietly placed to wait for solution stratification, separate two phases, evaporated and dried and dried to obtain quercetin powder, Accurately weighed quercetin reference substance 20mg, Placed in 100ml volumetric flask, add 60% ethanol dissolved, so that the solution volume to 100ml, The resulting concentration was 0.10 g / L, which was used as a sample solution.

3.3.2 preparation of quercetin reference substance solution. Accurately weighed quercetin reference substance about 5.0mg, set 50ml volumetric flask, add 40ml methanol, water bath on the micro-heating, after cooling to room temperature. Absorb 10ml, set 100ml volumetric flask, add water set the volume, prepared into 0.1mg / ml reference solution, shake that is.

3.3.3 Quercetin standard curve drawing. Take the quercetin reference substance solution volume of 0,1,2,3,4,5 ml, as a linear range, Placed in 50ml volumetric flask, dissolved in 60% ethanol, added to
the limited capacity scale. At the maximum wavelength of 370nm, the relationship between the concentration of quercetin (y) and absorbance (x) was measured by ultraviolet spectrophotometry.

3.3.4 Precision experiment. Four kinds of processed samples were processed in the order of Health products Sophora japonica, Fried flowers, Charred sophora flower, Vinegar sunburn Sophora, according to the method of "3.3.3", and measure the absorbance 6 times continuously.

3.3.5 Stability experiment. According to "3.3.3" method, processing four samples by "3.3.3" method, and measure the absorbance at 10min, 20min, 30min, 40min, and 50min.

3.3.6 Repetitive experiment. According to the method of "3.3.3" precision take four kinds of processed samples for 5 copies, according to "3.3.3" method, preparation, measured absorbance, measured 6 times.

3.3.7 Sample recovery rate experiment. According to "3.3.3" steps accurately weighed the sample 5 copies, according to "3.3.3" method, preparation, add the reference substance to each sample 0.08 g / L, at its maximum absorption wavelength measured absorbance value.

3.3.8 Determination of sample content. Accurately weighed a certain amount of the control solution, configured as a solution, at 200 ~ 400nm scan the reference wavelength range, the results found at 370nm absorption peak maximum, least interference, so choose the 370nm absorption peak. And then through each processed products measured absorbance x into the regression equation, obtained the concentration of the test solution, and finally get the quality of quercetin, calculate the extraction rate.

4. Experimental results

4.1. Determination of rutin content.

4.1.1 Rutin standard curve. Rutin standard curve shown in Figure 1. The regression equation is calculated as $Y = 12.106x - 0.0025$ The linear relationship is shown in Figure 1.

![Rutin standard curve](image)

**Figure 1.** Rutin's standard curve.

4.1.2 Rutin precision experimental data. The results show that RSD =1.19%<5, the precision of this experiment is good.

4.1.3 Rutin stability experimental data. The results showed that RSD=2.44%<5%, the stability of this experiment is good.

4.1.4 Rutin repeatability data. The results showed that RSD =3.12%<5%, the reproducibility of this experiment is good.
rutin recovery rate of experimental data. The results show that RSD =3.37%<5%, the experimental precision is good, high accuracy, high sensitivity.

4.1.5 Determination of rutin in different processed products. The result :Health products Sophora japonica :10.83%; Fried Sophora japonica:11.26%; Charred sophora flower:5.62%;Vinegar sunburn Sophora:11.14%

4.2 Determination of quercetin content

4.2.1 Quercetin standard curve. At the maximum wavelength of 370 nm, the relationship between the concentration of quercetin (y) and absorbance (x) was measured by ultraviolet spectrophotometry. Draw a standard curve of quercetin. The standard curve of quercetin is shown in Figure 2.

4.2.2 the accuracy of quercetin experimental data. The results show that RSD=3.39% <5%, the experimental precision is good.

4.2.3 quercetin stability of the experimental data. The results showed that RSD =2.67%<5%, the stability of this experiment is good.

4.2.4 Reproductive test data of quercetin. The results showed that RSD 2.36%<5%, the reproducibility of this experiment is good.

4.2.5 quercetin recovery rate of experimental data. The results show that RSD=2.36% <5%, the experimental precision is good, accurate Du high, high sensitivity.

4.2.6 Determination of quercetin in different processed products. Health products Sophora japonica: 3.78%; Fried Sophora japonica:6.65%; Charred sophora flower:13.32%; 4.39%

5. Discussion
The effect of different processed products on the content of rutin in Sophora japonica L. was studied. From the experimental results, we can see that the content of rutin in the order of rutium is in the order of Fried Sophora japonica>Vinegar sunburn Sophora> Health products Sophora japonica> Charred sophora flower. The experimental results show that the higher the processing temperature, the higher the content of rutin; but the processing time is too long rutin content will gradually decrease.Four kinds of quercetin in the processed products from high to low arrangement of Charred sophora flower> Fried Sophora japonica> Vinegar sunburn Sophora>Health products Sophora japonica. The results of sample determination showed that the content of quercetin increased with the increase of temperature, and the quercetin content of Sophora japonica was about 5 times of that of Sophora japonica. Under certain conditions, the content of quercetin increases with temperature, but the content of quercetin will decrease when the temperature is too high.
6. conclusion
The results showed that the content of rutin increased with the increase of processing temperature. But if the processing time is too long, the rutin content will gradually decrease. The content of quercetin gradually increased with increasing temperature. And the content of quercetin in Fried Sophora japonica is about 5 times that of Health products Sophora japonica. Under certain processing conditions, the content of quercetin increases with increasing temperature. However, when the temperature is too high, the content of quercetin will show a downward trend.

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