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Research Article

Extraction and Stability of Red Pigment from Grape Skin

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Abstract: The extraction and stability of red pigment from grape skin were studied. The optimum extraction conditions of red pigment from grape skin were showed as follows: the ethanol concentration was 70%; the extraction temperature was 70°C; the extraction time was 70 min. Under these conditions, the absorbency of extraction liquid of red pigment from grape skin was about 0.8. The red pigment from grape skin had good resistance to light decomposition and heating. Heating and lighting had little effect on the pigment stability.

Keywords: Extraction, grape skin, red pigment, stability

INTRODUCTION

Food coloring is an indispensable food additive in food industry. Along with the development of science and technology, many synthetic pigments are widely used. Due to the discovery that synthetic pigments are harmful to human health, they are gradually eliminated (Wissgott and Bortlik, 1996). Therefore, the study of new food coloring, especially natural pigments, increases widespread attention at home and abroad (Francis, 1987; Giusti *et al*., 1999). Many technology workers are studying on inexpensive natural pigments to replace the currently used synthetic pigments (Wang *et al*., 2006).

The Changbai Mountain area of Jilin province is rich in wild grapes and they mostly are colored grapes whose skins are rich in red pigment. To take full advantage of these development resources, extraction and stability of red pigment from grape skin were studied in this study.

MATERIALS AND METHODS

Materials: The grape purchased from the local farmer's market in Tonghua City. Anhydrous alcohol, hydrochloric acid, sodium hydroxide and other reagents were of analytically pure and the water was deionized water.

Instrument: 722S spectrophotometer (Shanghai Precision and Scientific Instrument Co., Ltd.), HWS-26 electric-heated thermostatic water bath (Shanghai Technology Co., Ltd., a constant), PHS-3C digital display pH meter (Shanghai Grand Cape Instrument Co.), MP21001 electronic Balance (scientific instrument Co., Ltd. Shanghai Heng Ping).

Pre-processing of grape: The contents of grape seeds, pulp and juice and the outside of the stem were removed. After the grape skin was washed with distilled water, drying at 80°C for 8 h, then the grape skin was dried in a dryer saved for use later (Maier *et al*., 2008).

Extraction of red pigment from grape skin: Accurately weighing amount of grape skin, then added a small amount of extraction solvent to ground into a paste. Made up the extraction solution and adjusted the pH about 3.0. Under a certain temperature speedy freeze for a period of time, then filtration and the OD value of the supernatant was measured at 516 nm to determine extraction solvent (ethanol) concentration, extraction temperature, extraction time and other factors which affect extraction of red pigment from grape skin (Wrolstad *et al*., 2005).

Stability of red pigment: Under different illumination time and different temperature, the preparation solution of red pigment from grape skin was handled for a period of time, then observed the color change and measured the OD values at 516 nm to determine the stability of it.

Statistical analysis: The experimental results obtained were expressed as means±S.D. of triplicates.

RESULTS AND DISCUSSION

Effect of ethanol concentration: About 10.0 g grape skins, crushing and grounding, added different concentrations of ethanol and pH of the mixture were adjusted to about 3.0 with 1 mol/L HCl. The extraction was in water bath at 70°C for 1 h, quickly cooling and

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Table 1: Effect of ethanol concentration on pigment extraction

Ethanol concentration (%)	60	70	80	90
OD_{516}	0.728±0.045	0.839±0.035	0.774±0.021	0.667±0.023

Table 2: Effect of extraction temperature on pigment extraction

Extraction temperature (°C)	50	70	90
OD_{516}	0.611±0.024	0.673±0.031	0.595±0.014

Table 3: Effect of extraction time on pigment extraction

Extraction time (min)	50	70	90
OD_{516}	0.482±0.015	0.784±0.038	0.789±0.043

Table 4: Effect of illumination time on pigment stability

Illumination time (h)	0	4	8
OD_{516}	0.936±0.052	0.889±0.056	0.847±0.034
Color	Rose-bengal	Rose-bengal	Rose-bengal

Table 5: Effect of heating temperature on pigment stability

Heating temperature (°C)	0	20	50	80
OD_{516}	0.784±0.044	0.756±0.025	0.671±0.028	0.585±0.019
Color	Rose-bengal	Rose-bengal	Rose-bengal	Rose-bengal

filtering, then the OD value at 516 nm was measured using a spectrophotometer. As was shown in Table 1, with increasing ethanol concentration, the OD value increased. When ethanol concentration was 70%, the largest OD value was measured, indicating that the most complete extraction of red pigment under such conditions. When continuing to increase ethanol concentration, the OD value decreased. This might be because there were the polar groups in red pigment components, which was not easily soluble in non-polar solvents. Therefore, extraction agent (ethanol) concentration was determined at 70%.

Effect of extraction temperature: About 10.0 g grape skins, crushing and grounding, added 70% ethanol and pH of the mixture were adjusted to about 3.0. The extraction was in the water bath quench at different temperatures for 1 h, quickly cooling and filtering, then the OD value at 516 nm was measured using a spectrophotometer. Table 2 showed that when the extraction temperature was 70°C, the maximum OD value was measured. With the temperature increasing, the OD value also increased, but the temperature was too high, OD value declined. This might be because that the solubility of the red pigment decreased at high temperature. Therefore, the extraction temperature was determined at 70°C.

Effect of extraction time: About 10.0 g grape skins, crushing and grounding, added 70% ethanol and pH of the mixture was adjusted to about 3.0 with 1 mol/L HCl. The extraction was in the water bath quench at 70°C for different extraction time, quickly cooling and filtering, then the OD value at 516 nm was measured using a spectrophotometer. Table 3 showed that when the extraction time reached 70 min later, with the extraction time increasing, the OD value slowly increased. This indicated that most of the pigment has been entirely extracted within 70 min. Therefore, considering economic benefit of the extraction process (Escribano-bailón *et al*., 1995; Morais *et al*., 2002), the extraction time was determined at 70 min.

Effect of illumination time on stability of red pigment: The preparation solution of red pigment from grape skin was placed under sunlight irradiation for 0, 4 and 8 h, respectively. Then, OD value at 516 nm was measured using a spectrophotometer and observed color changes. As was shown in Table 4, with the extension of the light duration, the OD value of the pigment fell slightly and its color had not changed significantly in visual. Therefore, light stability of red pigment was higher.

Effect of heating temperature on stability of red pigment: About 20 mL preparation solution of red pigment from each test tube was incubated at constant temperature for 5 h at different temperatures. Then, the evaporating solution was completed and the OD value at 516 nm was measured using a spectrophotometer. The results were shown in Table 5. The determination results showed that when heating temperature of the red pigment rose, the OD values had little impact. Although there was a slight change of OD value, the solution color of red pigment was essentially the same. It was still a rose red. So, effect of heating on red pigment from grape skin was small. It had a good heat tolerance.

CONCLUSION

The optimum extraction conditions of red pigment from grape skin were showed as follows: the ethanol concentration was 70%; the extraction temperature was 70°C; the extraction time was 70 min. Under these conditions, the OD value of natural red pigment from grape skin extracting solution was about 0.8. The red pigment from grape skin had good resistance to light decomposition and heating. Heating and lighting had

little effect on the pigment stability and its color was still rose-bengal.

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