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Study on drying methods and their influences on effective components of loquat flower tea

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ABSTRACT

Different drying methods and their influences on effective components contents of loquat flower tea were investigated in this study. The determination of total polyphenols (TP), total flavonoids (TF), free amino acid (AA), caffeine and triterpene acids showed relatively higher contents were found at full-bloom stage and in petal tissue. This stage flower was dried to produce loquat flower tea by methods of freeze drying, microwave drying, vacuum drying and hot-air drying, respectively. The results showed that four water-soluble components contents in tea prepared by freeze drying were the highest. Those by microwave drying increased firstly, then decreased with power, with the maximum at 420 W. In vacuum-dried tea, total polyphenols content (TPC) and total flavonoids content (TFC) reduced with temperature, but for AA, it increased with temperature. In hot-air dried flower tea, TPC and TFC exhibited a similar tendency as those by microwave dry, with the maximum at 80 °C and minimum at 40 °C. For AA, it increased with temperature. The contents of caffeine, triterpene acid in tea prepared by all drying methods showed no significant difference. It was concluded that the methods of freeze drying and microwave drying at 420 W can protect the effective components preferably.

1. Introduction

Loquat (*Eriobotrya japonica* (Lindl.) Thunb.) fruit is well known for its delicacy, nutrition and healthfulness. It originates from China, named as 'pipa' in Chinese phonetic alphabet, distributing in eastern, central southern and southwest regions of China, and has been cultivated for more than 2200 years. Now the yield of loquat has exceeded thirty-eight thousand tons in China, occupying two-thirds of that in the world. Moreover, loquat is also planted partly in Japan, Spain, Turkey, Brazil and so on, but is of less economic significance to these countries.

In China, fruit, kernel, leaves, and flowers of the loquat tree can all serve as traditional Chinese medicinal materials(Chen, Zhou, Chang, & Zeng, 2012; Dong, Jae & Hoon, 2011; Deng et al., 2006; Wang, Liu, Yu, Xiao, & Yang, 2006). Loquat flower is a kind of folk medicine for cough and asthma, and can be used to moisten lung for resting cough (Deng et al., 2006; Wang et al., 2009;). The flower is also rich in bioactive components such as flavone (Hu, Zhang, Liu, Tao, & Zhong, 2008; Zheng et al., 2009) and triterpene acid (Cheng, Liu, Chen, & Luo, 2001; Hu, Zhang, Liu, Zhang, & Tao, 2009; Li et al., 2009). These components may exert protective effects against cardiovascular disease (Somova, Nadar, Rammanan, & Shode, 2003), cancer (Ito et al., 2000), inflammation (Mix et al., 2001), hepatoprotection (Liu, 1995), and other chronic diseases (Koba, Matsuoka, Osada, & Huang, 2007). Moreover, loquat flower contains eighteen kinds of amino acids, of which eight necessary amino acids have a higher proportion.

The flowers of loquat, blooming from October to next April in North Hemisphere, a good source of honey for bees in winter, grow in clustering. Every inflorescence of the flower has 80–100 flowers, a very hugeness in quantity. But, only a small part of flowers can develop into fruits. About 60~80 percent of flowers were thinned or fall physiologically during flowering phase (Li et al., 2009). Unfortunately, most of loquat flowers thinned or falling had been discarded in the field, maybe because people did not know about them sufficiently or how to utilize them preferably. Till now, reports on detecting biological components of loquat flowers and how to

Abbreviations: TP, total polyphenols; TF, total flavonoids; TPC, total polyphenols content; TFC, total flavonoids content; AA, amino acid; OA, oleanolic acid; UA, ursolic acid; DPPH, 1, 1-diphenyl-2-picrylhydrazyl; ABTS, 2, 2′-azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid).

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process them effectively are scarce. Drying is commonly used to process fresh materials by removing their moisture, and the quality of dried products is dependent on drying methods applied (Dong, Fu, Ma, Mo, & Xia, 2011). Loquat flower is a kind of delicate material because its tissues are easy to be damaged, and its effective components are liable to be damaged. Thus, in order to preserve their effective components, more comprehensive studies are required.

The objective of this study was to investigate the effects of drying methods on the contents of effective components in loquat flower, and to find better drying ways to produce loquat flower tea with high effective components and good quality. Thereinto, TP, TF and triterpene acids are bioactive compounds, while the contents of AA and caffeine can affect the taste of tea soup. It is expected to get a new knowledge about loquat flower, and the information from this study can help consumers to better understand the potential health benefits of loquat flower.

2. Materials and methods

2.1. Materials

The whole inflorescences of loquat flower, as shown in Fig. 1, were carefully pruned using a scissors at 9:00–11:00 am on Nov. 8, 2013. The pruned inflorescences were then transported to the laboratory at once, and the flowers on inflorescences were picked off by hand. Different tissues of loquat flower were obtained by dividing the full-bloom flower into petal, calyx and stamen; and different bloom stages were classified by budding, post-budding, full-bloom and final-bloom of flowering (as shown in Fig. 1). The samples of different tissues and bloom stages were freeze-dried, and the contents of effective components in the dried samples were analyzed. The flowers of the stage adapt to produce flower tea were used to produce flower tea by different drying methods.

Standard samples of rutin, gallic acid, glutamic acid, caffeine, oleanolic acid and ursolic acid were obtained from Sinopharm Chemical Reagent Co., Ltd. (Shanghai, China). Free radicals of 1,1-diphenyl-2-picryl-hydrazyl (DPPH·), 2, 2′-Azino-bis (3-ethylbenzthiaz-oline-6-sulfonic acid) (ABTS·) were purchased from Sigma–Aldrich Chemical Co. (Shanghai, China). All other reagents were of analytical grade and made in China.

2.2. Methods

2.2.1. Different drying methods of loquat flower

Our previous study showed that pretreatment by microwave can inactivate the polyphenoloxidase and peroxidase in loquat flower. After loquat flowers were treated for 75 s at 420 W, the POD and PPO activities declined to below 5%. So loquat flowers were firstly pretreated for 75 s by microwave at 420 W, then dried by freeze drying for 16 h (Freeze Dryer, FD5508, SIM International, Co., Korea), hot-air drying (Electrothermal Blowing Dry Box, HG-9070A, Shanghai Jing Hong Laboratory Instrument Co., Ltd., China) at 40, 60, 80 and 100 °C singly for 8, 5, 3 and 1 h, microwave drying (Microwave Oven, WP700P21, Galanz Group Co., Ltd., China) at 140, 280, 420, 560 and 700 W singly for 14, 12, 8, 6 and 6 min, and vacuum drying (Vacuum Drying Box, DZF-6050, Shanghai Jing Hong Laboratory Instrument Co., Ltd., China) at 40, 50 and 60 °C singly for 8, 7 and 5 h, respectively.

2.2.2. Determination of the water content of loquat flower tea

The water content of loquat flower tea was determined according to the method of determination of moisture in foods (GB/T 5009.3, 2010). Firstly cleaned weighing bottle was dried to constant weight at 105 °C. Three gram loquat flower tea (accurate to 0.0001 g) was put into the weighing bottle. Then the bottle was dried to constant weight in Infrared rapid moisture tester (SH10A, Shanghai INESA Scientific Instrument Co., Ltd., China) at 105 °C, whose cap was inclined on it. Then the sample of loquat flower tea before and after dried was weighed respectively. So the gravimetric difference was obtained. The water content of loquat flower tea was calculated as the percentage ratio of gravimetric difference and original sample weight.

2.2.3. Extraction of effective components in loquat flower tea

2.2.3.1. Extraction of water-soluble effective components. In accordance with the objective to produce loquat flower tea, water-soluble effective components were extracted. One gram of dried loquat flower tea was extracted for 45 min at 80 °C using 150 mL of water. The extracted solution was used to analyze the contents of water-soluble effective components, namely, TP, TF, AA and caffeine, as well as radical scavenging activities.

2.2.3.2. Extraction of triterpene acids. Because main triterpene acids in loquat flower were OA and UA, which were liposoluble, they were extracted by ethanol (Wang, Zheng, & Lu, 2013). One gram of dried loquat flower tea was extracted for 40 min at 50 °C using 40 mL of 80% ethanol. The extracted solution was used to determine the contents of UA and OA by HPLC.

2.2.4. Analysis of the contents of effective compounds

2.2.4.1. Analysis of total polyphenols content (TPC). TPC in dried loquat flower tea was determined by the Foline-Ciocalteu colorimetric method (Yang, Jia, & Zu, 2009). A 1-mL sample extract obtained from loquat flower tea and 1 mL of 0–0.025 g/L gallic acid standard solutions was put into a series of 25-mL test tubes with 0.5-mL Foline Ciocalteau reagent respectively. After sitting at room temperature for 5 min, the mixture was added with 5-mL 5% Na_2CO_3, and placed for 60 min at room temperature. The absorbances of the sample and standards were measured

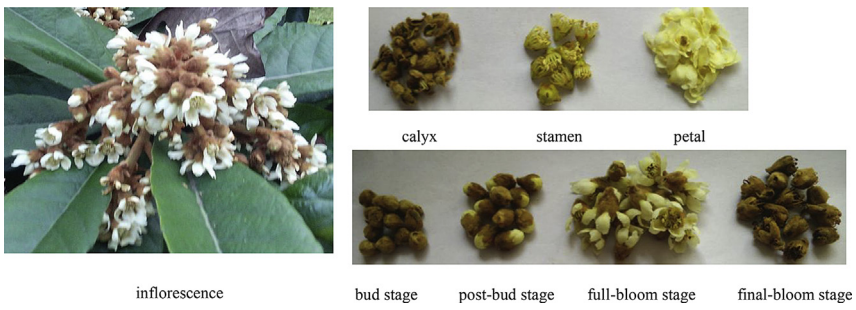

Fig. 1. Photographs of inflorescence, tissues and bloom stages of loquat flower.