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Determination of Chemical Characteristics of Saffron in Different Area of Iran

[1]Mohammad Jouki, [2]Naimeh Khazaei, [3]Hamid Tavakolipour, [4]Saeed Rajabifar, [4]Farahnaz Motamedi Sedeh and [5]Ahmad Kalbasi
[1]Department of Food Science and Technology, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran
[2]Young Researchers Club, Islamic Azad University - Shahr-e-Qods Branch, I.R. Iran
[3]Department of Food Science, Islamic Azad University-Sabzevar Branch, I.R. Iran
[4]National Radiation Protection Department, Atomic Energy Organization of Iran
[5]Department of Food Science, University of Tehran, Karaj, I.R. Iran

Abstract: In this research, saffron samples collected from 11 regions of Khorasan-Iran and chemical characteristics of them such as color, flavor and aroma were studied. Chemical characteristics of saffron (*Crocus sativus L.*) were determined by spectrophotometric device Using 255, 325 and 440 nm wavelength for three components, picrocrocin, safranal and croicn which are responsible for flavor, aroma and color parameters respectively. Spectrophotometric analysis showed that maximum absorption were 1/928 and 2/760 for pricrocrocin and crocin respectively for samples which are collected in TorbateHeydariyeh county and maximum absorption for safranal was 1/008 for samples which are collected in sheshtamad.

Key words: Crocin, khorasan, picrocrcin, saffron, safranal, spetrophotometry

INTRODUCTION

Saffron cultivation has been linked with either concealed or overt research in traditional countries of cultivation such as Iran, Spain, Greece, India, Italy, Azerbaijan, and France and in other countries such as China, Israel, Japan and Mexico (Negbi, 1999). *Crocus sativus* (saffron) has been cultivated in Iran for centuries. Saffron (*Crocus sativus*L.) is the world's most expensive spice and 75 % of the production is coming from Iran. Production 250 ton per year in 2007 showed that Iran is greatest producer saffron in the world. It has been used as food additive, culinary proposes, medicinal and coloring agents. The novel use of saffron in recent years has been associated in cancer cure. This delicate spice has been utilized for thousands of years for different parts of world particularly Iran, China, Spain, Italy, India, Turkey and Greece. Saffron cultivated area in Iran is about 47000 ha. The best saffron, possessing the most powerful aroma, is cultivated in Iran, Spain and Azerbaijan (Askerov, 1934).

In this article, we delve into the topic of saffron within the geographic context of Iran. Saffron is cultivated in the semiarid Khorasan region of Iran (Behzad *et al*., 1992a; Behzad *et al*., 1992b). According to a newspaper article, some 6,000 ha in this region produce 30 tonnes annually (Anon, 1989). We traveled to Khorasan, Iran, specifically to participate in the autumn saffron harvest and to experience firsthand the local-scale activities associated with its cultivation. In this research saffron samples collected from 11 region of Khorasan of Iran and studied separately. Chemical characteristics of saffron (*Crocus sativus L.*) were determined by spectrophotometric device Using 255, 325 and 440 nm wavelength for three components, picrocrocin, safranal and crocin which are responsible for flavor, aroma and color parameters respectively. Each sample of each area set to tube and container that wear it with in Scriptable film to light and after Collection carries to laboratory in nuclear agricultural department in Iran (Karaj). Then water solution of sample was prepared and sample was injected to spectrophotometer and Absorption readied and recorded.

MATERIALS AND METHODS

Sample preparation and storage: Saffron samples were obtained from different area of Khorasan state of Iran contain 11 regions (Tabas -Ttorbatheydariyeh - Ghaen - Ferdos - Birjand - Gonabad - Bardaskan - Sheshtamad - Khor- Bijvard - Kashmar - Bajestan). Saffron samples picked with forceps and put in tube from each farm (Fig. 1 and 2).This study was conducted in October 2010 and all analyses were performed in the laboratory of Agricultural, Medical and Industrial Research School-Nuclear Science and Technology Research Institute (NSTRI), in Karaj, Iran.Thirty three packets of samples

Corresponding Author: Mohammad Jouki, Department of Food Science and Technology, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran

Fig. 1: Photo of saffron sampling

Fig. 2: Field of saffron in Torbat-e-heydarie

Fig. 3: Photo dissolving of saffron in water by using magnetic shaker

Fig. 4: Measuring of chemical characteristics of saffron by spectrophotometer

were selected each containing 1g of saffron. Packets were stored at room temperature (25-30ºC) in dark and dry place.

Spectrophotometer analysis: Saffron samples milled to make a fine powder before spectrophotometery. 500 mg of saffron was dissolve in 90 mL water slowly using magnetic shaker for 1 hours and the final volume made to 1 L. 20 mL of this sample taken and dilution make by compressive syringe and membrane (0/45 micron). This sample was taken for spectrophotometer analyzer (Fig. 3 and 4).

All of absorption recorded and among of each compound accounted with under equation:

$$n = \frac{A.100}{M} \cdot \frac{100}{100 - H}$$

M = Mass of sample
H = Humidity of saffron
A = Absorption spectra

Statistical analysis: Data obtained was analyzed statistically (ANOVA) wherever possible and percent loss against control was computed, difference among the results obtained by different treatments were analyzed statistically and means were separated by Least Significant Difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

For many consumers who use it only as a magnificent yellow food color (Sastry *et al*., 1955; Rietz, 1961; Zarghami, 1970), this parameter is quantitatively and readily determined spectrophotometrically as above. Quantitative and simple determinations of safranal and picrocrocin, even approximate, are more problematic. Saffron's aqueous spectrum shows three peaks of different heights, at about 440 (visible), 325 and 255 nm (ultraviolet) (Basker and Negbi, 1985). It has been reported that the two ultraviolet peaks can be used to estimate relative concentrations of safranal and picrocrocin, respectively, either directly (International Standards Organization, 1990) or by difference from a low-point at 297 nm (Corradi and Micheli, 1979). Confirmation of such methods would be desirable and useful: the pure products are required for calibration purposes-methods for their laboratory extraction from saffron are given by Guenther (1952) (safranal by steam-distillation), by Kuhn and Winterstein (1934) (picrocrocin by solvent extraction), and by Iborra *et al*. (1992) for microsamples (Guenther, 1952; Kuhn and Winterstein, 1934; Iborra *et al*., 1992). HPLC (high-performance liquid chromatography) has also been employed (Solinas and Cichelli, 1988).

A summary of the results of Spectrophotometric analysis is shown in Table 1. Spectrophotometric analysis showed that maximum absorption were 1/928 and 2/760 for pricrocrocin and crocin respectively for samples which are collected in TorbateHeydariyeh county and maximum

Table 1: Saffron chemical characteristics of different area of Iran

Chemical characteristics City	Spect absorption (Mean±SE)		
	$_{255\ nm\ a}$ Flavor	$_{325\ nm\ b}$ Aroma	$_{440\ nm\ c}$ Color
Sheshtamad	1.656±0.009	1.008±0.006	0.728±0.003
Khor-bijvard	1.092±0.003	0.576±0.005	2.530±0.013
Bardaskan	1.812±0.003	0.628±0.007	2.580±0.002
Bajestan	1.580±0.005	0.696±0.002	2.440±0.001
Kashmar	1.800±0.008	0.709±0.006	2.760±0.002
Torbateheydarieh	1.360±0.005	1.360±0.004	1.360±0.005
Qaen	1.360±0.005	0.633±0.002	2.560±0.013
Gonabad	1.618±0.002	0.933±0.005	0.473±0.002
Ferdos	0.639±0.006	0.282±0.009	0.698±0.002
Birjand	1.610±00.002	0.535±0.004	2.320±0.011
Tabas	1.148±0.004	0.500±0.006	0.943±0.002

[a]: For flavor and aroma intensity and 0 (tender) to 3 (tough;)[b]: For flavor and aroma intensity and 0 (tender) to 3 (tough); [c]: Scale ranged from 0 (none color (red)) to 3 (strong color)

absorption for safranal was 1/008 for samples which are collected in sheshtamad.

After a brief overview of some of the botanical and biological features of *Crocus sativus* L., I discuss saffron cultivation in northeast of Iran. I draw attention to the geographical and cultural characteristics that give rise to Khorasan saffron, which is famous for its distinct aroma and ability to provide intense color to whatever it is added. In Iran, saffron is mainly grown in Khorasan, which is located at the Northeast, and an altitude of about 1000 m. However, saffron-growing plots are located at an altitude of about 1200 to 1400 m in a warm microclimate which is nevertheless cooler than in Khorasan itself, thereby enabling higher yields and better quality saffron. Winter is relatively cold with snowy days. Although the snow cover is usually thin and short lasting, it can cause significant damage to the leaves, the photo synthetically active organs. This, in turn reduces the filling of the daughter corms and, consequently the yield of the following year. Summer temperatures can reach 25-30ºC and air is relatively dry year-round. Rainfall in the area ranges from 100 to 200 mm/annum. Dominant winds blow in a N-NW direction and frost can occur from January to March. Soils in the saffron-growing areas are either sandy loam or calcareous clay with a fairly loose texture.

Farm manure is used at 10 to 20 tons per ha, depending on its availability, and thoroughly mixed with the soil. Before planting, the land is leveled to facilitate irrigation. The soil is prepared during August and September. Manure is also used in the third or fourth year of planting. No other fertilizers are used in the area for saffron production. After planting, the crop is irrigated and the soil is superficially worked once it is relatively dry to allow for good aeration and flower emergence.

CONCLUSION

Spectro photometric analysis showed that maximum absorption for pricrocrocin and crocin were 1/928 and 2/760, respectively for Torbat-e-Heydariyeh county, and maximum absorption for safranal was 1/008 for she shamed of Sabzevar county. Under the field conditions of Torbat-e-heydariyeh-Iran, urea fertilizer and regular irrigation may have effect on the picrocrocin and saffranal compounds value, fresh and dry weights of saffron plant in comparison to others samples. The soil where saffron is being cultivated have a texture of sandy and clay which is rich in terms of organic materials (middle texture). Under the field conditions of Sheshtamad-Iran, cold weather, sandy soil, cultivate in mountain and semi dry area, early removal time and irregular irrigation and using organic fertilizer may have effect on the crocin compound (aroma) of saffron plant in comparison to others samples. Many factors are effective in value of flavor, aroma and color such as: properties of weather, soil, temperature of region and removal time.

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