Results Obtained by Investigating Saffron Using FT-IR Spectroscopy

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Abstract

Investigations of authentic and commercial saffron samples of different origin is very important. The biological activity and the pharmaceutical properties of plants are strongly dependent on their structure. The FT-IR spectra of saffron (commercial from India) have been obtained and the vibrational fundamentals from the IR spectrum, were analyzed and assigned according to the available literature.

Keywords: *FT-IR (Fourier transform infrared) , Saffron (Crocus sativus)*

INTRODUCTION

Saffron (*Crocus sativus*) belongs to the iris family is one of the highly prized spices known since antiquity for its color, flavor and medicinal properties. This contains several plant-derived chemical compounds that are known to have been anti-oxidant properties and it's a good source of minerals like copper, potassium, calcium, manganese, iron, selenium, zinc and magnesium.

This colorful spice has many non-volatile active component and the most important of them Alfa-crocin, a carotenoid compound, which gives the spice its characteristic golden-yellow hue, has been found to have anti-oxidant, anti-depressant, and anti-cancer properties.

Saffron extract has been shown to be capable of inhibiting or retarding the growth of tumors in a variety of experimental models in vivo. A topical application inhibited second-stage skin cancer, and oral administration of saffron extract restricted soft tissue sarcomas and inhibited tumor cell growth in mice (Fikrat, 2002). Because,

the saffron is cultivated in many countries having very important medical properties is necessary experimental studies. Vibrational spectral techniques, FT-IR, offer several advantages in the context of current research and using this techniques we can identify molecular components in the samples studied. IR spectroscopy is based on the absorption of radiation in the 400 – 4000 cm⁻¹ range which excites molecular vibrations.

AIMS AND OBJECTIVES

Our research had the objective of analyzed a vibrational spectra of saffron commercially from India, using a method which is based on microscopic infrared study (FT-IR).

MATERIALS AND METHODS

The sample was obtained from 0,003 g of saffron commercially (filament samples). For FT-IR measurements were performed in the absorbance with a spectrophotometer FT-IR-4100 Jasco, using the KBr pellet technique. Spectral resolution was

Fig. 1 FT-IR spectra of saffron commercially (filament sample) from India.

set at 4 cm⁻¹ and all spectra were acquired over 256 scans. The spectral data were analyzed using Origin 6.0 software.

RESULTS AND DISCUSSION

Canssoni *et al.*, 2016, because the origin of saffron plants is important, make a study on authentic samples of saffron of known history (harvest and processing year, storage conditions, and length of time) some biomarkers were proposed using both FT-IR and NMR metabolomics regarding the shelf life of the product.

In other studies because this plants is a native of Southern Europe and today cultivated in many countries (Spain, Italy, France, Greece, Turkey, Iran, and in the India), Mid-infrared spectroscopy combined with multivariate analysis has been applied for the discrimination of 250 saffron samples from Greece (40 samples), Iran (87 samples), Italy (60 samples) and Spain (63 samples) (Anastasak *et al.* 2010).

The best discriminatory approach was achieved in the spectral region 2000–700 cm⁻¹. The spectral region responsible for the differentiation of Italian samples is in the region of carbonyl group around 1746 cm⁻¹. The spectral region at around 1600 cm⁻¹ and the band at 1670 cm⁻¹ are responsible for the differentiation of samples from the remaining countries. In the present work the infrared spectra of saffron filament samples (commercially of India) were recorded.

The vibrational FT-IR spectra (presented in Fig. 1) for commercial saffron were analyzed by comparing the experimental vibrational modes with the previous published data.

Making a comparasion between FT-IR spectrum of saffron India and saffron of other countries, the

peak at 1746 cm⁻¹ attributed to the carbonyl grup, responsible for the differentiation of Italian samples, showed in previous studies (Anastasak *et al.*, 2010), in this study is very weak and retrieved at 1741 cm⁻¹. Another peak correspond to the carbonyl group appears at 1721 cm⁻¹ in spectrum of saffron from India.

The vibrational IR spectra of saffron is increased in relative intensity in the wavenumber range 2800- 3000 cm⁻¹. The very strong peaks at 2942 cm⁻¹ and 2854 cm⁻¹ corresponds to the C-H stretching. The same attribution is available for the medium peak at 2964 cm⁻¹.

The strong peaks at 1462 and 1081 cm⁻¹, respectively correspond to the C= O stretching vibrations. Comparing our study whit previous studies the peak 1119 , 1376, 2924 and 2854 cm⁻¹ is traced in FT-IR spectrum of saffron original from India.

CONCLUSION

Using vibrational spectroscopy, it was proven that we can identify key molecular components in the samples studied and their molecular structure. The major changes were observed in the spectral ranges where the carbonyl group exhibit characteristic vibrational modes.

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