Factors Influencing Quick Oxidation Of Purple Potatoes

Sensus Technical Note (SEN-TN-0029) 05/19/2009

Youngmok Kim, Ph.D. and Kevin L. Goodner, Ph.D.

ABSTRACT

In a previous study, it was found that purple potato contains very unstable anthocyanin compounds compared to other crops such as red cabbage, purple corn, and hibiscus. In the present study, factors influencing the quick degradation of purple potato anthocyanin were evaluated.

INTRODUCTION

There are three main factors influencing anthocyanin stability.

1) pH

In an aqueous media, anthocyanins can exist in four structural forms depending on pH: the blue quinoidal base, the red flavylium cation (red), the colorless carbinol pseudobase, and the colorless chalcone. At low pH (<pH4) in aqueous media, the flavylium cation dominated while at pH 4-6 the colorless carbinol dominates. It means that at pHs over 4, anthocyanin does not play a role very well as a colorant. The stability of anthocyanin is higher at lower pH (even less than 1 because they are in the unionized form) but anthocyanin does not exist at pH higher than 6 (doesn't work as a colorant).

2) Temperature

Anthocyanins are thermally unstable. At low pH, anthocyanins show higher thermal stability. The exact mechanism of thermal degradation of anthocyanins is not fully understood yet. There are three possible mechanisms. First, flavylium cation is transformed to carbinol base then changed to several intermediates and finally to coumarin derivative. Second, flavylium cation is transformed to the colorless carbinol base then changed to the chalcone and finally to brown pigments. The last mechanism is similar with the second one but the only exception is chalcone is first inserted. All of those mechanisms are occurring with increased temperature.

3) Oxygen

Since anthocyanin has an unsaturated structure, it is susceptible to oxidation. For example, grape juice which is fully filled (no headspace) delays degradation of color from purple to brown. During oxidation, H_2O_2 (hydrogen peroxide) which is a precursor of hydroxyl radical is produced and it causes quicker color degradation. Hydrogen peroxide also involves the degradation of color and polymerization of colorless esters and coumarin derivatives are also participating in the degradation of color in fruit juice.

7255 Hamilton Enterprise Park Drive
Hamilton, OH 45011
Tel: 513-892-7100
www.sensusflavors.com

MATERIALS AND METHODS

Purple potatoes were purchased at Jungle Jim (Fairfield, OH), a local market.

Cut potatoes were divided into three groups and moved to three different locations to determine the factors degrading purple potato. Storage conditions are displayed in Table 1.

1 (control) was stored in a plastic cup at room temp., 2 (cold storage) was stored in the refrigerator in a plastic cup with a light source (flash light), 3 (No light exposure) was wrapped by aluminum foil with holes for air circulation and stored in the dark, and 4 (No air exposure) was placed in glass bottle and filled with nitrogen. All purple potato groups were stored for 2 days.

RESULTS AND DISCUSSION

Degradation of color from anthocyanin was quick. In 5 min of air exposure, dark purple color changed into brown (Figure 1).

Among three storage factors (temperature, light, and oxygen), oxygen is the reason of quick anthocyanin degradation in purple potatoes (Figure 2).

Table 1. Storage conditions for the purple potato experiments

	Temperature	Light	Oxygen
1 (control)	Room	Yes	Yes
2 (cold storage)	Cold	Yes	Yes
3 (No light exposure)	Room	No	Yes
4 (No air contact)	Room	Yes	No

7255 Hamilton Enterprise Park Drive
Hamilton, OH 45011
Tel: 513-892-7100
www.sensusflavors.com

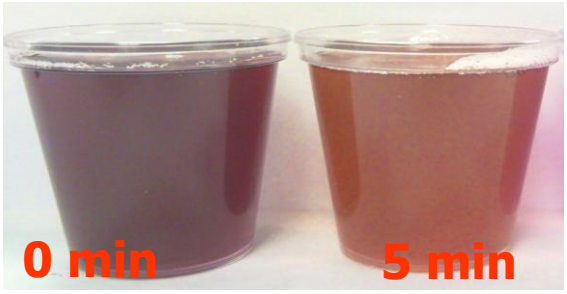

Figure 1. Difference in color of purple potatoes after 0 and 5 minutes of sitting at room temperature with air exposure.

Figure 2. Color (anthocyanin) changes of purple potatoes during 2 day storage at different conditions. 1. control, 2. cold storage, 3. no light exposure, 4. no air contact.

7255 Hamilton Enterprise Park Drive
Hamilton, OH 45011
Tel: 513-892-7100
www.sensusflavors.com