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Saffron an Unani Drug and Concept of Adulterant: A Comparative Assessment

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Abstract: Saffron is the name of dried stigmas of *Crocus sativus* L. flower whose dried stigmas which are a popular spice and food condiment renowned for its color, aroma, and flavor. It is used generally in the Unani system of medicine as a single and in compound drugs due to comprehensive pharmacological properties. The main bioactive constituents of saffron are carotenoids such as crocetin esters (or crocin), crocetin, and terpenoids like picrocrocin and safranal. Due to the high cost of saffron, adulteration occurs in local markets. For saffron adulteration, normally inexpensive and available plants, less important parts of the saffron plant, minerals, artificial colorant, weight agents, animal substances, and artificial substances are used. In this paper, we communicate a comprehensive review on comparative assessment of various adulterants of Saffron.

Keywords: Saffron, Stigma, Adulteration, Medicinal plant, Comparative assessment

INTRODUCTION

Unani is a traditional system of medicine developed during the medieval period, which employs natural drugs of herbal, animal and mineral origin for treatment (Reesha et al.,2022). Medicinal plants constitute an effective source of traditional and modern medicine. Herbal medicine has been shown to have genuine utility. In India, about 80% of the rural population depends on medicinal herb. Approximately 70% of synthetic medicines are derived from plants. Herbal adulteration is one of the common malpractices in herbal raw-material trades. Adulteration is described as intentional substitution with another plant species or intentional addition of a foreign substance to increase the weight or potency of the product or to decrease its cost. Saffron (*Crocus sativus*) covers about 4% out of the total cultivated area of the Kashmir valley and it provides about 16% of total agricultural income (Anonymous Saffron is considered to be the highest priced spice in the world, so adulteration is very common in this drug with cheaper substitutes such as *Zea mays, Onopordum*

acanthium, Carthamus tinctorius, Chrysanthemum morifolium Ramat. and *Calendula officinalis* and many more. However, the contents of the active compounds of these adulterants are distinct from that of saffron which obviously reduces the efficacy of *C. sativus*. Thus, for the benefits of consumers and the quality control of saffron, correct identification is necessary (Wei-juan et al 2015).

Saffron (*Crocus sativus* L.)

C. sativus L. belongs to Iridaceae family. It is commonly known as Saffron. This herb is perennial and widely cultivated in Iran and other countries like India and Greece. Commercial Saffron comprises the dried red stigma with a small portion of the yellowish style (Srivastava et al 2010).According to the Unani system of medicine, Saffron has been considered as aphrodisiac, emmenagogue, antidepressant, anodyne, respiratory decongestant, antispasmodic, diaphoretic, sedative, expectorant and it is one of the ingredients of many Unani compound formulations. Therefore, it has been used to treat in many diseases like scarlet fever, smallpox, colds, asthma, heart diseases, tumor, cancer, flatulent colic and in menstrual disorders (Syed et al 2020). Coloring properties of Saffron are mainly due to the water-soluble crocin. The colorless glycoside is picrocrocin. Safranal is responsible for the aroma of Saffron (Amjad et al 2020).

General tests such as moisture content, volatile substance, bitterness, flavor, color strength, floral waste content, microscopic examination of Saffron powder, determination of total ash, acid soluble and insoluble ash with measurement of crocin, picrocrocin and safranal by spectrophotometry can use for its identification. Besides, there is one more standard (Microbial Specification and its Tests) used to examines microbial contamination during the process of picking of flowers, transportation, stigma separation, drying and packing also (Amjad et al 2020).

Vernacular names: Saffron, Spanish Saffron, True Saffron, (Heber 2003). Kesar, Zaffran, Kumkuma, Mangal, Kusrunam, Saffron, Zafrah (Srivastava et al 2010).

Part used: Stigma (Heber 2003).

Temperament: Hot (2) & dry (1) (Ghani 1971).

Macroscopy: Color of stigma is dark red to reddish brown and style is yellowish brown to yellowish orange (Srivastava et al 2010). Stigmas 3, united or separate, attached to the top of the style; usually about 25 mm in length, cornucopia-shaped, of a dark red color, the margin fimbriate or dentate; styles about 10 mm in length, more or less cylindrical, solid, yellowish (Heber 2003). Odor is strong, characteristic, aromatic and bitter in taste. Upon chewing the Saffron, the saliva is colored a bright orange-yellow. Saffron should not be exposed to light and should be preserved in amber-colored bottles or tin boxes. (Heber 2003).

Figure.1: *Crocus sativus* L.

Microscopy: The distal end of stigma shows numerous bladdery, cylindric papillae about 150 µm in length, among which occur a few smooth, spherical pollen grains from 40 µm to 90 µm in diameter and occasionally pollen grains showing outgrowths in the form of pollen tubes (Heber 2003).

Chemical constituents: It possess crocin, picrocrocin, and safranal. Non-volatile active components (carotenoids including zeaxanthin, lycopene, and various α- and β-carotenes). The volatiles components (terpenes, terpene alcohols, and their esters). However, Saffron showed golden yellow-orange color primarily due to α-crocin (Srivastava et al 2010).

Pharmacological actions: Resolvent (muhallil), exhilarant (mufarreh), deobstruent (mufatteh), diuretic (mudirre baul), sexual stimulant (muharrike bah), liver tonic (muqawwie jigar), tonic to respiratory organs (muqawwie alaate tanaffus), astringent (qabiz), stomachic (muqawwie meda), aparient (mulaiyin), coctive (munzij), tonic to visceral organs (muqawwie ahsha), carminative (muhallile riyah), emmenagogue (mudirre haiz), agglutinant (mugharri), sedative (musakkin), cardiotonic (muqawwie qalb), antispasmodic (dafae tashannuj), uterine tonic (muqawwie reham), brain tonic (muqawwie dimagh), improves eyesight (majalli basr) (Haleem, 2009; Ghani,1971)

Medicinal uses: Use in headaches, catarrhal infections (Srivastava et al 2010); measles (Heber 2003); Depression, insomnia, measles, dysentery, jaundice, and cholera (Vijaya 2011). Chiefly use as a flavoring and coloring agent (Heber 2003).

Important formulation: Habb-e-hamal, Habb-e-jawahar, Habb-e-mumsik qawi, Habb-e-mun'ish, Dawa-ul-kurkum, Majoon suparipak, Majoon dabeed-ul-ward

Adulterants of saffron: There are three types of adulterants can be used, *viz*. (a) substances which have some external resemblance to Saffron, (b) exhausted Saffron recovered by dyes and (c) substances added in order to increase the weight of Saffron (Srivastava et al 2010). *Crocus*, *Calendula officinalis*, *Carthamus tinctorius* L. and *Zea mays* are use as substitute, may be mixed with Saffron or supplied in place of Saffron (Srivastava et al 2010).

Maize (*Zea mays* L.)

Corn silk is a collection of the stigmas (fine, soft, yellowish threads) from the female flowers of the maize plant (Thoudam et al 2011). Maize (*Zea mays* L.) is the most important cereal crop after wheat followed by rice in the world. The cultivated maize, also called corn in some parts of the world, belongs to the genus *Zea* from the tribe of Andropogoneae in the family of Poaceae, subfamily Panicoideae (Luka et al 2019).

Vernacular names: Corn Silk, Stigmata Maydis

Part used: Fresh styles and stigmas.

Macroscopy: It occurs in masses consisting of more or less tangled slender filaments of a light green, yellow, light brown or purplish red color. Each entire filament consists of a long style (up to 30 cm) and a bifid stigma. The odor is slight. The taste is slightly sweet (Heber 2003).

Microscopy: The styles consist of an epidermis surrounding a matrix of parenchyma through which course two parallel bundles, possessing slender annular and spiral tracheae. Many of the epidermal cells, particularly of the distal region, show outgrowths in the form of multicellular hairs from 200 µm to 800 µm long. The basal portion of each of these hairs comprises two to five united cells, the distal portion usually one cell. Numerous spinose pollen grains are also evident either adhering to the style or upon the stigmatic surfaces (Heber 2003).

Chemical constituents: Resin, fixed oil, volatile alkaloid, maizenic acid, sugar, etc. (Heber 2003). Flavonoids, alkaloids, phenols, steroids, glycosides, carbohydrates, terpenoids and tannins (Thoudam et al 2011).

Pharmacological actions: Diuretic (Heber 2003), antilithiatic, uricosuric and cystitis, gout, kidney stones, nephritis and prostatitis (Thoudam et al 2011).

Medicinal uses: Urinary system disorder, Jaundice, Blood pressure. Ulcer, wound, swelling, vomiting, nausea (Adiaha 2017).

Safflower (*Carthamus tinctorius* L.)

Carthamus tintorius L. commonly known as 'Safflower' belongs to family Asteraceae or Compositae in the order Asterales, native of Egypt. It is frequently used as adulterant of Saffron. It is cultivated in various parts of the world mainly form seeds and flowers. Its flower dye is used as substitute for the Saffron (Rashmi & Ashwini 2015). Safflower plant can be described as a bushy, herbaceous annual possessing several branches. The flowering period in safflower lasts for a month. Flowering in a capitulum begins in the outermost whorl of florets and proceeds centripetally over 3 to 5.

Vernacular names: African Saffron, American Saffron, Bastard Saffron, Dyer's Saffron, Safflower, Wild Saffron.

Macroscopy: The tubular florets of *Carthamus tinctorius*, are of a deep orange-red color, 25 to 40 mm long and exhibit a thin, cylindrical corolla tube, terminating in a 5 cleft limb, each lobe being up to 6 mm long. From the throat of the corolla tube projects the yellow anther column and through the center of this the stigma. The pollen grains are spheroidal and spinose (Heber 2003).

Microscopy: In Safflower, the anther wall at maturity consists of a single epidermis, an endothecium, a middle layer and the tapetum. It consists of single layer of epidermal cells. However, this single-layer appearance is punctuated by loci having 'two-celled' groupings due to additional periclinal divisions in some tapetal layer cells (Edward et al 2011).

Part used: Flowers, seeds and the oil extracted from its embryos (Ali 2015).

Chemical constituents: Quinochalcone C-glycosides, tinctormine yellow pigments. Triterpene alcohol constituents, Heliaol, α-amyrin, β-amyrin, lupeol, cycloartenol, 24-methylenecycloartanol, tirucalla-7,24-dienol and dammaradienol isolated from the *Carthamus* flowers. Carthamine, hydroxyl Safflower yellow-A, carthamidine, luteolin are the main phytoactive principles of this plant (Rashmi & Ashwini 2015).

Pharmacological actions: Tonic, diuretic, expectorant, purgative, carminative, aphrodisiac, analgesic, anti-inflammatory, antipyretic, cancer, fibrosis, antioxidant, antidiabetic, hepatoprotective, antihyperlipidemic effect (Rashmi & Ashwini 2015; Kirtikar & Basu, 1998).

Medicinal uses: Boils, ringworm, scabies, leukoderma, piles, bronchitis, menstrual problems, post-partum hemorrhage, osteoporosis, diabetes; cancer (Rashmi & Ashwini 2015; Kirtikar & Basu, 1998).

Garden Marigold (*Calendula officinalis* L.)

Vernacular names: Zerzul, Garden Marigold, Fleur de tous les mois, Rinjel blume.

Part used: Fresh or dried flowers.

Macroscopy: This herb is approximately 80cm long; bears the branched stem; having elongated tap root along with various supporting roots; setaceous, sharp, slanting, alternating and stalkless leaves; flower head inflorescence; grows each year. Blossom of this herb found yellow to orange along with feminine ray flowers and hermaphrodite, tridentate, cannular, disc florets; and curvaceous, sickle pattern, ringed small dry one-seeded fruit (Nelofer et al 2017). Corolla oblong spatulate, 15-25 mm long and 3 mm wide; corolla of disc flowers rounded, at the top tridentate, 1.5-2.5 cm long and 4-7 mm in diameter with 5 mm long tubular florets. (Disha et al 2013).

Microscopy: It comprises fragments of the corolla, anomocytic stomata in the apical region of outer epidermis, covering and glandular trichomes, elongated sclerenchymatous cells, pollen grains, fragments of the walls of the ovaries containing brown pigment, fragments of stigma, fragments of the fibrous layer of the others (Disha et al 2013).

Chemical constituents: It contains lipids, carbohydrates, steroids, phenolic compounds, terpenoids, tocopherols, carotenoids and quinones (Re et al 2009) .Essential components of this herb are saponins, flavonoids, triterpenoid esters and including hyperoside and rutin. Carotenoids consisting of auroxanthin and flavaxanthin are more contented in orange blossom. (Roopashree et al 2008).

Pharmacological actions: Disinfectant, tonic, perspiration inducing, spasmolytic and febrifuge (Kirtikar & Basu 1993). Antipyretic, anti-inflammatory, antiepileptic and antimicrobial (Kasiram et al 2000). Disinfectant, diuretic, anti-viral and anti-cancerous activity (Tiwari 2008; Nelofer et al 2017).

Medicinal uses: Colitis, gastritis and bleeding of duodenal ulcers (Bone et al 2003). Hemorrhoids, poor eyesight, varicose veins, menstrual irregularities and duodenal ulcers (Cetkovicet al 2004), headache, jaundice, HIV, leukemias, fibrosarcoma, melanomas, ca. of breast, cervix, prostate, pancreas and lung (Nelofer et al 2017). In India, China, Europe and US Calendula officinalis L. (pot Marigold) is often used as therapeutic herb (Muley et al 2009).

Scotch thistle *(Onopordum acanthium* L.*)*

Onopordum acanthium L (*O. acanthium*) is biennial plant of the family Asteraceae, subfamily Carduoideae. It is also known as Scotch thistle. The plant is widespread in the world; The genus *Onopordum* includes about 50 species. The species *O. acanthium* L. is widely distributed (Moufida 2019).

Vernacular names: Scotch thistle, cotton thistle, heraldic thistle, eselsdistel, krebsdistel. (Moufida et al 2019).

Part Used: The flowering plant, the juice, seed and root (Ali 2020).

Macroscopy: *O. acanthium* L. is a biennial herb that grows up to 50–200 cm in height. The radix is thick and succulent above 30 cm. The stem is upright, branching, has wings less than 1.5 cm wide with spines on the edge. The stem is round and 2–3 cm in diameter. All leaves have stout yellow spines on the edge and thick pubescence. The calyx consists of hairs. The corolla is purple and flowers are hermaphrodite (Garsiya et al 2019).

Chemical constituents: Phenol, triterpene, and steroid, Sesquiterpene,lactones and polyacetylenes are found in the roots (Garsiya et al 2019), Saponins, alkaloids, sesquiterpene lactones, flavonoids, lipids, nitrogen-containing compounds, phenolic acids, coumarins, inulin, soluble sugars, protein and oil, Fatty acids identified in the plant were palmitic, stearic, oleic, and linoleic (Ali 2020).

Pharmacological actions: Anti-inflammatory, antitumor, and cardiotonic agent. Carminative (Moufida et al 2019), diuretic, to treat nervousness, stimulate the central nervous system and has cardiotonic and hemostatic properties (Garsiyaet al 2019), bactericide, antibacterial, antioxidant, anticancer, analgesic, antipyretic, hypotensive, antiepileptic, wound healing effect(Ali 2020). .

Medicinal uses : inflammation of the bladder and the respiratory and urinary systems(Ali 2020); Cancers and ulcers also.

Mums (*Chrysanthemum morifolium* Ramat.)

Chrysanthemum morifolium is a species of perennial plant from the Asteraceae family. This plant is also known as mums. Among the four species of Chrysanthemum, it is most famous plant in China (Ying et al 2018).

Vernacular names: Florist's daisy, Spray mum, Garden mum

Macroscopy: Most plants of the genus are perennial herbs or subshrubs. Many have simple aromatic leaves that alternate along the stem. Some have both disk and ray flowers in the heads, but others lack ray or disk flowers with yellow petals (Ah-Reum et al 2019).

Chemical constituents: Volatile oils, flavonoids, chlorogenic acid, polysaccharides, phenols and trace elements (Ying et al 2018), phenolic acids, six flavonoids, and three anthocyanins (Ah-Reum et al 2019).

Pharmacological actions: Antioxidant, cardiovascular protective and anti-inflammatory functions and potent neuroprotective activity (Oladipupo 2014). Anti-inflammatory, anti-pyretic, sedative, anti-arthritic, Anti-allergic and anti-

hypertensive effects (Ah-Reum et al 2019).Anti-diabetes, anti-oxidant, and anti-tumor activities (Yoonjin et al 2021).

Medicinal uses: Eye diseases, headaches, insomnia, Parkinson's disease and hyperglycemia (Oladipupo et al 2014). common cold, fever, migraine, conjunctivitis, eye irritation, hypertension, inflammation, ulcerative colitis, vertigo, ophthalmia with swelling as well as skin infections (Fadia et al 2020).

Table1. Adulterants of Saffron

Adulterants	**Common name**	**Family**	**Part**	**Effect**
Zea mays L.	Corn	Poaceae	Dried stigmas,	Increasing bulk qty
Carthamus tinctorius L.	Safflower	Asteraceae	Dried flowers	Increasing bulk qty
Calendula officinalis L.	Pot marigold	Asteraceae	Dried flowers, sometimes dyed with methyl orange	Increasing bulk qty
Onopordum acanthium L.	Scotch thistle	Asteraceae	flowering plant	-
Chrysanthemum morifolium Ramat	Chrysanthemum, mum	Asteraceae	Dried petals, powdered flower	Accidental or economic adulteration

CONCLUSION

Nowadays substitution or adulteration of natural drugs become a health problem. Therefore, it is very important to know the way of adulteration, more research and information is required to rectify and minimized the illegal addition of adulteration. This type of adulteration of natural herbal drug with chemical drug can result in serious health risk for consumers. Sometime adulteration causes a variety of adverse effect from mild to severe to humankind. Several adulterants of Saffron are available in the market. The efficacy of the drug decreases if it is adulterated, and in some cases, can be lethal if it is substituted with toxic adulterants. Accurate and easy identification of the drug plant is the key to success for the herbal drug industry. This detailed study on Saffron is beneficial to scientific community because it provide an extensive directory to identify genuine drug available in the market.

DECLARATION OF CONFLICT OF INTEREST

No conflict of interest to declare.

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