

## Kaempferol from Saffron Petals

Farzin Hadizadeh<sup>\*a,b</sup>, Naaman Khalili<sup>a</sup>, Hossein Hosseinzadeh<sup>a,b</sup>, Randa Khair-Aldine<sup>a</sup>

<sup>a</sup>Faculty of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran, <sup>b</sup>Bu-Ali Pharmaceutical Sciences Research Center, Bu-Ali Square, Mashhad, Iran.

---

### Abstract

A flavonol, kaempferol, isolated from the fresh flower petals of *C. sativus* L. (Iridaceae) as the sole component. The structure of the compound was determined by chemical and spectroscopic methods.

**Keywords:** Flavonol; Kaempferol; *Crocus sativus*.

---

### Introduction

*Crocus sativus* L., (Iridaceae) commonly known as saffron is native to Asia Minor and Southern Europe. It is used in folk medicine as antispasmodic, carminative, stomachic, expectorant, aphrodisiac, cardiogenic and stimulant (1). In traditional medicine this plant is utilized as an exhilarant and curative of anxiety (2, 3). Furthermore modern pharmacological studies have demonstrated that saffron extract have antitumor effects (4), radical scavenger properties (5) and hypolipemic effects (6). In addition, it has recently been found that it could be useful in neurodegenerative disorders accompanying memory impairment (7). Also it has been recently reported that ethanol extract of Saffron petals possesses antidepressant activity (8). Phenolic compounds are likely to be the biologically active components of the petals (9). Flavanoids and anthocyanins are among phenolic compounds of this species (10). This work is a continuation of phytochemistry studies on the phenolic compounds present with *C. sativus* and reports isolation and elucidation of a flavonoid from *C. sativus* petals as the sole compound, possessing pharmacological activity (11).

### Experimental

#### Apparatus

<sup>1</sup>H-NMR spectra were recorded on a Bruker Ac-100 spectrometer. UV spectra were determined in MeOH on Shimadzu UV-160A UV/VIS spectrophotometer. Thin layer chromatography was performed on silica gel plates (Merck, Germany) with the mixture HCO<sub>2</sub>H-H<sub>2</sub>O-MeOH (1:9:20).

#### Plant Material

The petals of *C. sativus* were collected from near the city of Torbat-Heidariye, north east of Iran in October 2000 and dried in shadow followed by grinding. The *C. sativus* L. was properly identified by the Department of Botany Ferdowsi University, and voucher samples were preserved for reference in the herbarium of the school pharmacy, Mashhad, Iran (143-0319-1).

#### Extraction and Isolation

Powdered petals of *C. sativus* (100g) were extracted with MeOH containing 1% concentrated HCl at room temperature, until complete discoloration of petals. The combined methanol extract was evaporated *in vacuo* at 30°C to leave a crude extract (5g). The crude extract was hydrolyzed with HCl (1.8N, 5ml for each 150mg crude extract) under nitrogen atmosphere according to the literature (12). The resulting solution was extracted with amyl alcohol (5ml x 3). The organic layer was

---

\* Corresponding author:

Email: fhadizadeh@yahoo.com

**Table 1.**  $^1\text{H}$  NMR ( $\text{CD}_3\text{OD}$ ) spectra data of hydrolysis product and that of kaempferol reported

H	found	kaempferol
6	6.27 d (1.90)	6.28 d (2)
8	6.46 d (1.94)	6.48 d (2)
2'	8.15 d (8.86)	8.05 d (9)
3'	6.99 d (8.87)	6.95 d (9)
5'	6.99 d (8.87)	6.95 d (9)
6'	8.15 d (8.86)	8.05 d (9)

washed with water until the pH of the aqueous phase remained constant. Organic phase was evaporated *in vacuo* to leave a residue. The structure of the residue was determined by spectroscopic methods.

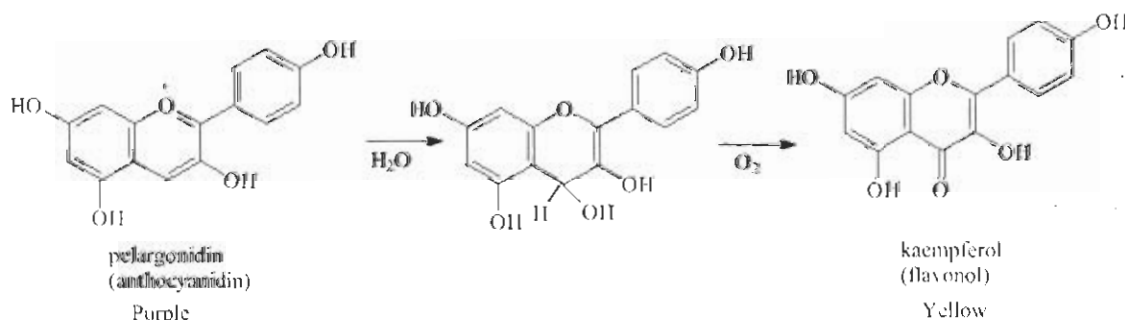
### Results and Discussion

Thin layer chromatography of the dried MeOH extract of petals showed only one fraction ( $R_f = 65$ ). Thin layer chromatography of acid hydrolysis product also showed only one fraction ( $R_f = 54$ ). It was identified as kaempferol by  $^1\text{H}$ -NMR studies (table 1). Its NMR data was compared with that of kaempferol (13). UV spectra were taken in MeOH. Absorption maximas were 265 and 365 nm, identical to that of the standard kaempferol (14). This result was in contrast to previous reports of Khorasan center of Iranian institute of science and technology which has mentioned the anthocyanidin, delphinidin, as the sole component of the *C. sativus* petals in the same region (11). Perhaps anthocyanidins of petals (e.g. pelargonidin), which with respect to their color, should be present were missing, destructed or most probable oxidized to kaempferol during extraction or hydrolysis (scheme 1) process.

Isolation of flavonols, including kaempferol, from saffron crude plant has also been previously reported elsewhere in the literature (15, 16).

### References

- (1) Zargari A. *Medicinal Plants*, Volume 4, Tehran University Press, Tehran (1993) 574-578
- (2) Mirheidar H. *Maarife Ghiahi*, Farhang-e Eslami Press, Tehran (1994) 341-5
- (3) Salomi MJ, Nair SC and Panikkar KR. Inhibitory effects of *Nigella sativa* and *Crocus sativus* on chemical carcinogenesis in mice. *Nat. Cancer* (1991) 16: 67-72
- (4) Rejhan MS. *Herbal drugs and treatment*, Alavi Press, Tehran (1995) 87
- (5) Nair SC, Kurumboor SK, Hasegawa JH. Saffron chemoprevention in biology and medicine. *Cancer Biother.* (1995) 10: 257-264
- (6) DerMarderosian A. *Review of Natural Products*, Facts and Comparison, Missouri (2001) 520.
- (7) Abe k and Saito H. Effects of saffron extract on learning behavior and long-term potentiation. *Phytother. Res.* (2000) 14: 149-152
- (8) Karimi G, Hosseinzadeh H and Khaleghpanah P. Study of antidepressant effect of aqueous and ethanol extract of *Crocus sativus* in mice. *Iranian J. Basic Sciences* (2001) 4: 186-190
- (9) Garrido-Pol JL, Diez de Bethencourt C and Revilla E. Flavonoids composition of hydrolyzed petal extracts of *Crocus sativus*. *Anal. Brometol.* (1987) 39: 69-77
- (10) Isao k and Ikuyo KH. Flavonols from saffron flowers, tyrosinase activity and inhibition mechanism. *J. Agric. Food Chem.* (1999) 47: 4121-4125
- (11) Hosseini DK and Shariatmadar, Sh. *Identification of anthocyanins of Crocus sativus petals*. Iranian Institute of Science and Technology Reports, Khorasan Center (1994)
- (12) Strack D and Wray V. Anthocyanins in Methods Plant Biochem (1989) 1: 325-326
- (13) Smolarz, HD. Flavonoids from *Polygonum lapatifolium* ssp. *tomentosum*. *Pharm. Biol.* (2002) 40: 390-394
- (14) Budavari S. (Ed) *The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals*, 13<sup>th</sup> ed. Merck & Co. INC, New Jersey (2001) 5288
- (15) Tarantilis PA, Tsoupras G and Polissiou, M. Determination of saffron (*Crocus sativus* L.) components in crude plant extract using high-performance liquid chromatography-UV-visible photodiode-array detection-mass spectrometry. *J. Chromatogr. A* (1995) 699: 107-118
- (16) Lozano P, Castellar MR, Simancas MJ and Iborra JL. Quantitative high-performance liquid chromatographic method to analyses commercial saffron (*Crocus sativus* L.) products. *J. Chromatogr. A* (1999) 830: 477-483

**Scheme 1**