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(RESEARCH ARTICLE)

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Spectrophotometric estimation of curcumin in herbal face cream

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Abstract

Aim/Objectives: Before using plant material in cosmetics, it is important to properly identify the plant, standardize it, and use the standardized form. The prevalence of misbranded and/or spurious herbal cosmetics necessitated the regulation on their import, manufacture, sell and distribution. Hence, the study focuses on the development of a precise and reliable method for quantifying curcumin in herbal face creams. Curcumin, a frequently used phyto-constituent in these creams obtained from *Curcuma longa* L. (CL)belongs to the family Zingiberaceae, is known for its anti-inflammatory and wound healing properties. The proposed colorimetric method is not only accurate and reproducible, but it also has the potential to greatly contribute to the quality control and standardization of herbal cosmetics.

Materials and methods: Standard methods were followed for preparation of in-house formulation and evaluation. In-house formulation was compared with four marketed samples.

Results and Conclusion: Marketed samples were found to be at lower side in respect of curcumin content but comparable with in-house formulation. Although the sample number was small, the method is cost effective and gave reproducible and rapid results, hence could serve as a commercial method for standardization. The study was found to be commendable and holds great promise for the herbal cosmetics industry.

Keywords: *Curcuma longa* L.; Curcumin; Colorimetric Estimation; Standardization; Herbal Cosmetics.

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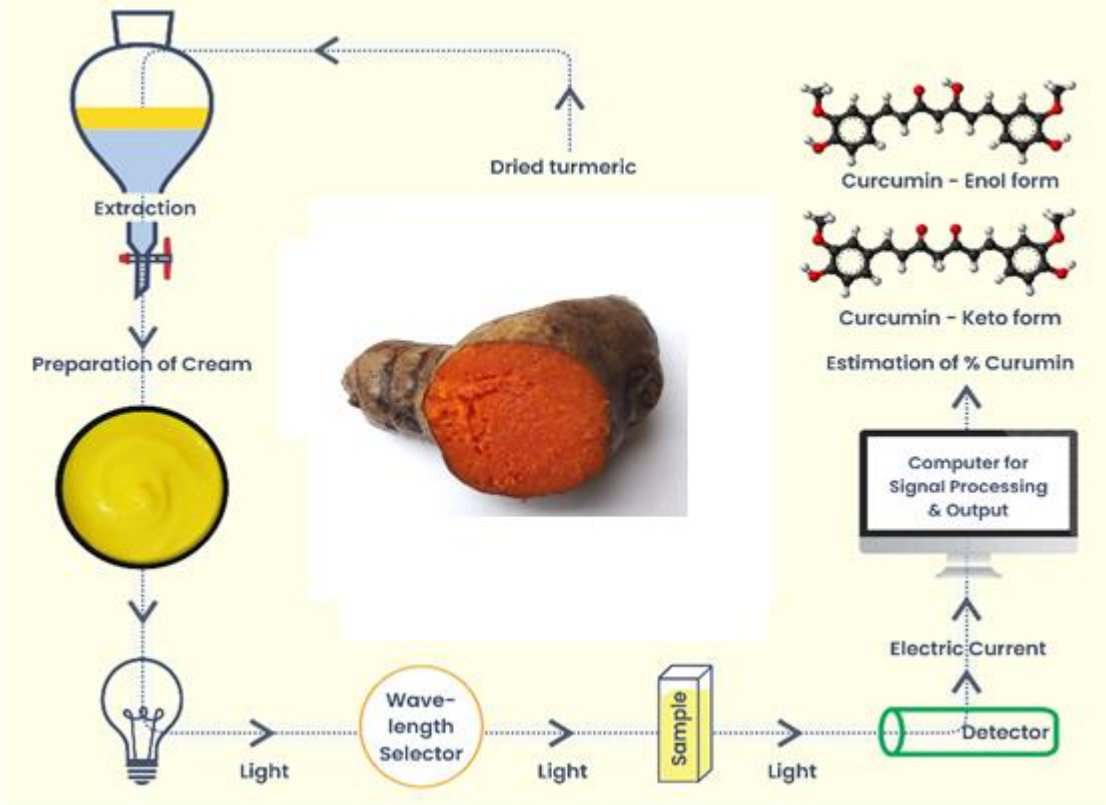
Graphical abstract



1. Introduction

Before 1962, there was no regulation on import, manufacture, sell and distribution of cosmetics. This led to the prevalence of misbranded and/or spurious herbal cosmetics, which necessitated the regulation of their import, manufacture, sell and distribution. To address this issue, the cosmetics were brought under the Drug Act, 1940, and the act was named as the Drug and Cosmetics Act, 1960. However, the implementation of these provisions came into effect from 1964, when the rules were framed by the Government of India. As part of this regulation, the Bureau of Indian Standards confirmed 28 finished cosmetics to Indian standards specifications, which were included under Schedule 'S' of the D and C Act. One of the categories regulated under this act is skin cream, which is a solid or semisolid emulsion. Herbal skin creams are composed of plant materials in a cosmetic base, and different plant parts can be used in the form of extract, tincture, or distillate. Before using plant material in cosmetics, it is important to properly identify the plant, standardize it, and use the standardized form. (Sharma PP, 1998, Mithal and Saha, 2000)

A number of plants have been used in herbal creams for their specific purpose, like, *Aloe vera* for moisturizing and anti-inflammatory effect, *Medicago sativa* as exfoliating agent, *Amygdalus communis* for cleansing, *Cucumis sativus* in palliative preparations, *Lavendula officinalis* as anti- pimple or anti- acne (due to antiseptic effect), CLfor fairness, *Tanacetum vulgare* for blemishes and pimples etc.

CL commonly known as Turmeric is one of the most important part of Indian spices, frequently used as complexion improver due to the misperception of fair complexion as beutiful. It contains about 5 % curcumimoids, which consist of mixture of curcumin and its derivatives. The curcuminoids are polyphenols and are responsible for the yellow color of turmeric. Since curcumin is brightly colored, it may be used as a food colorant (E number:E100). Curcumin can exist in at least two tautomeric forms, keto and enol. The enol form is energetically more stable in the solid phase and in solution. (Mukherjee KP, 2002) Curcumin is known for its hepatoprotective, (Deshpande UR, et al., 1998, Rajshekaran, et al., 1998) antitumor, (Kim, et al., 2001, Duvoix, et al., 2005, Khar, et al., 1999, Kuttan, et al., 1985) antioxidant, (Selvan, et al., 1995, Anto, et al., 1994, Ruby,et al., 1995, Scartezzini and Speroni, 2000) antiarthritic, anti-amyloid and anti-inflammatory properties. (Jain, et al., 2007) A number of curcumin analogs have also been developed to have greater bioavailability, but have not been tested broadly, neither in- vitro nor in- vivo, for medicinal purpose.

A variety of plants have been utilized in herbal creams for their specific purposes. For instance, Aloe vera is known for its moisturizing and anti-inflammatory effects, Medicago sativa acts as an exfoliating agent, *Amygdalus communis* is used for cleansing, *Cucumis sativus* is found in palliative preparations, *Lavendula officinalis* is effective against pimples and acne due to its antiseptic properties, and CL, commonly known as Turmeric, is frequently used as a complexion improver in Indian spices. Turmeric contains curcumimoids, which are polyphenols responsible for its yellow color. Curcumin, a component of curcumimoids, can be used as a food colorant. It exists in both keto and enol forms, with the enol form being more stable. Overall, the use of these plants in herbal creams is highly regarded and holds great potential.

Curcumin is widely recognized for its impressive range of beneficial properties. It has been found to possess hepatoprotective, antitumor, antioxidant, antiarthritic, anti-amyloid, and anti-inflammatory properties. In addition, numerous curcumin analogs have been developed with the aim of enhancing their bioavailability. Although these analogs have not yet undergone extensive testing, both in-vitro and in-vivo, for medicinal purposes, there is great optimism regarding their potential.

2. Materials and method

2.1. Extraction

The marc obtained after successive petroleum ether and chloroform extraction of the powdered rhizomes of CL was further extracted with methanol. The residue was evaporated to dryness.

2.2. Preparation of Cream

A vanishing cream was prepared using the formula as described by Mithal and Saha, 2000, containing 20 % stearic acid, 1.4 % potassium hydroxide, glycerin 4 %, turmeric extract 16 %, water 59.6 % and perfume, preservative q.s. Oil phase was mixed gradually in the order of their increasing melting points. Components of aqueous phase were mixed together and warmed to about same temperature as oil phase, then mixed together with continuous stirring until smooth cream resulted. Perfume was added at last after cooling and finally passed through triple roller mill.

2.3. Estimation of Curcumin by Spectrophotometric Method

Cream equivalent to 0.1 g (625 mg) turmeric extract was weighed, dissolved in 25 ml ethyl alcohol and warmed for complete dissolution of soluble fraction, while insoluble fraction of oily phase was removed by centrifugation at 3000 rpm for 5 min. using centrifuge (Eppendorf 5810 R). The solution was then filtered through whatman filter paper no. 41. Filter paper was then washed with little alcohol and filtrate was transferred into 100 ml volumetric flask. Volume was made up to 100 ml with ethyl alcohol. 10 ml of this solution was pipette out to another 100 ml volumetric flask and the volume was again made up-to 100 ml with the same solvent. Absorbance was then measured at 425 nm in 1 cm cell against an alcohol blank. All the determinations were carried out in triplicate. In-house formulation was compared with four marketed samples (MS-I,II,II,IV). (Rajpal, 2005)

2.4. Calculation

A standard solution of curcumin 0.0025 g/l gives absorbance value of 0.42 at 425 nm. (l=1)

$$\text{Absorptivity of Curcumin (A)} = \frac{0.42}{l} \times 0.0025$$

$$\text{\% Curcumin} = a \times \frac{100}{l} \times A \times W$$

where,

a = absorbance at 425 nm.
l = cell length in cm
A = absorptivity
W = weight of sample in g

3. Results and discussion

Herbal cosmetics are becoming increasingly popular with increased awareness for beauty with safety. Due to their safety, effectiveness and easy availability, herbs are gaining much more attention and accordingly a number of manufacturers brought their products with various phyto- constituents, but there is lack of regulations for manufacture and practice. The source and quality of the ingredients is also not standardized hence, there is a need to analyze every batch before release into market. Although most of the marketed preparations are good, there is lack of methods to identify them. However sophisticated and advanced methods were found to be more accurate and time efficient, their cost sometimes limit their use by small industries hence cost effective instruments and methods always secure their place and remain important for batch to batch analysis. Analysis cost directly increases the product cost hence, cost effectiveness of the method indirectly ensures the affordability with quality.

Curcumin, which is a lipophilic polyphenol present in CL, is the most widely used phyto- constituent of herbal face creams. In animal studies, curcumin is reported to be rapidly metabolized, conjugated in the liver and excreted in the feces, therefore having limited systemic bioavailability. Curcumin inhibits cytokines possibly by regulation of activation of certain transcription factors like, protein-1 (AP-1) and NF-xB in stimulated monocytes and alveolar macrophages hence blocking of expression of cytokine gene expression. Some researchers found curcumin as effective antioxidant by scavenging free radicals like superoxide, hydrogen peroxide and nitric oxide etc.(Julie, et al., 2009, Tanvir, et al., 2017)

In the present study, a cream containing turmeric extract was prepared and the percentage of curcumin was estimated and compared with four available marketed samples.

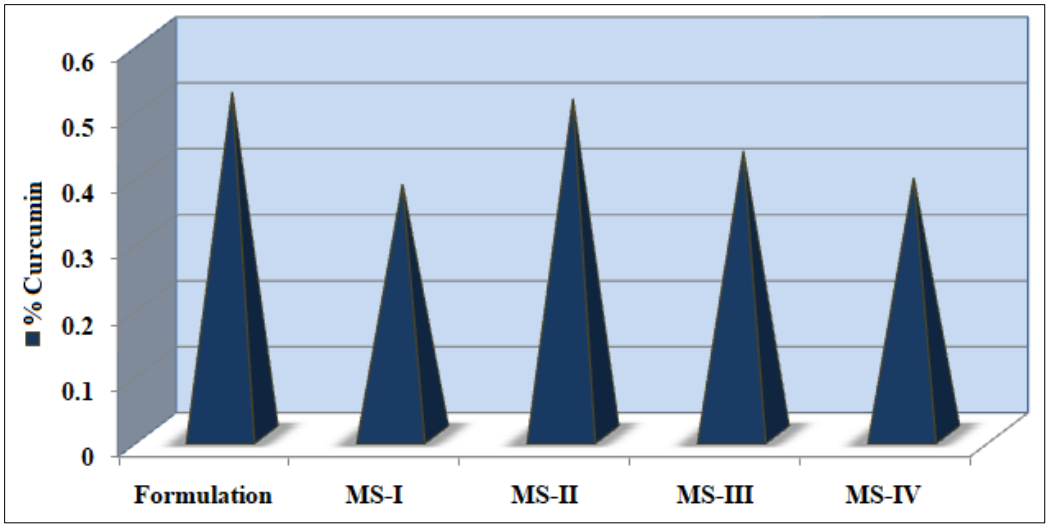


Figure 1 Comparative % Curcumin in different samples of herbal face cream

Marketed samples were found to be at lower side in respect of curcumin content but comparable with in-house formulation which may be attributed to the source, collection time, processing and storage conditions of raw drugs. Preparation formula and method may also impact the results. Although the sample size was small, the method was found to be cost effective and gave reproducible and rapid results, hence could serve as a commercial method for standardization. The study was found to be commendable and holds great promise for the herbal cosmetics industry.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare that there are No Conflicts of Interest.

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