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Study on Extraction Technology of Polysaccharides from Jujube by Microwave Method

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Abstract

Jujube polysaccharide is one of the important natural active ingredients. In this paper, microwave extraction technology was utilized to extract jujube polysaccharide in different conditions using the yield as test index. The results showed that the optimum conditions were solid-liquid ratio 1:30, ultrasonic lasting time 25 min, temperature 50˚C, which achieve the highest yield rate 5.38%.

Subject Areas

Analytical Chemistry

Keywords

Microwave Extraction, Polysaccharides, Jujube

1. Introduction

Ziziphus jujube, the fruits of rhamnales, is one of Chinese traditional health foods, which has been applied in curing deficiency of qi and weakness of the spleen as a Chinese medicine for about 2000 years [1]. It has been found in recent pharmacological studies that a variety of natural bioactive substances are contained in jujube, such as polysaccharides, flavonoids and dietary fiber [2] [3] [4]. Polysaccharides are composed of a number of monosaccharides joined by glycosidic bonds, which have medical effects of the immunoregulatory, lowering blood lipids and antitumor. The main extraction methods of polysaccharides from jujube in recent reports are hot water bath extraction, organic solvent extraction and sour alkali soak extraction, while these methods have some disadvantages like long extraction time, low extraction efficiency and high impurity content.

The principle of microwave assisted extraction is to let rays penetrate the cell wall to reach the cell interior under microwave, making temperature rise and pressure increase, thus the cell wall would be broken, at the same time, the effective components inside of the cell are released and transferred into the solution [5] [6]. In this paper, microwave extraction technology was utilized to extract jujube polysaccharides.

2. Experimental

2.1. Materials and Methods

2.1.1 Materials

Chinese jujube were bought in the local area, after cleaned and dried to constant weight at 50˚C, they were ground to the particle size 60 mesh. Glucose, sulfuric acid and phenol were purchased from Chemical Reagent Co. Ltd. (Tianjin, China). All the solvent used are analytical reagent.

Instruments: high speed disintegrator, Midea M1-L202B microwave oven and 751 UV spectrophotometer.

2.1.2. Determination of the Drawing of Standard Curve

10.0 mg glucose was dissolved in distilled water, then transferred into a 250 mL volumetric flask to calibrate, shaked up and placed still. Afterwards 0.0, 0.2.0, 0.4, 0.6, 0.8, 1.0, and 1.2 mL glucose standard solution were sucked up respectively to different 2 mL comparison tubes, then added 1.0 mL 6% phenol solution and 5.0 mL sulfuric acid to each test tube. Used distilled water as a reference to measure its absorbance at 490 nm, thus obtained the standard curve under different concentrations. The equation between Absorbance (Y) and concentration of glucose (X) in the scope of measurement was: $Y = 7.81868X + 0.10226$, $R^2 = 0.9980$ (**Figure 1**).

2.1.3. Calculation of Polysaccharide Yield

Polysaccharide extraction yield (%) = determined polysaccharide mass/raw material mass × 100%.

3. Results and Discussion

The extraction yield of polysaccharide is mainly influenced by extraction temper-

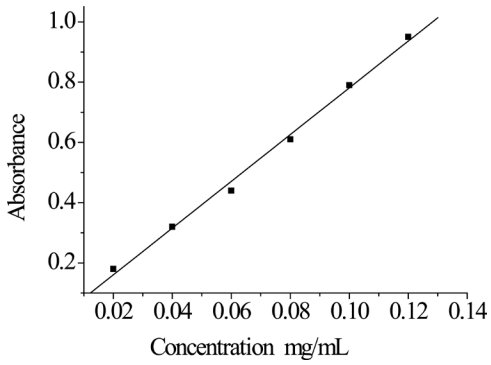

Figure 1. Standard curves of glucose solution.

ature, time and weight ratio of liquid/solid. In order to control the extraction temperature exactly, we maintain microwave power at 300 W, the three factors above are investigated to study effect on the extraction yield.

3.1. Effect of Temperature on Extraction Yield

Temperature is an important factor of extraction yield. It is shown that the different yield of polysaccharide from jujube at different temperature in Figure 2. High temperature would increase the solubility of polysaccharide from jujube, as is seen in the temperature scope from 20˚C to 50˚C. But higher temperature beyond 50˚C will cause degradation of polysaccharide.

3.2. Effect of Radiation Time on the Extraction Yield

Microwave radiation time is another important factor influenced the yield of polysaccharide. The results show in Figure 3 that under microwave radiation, the yield is increasing among 10 - 25 min and reach the maximum 5.3%, afterwards it falls. It illustrates that the structure of polysaccharide could be changed and the sugar chain be broken, so that overlong radiation time would also cause degradation of polysaccharide.

3.3. Effect of Weight Ratio of Solid/Liquid on the Extraction Yield

We can clearly know from Figure 4 that the ration of solid/ liquid is obviously

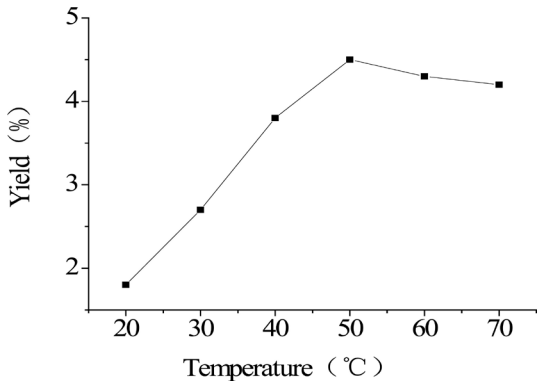

Figure 2. Effect of temperature on the extraction yield.

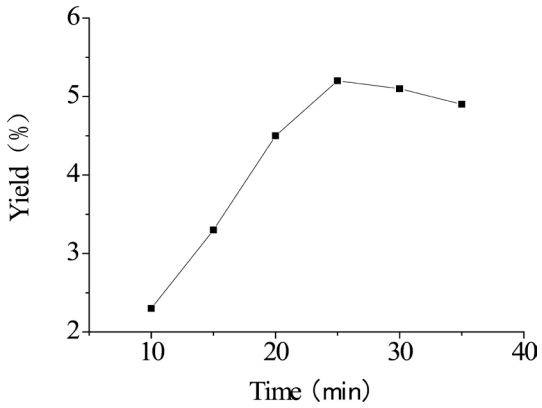

Figure 3. Effect of time on the extraction yield.

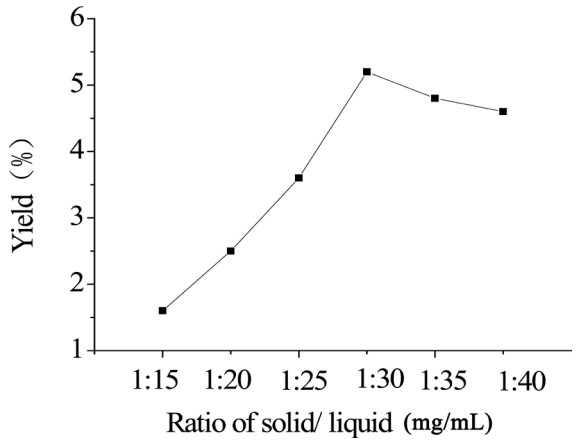

Figure 4. Effect of weight ratio of liquid/solid on the extraction yield.

influenced the yield, the yield is increasing in accordance with the augment of ration of solid/liquid, considering the cost and difficulty of separation, the ratio 1:30 is preferred.

4. Conclusion

In this study, it was investigated the extraction of polysaccharide from jujube based on single-factor tests using microwave radiation method. We obtain the optimization condition at 300 W power, extraction time 25 min, temperature 50˚C, weight ratio of solid/liquid 1:30. The extraction process has some advantages like mild condition, short time and easy post-process, which provides a technical possibility for local jujube's deep processing.

Acknowledgements

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