

Storage of vegetable products in expanded polystyrene packages

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Introduction

The quality of vegetable products is significantly affected by the package, which is used in order to protect the commodities during transportation and storage and maintain its optimal condition until it is purchased by the consumers. Packages from expanded polystyrene is already applied in a limited number of vegetable products and can even replace the conventional packaging systems in even more of them.

The wide use of EPS as a packaging system is due to its unique properties, some of which are the maximum capacity of thermal insulation, the minimal water absorbance, the low weight, the protection from mechanical damages and the low cost. In addition, given that it is recyclable, it is an environmentally friendly material, as well (Eaves, 2004).

The aim of this study was to evaluate the possibility of postharvest storage and quantify the quality changes of 3 vegetable products in closed packages of expanded polystyrene.

Material and methods

During Fall 2016- Summer 2017, broccoli heads, tomato fruit harvested at 3 ripening stages (mature green, pink and red) and baby spinach leaves were stored in closed packages of expanded polystyrene or in conventional open corrugated carton boxes at 2 temperatures (5 and 15 °C for the broccoli heads for 7 to 21 days, 10 and 20 °C for the tomato fruit for 4 to 30 days, 5 and 10 °C for the spinach leaves for 5 to 15 days). Inside each package, temperature and relative humidity data loggers were placed. Samples were examined at least 3 times during storage for each product in order to determine weight loss, as well as color and nutritional composition.

Results

● The closed EPS:

- ✓ Maintained the relative humidity (RH) in maximum level (>90%) in all storage temperatures, in comparison to the conventional carton boxes, in which a significant variation of RH was recorded in all temperatures, especially at low temperatures, due to the recirculation of the air during the operation of the cooling agent (Fig. 1).
- ✓ Significantly reduced the weight loss in all 3 products (Figs. 2-4).
- ✓ Didn't affect the color in all 3 products during 2 weeks of storage (Figs. 2-4) and the firmness (data not shown) and the color in tomato fruit (Fig. 3), implying the avoidance of ethylene accumulation in the closed EPS package.
- ✓ Maintained the dry matter, the soluble solids, the soluble phenols' content and the antioxidant capacity in the 3 vegetable products, as well as the titratable acidity and carotenoids in tomato (data not shown).

- However, it should be stated that the high relative humidity in the closed packages, as is the EPS, favors the microbial proliferation in products such as broccoli and spinach and fruit cracking on the tomato fruit and therefore frequent opening of the packages is suggested.



Photo 1. Broccoli heads (A), baby spinach leaves (B), tomato fruit red (C), pink (D) and mature green stage (E), broccoli heads after 21 days of storage at 5 °C (F), baby spinach leaves after 15 days of storage at 5 °C (G) and tomato fruit at the pink ripening stage after 21 days of storage at 20 °C (H), in closed EPS packages.

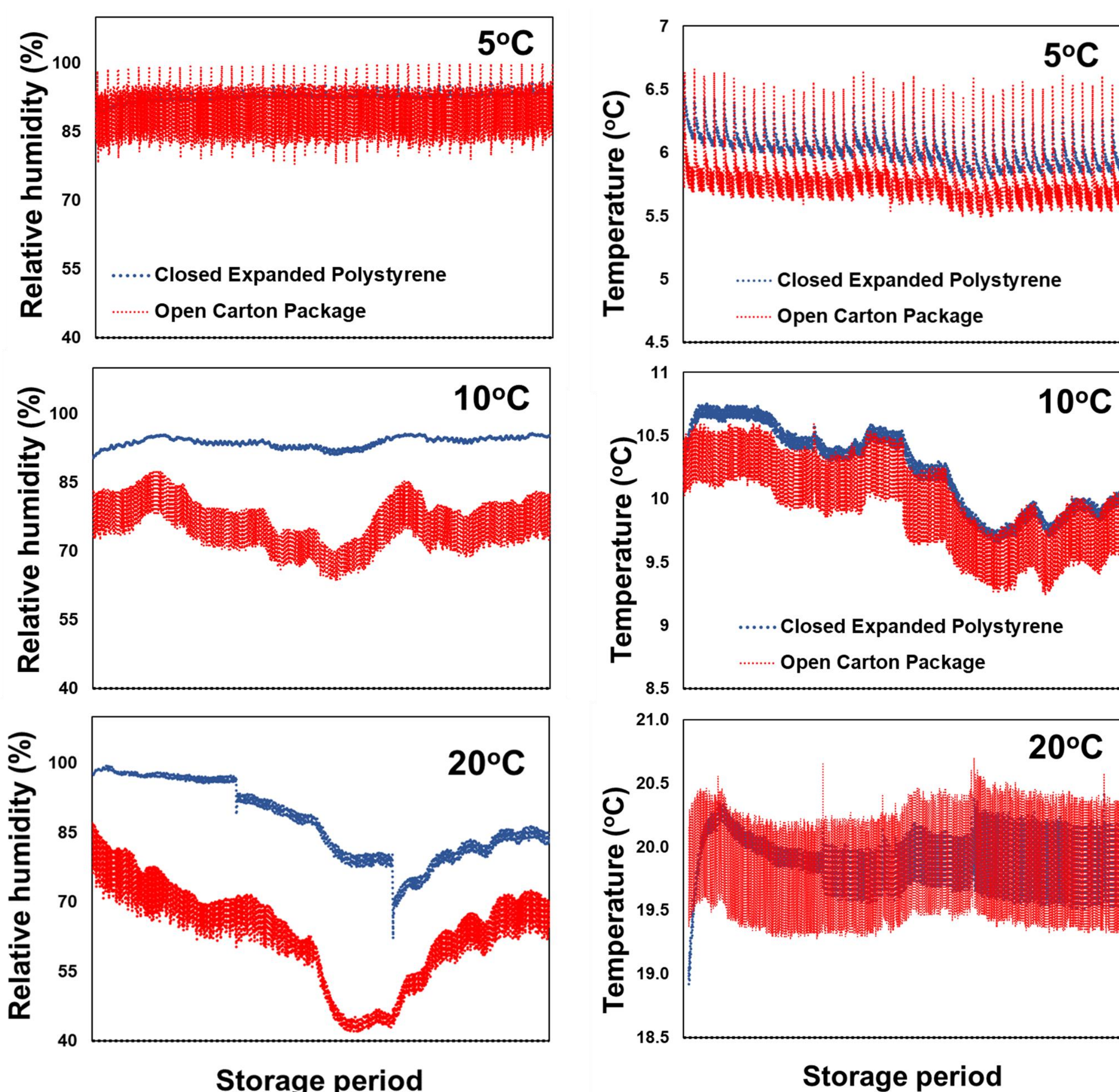


Figure 1. The relative humidity and the temperature inside the closed EPS package and the open corrugated carton boxes at various storage temperatures (5, 10 or 20°C)

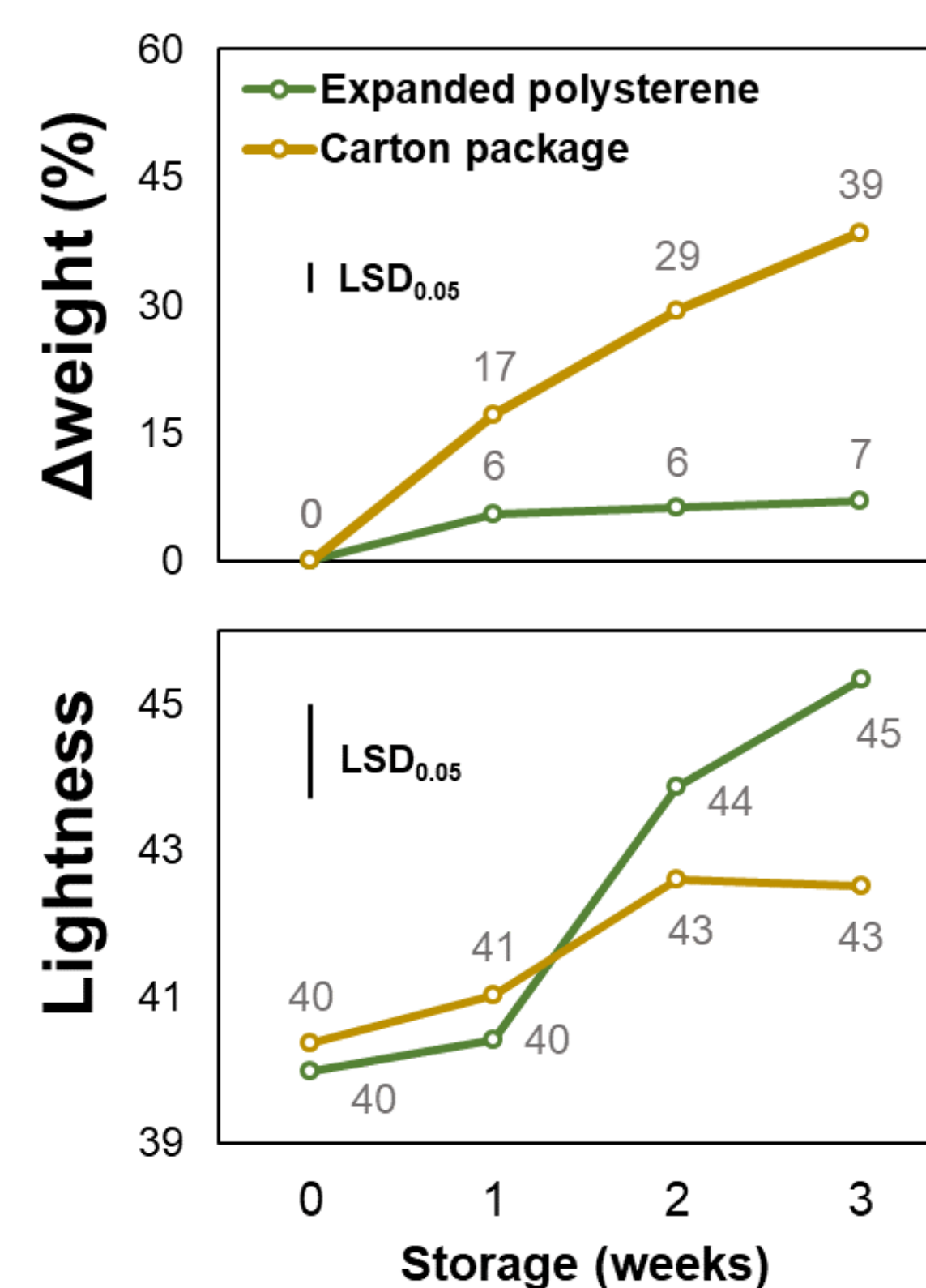


Figure 2. Weight loss and lightness of broccoli heads during storage at 10°C.

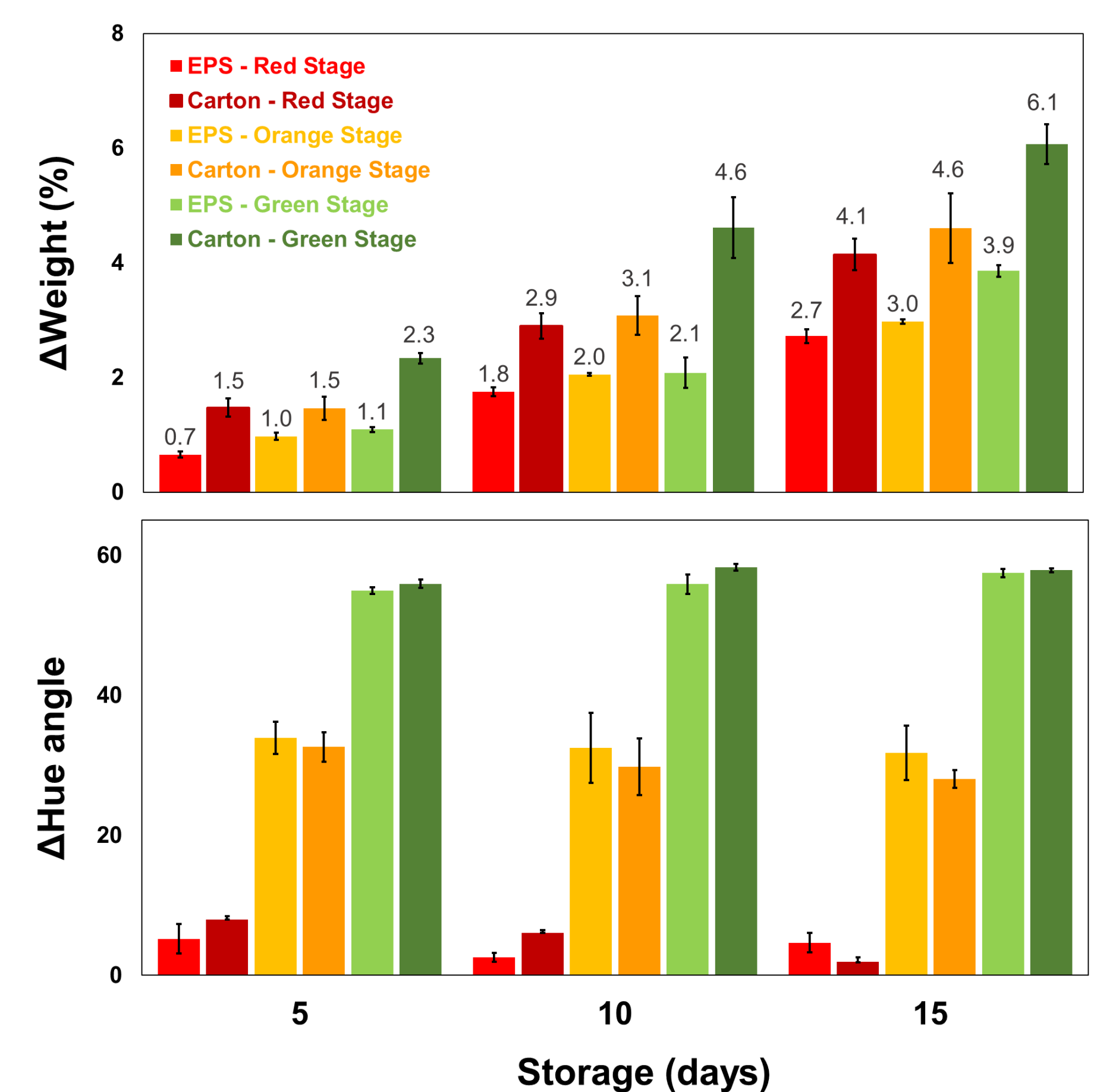


Figure 3. Weight loss and H° color parameter changes of tomato fruit harvested at 3 different ripening stages and stored at 20°C.

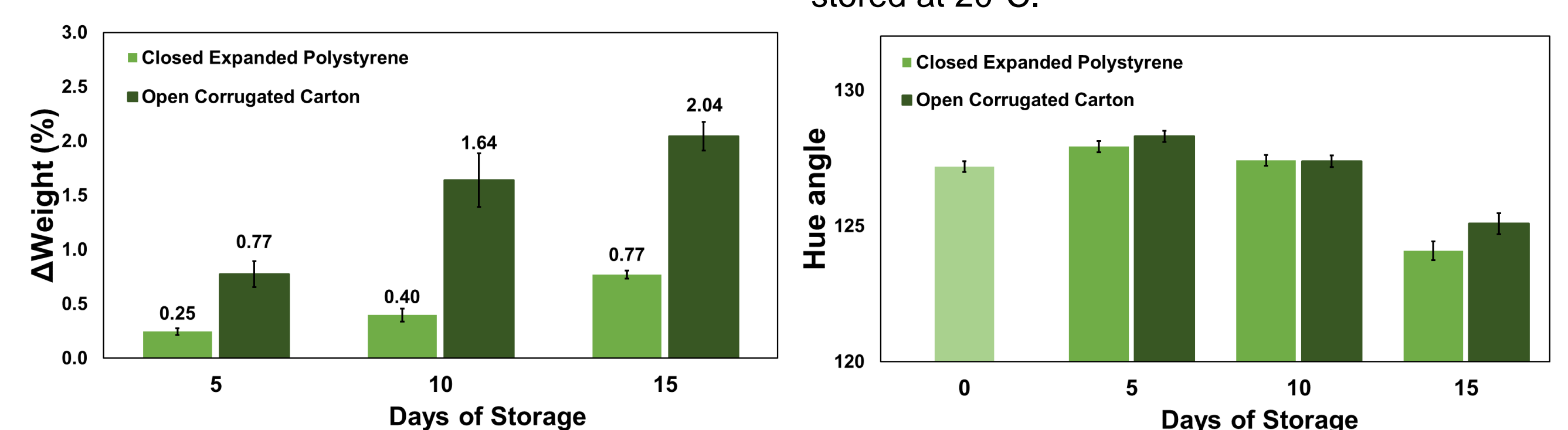


Figure 4. Weight loss and H° color parameter of spinach leaves during storage at 10°C.