

Contents List available at VOLKSON PRESS

New Materials and Intelligent Manufacturing (NMIM)

DOI: http://doi.org/10.26480/icnmim.01.2018.326.329

Journal Homepage: https://topicsonchemeng.org.my/



ISBN: 978-1-948012-12-6

POLYSACCHARIDE EXTRACTED FROM ARMILLARIA MELLEA BY ULTRASONIC-ASSISTED METHOD

Xin Zhong, Hui-Ying Jiang, Jun-Lin Guo, Zhi-Chen Liu, Li-Ying Yu*

Jilin Institute of Chemical Technology, Jilin City, Jilin, 132022, P. R. China.

This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ARTICLE DETAILS

ABSTRACT

Article History:

Received 26 June 2018 Accepted 2 July 2018 Available online 1 August 2018 Polysaccharides extracted from Armillaria Mellea by Ultrasonic assisted method was studied in this paper. Single factor and orthogonal experiments were used to determine the optimum extraction conditions. The content of polysaccharides in Armillaria Mellea was determined by phenol sulfuric acid colorimetry. The optimum extraction conditions were as follows: the extraction time was 30s, the ultrasonic power was 200 W, the ratio of the material to liquid was 1:20. The extraction rate of the total polysaccharide in the Armillaria Mellea could reach 3.17% under the optimum conditions.

KEYWORDS

Armillaria Mellea, Ultrasonic-assisted Method, Extraction, Polysaccharide.

1. INTRODUCTION

Wild mushroom (armillaria mellea) is also called Armillaria mellea. It is a kind of extremely important fungus at medicinal and food in our country. The major chemical constituents of Armillaria mellea include proteins, amino acid, lipid compounds, and purine derivatives. Armillaria mellea is enriched with trace elements, such as Copper, Iron, Zinc, Manganese and other nutrients vitamin C, and so on. Armillaria mellea has an effect on antiapoptosis and antioxidation, treating with epilepsy, hypoglycemic, lumbocrural pain and rickets. People can prevent poor eyesight, night blindness and dry skin by eating it daily [1-3]. It also builds up the ability of resist infection in respiratory and digestive tract [4].

Polysaccharide (polysaccharide) is widely distributed in animals, plants and microorganisms [5]. It contains more than ten monosaccharides units joined by glycosidic bonds, natural polymers, which contains ketone and aldehyde. The polysacchanae has many kinds of bioactivities, such as antitumor, anti-aging, anti-oxidative, anti-inflammation and immunomodulating, and so on [6-9]. Using polysaccharide extracted from Armillaria mellea may be a bright prospect in the future. It has profound action at foodstuffs and pharmaceuticals. Accordingly, it's significant for using Armillaria mellea as material to extract polysaccharide.

The extraction methods of natural products mainly include hot water extraction, enzymolysis, microwave-assisted and micro-pressure, etc [10-13]. But these methods need to consume a long time. Ultrasonic-assisted extraction (Ultrasonic-assisted extraction, UAE) utilizes the ultrasound generated by cavitations, vibration wave and stirring to destroy the cell wall. It can lead the solvent to reach the interior of entire cell, accelerate the movement of molecules and increase the dissolution of effect constitutes [14]. Therefore, compared with other methods the rate of abstraction can be greatly improve, and the time can be shorten. This is an effective extraction method.

2. EXPERIMENTAL

2.1 Materials and chemicals

Armillaria Mellea were purchased from local market. Armillaria Mellea was dried and smashed to powder, and then kept at $3-7^{\circ}$ C in a refrigerator

until used. All other chemicals used in this experiment were analytical reagent grade and purchased from local chemical suppliers in China.

2.2 UAE of polysaccharides from Armillaria Mellea

For the UAE experiments, 2 g of dried Armillaria Mellea powder was mixed with an appropriate amount of distilled water in a 100 ml flask with three necks. Experiments were performed using Xianghu Microwave & Ultrasonic & UV Combination Instrument (XH-300UL, Xianghu,China) was extracted with water, and a fivefold volume of ethanol was added into the concentrated solution for precipitating polysaccharide. Based on previous research, the orthogonal matrix method was used for optimizing the extracting condition. The content of polysaccharide in the extract was determined by phenol-sulfuric acid method, at 490 nm. The linear equation was A=0.0297 C-0.0113 with correlation coefficient of 0.9999.

The content of polysaccharide in the extract and the yield of polysaccharide in Armillaria Mellea were calculated by the following equations:

Polysaccharide content in the extract % $(w/w) = \frac{\text{concentration} \times \text{diluted times} \times \text{sample volume}}{\text{sample weight}} \times 100\%$

Polysaccharide yield % $(w/w) = \frac{\text{Polysaccharide content} \times \text{the extract weight}}{\text{Armillaria Melle weight (2g)}} \times 10004$

3. RESULTS AND DISCUSSION

3.1 Effect of extraction time on polysaccharide yield

The effect of extraction time on the polysaccharide yield was shown in Fig. 1. Different extraction times were tested, and other extraction conditions were kept as follows: ultrasonic power was 120W, and the ratio of material to solution was 1:20 (g/mL). The polysaccharide yield was rapidly increased as the extraction time from 15s to 30s. A maximum yield 2.34% was achieved. With the further increase of extraction time, the yield was decreased. The results indicated that the optimum time of extraction was 30s.

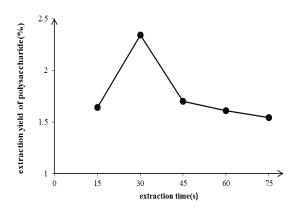


Figure 1: Effect of different extraction time of polysaccharide yield

3.2 Effect of ultrasonic power on polysaccharide yield

The effect of ultrasonic power on the polysaccharide yield was shown in Fig. 2. Different ultrasonic power were tested, and other extraction conditions were kept as follows: the extraction time was 30s, and the ratio of material to solution was 1: 20 (g/mL). The polysaccharide yield was rapidly increased as the ultrasonic power from 100W to 200W. A maximum yield 2.16% was achieved. With the further increase of ultrasonic power, the extraction yield of polysaccharide was decreased. The results indicated that the optimum ultrasonic power was 200W.

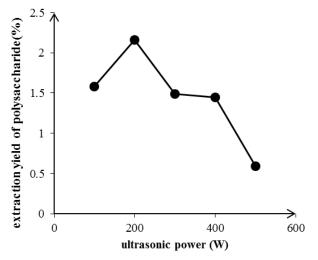


Figure 2: Effect of different ultrasonic power of polysaccharide yield

3.3 Effect of the ratio of material to solution on polysaccharide yield

The effect of the ratio of material to solution on the polysaccharide yield was shown in Fig. 3. Different the ratio of material to solution were tested, and other extraction conditions were kept as follows: the extraction time was 30s, the ultrasonic power was 200W. The polysaccharide yield was rapidly increased as the ratio of material to solution from 1: 10 (g/mL) to 1: 20 (g/mL). A maximum yield 2.56% was achieved. With the further increase of the ratio of material to solution, the extraction yield of polysaccharide was decreased. The results indicated that the optimum ratio of material to solution was 1: 20 (g/mL). When the solvent was little, the raw material couldn't be fully dissolved. With the increase of solvent volume including Armillaria Mellea and solvent, the extraction rate of polysaccharide was also increased. However, the excessive amount of solvent led to the reduction of ultrasonic absorption of materials and the dissolution of incomplete polysaccharides.

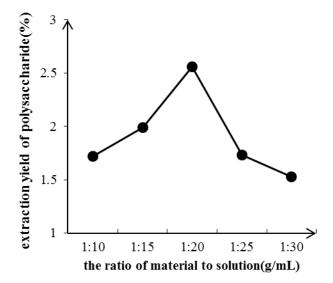


Figure 3: Effect of different the ratio of material to solution of polysaccharide yield

3.4 Orthogonal experiment

The design of three levels orthogonal experiment and the results of extracting polysaccharide from Ginkgo biloba leaves were shown in Table 1 and Table 2, respectively.

Level	Factor				
	A ultrasonic power (W)	B extraction time (S)	C Armillaria Mellea : water (g/mL)		
1	100	15	1:15		
2	200	30	1:20		
3	300	45	1:25		

Table 1: Factor and level of experiment

Table 2: Design and results of orthogonal experiment L 9 (33)

Test no.	Factor			
	A ultrasonic power (W)	B extraction time (S)	C Armillaria Mellea : water (g/mL)	extraction yield (%)
1	1	1	1	2.34
2	1	2	2	2.52
3	1	3	3	2.19
4	2	1	2	2.72
5	2	2	3	1.92
6	2	3	1	2.37
7	3	1	3	1.97
8	3	2	1	1.58
9	3	3	2	3.00
K _{1j}	2.35	2.34	2.10	
K _{2j}	2.34	2.01	2.75	
K _{3j}	2.18	2.52	2.03	
R	0.17	0.51	0.72	
R order	C > B > A			
Best level	A_1	B_3	C2	

The results indicated that the primary influencing factor (R value) in the extraction yield of polysaccharide was the ratio of material to solution, and the optimum condition was $A_1B_3C_2$. The optimum condition was the ratio of material to solution 1:20, ultrasonic power 200W and reaction time 30s. Under this condition, the yield of polysaccharide extracted from Armillaria Mellea was 3.17%.

4. CONCLUSIONS

Polysaccharides extracted from Armillaria Mellea by Ultrasonic assisted method was studied in this paper. The optimum extraction conditions of Polysaccharide extracted from Armillaria Armillaria were established. Optimum extraction condition of polysaccharide was performed by orthogonal experiment. The extraction yield of polysaccharide was 3.17% in Armillaria Mellea.

REFERENCES

- [1] An, S.S., Lu, W.Q., Zhang, Y.F., Yuan, Q.X., Wang, D. 2017. Pharmacologic alBasis for Use of Armillaria mellea Polysaccharides in Alzheimer's Diseas e: Antiapoptosis and Antioxidation. Oxidative Medicine and Cellular Long evity, doi: org/10.1155/2017/4184562
- [2] Zhang, S., Liu, X., Yan, L. 2015. Chemical compositions and antioxidant

activities of polysaccharides from the sporophores and cultured products of Armillaria mellea. Molecules, 20(4), 5680-5697. doi: 10.3390/molecule s20045680

- [3] Yong, T., Chen, S., Xie, Y., Chen, D., Su, J., Shuai, O., Hu, H., Zuo, D., Liang, D. 2018. Hypouricemic Effects of Armillaria mellea on Hyperuricemic Mic e Regulated through OAT1 and CNT2. Am J Chin Med, 1-15. doi: 10.1142/S0192415X18500301
- [4] Chang, C.C., Cheng, J.J., Lee, I.J., Lu, M.K. 2018. Purification, structural el ucidation, and anti-inflammatory activity of xylosyl galactofucan from Ar millaria mellea. International Journal of Biological Macromolecules, 584-5 91. doi: 10.1016/j.ijbiomac.2018.02.033
- [5] Tang, Y., Zhu, Z.Y., Pan, L.C. 2018. Structure analysis and anti-fatigue ac tivity of a polysaccharide from Lepidium meyenii Walp. Natural Product R esearch, 1. doi: 10.1080/14786419.2018.1452017
- [6] Yu, Y., Shen, M., Song, Q., Xie, J. 2018. Biological activities and pharmac eutical applications of polysaccharide from natural resources: a review, C arbohydr Polym, 183, 91-101. doi: org/10.1016/j.carbpol.2017.12.009
- [7] Li, S., Liu, H., Wang, W., Wang, X., Zhang, C., Zhang, J. 2017. Antioxidant and anti-aging effects of acidic-extractable polysaccharides by agaricus bi sporus. International Journal of Biological Macromolecules, 1297-1306. d

oi: 10.1016/j.ijbiomac.2017.08.135

- [8] Liu, M., Li, S., Wang, X., Zhu, Y., Zhang, J., Liu, H. 2018. Characterization, anti-oxidation and anti-inflammation of polysaccharides by hypsizygus m armoreus against lps-induced toxicity on lung. Int J Biol Macromol, 111, 1 21-128, doi: org/10.1016/j.ijbiomac.2018.01.010
- [9] Zheng, R., Jie, S.D., Moucheng, W. 2005. Characterization and immuno modulating activities of polysaccharide from lentinus edodes. Internation al Immunopharmacology, 5 (5), 811-820. doi: org/10.1016/j.intimp.2004.11.011
- [10] Wang, K.T., Jing, C., Wood, C., Nagardeolekar, A., Kohan, N., Dongre, P. 2017. Toward complete utilization of miscanthus in a hot-water extractio n-based biorefinery. Energies, 11, doi: org/10.3390/en11010039
- [11] Sheng, Y.P., Ya, M.L., Xin, C.L. 2012. Optimization of enzymatic hydrol ytic extraction conditions for high yield polysaccharide manufacturing from liquid fermented materials of hypsizigus marmoreus. Applied Mechani

- cs and Materials, 145, 154-158, doi: org/10.4028/www.scientific.net/AM $\rm M.145.154$
- [12] Yuan, Y., Xu, X., Jing, C., Zou, P., Zhang, C., Li, Y. 2017. Microwave assisted hydrothermal extraction of polysaccharides from ulva prolifera: functional properties and bioactivities. Carbohydr Polym, 181, 902-910, doi: or g/10.1016/j.carbpol.2017.11.061
- [13] Bi, Y.G., Wang, Z., Huang, H.L., Chen, X.W., Liu, X.M., Yu, H. 2017. Exper imental Research on Single Factor Ultrasonic Assisted Extraction of Polys accharides from Gracilaria lemaneiformis. International Conference on Ad vanced Material Engineering, doi: 10.2991/ame-17.2017.15
- [14] Hanafiah, M.M., Ali, M.Y.M., Aziz, N.I.H.A., John, A. 2017. Biogas Production From Agrowaste And Effluents. Acta Chemica Malaysia, 1 (1), 13-15, doi: 10.26480/acmy.01.2017.13.15

