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Original Article

Kaempferol from Saffron Petals

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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, cardiotonic 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 hypolipaemic 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).

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Experimental

Apparatus

^{1}H-NMR spectra were recorded on a Brucker 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_2H-H_2O-MeOH (1:9:20).

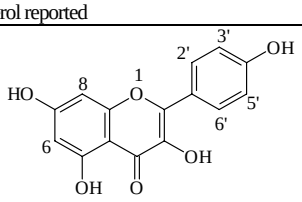
Plant Material

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 vacuum* at 30^{o}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

Table 1. ^{1}H NMR (CD_3OD) 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 vacuum* 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}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 anthoyanidins 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).

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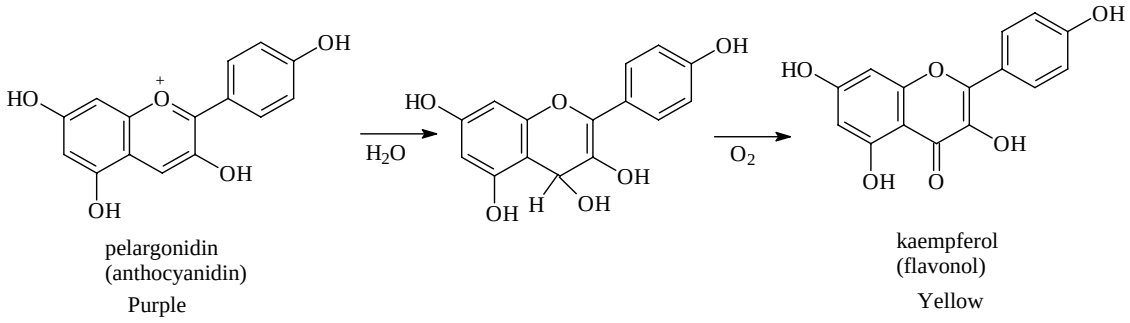

pelargonidin
(anthocyanidin)
Purple

kaempferol
(flavonol)
Yellow

Scheme 1