Saffron (Crocus sativus L.) characterization: an analytical integrated approach

Vignolini P., Alessandri S., Ieri F., Miotti C., Romani A.

PHYTOLAB laboratory, DiSIA –Department of Statistics, Informatics, Applications, University of Florence, Via Ugo Schiff, 6–50019, Sesto F.no (FI)

Dried red stigmas of Crocus sativus L. are a very expensive spice known as saffron, used as a food flavoring and coloring agent and as a traditional herbal medicine [1]. The purpose of this paper is to report the analyses of stigmas from different samples of C. sativus cultivated in Italy (2 samples from Tuscany and 2 from Umbria, provided by Associazione Zafferano Italiano) in order to characterize this product from a quality point of view [2]. The identification of crocins, safranal, picrocrocin, and flavonols was carried out by HPLC/DAD analyses of the hydroalcoholic (EtOH:H₂O 70:30, pH 3.2) extracts. In stigma samples crocin contents ranged from 341.90 to 523.58 mg/g; flavonols from 15.71 to 20.00 mg/g; safranal from 0.66 to 0.98 mg/g, and, finally, picrocrocin from 36.32 to 55.22 mg/g. The following parameters, moisture, ash, fiber, protein, fat, sugars and minerals (Na, K, Mg, Ca, Fe, C, Zn, Mn) were evaluated to draft a nutritional table for the label of commercial saffron. Moreover, the quantitative analyses of an aqueous extract was carried out by spectrophotometric analyses (ISO/TS 3632-2:2003). This method allowed the determination of picrocrocin (71.97 - 102.93 mg/g), safranal (25.04 - 34.81 mg/g) and total crocin (163.29 - 210.01 mg/g) contents. Moreover, a quali-quantitative HPLC/DAD analysis of the aqueous extracts was performed for an in depth knowledge of biomolecules. Saffron aqueous extracts (ISO/TS 3632-2:2003, enriched with D₂O 10% vol. for the locking signal and DSS 0.01 mM as internal standard) were also analyzed by high resolution NMR (400MHz), to further characterize this product [3-5]. Two kind of ¹H experiments were carried out, both gradient-based and both using excitation sculpting by water-selective 180° shaped pulse to achieve solvent suppression: a one-dimension experiment (size of FID 65535, 256 scans or more, depending on the sample) and a two-dimension total-correlation experiment (TOCSY, with size of FID 2048-512*256-512, 128-256 scans, depending on the sample). The building of database is in progress, to integrate and correlate the information derived from the different applied analytical methods [6].