

## Research Article

### Effect of Blanching Frequency on Physicochemical Properties of Blanch Water of *Pleurotus eryngii*

Fei Lu, Yunbo Li, Yajing Zhang, Yanhua Xu and Bo Li

School of Food Science, Henan Institute of Science and Technology, Xinxiang 453003, China

**Abstract:** Blanching treatment is an important operation for most mushroom processing. Reutilizing the blanch water can avoid environmental pollution and reduce the waste of resources because some nutrients are dissolved into the water during blanching. The effect of blanching frequency on the contents of polysaccharide, soluble protein and soluble solids, conductivity and browning degree of blanch water of *Pleurotus eryngii* was investigated. The result showed that the contents of polysaccharide, soluble protein and soluble solids, the conductivity and browning degree of blanch water of *P. eryngii* increased gradually with the enhancement of blanching frequency. Furthermore, the increase rates of polysaccharide, soluble protein, soluble solids and conductivity were high from the first to the fourth blanching and then the improvement became gently after the fifth blanching. This indicated the optimal blanching frequency was four times for recycling blanch water at the conditions of 1 cm thickness of mushroom slice and 1/2 ratio of mushroom to water. This study provides an useful basis for utilizing the blanch water of *P. eryngii* in a rational way.

**Keywords:** Blanching, mushroom, *Pleurotus eryngii*, polysaccharide, protein, reutilization

## INTRODUCTION

*Pleurotus eryngii*, also named king oyster mushroom, is considered as the best one of all *Pleurotus* species due to its excellent consistency of cap and stem, culinary qualities and longest shelf life than any other oyster mushroom (Moonmoon *et al.*, 2010). In recent years, *P. eryngii* has been commercially cultivated and fast developed in China for its excellent flavor and nutrition (Zhang *et al.*, 2013). Now *P. eryngii* is the second largest mushroom species of year-round industrializing production in China. With the fast increase of *P. eryngii* yield, the contradiction between production and marketing became outstanding more and more. As a result, some enterprises process this mushroom into all kinds of foods to improve the added value and extend the storage life.

Blanching is a heat treatment to which the vegetables or fruits are subjected prior to further processing. It consists of heating at high temperature in water or steam (Szymanek, 2011). It is a fundamental operation due to the vital importance of maintaining the quality attributes such as color and texture, besides its benefits in terms of microbial destruction and enzyme inactivation, such as polyphenol oxidase (Jaiswal *et al.*, 2012; Kinalski and Norena, 2014). Blanching is also an important operation for most mushroom processing. During blanching, some nutrient substance of mushroom dissolves into hot water and the color and

concentration of blanch water become higher and higher. Thus, the blanch water has to be replaced by fresh water and discarded after a few times of blanching. However, the discarded blanch water creates the environmental problem for its high BOD (Biochemical Oxygen Demand) value caused by the nutrients containing. In addition, a significant number of nutrients of mushroom is lost and wasted. Therefore, recycling the blanch water can not only avoid environmental pollution, but also reduce resource waste.

A lot of researches have been done on the effect of blanching treatment on nutritional and sensory quality of vegetables and fruits (Onayemi and Badifu, 1987; Mosha *et al.*, 1995; Gamboa-Santos *et al.*, 2012; Nath *et al.*, 2013). However, the change rule of chemical composition and physical property of blanch water has not been reported till now, which is important for making use of blanch water in a rational way. There is a small number of reports on the utilization of blanch water of mushroom. Xu *et al.* (1995) concentrated mushroom blanch water by using reverse osmosis method to prepare mushroom flavoring. Liu and Zhou (1989) produced mushroom extraction and soy sauce with blanch water. Zhou *et al.* (2009) cultivated domestic fungus using blanch water. Chen *et al.* (2012) prepared nutritional powder from blanch water of *Stropharia rugoso-annulata* with spray drying. However, the utilization of blanch water of *P. eryngii*.

**Corresponding Author:** Bo Li, School of Food Science, Henan Institute of Science and Technology, Hualan Road, Xinxiang City 453003, China

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has not been reported. The objective of this study was to investigate the effect of blanching frequency on the chemical composition and physical property of blanch water of *P. eryngii*, as a result, providing the basis for the utilization of blanch water.

## MATERIALS AND METHODS

**Materials:** *P. eryngii* was purchased from local market of Xinxiang City, Henan Province, China. All reagents used were of analytical grade.

**Experimental procedure:** Fresh *P. eryngii* was washed with clean water and cut into slices of 1 cm thickness. The mushroom slices (300 g) were subjected to blanching treatment with boiling water (600 mL water in a 1 L of beaker) for 5 min. After blanching, the slices were taken out and 20~40 mL of blanch water were also collected for physicochemical analysis. Clean water was added into the beaker to keep the volume of blanch water at 600 mL. Then, another 300 g of fresh mushroom slices were put into this boiling water for the second blanching. The procedure was repeated for ten times. Chemical composition and physical property of blanch water samples of ten times were measured.

**Determination of polysaccharide content:** Polysaccharide was determined according to the phenol-sulfuric acid method at 490 nm (DuBois *et al.*, 1956). The content of polysaccharide in blanch water was calculated on the basis of the calibration curve of glucose.

**Determination of soluble protein content:** Soluble protein was determined by the Lowry method at 500 nm (Lowry *et al.*, 1951). The content of soluble protein in blanch water was calculated on the basis of the calibration curve of casein peptone.

**Determination of soluble solids content:** The soluble solids content of blanch water was determined by Abbe refractometer.

**Determination of conductivity:** The conductivity of blanch water was tested by conductivity meter.

**Determination of browning degree:** Blanch water was centrifuged at 5000 r/min for 10 min. The browning degree of supernatant was determined by spectrophotometer at 420 nm and color-difference meter, respectively.

**Statistical analysis:** All the experimental results were the mean ( $\pm$ standard deviation) of three parallel measurements. The data was analyzed by statistical software SSPS (ver17.0).

## RESULTS AND DISCUSSION

**Effect of blanching frequency on polysaccharide content in blanch water:** Polysaccharide is one of the primary components of *P. eryngii* and other mushrooms (Zhang *et al.*, 2013). Many polysaccharides can dissolve in hot water, so there should be some polysaccharide loss from *P. eryngii* slices during blanching. The effect of blanching frequency on polysaccharide content in blanch water of *P. eryngii* was shown in Fig. 1. The result showed that polysaccharide content in blanch water increased with the enhancement of blanching frequency. Moreover, polysaccharide content improved faster from the first blanching to the fourth blanching than that of after the fifth blanching. This is because some polysaccharide can dissolve in hot water from *P. eryngii* slices during blanching. With the increase of polysaccharide concentration in blanch water, the dissolution quantity of polysaccharide for each blanching decreased

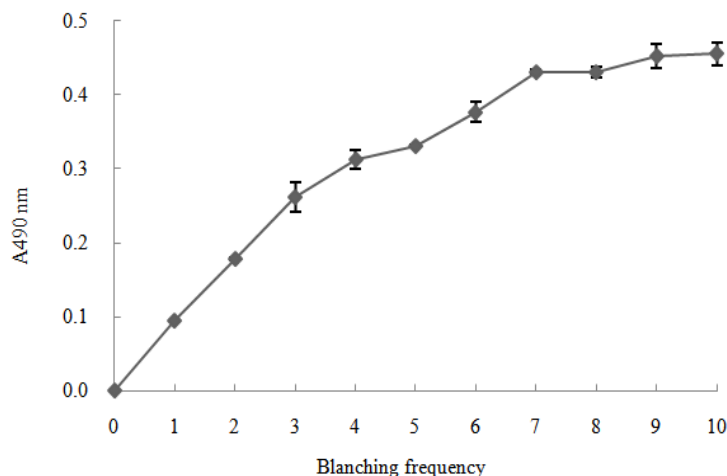


Fig. 1: Effect of blanching frequency on polysaccharide content in blanch water of *P. eryngii*

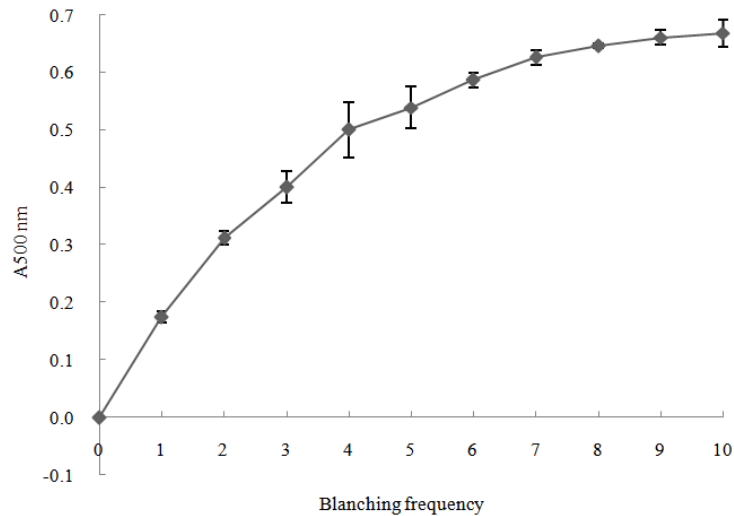


Fig. 2: Effect of blanching frequency on soluble protein content in blanch water of *P. eryngii*

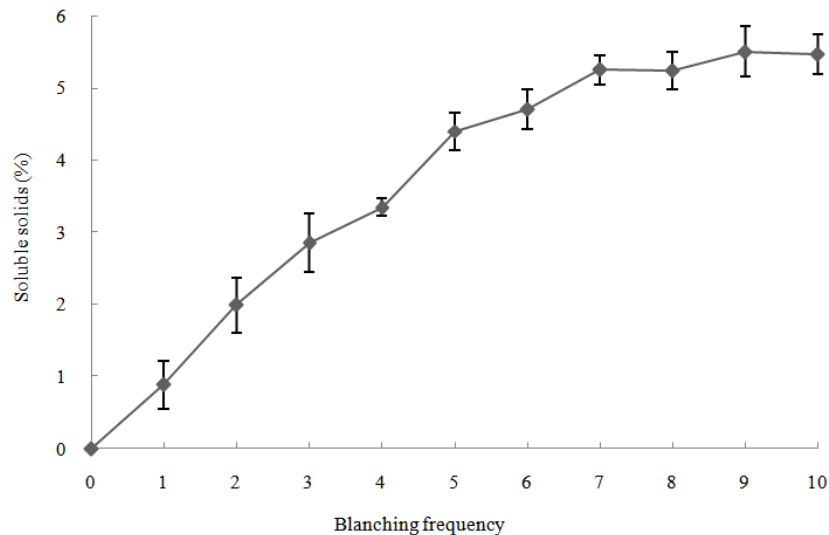


Fig. 3: Effect of blanching frequency on soluble solids content in blanch water of *P. eryngii*

gradually after the fifth blanching. The result indicates that the optimal blanching frequency would be four times for recycling the blanch water based on polysaccharide dissolution rate. Of course, the change rule of polysaccharide dissolution during blanching is also influenced by the size of mushroom slices and the ratio of material to water.

**Effect of blanching frequency on content of soluble protein in blanch water:** Protein is another main component of *P. eryngii* and other mushrooms. Some proteins are soluble in water, so there should be a part of protein lost from *P. eryngii* slices during blanching. The effect of blanching frequency on soluble protein content in blanch water of *P. eryngii* was shown in Fig. 2. The result showed that soluble protein content in blanch water increased with the enhancement of blanching frequency. In addition, the soluble protein

content improved significantly during the first four times, then the increase rate became gently. This is because some protein can dissolve into hot water from *P. eryngii* slices during blanching. With the increase of protein concentration in blanch water, the dissolution quantity of protein for each blanching decreased gradually after the fifth blanching. It can be seen that the change rule for protein dissolution is almost same as the polysaccharide dissolution.

**Effect of blanching frequency on content of soluble solids in blanch water:** The soluble solids can reflect the total materials dissolved into blanch water from *P. eryngii* slices during blanching, which include probably polysaccharide, soluble protein, amino acids, mineral salts, soluble vitamins, etc. The effect of blanching frequency on soluble solids content of blanch water of *P. eryngii* was shown in Fig. 3. The result

showed that the soluble solids in blanch water increased with the enhancement of blanching frequency. The content of soluble solids raised faster from the first blanching to the fifth blanching than that of after the fifth blanching. This is probably because the dissolved components from mushroom slices for every blanching decreased gradually with the increase of concentration of soluble materials in blanch water.

**Effect of blanching frequency on conductivity of blanch water:** Plant cells contain alkaloid, organic acid and inorganic salt, which can be extracted and produce electric signal in the solvent. Therefore, conductivity can reflect indirectly the concentration of salt substances in extraction medium. The effect of blanching frequency on conductivity of blanch water of

*P. eryngii* was shown in Fig. 4. The result showed that the conductivity of blanch water increased with the rise of blanching frequency. Moreover, the increasing rate of conductivity became gently after the fourth blanching. The result suggested that some salt substances in mushroom cells dissolved into water during blanching and the dissolved quantity for each blanching decreased gradually with the improvement of salt concentration in blanch water.

**Effect of blanching frequency on browning degree of blanch water:** Mushroom contains phenolics which produce browning reaction in hot water. The browning degree can be assayed by absorbance value at 420 nm in spectrophotometer and b value in color-difference meter, respectively. The effect of blanching frequency

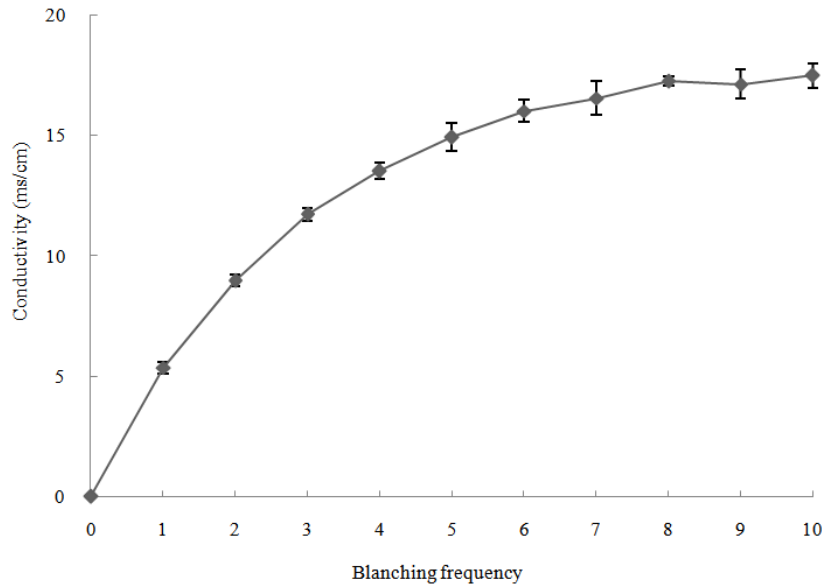


Fig. 4: Effect of blanching frequency on conductivity of blanch water of *P. eryngii*

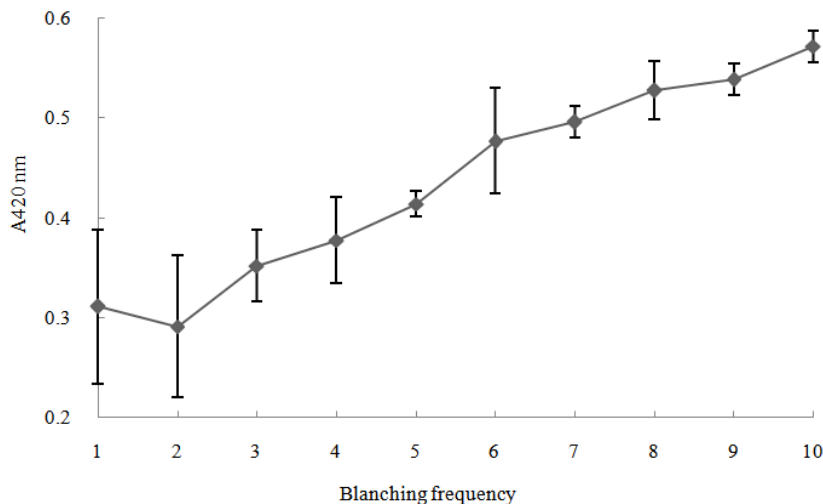


Fig. 5: Effect of blanching frequency on browning degree of blanch water of *P. eryngii* tested by spectrophotometer

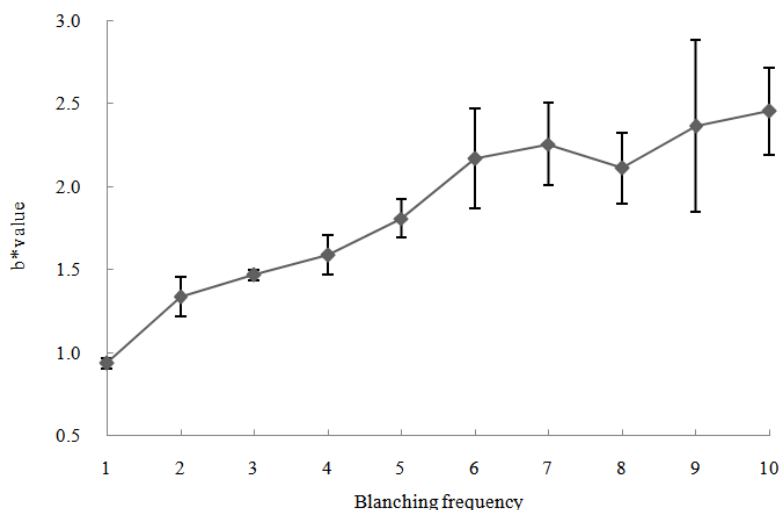


Fig. 6: Effect of blanching frequency on browning degree of blanch water of *P. eryngii* tested by color-difference meter

on browning degree of blanch water of *P. eryngii* was shown in Fig. 5 and 6. The results showed that browning degree of blanch water increased gradually with the enhancement of blanching frequency. This suggested that the blanch water must be refreshed after the use of several times for its deep color.

### CONCLUSION

This study investigated the effect of blanching frequency on chemical composition and physical property of blanch water of *P. eryngii*. The result showed that blanch water of *P. eryngii* contained rich nutrients dissolved from mushroom slices. The contents of polysaccharide, soluble protein and soluble solids, the conductivity and browning degree of blanch water increased gradually with the enhancement of blanching frequency. Furthermore, the increase rates of polysaccharide, soluble protein, soluble solids and conductivity were high from the first to the fourth blanching and then the improvement became gently after the fifth blanching. These results suggested the optimal blanching frequency was four times for recycling blanch water at the conditions of 1 cm thickness of mushroom slice and 1/2 ratio of mushroom to water. At this time, the blanch water can be reutilized for preparing health drink, condiment and nutrient powder. This finding maybe also applies to the blanching treatment of other mushrooms. Of course, the change rule for physicochemical properties of blanch water would be different if the ratio of mushroom to water and slice thickness are changed. This will be our next research work.

### ACKNOWLEDGMENT

This study was supported by Excellent Youth Foundation of Henan Province, China (2013-07).

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