

## **Extraction Technology and Physicochemical Properties of Broccoli Protein**

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**Keywords:** Broccoli Protein, Extraction Technology, Physicochemical Properties

**Abstract:**

temperature is 60 °C, leaf protein extraction rate is highest with the influence of extraction time to extraction rate are shown in Figure 3. Where, before 16 h, the extraction rate of broccoli stems and leaves protein gradually increases. Then it declines, which is probably because that some proteins are degenerated due to the overlong extraction time. So in the prospect of extraction efficiency, 16 h is more appropriate.

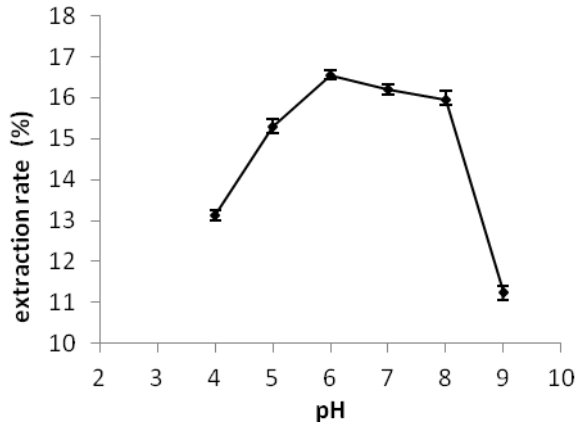


Fig. 1 Influence of pH on extraction rate

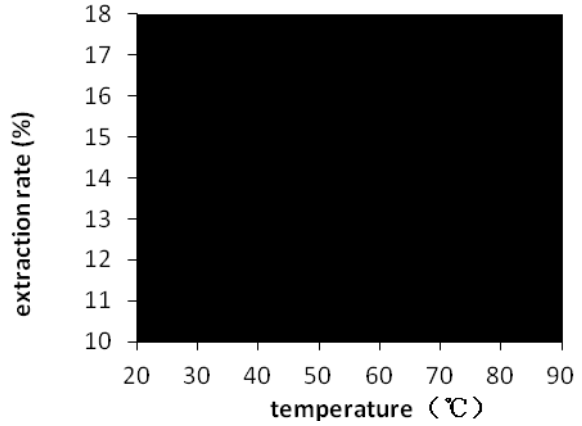


Fig. 2 Influence of temperature on extraction rate

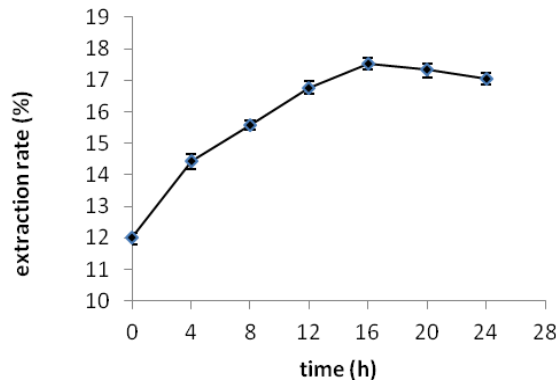


Fig. 3 Influence of time on extraction rate

Extraction technology is optimized by orthogonal experiment. The factor levels are presented in table 1, and the experimental results are shown in table 2. Where, it is found that, the influences of the three factors on extraction rate decrease by temperature > pH > time in order. By calculating, the optimal condition is A<sub>2</sub>B<sub>2</sub>C<sub>3</sub>, namely, pH 6, temperature 60 °C, time 20 h.

Table 1 Factors and levels of test

Level	A: pH	B: Temperature	C: Time
1	5	50	12h
2	6	60	16h
3	7	70	20h

Table 2 Results of orthogonal tests

Batch No.	A	B	C	Extraction rate
1	1	1	1	15.23
2	1	2	2	17.03
3	1	3	3	16.27
4	2	1	3	17.05
5	2	2	1	17.47
6	2	3	2	16.11
7	3	1	2	16.41
8	3	2	3	15.9
9	3	3	1	14.64
K1j	15.843	15.897	15.780	
K2j	16.727	16.800	16.033	
K3j	15.317	15.190	16.073	
Rj	1.410	1.610	0.643	

**Physicochemical properties of broccoli protein**

The water holding capacity, swelling property, emulsibility, and cation exchange capacity of broccoli protein are studied with soybean protein as a comparison as shown in table 3[5-7]. The water holding capacity, swelling property, and cation exchange capacity of broccoli protein are 3.32 424 P3 082; 42= 3 0; 26 42; 3 i i g i 0 g e i e i e i j soybean protein. But the emulsibility of broccoli protein is far lower than that of soybean protein.

Table 3 Physical and chemical properties of Broccoli protein

	Water holding capacity mL/g	Emulsibility %	Swelling property g/g	Cation exchange capacity pH7 (mmol/g)
Soybean protein	629 429f	=52 726e	82= 429e	: 26 42 f
Broccoli protein	726 424e	942 82f 5	82; 42=e	; 26 42; e

**Conclusion**

The extraction technology of broccoli stems and leaves protein is optimized by orthogonal experiment. The results show that, the influence of each factor to extraction rate decreases by temperature > pH > time in order. By calculation, the optimal condition is A<sub>2</sub>B<sub>2</sub>C<sub>3</sub>, namely pH 6, temperature 60 °C, time 20 h.

Comparing with soybean protein, the water holding capacity, swelling property, cation exchange capacity of broccoli stems and leaves protein are stronger, which is probably because that broccoli stems and leaves protein contains more hydrophilic groups. So it is indicated that the processing characteristics of broccoli stems and leaves protein is better. But the emulsibility of broccoli stems and leaves protein is poor. If the emulsibility is chemically modified, the processing characteristics can be further improved.

**Acknowledgements**

This work was financially supported by the Research Project of Department of Education of Zhejiang Province (Y201120923) and Zhejiang Provincial Natural Science Foundation of China(Q12C020002).

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