

yield of polysaccharide from *P. sinjiangensis* K.Y. Pan is shown in Figure 3. First, the number of extractions were set at 1, 2, and 3, while other extraction parameters were given as following: ratio of solvent to raw material 10:1, extraction temperature 85°C and duration of extraction 2 h. The extraction yield of the polysaccharide significantly increased from 17.50% to 38.67% as the number of extractions increased from 1 to 2 as showed in Figure 3. With increasing number of extractions from 2 to 3, the

extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan increased slowly. The maximum was 38.67% when the number of extractions was 2 [Figure 3].

Table 2: Factors and levels for orthogonal test

Variable	Level		
	1	2	3
Ratio of solvent to raw material	8:1	10:1	12:1
Number of extractions	1	2	3
Duration of extraction (h)	1.5	2	2.5

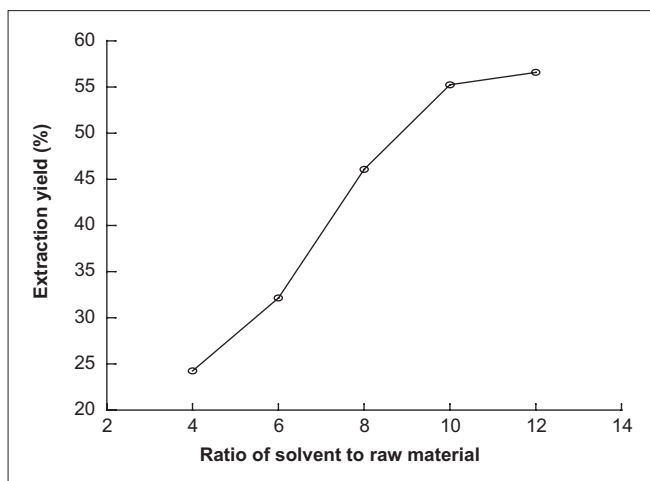


Figure 2: Effect of ratio of solvent to raw material on extraction yield of polysaccharide from *Paeonia sinjiangensis* K.Y. Pan

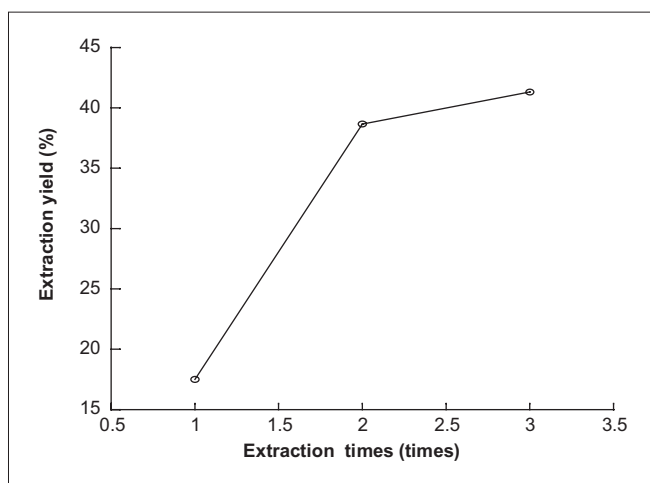


Figure 3: Effect of number of extractions on extraction yield of polysaccharide from *Paeonia sinjiangensis* K.Y. Pan

Effect of duration of extraction on extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan

Duration of extraction is another factor that would influence the extraction yield. The effect of duration of extraction on extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan is shown in Figure 4. First, the duration of extraction was set at 0.5, 1.0, 1.5, 2.0, and 2.5 h, while the other extraction parameters were given as the following: ratio of solvent to raw material 10:1, extraction temperature 85°C and number of extractions 2. It could be found that by increasing the duration of extraction from 0.5 to 2 h, the extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan increased from low to high and at 2 h to maximum, the extraction yield changed slowly.

Effect of extraction temperature on extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan

In this work, the efficiencies of different extraction temperatures on the extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan were investigated, and the results are listed in Figure 5. First, the other extraction conditions of polysaccharide from *P. sinjiangensis* K.Y. Pan, such as the ratio of solvent to raw material, duration of extraction, and number of extractions were fixed at 10:1, 2 h, and 2, respectively, and extraction temperature was slightly changed. As shown in Figure 5, the extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan continued to increase with the increasing temperature and reached the peak value (48.74%) when extraction temperature was 85°C. The extraction yield of polysaccharide from *P. sinjiangensis* K.Y. Pan changed slowly after the extraction temperature exceeded 85°C.

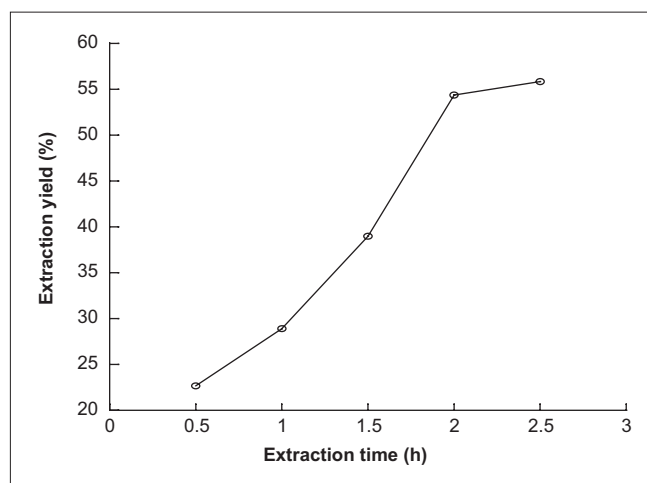


Figure 4: Effect of duration of extraction on extraction yield of polysaccharide from *Paeonia sinjiangensis* K.Y. Pan

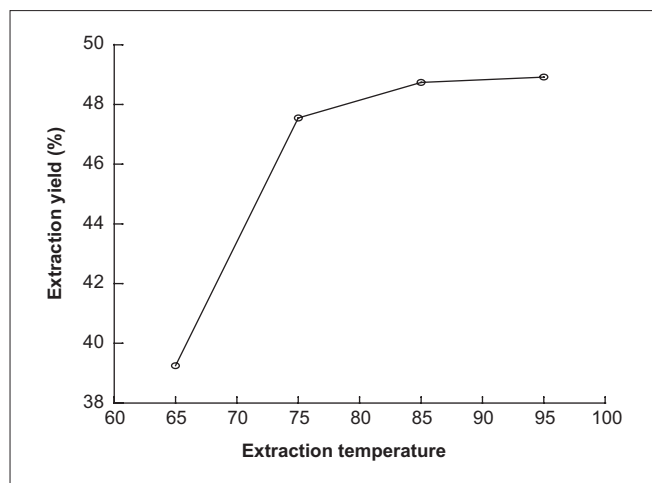


Figure 5: Effect of extraction temperature on extraction yield of polysaccharide from *Paeonia sinjiangensis* K.Y. Pan

Optimization of the extraction parameters of polysaccharide from *P. sinjiangensis* K.Y. Pan

The first step in the extraction procedure of polysaccharide from *P. sinjiangensis* K.Y. Pan is to optimize the operating conditions to obtain an efficient extraction of the target compounds and avoid the co-extraction of the undesired compounds, such as fatty acids and their esters. Since various parameters potentially affect the extraction process, the optimization of the experimental conditions is a critical step in the development of a solvent extraction method. In fact, the ratio of solvent to raw material, number of extractions, and duration of extraction are generally considered to be the most important factors. Optimization of the suitable extraction conditions in the polysaccharide extraction can be carried out by using an experimental design. In the present study, all the selected factors were examined using an orthogonal $L_9(3)^4$ test design. The total evaluation index was used to analyze by statistical method. The results of orthogonal test and extreme difference analysis are presented in Tables 3 and 4. The analysis of variance was performed by statistical software SPSS 12.0 (SPSS Inc.) and the result is listed in Table 4.

The extract obtained from each test in the polysaccharide extraction was weighed and quantitatively analyzed and then the extraction yields of the crude extract and each compound were calculated. The results of experiments presented in Table 3 indicate that the maximum extraction yield of the crude extract was 51.57%. However, we could not select the best extraction conditions only based on these outcomes in Table 3, and a further orthogonal analysis was warranted. Thus, the K , k , and R values were calculated and listed in Table 3. As seen from Table 3, we can find that the influence to the mean extraction yields of the compounds decreases in the order: $A > C > B >$

Table 3: Analysis of $L_9(3)^4$ test results

No.	A, ratio of solvent to raw material	B, number of extractions	C, duration of extraction (h)	D, blank factor	Extraction yield (%)
1	1	1	1	1	51.43
2	1	2	2	2	50.64
3	1	3	3	3	51.57
4	2	1	2	3	48.14
5	2	2	3	1	49.55
6	2	3	1	2	49.26
7	3	1	3	2	41.93
8	3	2	1	3	44.89
9	3	3	2	1	42.45
K_1	153.64	141.5	145.58	143.31	
K_2	146.95	145.08	141.23	141.83	
K_3	129.07	143.08	143.05	144.6	
R	8.12	1.19	1.45	0.92	

Table 4: Variance analysis results

Variation sources	SS	V	MS	F	P
A	105.69	2	52.85	81.99	<0.05
B	2.14	2	1.07	1.66	>0.05
C	3.18	2	1.59	2.47	>0.05
D	1.29	2	0.64	1	
Error	1.29	2	0.64		

SS; V_i ; MS; $F_{0.05(2,2)} = 19$

D according to the R values. The ratio of solvent to raw material was found to be the most important determinant of the yield. In other words, the maximum yield of the polysaccharide was obtained when ratio of solvent to raw material, number of extractions, and duration of extraction were 8:1, 2, and 1.5 h, respectively.

CONCLUSION

From the experiment, we can conclude that the ratio of solvent to raw material was the most important determinant of the yield. The highest yield was obtained when ratio of solvent to raw material, number of extractions, and duration of extraction were 8:1, 2, and 1.5 h, respectively. The content of soluble polysaccharide is 51.57%. In this article, *P. sinjiangensis* K.Y. Pan-enriched polysaccharide is used as an experimental material to study the effect of proportion, temperature, times, and time on extraction yield of polysaccharide through a single-factor exploration. The results showed that the ratio of solvent to raw material, number of extractions, and duration of extraction were the main variables that influenced the yields of the extracts and were investigated through an orthogonal experiment ($L_9(3)^4$) to get the best extraction conditions.

The separation procedure of precipitation with alcohol and the purification by removing the proteins were deeply analyzed. Meanwhile, the contents of polysaccharide were determined by anthrone colorimetry. Besides, from the large amount of concerned literature, it was found that few reports have been published regarding the polysaccharide from *P. sinjiangensis* K.Y. Pan. However, the article has done the preliminary research of the polysaccharide from *P. sinjiangensis* K.Y. Pan. So it can be used as a reference to do further research of the polysaccharide from *P. sinjiangensis* K.Y. Pan for the other research works.

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Conflict of Interest: None declared

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