

THE INFLUENCE OF WASHING PROCEDURE ON THE ANTIOXIDANT CAPACITY OF *DAUCUS CAROTA SUBSP. SATIVUS*

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Abstract. Carrots are an important source of antioxidants. The main compound that gives them antioxidant capacity is beta-carotene. Storage and post-harvest treatments can influence negatively the antioxidant capacity of carrots. In order to evaluate the impact of storage and washing procedure samples from Atomic Red and Royal Chantenay varieties were analyzed using Photochem instrument from AnalytikJena before washing, immediately after washing, after 15 days of storage at 8°C and after 45 days of storage at 8°C. The results are expressed in mg/kg equivalent TROLOX. There is a small loss of antioxidant capacity between the first day and after 15 days of storage, 3,86 % on average in the control batch respect to 9,47 % on average for the samples. Between the first day and after 45 days of storage there is a big loss of antioxidant capacity, 19,22% on average in the control batch respect to 24,86 % on average for the samples.

Keywords: carrots, antioxidant capacity, washing

INTRODUCTION

Daucus carota subsp. Sativus (Carrot) is a widely used root vegetable, which can have different colors, but the usual one is orange. The carrot is used all around the world as one of the most popular food ingredients.[1] Carrots are perhaps best known for their rich supply of the antioxidant nutrient beta-carotene. However carrots also contain other nutrients like lutein, vitamin K, vitamin B6.[2, 3] All varieties of carrots contain valuable amounts of antioxidant nutrients. Included in this category of nutrients are traditional antioxidants like vitamin C, as well as phytonutrient antioxidants like beta-carotene. In most varieties of carrots, beta-carotene is by far the most plentiful antioxidant nutrient, accounting for over 95 % of all carotenoids in many carrot varieties. [4] Fresh vegetables were grown on almost 2,2 million hectares in the EU in 2015, nearly half of which were in Italy, Spain and Poland. Root, tuber & bulb vegetables, such as carrots, radishes, onions, shallots and garlic represent 18,8 % of that total. [5] Around 5,6 million tons of carrots were also produced in 2016. Carrot production was relatively high in Poland and the United Kingdom — together these two countries accounted for over a quarter (14,7 % and 12,9 % respectively) of EU-28 output in 2016. [6] Romania has produced in 2016 111,7 thousand tons of carrots. [5]

The purpose of the study is to evaluate the influence of the washing procedure on the carrots antioxidant capacity immediately after the washing, after 10 days and after 20 days.

MATERIALS AND METHODS

Samples and samples preparation. Samples from 2 varieties Atomic Red and Royal Chantenay were collected from a local farm in Cluj County. The carrots were analyzed as a whole they were not peeled. The laboratory samples were homogenized in a food processor and immediately divided into test portions. 1 g of homogenized sample was extracted using

5 mL of Methanol. The samples were centrifuge 10 minutes at 5000 RPM. The supernatant was extracted and analyzed.

Reagents and standards. Methanol from Merck, ultra-pure water produced using EVOQVA Siemens, Antioxidant capacity of the Lipid soluble Compounds (ACL) kit from AnalytikJena which contains a reaction buffer, PS-2 solution (photo sensitizer and detection reagent) and calibration solution for the quantification of lipid soluble antioxidants in equivalents of TROLOX.

Determination of the antioxidant capacity. The analysis was done using Photochem instrument from AnalytikJena. The principle of the instrument is photochemiluminescence (PCL).

Experimental conditions. The carrots were washed using the CALIPSO Root Washing Machine. The module consists of the following subassemblies: • Feed tray; • Washbasin; • Washing drum; • Feeder; • Drum and conveyor drive mechanism; • Ramp with nozzles for additional washing. 30 kg for each variety was washed. Analyses were done before the washing, immediate after washing, after 15 day of storage at 8°C and after 45 day of storage at 8°C. A batch of carrots was used for control, it was analyzed the day of the washing procedure (but the carrots were not washed), after 15 day of storage at 8 °C and after 45 day of storage at 8 °C. The humidity in the storage cellar was about 75-80 %.

RESULTS

The results obtained for the batch of carrots used for control are presented in table 1.

Table 1.

Results obtained for the batch of carrots was used for control

Crt. No	Carrot variety	Antioxidant capacity expressed as TROLOX equivalent (mg/kg)		
		Before washing After washing	After 15 day of storage at 8 °C	After 45 day of storage at 8 °C
1.	Atomic Red	27,14	26,18	22,20
2.	Royal Chantenay	29,45	28,22	23,49

The results obtained for the samples of carrots from the 2 varieties Atomic Red and Royal Chantenay collected from a local farm in Cluj County are presented in Table 2.

Table 2

Results obtained for the samples

Crt. No	Carrot variety	Antioxidant capacity expressed as TROLOX equivalent (mg/kg)			
		Before washing	After washing	After 15 day of storage at 8°C	After 45 day of storage at 8°C
1.	Atomic Red	28,65	27,81	25,79	21,76
2.	Royal Chantenay	29,34	28,34	26,71	21,81

The evolution of the antioxidant capacity for bought varieties for the control batch is presented in figure 1. There is a small loss of antioxidant capacity between the first day and after 15 days of storage, 3,86 % on average. Between the first day and after 45 days of storage there is a big loss of antioxidant capacity, 19,22% on average. The trend was similar for the samples with an average loss of 3,17 % after washing, 9,47 % after 15 days of storage and 24,86 % after 45 days of storage (Fig. 2).

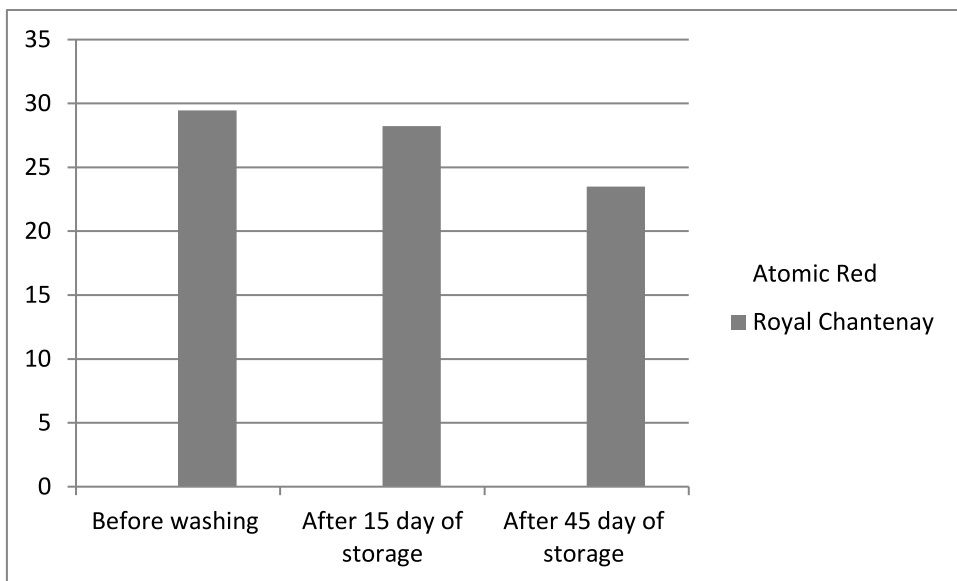


Figure. 1 Evolution of the antioxidant capacity for bought varieties for the control batch

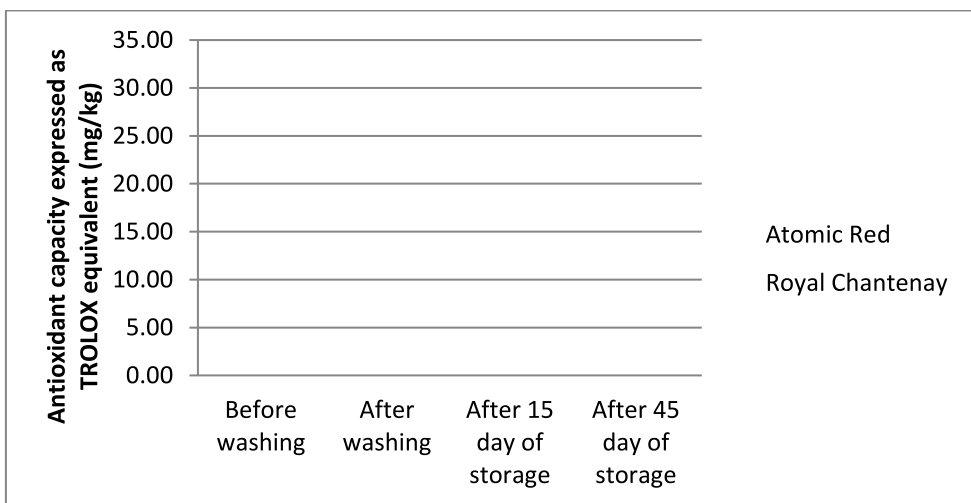


Figure 2. Evolution of the antioxidant capacity for samples

A greater lost was observed in the samples that where washed than in the control batch. There is a difference of about 5 % between the loss of antioxidant capacity in the control compared to the loss of antioxidant capacity in the samples. There was no significant difference between the two varieties regarding the loss of antioxidant capacity during storage.

CONCLUSION

- The reduced antioxidant capacity after storage is due to the degradation of carotenoids in the carrots.
- Temperature and humidity directly influence the antioxidant capacity loss.
- Washing influences negatively the antioxidant capacity of the carrots.
- After washing, the optimal time for selling the products is 10-15 day.
- Washing has the advantage that it removes pesticides and other residue found in the carrot plus it makes the carrots more marketable since the soil free ones are preferred to be bought by customers more than the ones with soil on them.

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