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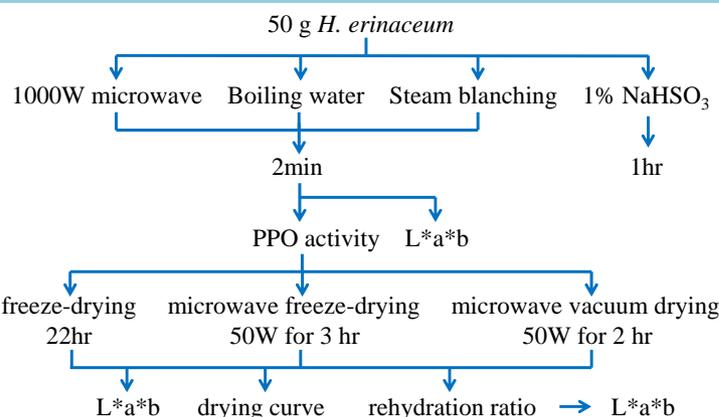
## Abstract

*Hericium erinaceum* is one of the most important medicinal and edible mushrooms in Asia. *H. erinaceum* consists of several pharmacological functions, including hypoglycemic, hypolipidemic, antiulcer, antioxidant, antitumor and improving neurasthenia. However, browning reactions especial polyphenoloxidase (PPO) occurs in the dried mushrooms. Therefore, the objectives of this study were to determine the influence of different blanching pretreatments (boiling water, steam, microwave and sodium bisulfite) on PPO activity, and the qualities of dried *H. erinaceum* obtained by different drying methods (microwave vacuum drying, microwave freeze-drying and freeze-drying). The PPO activity of fresh *H. erinaceum* was 128.33 units. The PPO retentions of *H. erinaceum* blanched by boiling water for 2 min, steam for 2 min, microwave for 2 min and dipping in 1% sodium bisulfite for 1hr were 9.6%, 5.5%, 9.4% and 13.8%, respectively. The browning index of fresh *H. erinaceum* and those pre-treated by boiling water for 2 min, steam for 2 min, microwave for 2 min and dipping in 1% sodium bisulfite for 1hr were 8.0, 6.3, 6.7, 6.8 and 4.6, respectively. Therefore, steam blanching of *H. erinaceum* was chosen for the following drying studies. The drying time of 50 g *H. erinaceum* by microwave vacuum drying, microwave freeze-drying and freeze-drying were 2 hr, 3 hr and 22 hr, respectively. The rehydration ratios and L\*<sup>a</sup>-values of dried *H. erinaceum* were ranked in a descending order as freeze-drying, microwave freeze-drying, and microwave, respectively. However, microwave vacuum drying and microwave freeze-drying *H. erinaceum* can significantly reduce drying time and save energy.

## Introduction

*Hericium erinaceum* (*H. erinaceum*) is a white and spine fungi has been known as Chinese medicine or food in China and Japan. Drying can prevent spoilage, but formerly hot air drying and freeze drying must spent long time. Many studies indicated that microwaves can be used to assist drying and considerably reducing of drying time. Color changes during drying are mostly in the form of browning caused by enzymatic or non-enzymatic reactions between carbohydrate and amino acids at elevated temperature. Polyphenoloxidase (PPO) is the primary enzyme responsible for browning, so how to reduce the PPO activity efficiently and consideration to the quality are recognized as a serious problem.

## Materials and method



## Results and discussion

The PPO enzyme activities of fresh *H. erinaceum* was 128.33 units. Table 1 show that various blanching methods pretreatments were effective to reduce the PPO activity. The steam blanching for 120s could inhibition PPO activity to reach 94.55%. The inhibit effect of various blanching methods based on measurements at their minimum PPO retention in the following order: steam blanching > microwave > water blanching > NaHSO<sub>3</sub>. As illustrated in Fig. 1 and Fig. 2, microwave freeze-drying and microwave vacuum drying were the much faster drying process than freeze drying. While it took only 2 and 3 hour for the microwave freeze-drying and microwave vacuum drying to reach a final dimensionless moisture content under 0.05. The color after different drying. The BI of steam blanched *H. erinaceum* was lower than unblanched by microwave freeze-drying and microwave vacuum drying (Table 2). The L\*<sup>a</sup>-values of dried *H. erinaceum* were ranked in a descending order as freeze-drying, microwave freeze-drying, microwave vacuum drying, respectively (Table 2). The highest rehydration ratio of dried *H. erinaceum* was steam blanched with freeze-drying (5.65%); the lowest one was unblanched with microwave vacuum drying (3.37%) (Table 3).

Table 1. Effect of different pretreatments on the PPO retention and color of *H. erinaceum*

Sample	PPO retention %	Hunter color values and parameters			
		L*	a*	b*	BI
(A) Fresh	100.00	66.29 ± 0.40 <sup>c</sup>	2.66 ± 0.40 <sup>a</sup>	24.65 ± 2.00 <sup>ab</sup>	7.95
(B) 1000W microwave 120s	9.35	59.52 ± 0.39 <sup>c</sup>	1.71 ± 0.66 <sup>bc</sup>	25.20 ± 1.40 <sup>a</sup>	6.79
(C) Boiling water 120s	9.61	69.89 ± 0.50 <sup>a</sup>	2.00 ± 0.43 <sup>ab</sup>	19.73 ± 0.48 <sup>de</sup>	6.32
(D) Steam blanching 120s	5.45	61.44 ± 0.23 <sup>d</sup>	1.79 ± 0.12 <sup>abc</sup>	21.68 ± 0.45 <sup>cd</sup>	6.74
(E) 1% NaHSO <sub>3</sub> 1hr	13.77	68.47 ± 0.03 <sup>b</sup>	1.02 ± 0.38 <sup>cd</sup>	22.39 ± 1.31 <sup>bc</sup>	4.58

\*\*\* Means in color values with different letters are significantly different between different blanching conditions (p < 0.05). Data are expressed as percentage. (n = 3, mean ± S.D.)

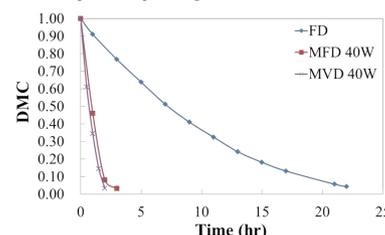


Fig. 1 The drying curve of unblanched *H. erinaceum* by different drying methods.

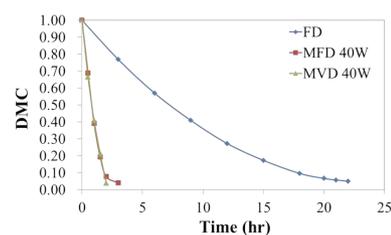


Fig. 2 The drying curve of steam blanched *H. erinaceum* by different drying methods.

Table 2. Effect of pretreatment and drying method on the color of dried *H. erinaceum*

sample	Hunter colour values and parameters			
	L*	a*	b*	BI
<b>Unblanched</b>				
(A) FD	63.22 ± 0.70 <sup>a</sup>	5.76 ± 0.43 <sup>c</sup>	31.36 ± 1.35 <sup>ab</sup>	14.63
(B) MFD	53.05 ± 0.22 <sup>b</sup>	7.34 ± 0.13 <sup>b</sup>	33.30 ± 0.46 <sup>a</sup>	21.18
(C) MVD	51.53 ± 0.16 <sup>c</sup>	8.78 ± 1.73 <sup>a</sup>	29.73 ± 2.11 <sup>b</sup>	25.28
<b>Steam blanched</b>				
(D) FD	62.51 ± 1.52 <sup>a</sup>	5.98 ± 0.57 <sup>b</sup>	31.82 ± 3.08 <sup>a</sup>	15.25
(E) MFD	57.32 ± 0.25 <sup>b*</sup>	7.16 ± 1.55 <sup>a</sup>	33.49 ± 0.91 <sup>a</sup>	19.22
(F) MVD	51.49 ± 1.10 <sup>c</sup>	7.44 ± 0.75 <sup>a</sup>	32.69 ± 3.18 <sup>a</sup>	22.05

\*-c Means in color values with different letters are significantly different between different drying methods (p < 0.05). Data are expressed as percentage. (n = 3, mean ± S.D.)

Table 3. Effect of pretreatment and drying method on rehydration ratio and the color of rehydrated *H. erinaceum*

SampleS	Rehydration ratio (%)	Hunter colour values and parameters		
		L*	a*	b*
<b>Unblanched</b>				
(A)FD	4.46 ± 0.58 <sup>a</sup>	59.28 ± 0.26 <sup>a</sup>	2.04 ± 0.27 <sup>c</sup>	16.67 ± 0.08 <sup>b</sup>
(B) MFD	4.35 ± 0.76 <sup>a</sup>	56.91 ± 0.39 <sup>b</sup>	2.59 ± 0.33 <sup>b</sup>	18.48 ± 1.00 <sup>a*</sup>
(C) MVD	3.37 ± 0.38 <sup>b</sup>	47.09 ± 1.33 <sup>c</sup>	4.50 ± 0.27 <sup>a*</sup>	18.07 ± 1.23 <sup>a*</sup>
<b>Steam blanched</b>				
(D) FD	5.65 ± 0.35 <sup>a*</sup>	58.81 ± 0.45 <sup>a</sup>	2.98 ± 0.06 <sup>b*</sup>	18.37 ± 0.66 <sup>a*</sup>
(E) MFD	4.51 ± 0.66 <sup>b</sup>	58.27 ± 0.33 <sup>a*</sup>	2.40 ± 0.19 <sup>c</sup>	15.23 ± 0.26 <sup>b</sup>
(F) MVD	4.25 ± 0.91 <sup>b*</sup>	49.63 ± 0.22 <sup>b*</sup>	3.30 ± 0.26 <sup>a</sup>	15.73 ± 1.10 <sup>b</sup>

\*-c Means in color values and rehydration ratio with different letters are significantly different between different drying methods (p < 0.05). Rehydration ratio data are expressed as percentage. (n = 5, mean ± S.D.); color values data are expressed as percentage. (n = 3, mean ± S.D.)

## Conclusions

The steam blanching was effective to reduce the PPO activity and prevent browning. Microwave drying and microwave freeze-drying *H. erinaceum* can significantly reduce drying time and save energy.