

Turmeric (*Curcuma longa* L.) Bioactive Compounds and Applications

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ABSTRACT

Turmeric is widely utilized as a spice, food colorant, and preservative in India, China, and South-East Asia. Potential bioactive compounds present in the turmeric and its extracts, it has been utilized in traditional medicine for various diseases such as diabetes, hepatitis, hemorrhoids, hysteria, indigestion, skin disease, inflammation, anorexia, hepatic disorders, cough, and sinusitis. Turmeric contains 3-6% polyphenolic compounds, collectively known as curcuminoids, which is a mixture of curcumin, demethoxycurcumin and bisdemethoxycurcumin. Curcuminoids are major components responsible for various biological actions. Pure curcumin has more potent superoxide anion scavenging activity. Curcumin acts as a pro-oxidant in the presence of transition metal ions (Cu and Fe) and is a potent bioprotectant with a potentially wide range of therapeutic applications. This review article comprises several inputs like presence of active compounds, extraction procedure, structure curcumin, various pharmaceutical applications and recent research.

INTRODUCTION

India is the largest producer, consumer and exporter of turmeric in world wide. It is known as “Golden Spice” and it accounts for about 80% of the total production in global. It belongs to the family of Zingiberaceae and is found native to Asia and

India (Urosevic *et al.*, 2022). This rhizome is scientifically known as “*Curcuma longa*” and is mainly used in culinary and treatments. In the year 2022-23, an area of 3.24 lakh hectare was under turmeric cultivation in India, with a production of 11.61 lakh tons (over 75% of

global turmeric production). More than 30 varieties of turmeric are grown in India, and it is grown in over 20 states in the country. The largest producing states of turmeric are Maharashtra, Telangana, Karnataka, and Tamil Nadu (Chinnadurai, *et al.*, 2018).

Tamil Nadu shares 14.04 percent of the total production. In Tamil Nadu, Erode district is the largest district in turmeric cultivation, contributing 20.5 percent of the total area and 24.65 percent of the total production (Statistical Hand Book of Tamil Nadu, 2016, Government of Tamil Nadu). It is grown as a kharif crop. The optimum temperature for the growth of turmeric is likely between 25 and 30°C and it is grown in two seasons, i.e., February to May and August to October. Maturing depends on the variety and is usually done in 7-9 months i.e., harvesting is done between January and April. Some of the important varieties of turmeric cultivated in India are Suvarna, Suguna, Sudarsana, Roma, Suroma, and Co-1, of these varieties, Roma and Suroma has the highest curcumin content of 9.3% and Co-1 has the lowest curcumin content of about 3.2% (Vikaspedia) (Chinnadurai, *et al.*, 2018).

Nutritional composition of turmeric

Turmeric contains high carbohydrate content (approximately 42 g/ 100 g) in the form of native starch. It also had a high content of total dietary fiber (approximately 36 g/100 g). Quantities of minerals and vitamins in turmeric (per 100 g dry matter) include 200 mg of calcium, 260 mg of phosphorus, 2500 mg of potassium, 47.5 mg of iron, 0.9 mg of thiamine (B1), 0.19 mg of riboflavin (B2), 4.8 mg of niacin (B3), and 50 mg of ascorbic acid (Susan *et al.*, 2017).

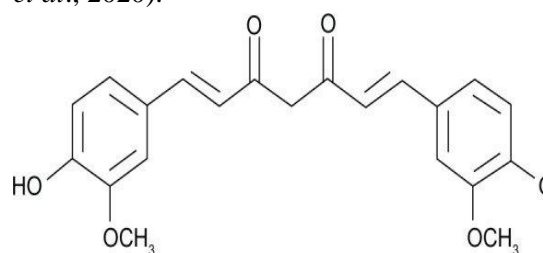
Bioactive metabolites in turmeric

The main ingredient of *Curcuma longa* is the rhizome. The intensive yellow colour is mainly due to the group of polyphenols. It is

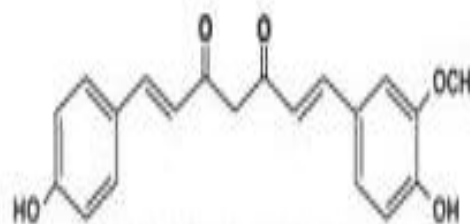
used as a natural food colouring agent in culinary purposes. The major bioactive compounds are curcumin, α -Turmerone, β -turmerone, phellandrene, terpinolene, α -zingiberene, 1,8-Cineole, α -phellandrene p-cymene, β -sesquiphellandrene, terpinolene (Filho *et al.*, 2020).

Structure of curcumin

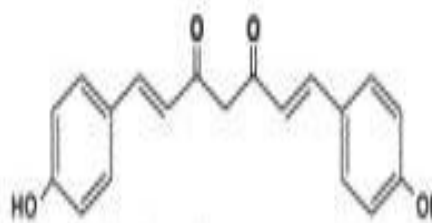
Curcumin (diferuloylmethane) is a polyphenolic compound and is found to occur with its secondary metabolites such as demethoxycurcumin, and bis-demethoxycurcumin, in *Curcuma longa* (Filho *et al.*, 2020).



Curcumin I



Curcumin II



Curcumin III

Extraction of curcumin

The dried rhizomes are taken and ground into fine powders. Once grounded, the powder is allowed to dry for some time to remove the excess moisture. Now, a known weight of the

sample is taken and treated with solvents like acetone or ethanol in an extraction column. After the extraction process, cool the contents to room temperature. Filtration was made using Whatman No.1 filter paper and then the contents were concentrated in a rotary evaporator. After drying, dried the residue at 60°C, the direct crude curcumin was obtained.

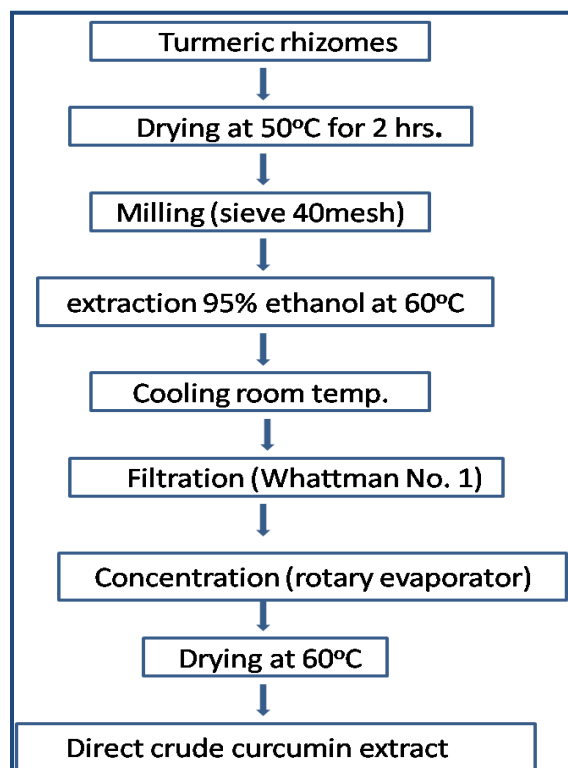


Fig. 1. Flow chart for the extraction of curcumin

Applications of turmeric

- It is a natural colouring and flavouring agent. The allowable daily intake (ADI) of curcumin ranges between 0-3 mg/kg, according to JECFA (the Joint United Nations and World Health Organization Expert Committee on Food Additives) and EFSA (the European Food Safety Authority)
- It has significant pharmaceutical uses, because of its anticancer, antiinflammatory, antioxidant,

antimicrobial, antiviral and neuroprotective properties.

- It is used in the treatment of arthritis, metabolic syndrome, anxiety, and hyperlipidemia. Curcumin shows cardioprotective and antidiabetic effects.

Recent research

- Though curcumin has many pharmaceutical uses, its hydrophobic nature or poor solubility in aqueous solutions challenges the pharma industry. Recent studies state that the encapsulation of curcumin in nanoparticles eases the drug delivery system.
- Curcumin finds its application in neuropharmacology and neuroscience by treating neurodegenerative diseases like Alzheimer's and Parkinson's.

CONCLUSION

Turmeric has been used in traditional medicine, especially in India. It has various pharmacological activities such as anti-cancer, anti-microbial, anti-inflammatory, anti-diabetic, and anti-arthritis properties. These properties are mainly due to the presence of bioactive compounds like curcumin, α -Turmerone, β -turmerone, phellandrene, terpinolene etc. So, future studies may focus on finding how turmeric can be used as a medicine.

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