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Application of maltodextrin and gum Arabic in microencapsulation of saffron petal's anthocyanins and evaluating their storage stability and color

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ABSTRACT

In this work, anthocyanin stability and color of encapsulated freeze-dried saffron petal's extract with various matrices consisting gum Arabic (AG) and maltodextrin (M7 and M20) were studied. Total anthocyanins of powders and color parameters (a^*, b^*, L^*, C, H° and TCD) were measured immediately after production and during storage up to 10 weeks by pH differential method and computer vision, respectively. Different compounds of wall materials did not show any significant differences in terms of stabilizing anthocyanins ($P < 0.01$) and no significant decrease in anthocyanin content of the powders was observed after storage. The efficiency order of wall materials considering total color differences (TCD) was AG > M20 > M7. By evaluating 3D surface and Cox trace plots it was revealed that wall formulas which had the lowest amount of AG and highest amounts of M20 and M7 showed the lowest total color differences after storage ($P < 0.05$). To conclude, microencapsulation by freeze drying could be recommended as a suitable method for stabilizing anthocyanins of saffron petal's extract.

1. Introduction

The first property that the consumer observes in every food product is its visual color, which is an indicator of pigment concentration that is measurable immediately. Color can be changed during heat processing based on different reactions of pigments such as pigment degradation, browning reactions like Millard reactions, enzymatic browning and oxidation of ascorbic acid (Maskan, 2006). Most of the synthetic colors which are used in the food industry have chemical sources with harmful health effects. Since the anticancer and antioxidant properties of natural colorants are proven, today there are more tendencies to use natural colorants instead of synthetic ones (Andersen, Jordheim, Lew, & Hung-Wen, 2010).

Anthocyanins as natural pigments are found in roots, leaves, fruits and flowers of plants. Attractive color and functional properties (like prevention of neuronal and cardiovascular, cancer and diabetes illnesses) of anthocyanins make them a good substitute for synthetic pigments in the food industry (Castaoveda-Ovando, Pacheco-Hernondez, Priez-Hernandez, Rodriguez, & Galoan-Vidal, 2009). These natural soluble water colorants are rather unstable and influenced by final processing temperature, storage temperature, pH, chemical structure and concentration of anthocyanin, light, oxygen, enzymes, proteins and metallic ions (Patras, Brunton, O'Donnell, & Tiwari, 2010).

Saffron (*Crocus sativus*) which is produced largely in Iran, with more than 90% of total annual saffron production in the world (Kafi, 2006), has cyanic color flowers with major colorant of anthocyanins (Nørbæk, Brandt, Nielsen, Ergaard, & Jacobsen, 2002). The existence of anthocyanins in saffron's petal had been proven before by Williams, Harborne, and Goldblatt (1986) and Nørbæk et al. (2002) too. Since nearly 86.4% wet base or 96.36% dry base of total weight of saffron flowers is related to the petals (Hemmati, 2001) and a large scale of saffron flowers is disposed to the nature after picking stigmas annually; anthocyanins of petal extract can be used as a natural resource of colorants in the food industry adding to its other medicinal/industrial applications (Kafi, 2006).

Microencapsulation is a technique to package materials (like natural colorants) in the form of micro- and nano-particles. Microencapsulation can protect sensitive materials from moisture, heat, light or oxidation (Jafari, Assadpoor, He, & Bhandari, 2008). There are different methods for encapsulation in the food industry. Freeze drying which has a long dehydration period has been used as a simple technique in encapsulating water-soluble essences and natural aromas or drugs. During this procedure, core materials and matrix solutions are homogenized and then co-lyophilized to make dried materials (Fang & Bhandari, 2011).

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