



Investigating the changes in the appearance of dry leaves of *Eryngium caeruleum* L. in different periods of storage

Soudabeh Nourzad^{1*}, Hasanali Naghdi badi^{2,3}, Sepideh Kalateh jari⁴, Ali Mehrafarin⁵, Sakineh Saeidi sar⁶

¹ Ph.D. candidate, Department of Horticultural Science and Agronomy, Science and Research Branch, Islamic Azad University, Tehran, Iran

² Department of Agronomy and Plant Breeding, Faculty of Agriculture, Shahed University, Tehran, Iran

³ Medicinal Plants Research Center, Shahed University, Tehran, Iran

⁴ Assistant Professor, Department of Horticultural Science and Agronomy, Science and Research Branch, Islamic Azad University, Tehran, Iran

⁵ Medicinal Plants Research Center, Institute of Medicinal Plants, ACECR, Karaj, Iran

⁶ Department of Agricultural Science, Technical and Vocational University (TVU), Tehran, Iran

*Email: s.nourzad13@gmail.com

ARTICLE INFO

Received: January 2023

Accepted: March 2023

Type: Original Research

Topic: Phytochemistry

ABSTRACT

Introduction: *Eryngium caeruleum* M.B. (*E. caucasicum* Trautv.) is a herbaceous and perennial plant that can be found abundantly in the humid and forested areas of northern Iran and has been of interest to the natives of this region for a long time. Young leaves of Sea holly (can be used before flowering and reproductive phase) are mainly collected from humid areas and sold in local markets. *Eryngium* leaves are widely used as an edible vegetable and flavoring agent in preparing local dishes. In order to investigate the changes in appearance of leaves of Sea holly plant during different drying methods and storage time, this research was carried out in the spring of 2019.

Experimental: The research was conducted in the form of a factorial completely randomized design in three replications. The green leaves of Sea holly plant were collected from the gardens of Noor city in the vegetative stage. The treatments of this study are drying methods 4 level (shade room with a temperature of about $25\pm 3^{\circ}\text{C}$ and proper ventilation, oven at a temperature of 55°C , vacuum oven at a temperature of 55°C and a microwave with a power of 500 watts) and storage times 3 level (first day, 75th and 150th day). The amount of plant pigments, lab colorimetric indices, hue angle, redness index, browning and brightness were measured.

Results and Discussion: The results of interaction effect of treatments showed that different drying methods and storage time had a significant effect on the studied traits. The lowest amount of green plant pigments was related to dry shade samples that were stored for 150 days. The qualitative characteristics of the plant samples that were dried in that

vacuum at 55°C and then dried in a normal oven at 55°C were preserved more than other treatments. The colorimetric test showed that the plants dried in the vacuum oven method at 55 °C kept their green color well, unlike the shade-dried plants. Of course, increasing the duration of storage caused a decrease in the appearance quality of plant samples due to the decomposition of photosynthetic pigments. In thermal treatments, due to the role of heat in the destruction and decomposition of carotenoids, the amount of this compound decreases drastically. During drying, color changes occur due to the destruction of plant pigments and non-enzymatic reactions. Vegetable pigments are degraded during drying due to factors such as long processing time, high processing temperature, and seasonal changes. Degradation of photosynthetic pigments affects not only the attractive color of plants but also their nutritional value and taste. An increase in temperature has led to an increase in the rate of non-enzymatic browning reactions, and subsequently, yellowness has increased. The reason for the constant yellowness in the oven methods is probably the reduction of wrinkling at high temperature and as a result the proper reflection of light as well as the destruction of pigments. Drying at a low speed (ambient temperature) compared to rapid drying, will keep the product in a moist state for a longer period of time, which in turn will provide more time for Millard reactions and the formation of brown pigments.

Extension: In total, this study showed that the maximum greenness and appearance quality of plants dried in a vacuum oven at 55 degrees Celsius and if storage is necessary, less than 75 days of storage will be better than long-term storage, which is recommended.

Keywords: Brightness index, Chlorophyll, Color change, Oven, Storage.
