

Study on the Different Method of Extraction of Star Anise Oil

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Abstract: The three reagents of anhydrous ethanol, petroleum ether and ethyl acetate were selected by soxhlet extraction, steam distillation and ultrasonic extraction to extract the star anise oil from the fine anise powder. Three kinds of methods for extracting star anise oil were studied on different pattern organic solvent. The result of the different volume fractions of ethanol is that the highest extraction rate is 99.7% ethanol. It can be seen that the extraction rate are: ethanol > petroleum ether > acetic acid ethyl ester. The different methods of extracting the star anise oil shows that the extraction rate are: soxhlet extraction method > ultrasonic extraction method > steam distillation extraction method. In summary, it can be seen by soxhlet extraction method and the best solvent is 99.7% ethanol.

1 Introduction

Star anise is also known as star anise and anise. Its trees grow in southwest China with an annual output of 3000 tons. Its color is dark brown and has a sweet taste and a strong aromatic smell, which comes from the volatile anisaldehyde in it. Dried and mature anise contains about 5%-8% aromatic oil, about 22% fatty oil, protein and shikimic acid, etc^[1-2]. Star anise oil is a kind of natural flavor oil with complex components extracted from the fruits or leaves of anise, generally as a volatile oil-like liquid. The essential oil mainly contains anisole, in addition, it also contains anisaldehyde, p-allyl isoprene, flavonoids and organic acids^[3-4].

In the past decades, star anise is just a condiment to the cook. With the development of science and technology, more and more active components of star anise had been discovered. In recent years, star anise oil has been proved to have a benefit on bacteriostatic, insecticidal and anti-free radical oxidation activities. The main ingredient in star anise oil, anisole, was also found that exhibits various pharmacological properties such as anesthetic, antimicrobial, anti-inflammatory and antioxidant activities^[5-6]. Besides, anisole has been conveniently transformed to a functional monomer which possess good thermostability and good mechanical properties^[7-10].

In the traditional use, star anise fruit is directly used, and the utilization rate of star anise oil is low. With the development of the food industry, the extraction of star anise oil has replaced the use of star anise fruit because of its small size, sanitation, easily to use, and less added amount. In order to improve the yield of star anise oil, it

is necessary to study the extraction technology of star anise oil.

At present, the common extraction methods of anisole oil at home and abroad include soxhlet extraction, steam distillation, ultrasonic extraction, supercritical CO₂ fluid extraction, etc^[11-13]. Different extracted solvent not only has a great influence on the work of star anise oil and its components, but also its physical properties^[14-16].

There are few studies on the influence of content determination and extraction effect under laboratory conditions. The methods adopted in this study are soxhlet extraction, steam distillation and ultrasonic extraction to extract star anise oil. The differences between the same method and different solvent extraction and the differences between different methods to extract star anise oil were studied.

2 MATERIALS AND METHODS

2.1. Materials and measurements

All commercially available chemicals were of reagent grade and used as received without further purification. The star anise powder can be obtained by drying the star anise under 100°C for more than 4h, grinding and sifting through a suitable sieve. Infrared spectra were measured on a Nicolet 380 FT-IR spectrometer in the region of 400 ~ 4000 cm⁻¹ using KBr pellets.

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2.2. Method of extraction

2.2.1. Soxhlet extraction

The device diagram is shown in the figure 1.



Figure 1 Soxhlet extraction

Extraction by different solvents A mixture of 18.0g star anise powder and 80mL organic solvent (ethanol/petroleum ether/ethyl acetate) was stirred under 50V. When mixture is close to colorless, stop heating. Vacuum distillation with rotary evaporator will steam out a lot of solvent. The distillation ends when no condensation drops. After cooling, the mass of the product was weighed and the extraction rate was calculated.

Extraction by different volume fractions of ethanol A mixture of 18.0g star anise powder and 80 mL ethanol was stirred under 50V volts. When mixture is close to colorless, stop heating. Repeating the above operation and calculating the extraction rate was calculated.

2.2.2. Water vapor distillation

The device diagram is shown in the figure 2.



Figure 2 Water vapor distillation

A mixture of 30.0g star anise powder and 150 mL distilled water was stirred and refluxed for 3 hours. When mixture is nearly colorless, stop heating. After distilling and cooling, the mass of the product was weighed and the extraction rate was calculated.

2.2.3. Ultrasonic extraction

A mixture of 10.0g star anise powder and 200mL organic solvent(ethanol/petroleum ether/ethyl acetate) was carried by ultrasonic cleaner under the temperature of 40°C for one hour. After distilling and cooling, the mass of the product was weighed and the extraction rate was calculated.

3. Results & Discussion

3.1. FTIR measurement results

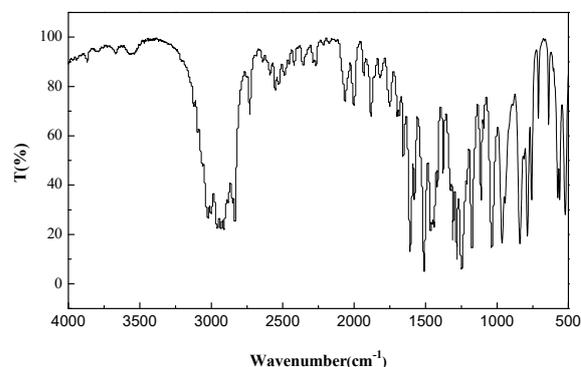


Figure 3 The infrared spectrum of star anise oil

Since star anise oil contains 80-90% of anisole, infrared spectrum is used to determine whether the extract contains anisole. As shown in figure 3: 3005.73cm⁻¹ (C-H); 2934.65cm⁻¹ (-CH₃); 2856.72cm⁻¹ (-CH₂); 1600.50cm⁻¹ (C=C); 1458.34cm⁻¹ (-CH₂); 1000cm⁻¹ (C-O) and 843.55cm⁻¹ (C-H on the benzene ring). It can be seen that the extraction of star anise contains various functional groups such as double bond, alkoxy groups, benzene ring in the molecule, which is basically consistent with the known structure.

3.2. Different organic solvent by soxhlet extraction

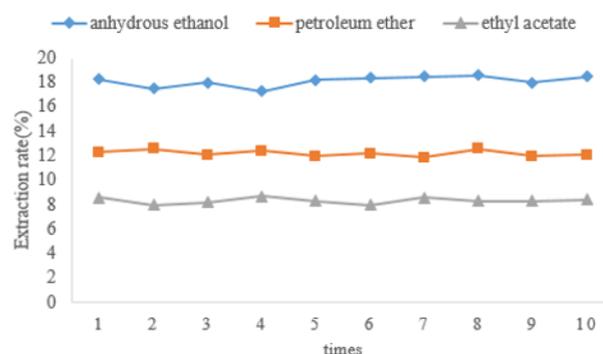


Figure 4 Extraction rates under different solvents

In the soxhlet method, anhydrous ethanol, petroleum ether and ethyl acetate were used to extract aniseed oil under the same experimental conditions. As can be seen from the figure 4, when anhydrous ethanol was used as an organic solvent, the extraction rate of star anise oil was the highest, with the highest value being 18.6%.

3.3. Different volume fractions of ethanol by soxhlet extraction

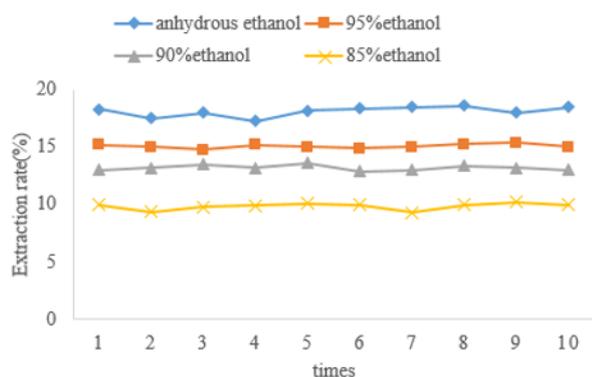


Figure 5 Extraction rates under different volume fractions of ethanol

In order to observe whether the concentration of ethanol has any effect on the extraction rate of star anise oil, experiments were carried out at the volume fractions of ethanol of 85%, 90%, 95% and 99.7% (anhydrous ethanol) respectively. As can be seen from the figure 5, the highest extraction rate was 99.7% of anhydrous ethanol.

3.4. Different organic solvent by ultrasonic extraction

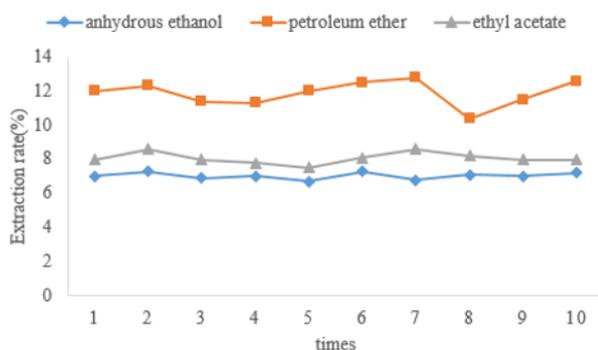


Figure 6 Extraction rates under different organic solvent by ultrasonic extraction

Anhydrous ethanol, petroleum ether and ethyl acetate were used to extract star anise oil under the same experimental conditions by ultrasonic cleaner. As can be seen from the figure, when petroleum ether was used as an organic solvent, the extraction rate of star anise oil was the highest, with the highest value being 12.8%.

3.5. Comparison of three methods

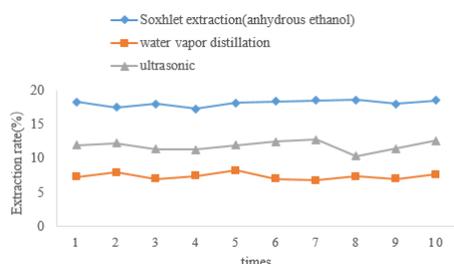


Figure 7 Extraction rates under comparison of three methods

Compared with the three methods, it can be seen from figure that the extraction yield of soxhlet extraction is significantly higher than the other two methods.

4 Conclusions

The result of the different volume fractions of ethanol is that the highest extraction rate is 99.7% ethanol. It can be seen that the extraction yield are: ethanol > petroleum ether > acetic acid ethyl ester. Extracting the star anise oil from different methods shows that the extraction yield are: soxhlet extraction method > ultrasonic extraction method > steam distillation extraction method. In summary, it can be seen by soxhlet extraction method and the best solvent is 99.7% ethanol.

Acknowledgments

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