ASSESSMENT OF THE QUALITY OF SAFFRON SYRUP EXTRACT BY RAMAN SPECTROSCOPY

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Abstract: Saffron is considered a very valuable substance, containing vitamins B, C, A, PP, minerals such as iron, calcium, magnesium, sodium, fluoride, potassium, and essential oils. Many countries produce medicinal preparations and supplements based on saffron in traditional medicine: improving digestive activity, detoxifying the body, removing toxins, relieving pain and spasms, calming the nervous system, increasing skin elasticity, improving skin condition, enhancing the activity of the hematopoietic system, inhibiting the development of pathogenic flora in the body, and strengthening the immune system. Saffron acts as an antispasmodic, anticoagulant, diuretic, and anti-inflammatory agent. It enhances memory and improves digestion. Saffron is used to treat dry bronchitis, asthma, and coughs. Its medicinal infusion is used to heal deep wounds and burns. Its antimutagenic properties and ability to counteract the development of sarcoma tumors are actively being studied. Its pleasant aroma is recommended for treating respiratory tract infections.

Saffron, the dried stigma of Crocus sativus L., is highly valued for its unique characteristics, labor-intensive harvesting process, and the numerous beneficial properties of the flower. Each flower produces approximately 6 mg of saffron stigma. Therefore, to produce 1 kg of saffron, around 150,000-160,000 flowers are required. Saffron is primarily cultivated in Iran, India, Greece, and Spain. Factors such as cultivation region, climate, harvesting process, and storage conditions influence the quality of saffron.

The antioxidant properties of saffron make it a widely used ingredient in traditional medicine. Its high value makes it economically important for many regions. Saffron products and artificial dyes often reduce the concentration of saffron, or use synthetic colors to preserve the color of saffron products. However, current analytical methods do not provide accurate results. Additionally, traditional methods of quality control are influenced by human factors.

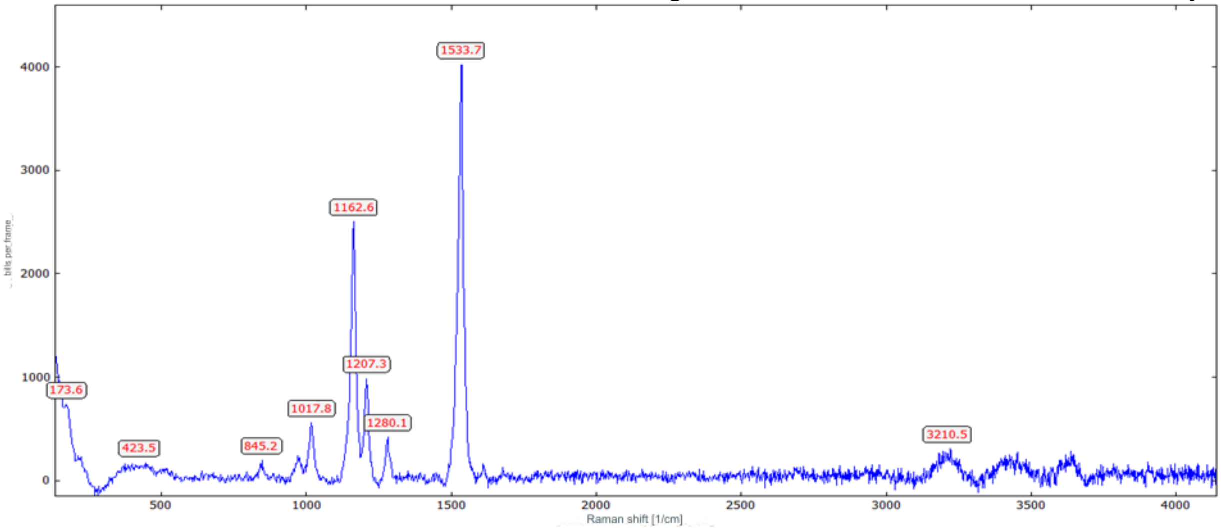
Morphological and histological methods are complex and require sufficient expertise to analyze dried plant materials objectively. High-performance liquid chromatography and gas chromatography-mass spectrometry are expensive and time-consuming for analyzing complex processes.

Therefore, the use of reliable analysis methods that do not harm the environment is essential for collecting and processing data automatically according to modern standards.

Research objective: Based on the above considerations, the purpose of the research is to evaluate the quality of saffron products using Raman spectroscopy.

Materials and methods: Raman spectra were recorded using a Raman spectrometer "R-532" produced by the US company "Enhanced Spectroscopy". Technical specifications of the instrument: spectral range 100-6000 cm-1, resolution 5-8 cm-1, laser wavelength 532 nm, power 50 mW, detector type CCD, number of pixels 3648, focal length 75 mm, entrance slit 20 μm, holographic diffraction grating 1800 lines/mm.

Results and conclusions: Raman spectra of saffron samples cultivated in the Zomin region of Jizzakh province, Uzbekistan were obtained using Raman spectroscopy. The results are presented in the figure. The main spectral features in the Raman spectrum of saffron syrup extract were observed in the spectral range from 1900 to 800 cm-1. The highest intensity peaks correspond to the stretching vibrations of C=C bonds at 1533 cm-1. Additionally, C-O stretching vibrations were observed at 1280 cm-1 and C-C bonds at 1207 cm-1. The presence of C-O-C bonds was confirmed at 1162 cm-1 following the C=C bond based on intensity.



1 - Figure. Raman spectra of saffron flower stigma water extracts

Modern Raman spectroscopy methods were used to assess the quality of saffron essence products. The obtained Raman spectrum of the sample identified the characteristic pathways at 1162, 1207, and 1535 cm-1 as intensive combination vibrations specific to the product.

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