



A Review on Phytochemical Potential of Safflower (*Carthamus tinctorious* L.)

Aditi R Dhonde* and S.S. Patale

Research Center Department of Botany, Smt. S. K. Gandhi Art's, Amolak Science and P. H. Gandhi Commerce College, Kada – 414 202 Tq. Ashti Dist. Beed, (M.S.) India

*Corresponding Author Email: adirth7@gmail.com

Manuscript details:

Received: 09.04.2026

Accepted: 09.05.2026

Published: 30.05.2026

Cite this article as:

Aditi R Dhonde and Patale SS (2026) A Review on Phytochemical Potential of Safflower (*Carthamus tinctorious* L.), *Int. J. of Life Sciences*, 14 (1A): 55-59.
<https://doi.org/10.5281/zenodo.20653865>

Available online on <http://www.ijlsci.in>

ISSN: 2320-964X (Online)

ISSN: 2320-7817 (Print)



Open Access This article is licensed under a Creative Commons

Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third-party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

ABSTRACT

Safflower (*Carthamus tinctorius* L.) belonging to the Asteraceae family is an annual herbaceous plant that is indigenous to Asia, India, and the Middle East. It is famous for its rich traditional medicinal applications, complex phytochemistry and medicinal properties, growing to a height of 130 cm with tubular flowers and lanceolate leaves. The plant contains more than 200 bioactive compounds including polyacetylenes, flavonoids, and alkaloids such as N-feruloylserotonin, Quino chalcones such as hydroxysafflor yellow A (HSYA), and fatty acids that are predominantly rich in linoleic acid. Pharmacological studies have emphasized its antimicrobial activity against pathogens causing dandruff and acne, hypoglycaemic action through the augmentation of insulin secretion and the mitigation of oxidative stress, potent antioxidant properties, and anti-inflammatory properties due to the presence of saponins, stigmasterol, and various other compounds.

Keywords- Safflower, Phytochemistry, Bioactive compound.

1. INTRODUCTION

The "Asteraceae" family includes *Carthamus tinctorious* L. The largest family of flowering plants is the Asteraceae, which has over 1500 genera and 22,000 species, ranging from woody shrubs to annual herbs. This genus is native to Asia, including India and the Middle East. This plant tends to be very busy. It can reach a height of 100–130 cm. The leaves are large and lanceolate, with serrated edges. The tubular, radial blossoms produce large inflorescences, or flower heads (Singh and Nimbkar, 2006; Emongor, 2010; Zhou, *et al.*, 2014).

Vernacular Names: Safflower is referred to by numerous names globally including kusum, kasunmba, kusumbo, kusubi, karbi, ma, sufir, kar/karar, sendurgam, agnisikha, hebu, su, suban, as well as affore, asfiore, asfrole, astifore, asfiori, zaffrole, zaffrone, and saffiore. In China, it is designated as hung-hua or 'red flower' (Smith 1996).

Taxonomical Classification

Kingdom	Plantae
Division	Phanerogamae
Sub Division	Angiospermae
Class	Dicotyledonae
Sub Class	Gamopetalae
Series	Inferae
Order	Asterales
Family	Asteraceae
Genus	Carthamus
Species	<i>tinctorius</i>

1.3 Morphology

As a thick annual herb, *C. tinctorius* has several branches that are categorized as primary, secondary, and tertiary. Each branch ends in a capitulum, which is a spherical structure (Zargari 1990). The colour of the flower before and after drying was used to define four different cultivar groups: (1) yellow blooming and red dried flowers, (2) yellow blooming and dried flowers, (3) orange blooming and dark red dried flowers, and (4) white blooming and dried flowers. Wind, dryness, and salinity don't affect safflower (Kaya *et al.*, 2003).

It is possible to grow safflower on low-fertility soil, ideally in a warm, dry region (Shabana, *et al.*, 2013). India, Bengal, southern France, the United States, Iran, Egypt, and China are home to the biggest plantations (Hill, 2008; Shirwaikar *et al.*, 2010; Hu *et al.*, 2016).

2. LITERATURE REVIEW

2.1. Phytochemistry

Safflower's tube-shaped flowers are the main hub for its active compounds packed with stuff like spermidine, polysaccharides, alkyl diols, lignans, sterols, flavonoids, and alkaloids. Beyond the flowers the seeds (or achenes) are loaded with healthy unsaturated fats, especially oleic and linoleic acids (Chen *et al.*, 2023). As Wang *et al.* (2021) point out the tocopherols and those unsaturated fatty acids in the seeds bring anti-aging benefits

2.1.1 Flavonoids

Flavonoids and their glycoside forms stand out as safflower's star active compounds they've gotten tons of research attention thanks to their tight link to the plant's powerful health effects. Pretty much all the safflower yellow (SY) and safflower red (SR) pigments fall into a group called quinone chalcone glycosides, which are these key flavonoid metabolites (Zhang J. *et*

al., 2018). So far scientists have pinpointed 25 of these quinone chalcone glycosides in safflower, most are simple monomers, though a few form dimeric polymers. On top of that safflower packs in other flavonoid goodies like dihydroflavonoids and flavanols, all bringing a range of pharmacological perks. Flavanol glycosides top the list of the most studied metabolites here some show clear structural similarities and the way glucose gets swapped in ties directly to their antioxidant power. To date researchers have identified 35 flavonoid metabolites in safflower with the big-name flavanols including quercetin, kaempferol, apigenin and a few others (Lee *et al.*, 2002).

2.1.2 Polyalkenes

Safflower's polyalkyne metabolites typically feature structures with 10 or 13 carbons. These glycosides in the polyne compounds usually come in an oily form that's pretty unstable and tends to clump up when exposed to air. But once processed into a powder they become much more stable (Li *et al.*, 2017). Zheng *et al.* (2019) note that they're mainly found in the stems, roots, flowers, and immature seeds infected by Epidermophyton. To date researchers have identified 26 distinct polyynes from safflower.

2.1.3 Alkaloids and spermidine

The alkaloid metabolites isolated from safflower mostly show up in the seeds and are mainly derivatives of 5-hydroxytryptamine (5-HT), which stands out for its lower polarity. Safflower oil has given us 13 alkaloids, while dried flowers have yielded 11 (Hao *et al.*, 2010; Sakamura *et al.*, 1980). The plant also contains spermidine derivatives featuring three coumaryl groups these are spermidine metabolites. Researchers used high-speed counter current chromatography to pull out five spermidine compounds from safflower (Jiang *et al.*, 2014).

2.1.4 Lignans and sterols

Safflower contains just a handful of lignans like liriioresinol A, double tetrahydrofuran syringaresinol and a few others. A lignan glycoside, traceloside, was investigated to exert an antiestrogenic effect (Peng *et al.*, 2017). Zhou *et al.* (2014) used IR, NMR, and MS techniques to identify compounds such as stigmaterol, campesterol, pregnenolone, and more.

2.1.5 Polyacetylene

Polyacetylene represents a class of simple linear conjugated polymers and related derivatives with

conjugated triple bonds. In early reports of polyacetylene in safflower plants in the 1980s, polyacetylene has since been distributed in roots, flowers, immature seeds, and stems infected with *Phytophthora* (Zhang, *et al.*, 2016). Several pairs of cis-trans isomers were observed from the structure of components isolated from Safflower. Perhaps because of its low content its pharmacological action is rarely investigated (Zhou, *et al.*, 2014).

2.1.6 Organic Acid:

Safflower is a plant that contains various organic acids in the oil from its seeds. Standard safflower oil contains approximately 71-75% linoleic acid, 16-20% oleic acid, 6-8% palmitic acid, and 2-3% stearic acid (Zhang, *et al.*, 2016).

2.1.7 Other metabolites:

Many other components have been isolated from *C. tinctorius*, such as roseoside, uridine, uracil erythro-alkane-6, 8-diol, aromatic glucosides and many more (Zhang, 2016). Zhou *et al.* (2008) discovered three new aromatic glycosides along with three known ones. On top of that, safflower seeds are mainly packed with tocopherol, oleic acid, and linoleic acid. Several pure compounds were isolated and proven to have biological action. Kinobean A, isolated from safflower cell culture, was shown to have potent antioxidants. In addition, the bioactive triterpenoid saponin, 3 β -O-[[β -D-xylopyranosyl (1-3)-O- β -D-galac-topyranosyl]-lup-12-ene-28 oic acid-28-O- α L -rhamnopyranosyl ester, exhibits anti-inflammatory activity (Zhou *et al.*, 2014).

2.2 Ethanopharmacology

Safflower has popped up throughout history in all sorts of ways from making oil and dyes to medicinal remedies and even cooking. Back in ancient Egypt people tucked safflower seeds, bundles and flower garlands into mummies (Weiss, 1971). Chinese mythology highlights safflower as a go-to remedy for healing wounds inside or out along with stomach tumors and heavy menstrual bleeding. In Iranian traditional medicine, it's a staple for tackling colic, baldness, phlegm buildup, and skin spots (Imami *et al.*, 2010). Ancient Persian texts detail its many roles in traditional healing. The seeds and flowers act as laxatives, while the seed oil helps with paralysis and rheumatism (Razi, 2000). It also promotes tissue contraction, helps medicines soak into target areas more easily and serves as a pain reliever. On top of

that, people turn to it for vitiligo, hyperpigmentation, psoriasis, and even mouth ulcers.

Folks in traditional healing have long turned to safflower's fruit and leaves for easing numb limbs, breaking up phlegm, and neutralizing scorpion stings (Ibn, 2007). The seeds get credit for improving semen quality and lifting moods clouded by melancholy, all thanks to their natural laxative kick (Jorjani, 2012; Uosefi, 1999). Old Persian medical writings highlight it for diabetes, fevers tied to phlegm, melancholy, and fluid buildup like dropsy (Aghili Khorasani and Makhzan al-Adwiyyah, 2011). Safflower's part of the Asteraceae family plants that have historically helped induce abortions. A water extract from it calms tough menstrual cramps, relieves constipation as a laxative, and fights inflammation (Zargari, 1992).

2.3 Pharmacological Effects

According to contemporary pharmacological research, safflower has anti-inflammatory, antitumor, antioxidant, vascular, osteoporosis-preventative, and hepatoprotective properties. It also exhibits remarkable medicinal efficiency in regulating the functions of the neurological, motor, and cardiovascular systems. Safflower exhibits significant antimicrobial activity against acne-causing bacteria. In the antidandruff test, the microbial inhibition zone that causes dandruff was obtained by 9 mm for Safflower extract, 3 mm for antifungal (fluconazole), and no solvent inhibition zone (control). It is proven that the presence of saponins and stigmasterol's could control various microbial growths. The ability of saponins to form soap also helps damage the walls of microbial cells, which in turn causes leakage of proteins and enzymes from these cells (James *et al.*, 2018).

3. CONCLUSION AND PERSPECTIVE

Based on data gathered from both traditional and contemporary literary sources, this article outlines the historical applications, chemical constitution and extensive pharmacological activities of safflower. Pharmacological studies have substantiated the traditional uses of safflower. Therefore, future research should strengthen the investigation of the biological activity of other chemical metabolites, their interactions and structure-activity relationships between alkaloids and flavonoids. Additionally, clinical

studies are necessary to effectively evaluate the efficacy, adverse reactions, and toxicity of safflower.

Conflict of interest

The authors declare no competing interests.

Data Availability Statement: Not applicable.

Correspondence and requests for materials should be addressed to **Aditi R Dhonde**

Reprints and permissions information is available at <https://www.ijlsci.in/reprints>

REFERENCES

- Aghili Khorasani SMH, Makhzan al-Adwiyyah (2011) Tehran. Tehran University of Medical Science, Tehran.
- Bai H, Yang J, Wang R (2025) *Carthamus tinctorius* L.: a comprehensive review of its ethnomedicine, phytochemistry, pharmacology, and clinical applications. *Frontiers in Pharmacology* 16:1609299.
- Chen J, Guo S, Hu X, Wang R, Jia D, Li Q, et al. (2023) Whole-genome and genome-wide association studies improve key agricultural traits of safflower for industrial and medicinal use. *Horticulture Research* 10(11):uhad197.
- Hill DS (2008) Pests of crops in warmer climates and their control. Springer Science & Business Media.
- Hu X, Yin S, Huang Z, Elomri A, Lu Y (2016) A new phenylpropanoid derivative isolated from *Carthamus tinctorius* L. *Records of Natural Products* 10(1):17.
- Ibn SH (2007) Qanun [A Sharafkandi, trans]. Kashan Morsal.
- Imami A, Taleb A, Khalili H (2010) PDR for herbal medicines, 1st edn. Andisheh-Avar, Tehran.
- James JM, Geethumol CU, Anilkumar A, Selvaraj G (2018) Phytochemical screening, antibacterial and allelopathic effects of few invasive plants of Kerala. *Plant Science Today* 5(4):175-181.
- Jiang S, Shi Z, Li C, Ma C, Bai X, Wang C (2014) Hydroxysafflor yellow A attenuates ischemia/reperfusion-induced liver injury by suppressing macrophage activation. *International Journal of Clinical and Experimental Pathology* 7(5):2595.
- Jorjani E (2012) Zakhireh kharazmshahi. Ehya Tebe Tabii Institute, Qom.
- Kaya MD, Ipek A, Öztürk A (2003) Effects of different soil salinity levels on germination and seedling growth of safflower (*Carthamus tinctorius* L.). *Turkish Journal of Agriculture and Forestry* 27(4):221-227.
- Lee JY, Chang EJ, Kim HJ, Park JH, Choi SW (2002) Antioxidative flavonoids from leaves of *Carthamus tinctorius*. *Archives of Pharmacol Research* 25(3):313-319.
- Li F, He Z, Ye Y (2017) Isocartormin, a novel quinochalcone C-glycoside from *Carthamus tinctorius*. *Acta Pharmaceutica Sinica B* 7(4):527-531.
- Peng XR, Wang X, Dong JR, Qin XJ, Li ZR, Yang H, Qiu MH (2017) Rare hybrid dimers with anti-acetylcholinesterase activities from a safflower (*Carthamus tinctorius* L.) seed oil cake. *Journal of Agricultural and Food Chemistry* 65(43):9453-9459.
- Razi M (2000) Al-Mansuri Fi At-Tibb. Darolkotob Alelmiyeh, Beirut.
- Sakamura S, Terayama Y, Kawakatsu S, Ichihara A, Saito H (1980) Conjugated serotonin and phenolic constituents in safflower seed (*Carthamus tinctorius* L.). *Agricultural and Biological Chemistry* 44(12):2951-2954.
- Shabana R, Abd El-Mohsen AA, Gouda HAH, Hafez HS (2013) Impact of temperature fluctuation on yield and quality traits of different safflower genotypes. *Scientific Research and Review Journal* 1(3):74-87.
- Shirwaikar A, Khan S, Kamariya YH, Patel BD, Gajera FP (2010) Medicinal plants for the management of post-menopausal osteoporosis: a review. *The Open Bone Journal* 2(1).
- Singh V, Nimbkar N (2006) Safflower (*Carthamus tinctorius* L.). Chapter 6:167-194.
- Smith JR (1996) Safflower. AOCS Publishing.
- Uosefi HU (1999) Riaz al-Advieh, 1st edn. Institute of Medical History, Islamic Medicine and Complementary Medicine, Tehran.
- Wang LW, Cui XY, He JF, Duan S, Liu CR, Shan CB, Ma CM (2021) Hydroxysafflor yellows alleviate thrombosis and acetaminophen-induced toxicity in vivo by enhancing blood circulation and poison excretion. *Phytomedicine* 87:153579.
- Weiss EA (1971) Castor, sesame and safflower. Leonard Hill, London.
- Zargari A (1990) Medicinal plants, vol 4. University of Tehran Press, Tehran, Iran.
- Zargari A (1992) Medicinal plants. University of Tehran Press, Tehran.
- Zhang LL, Tian K, Tang ZH, Chen XJ, Bian ZX, Wang YT, Lu JJ (2016) Phytochemistry and pharmacology of *Carthamus tinctorius* L. *The American Journal of Chinese Medicine* 44(2):197-226.
- Zhang SM, Li ZQ, Wang GY (2018) Clinical observation of 94 cases of female infertility treated by integrated Chinese and Western medicine. *Qinghai Medical Journal* 48:59-60.
- Zhao S, Lu X, Xiao C, Ning Z, Zeng H, Ding X, Liu Y (2014) Diversified bioactivities of four types of naturally occurring quinochalcones. *Fitoterapia* 99:7-20.
- Zhao S, Lu X, Xiao C, Ning Z, Zeng H, Ding X, et al. (2014) Diversified bioactivities of four types of naturally occurring quinochalcones. *Fitoterapia* 118:7-20.
- Zheng M, Guo X, Pan R, Gao J, Zang B, Jin M (2019) Hydroxysafflor yellow A alleviates ovalbumin-induced asthma in a Guinea pig model by attenuating the

expression of inflammatory cytokines and signal transduction. *Frontiers in Pharmacology* 10:328.

Zhou X, Tang L, Xu Y, Zhou G, Wang Z (2014) Towards a better understanding of medicinal uses of *Carthamus tinctorius* L. in traditional Chinese medicine: a phytochemical and pharmacological review. *Journal of Ethnopharmacology* 151(1):27-43.

Zhou YZ, Chen H, Qiao L, Xu N, Cao JQ, Pei YH (2008) Two new compounds from *Carthamus tinctorius*. *Journal of Asian Natural Products Research* 10(5):429-433.

© The Author(s) 2026

Publisher's Note

IJLSCI remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.