

TURMERIC, YELLOW MIRACLE FROM THE EAST

MICHAL JURÁŠEK and PAVEL DRAŠAR

Department of Chemistry of Natural Compounds, University of Chemistry and Technology, Technická 5, 166 28 Prague 6
drasarp@vscht.cz

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Turmeric, in English also Indian saffron, yellow root, yellow ginger, Indian medicine, Indian ginseng or yellow miracle, turmeric, castor saffron, saffron root), powder produced by cooking (in alkaline environment), drying and grinding of turmeric roots (*Curcuma longa* L., Son., *Curcuma domestica* Valetton, *Stissera curcuma* Gseke, *Amomum curcuma* Jacq.) there could be found also the name *Kua domestica* Medik. (nom. illeg.), that was created as a typo; with the Czech name „kurkuma dlouhá“, created by Presl (1846) či „kurkumovník dlouhý“, created by Mareček (1994), is a plant belonging to the family Zingiberaceae Lindl. – (zázvorovitě, in Czech). Described and characterized were numerous varieties of turmeric¹. Grown for at least 4000 years, it is a famous drug (medicinal drug) but also part of oriental cuisine and colouring. Especially in India, it is used either alone, or as a part of the masala or curry. Curry is originally an Indian food, a stew, where is typically added this spice that earned its English name "Curry Powder". Turmeric itself is also used to dye substances, wood and food to yellow (mustard, cereals, "egg" products, potatoes, cheese, ice creams, butter, margarines etc.)², famous is yellow curry rice or yellow potatoes dyed by the turmeric added to the water when they were cooked. In India there is also known and used a tea with the addition of such spices.

Yellow-brown powder characteristic fragrance and slightly burning, woody or burnt taste (with colour, which does not change and with scent that can lose the intensity by long storage). Right in Wikipedia, we will learn that it has excellent anti-inflammatory effects³ and is demonstrably antioxidant⁴. Significantly supports brain cognitive functions, especially in older people⁵. In world literature there can be found several serious descriptions of turmeric⁶, curcumin^{7,8}, and other components⁹. Czech literature, unfortunately, mostly restricts the description of the facts and sometimes a superstition, without literary quotes. In general, the turmeric and curcumin can be marked as highly active biological material with the potential to heal or prevent different diseases as well as in modern medi-



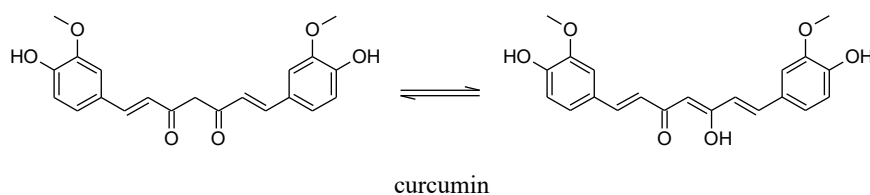
Obr. 1. „Cyperus“ from the spanish translation of Dioscorides book¹²

cine¹⁰. Using the turmeric finds use even against hypoxia at high altitudes¹¹.

Originally in Orient, most of the production in India (especially in the South Indian town of Erode, also known as "Yellow City"). Curcuma came to Europe from Arab merchants and Pedanius Dioscorides described it in around 50-75 A.C. in his work *Περὶ ὕλης ἰατρικῆς* (About medicinal drugs)¹², under name Cyperus. The name of the turmeric "Curcuma" comes from the Arabic kurkum or Hebrew karkom, representing yellow. Turmeric and curcumin have in food industry status GRAS (Generally Recognized As Safe)^{13,14}; however, they are not approved for the colouring of mayonnaise and salad dressings. Intake of curcumin from the normal diet as to the re-evaluation of EFSA from 2010 should be less than 3 mg/kg/day (ref.¹⁵).

The English name turmeric comes from Sanskrit and again in the meaning of yellow¹⁶. For its intensely yellow colour it is adulterated by metanil yellow (Acid Yellow 36, 3-(4-anilinophenylazo) sodium benzenesulfonate), which is toxic. In a "better" case it is adulterated by brick powder or chalk¹⁷.

More than 100 components were isolated from turmeric. The main component of the root is volatile fragrant oil containing turmerons and dyes called curcuminoids (mainly curcumin (2,86–5,69 %), demethoxycurcumin (1,47 %), bisdemethoxycurcumin (1,36 %), 5'-methoxycurcumin and dihydrocurcumin)¹⁸, studied for their antiox-



inant and anti-cancer effects. It has been reported that for antioxidant properties can also be responsible from turmeric isolated protein TAP (Turmeric Antioxidant Protein)¹⁹.

Curcumin (E100, CI Natural Yellow 3, turmeric yellow, kurkum, diferuoylmethane) is the main component and is basically responsible for turmeric biological activity. Its considerable disadvantage is practical insolubility in the water that makes $3 \cdot 10^{-5} \mu\text{mol mL}^{-1}$ (ref.²⁰); $\log P$ 2,92 (ACD/LogP v. 14.50). Water solubility can be improved 12 times by heating without chemical changes, as proved by the spectrophotometric analysis²¹. It better dissolves in ethanol. A number of successful substitutions, formulations and forms are described to increase solubility^{22,23}. Poor bioavailability of this very biologically active substance with minimal toxicity (p.o. in mice $\text{LD}_{50} > 2000 \text{ mg/kg}$) are causing that individual oral doses of turmeric 1–5 g/kg did not induce any toxic effects in rats²⁴. Curcumin was isolated in 1815, but only in 1910 was described its structure as diferuoylmethane ((1*E*,6*E*)-1,7-bis(4-hydroxy-3-methoxyphenyl)hepta-1,6-dien-3,5-dione) (ref.²⁵).

Already in 1949 it was published that curcumin has antibacterial properties²⁶ even against *Staphylococcus aureus*, *Salmonella paratyphi*, *Trichophyton gypseum* and mycobacterium (Tb). After 1970 it became the subject of further scientific research and activities were published as the antidiabetic²⁷, hypocholesteromic²⁸, anti-inflammatory²⁹ and antioxidant³⁰. Later, in the 1980s, it was pointed out for anticancer activity *in vitro* and *in vivo*³¹; really in many aspects (antiproliferation, proapoptotic, antimetastatic)²³. In 1995, it was reported that it exhibits anti-inflammatory activity by suppressing the pro-inflammatory nuclear transcription factor NF- κ B (ref.³²). Until now it can be seen exploring the use of curcumin as neuroprotective and substance positively affecting subjects with Alzheimer disease¹⁰ as well as a compound with substantial cardioprotective effects³³. Furthermore, curcumin is further investigated for antimalarial³⁴, fungicidal³⁵, and anti-cytotoxic³⁶ effects.

In the years 2017–2019, a clinical study of the use of curcumin was performed to maintain or improve physical and cognitive functions in adult aging at increased risk of their disability³⁷. Clinical trials (ClinicalTrials.gov shows

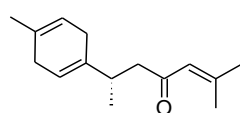
for the moment 272 cases) with curcumin were summarised in 2013³⁸ and 2021²³. In order to be honest, there are also mentions of the potential negative action of competing on human health³⁹, moreover, Drugbank online shows 796 possible cases of interaction with other medicines²⁴. There were also published reports of the use of synthetically modified curcumin²³.

Also turmerons have interesting biological properties. These include antimycotic⁴⁰, anti-inflammatory (psoriasis) activity⁴¹, application for prevention and treatment of ulcerative colitis⁴², but also to the prevention of dementia⁴³ inhibition of β -secretase, even against hepatocytes damage caused by ethanol⁴⁴.

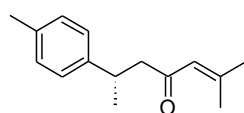
Some natural substances seem to have such a wide spectrum that we can consider almost universal remedy^{45–47}, which we like to record and continue^{48,49} in publishing it as „educational“ material on these topics in our Chemické listy journal.

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Abstract

Turmeric, Indian saffron, is being used for at least 4000 years. It is a well known medicinal drug and spice. Curcumin, the its main component, has vast biological activity, *i.a.* as an antibacterial, antidiabetic, hypocholesteromic, anti-inflammatory, antioxidant, neuroprotective, and even anticancer agent.

● Jurášek M., Drašar P.: *Chem. Listy* 116, 293–295 (2022).

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