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Formulation and Evaluation of Curcumin Corn Caps for the Treatment of Foot Corns

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A B S T R A C T

The extract known as "Curcuma longa" (Turmeric) is made from the rhizomes of the Zingiberaceae family plant "Curcuma longa." It contains a substance called curcumin, which has been used for countless medical purposes since ancient times. The objective of this study is to formulate & evaluate the ointment made from the Curcuma Longa (Turmeric) extract. The ointment has been prepared by the fusion method method. After that, it is further checked for its evaluation parameters such as the colour, odour, pH, extrudability, was hability, loss on drying, spreadability, solubility, etc. The linearity concentration of the curcumin was good and R^2value was found to be >0.99.The formulation was also checked for its stability at respected temperatures. So, it can be used easily as a simple dosage form. All of the prepared formulations (F1–F5) displayed comparable and acceptable evaluation results in terms of their physical appearance (orange-yellow color), characterizing odor, spread ability (6.6–8.0g.cm/sec), viscosity (105-245), loss on drying (20–50%), pathogen test (absent), and drug content (85–92%). Of these formulations, F2 had the highest drug content (91.56%), so it can be said that its performance is satisfactory.

Keywords: Curcuma longa (Turmeric) Extract, Ointment, Wound Healing, Stability

A R T I C L E I N F O

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Contents

1. Introduction

A number of European and North American nations, including the United States, the United Kingdom, France, Germany, Denmark, the Netherlands, and others, have been using and researching the usage of herbs for centuries in the pharmaceutical industry. Many human diseases have emerged in the twenty-first century under different labels. These herbs work well and have no negative responses or side effects [1-4].It is typical for humans to sustain wounds. Wound healing is a complicated biological process that can result in a number of issues from both internal and external sources [5,6]. If a wound is not adequately treated, it can frequently result in major adverse outcomes[7]. The following are the phases of wound healing: angiogenesis, remodeling, granulation tissue production, inflammation, and repair of connective and epithelial tissues [8]. Wound care is essential to getting the best functional and cosmetic outcomes quickly[9]. Since ancient times, people have used turmeric to treat wounds. The dried roots and rhizomes of the Zingiberaceae family plant "Curcuma longa" are used to make turmeric. Turmeric's primary ingredient, curcumin, has the ability to heal wounds[10]. Curcumin has experience managing under the archaic systems of China, India, and Iran[11]. Numerous nations, including China, India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia, and some African nations, are home to large populations of the plant "Curcuma longa"[12]. From curcumin, more than ten distinct

curcuminoids have been identified. They are Bisdemethoxy curcumin (Curcumin III), Desmethoxy curcumin (Curcumin II), and Curcumin I. Turmeric essential oils contain sesquiterpenoids, including turmerone and curlone, which are biological components of the oil. Their biological characteristics are comparable to those of curcuminoids[13]. Curcumin enhances the migration and re-epithelialization of cells, including macrophages, fibroblasts, and myofibroblasts[14]. Curcumin specifically inhibits the arachidonic acid cascade to reduce pain and inflammation[15]. The proinflammatory enzyme 5-LOX is inhibited and its expression is down regulated by curcumin. Additionally, it causes the down-regulation of a number of inflammatory cytokines, including interferon, TNF, IL-1, IL-6, IL-8, and some other chemokines.[16,17]. It is applied as an ointment to promote wound healing. Ointments are classified as semisolid dosage forms. When shear stress is applied, they often act like viscoelastic materials. They are usually meant to be applied topically to the body or mucous membrane, and they include medications [18].

2. Materials & Methods

Curcumin was procured from Research-Labfinechem industries, Hyderabad, India. Black cumin oil was obtained from natural remedies, Tirupati, India. Terpentine oil and Piperine oil were procured from RV Essentials, Delhi, India. Eucalyptus oil was procured from deevana products, Delhi, India. Cetosteryl alcohol was procured from SD fine chemlimited, mumbai, India. Methyl paraben and propylparaben were purchased from Accord labs. Hard Paraffin was purchased form Fischer Chemic Ltd, Chennai.

Collection of Curcumin powder:

Curcumin extract was purchased from Research-Lab Fine Chem Industries. It isorange-yellow in colour and stored in cool and dryplace. The turmeric extract contains 98% curcumin.

Procedure for Ointment preparation

The Ointmentis formulated by using Fusion method. First, the ointment base has been prepared by weighing the appropriate quantity of hard paraffin wax. It has been placed in the porcelain dish on a water bath. After the melting of hard paraffin wax, the remaining ingredients such as cetostearyl alcohol, wool fat, white soft paraffin were added. Further dry curcumin extract has been added to the ointment base. First, the powder is rubbed with a small quantity of the base to forming a concentrated ointment base containing a finely divided powder uniformly distributed in it. The concentrated ointment is then diluted with the remaining quantity of the base by rubbing with a spatula. Later the other ingredients such as Onion juice, Garlic juice, Vite oil, Baking soda were added according to formulation weight. At last the two preservatives that are Methyl paraben & Propylparaben has been added[19]. The formulation was stored in suitable container stoper form evaluation tests.

Evaluation Parameters

Colour& Odour

This is ascertained through the visual inspection.

Consistency

Grittiness-free and smooth to the touch. pH A digital pH meter was utilized to ascertain the ointment's pH. 100 milliliters of distilled water were used to produce the ointment solution, which was then left for two hours [20].

Loss on drying

The ointment in the petri dish is placed on a water bath and dried at 105ºC to evaluate the loss on drying [21].

Percentage loss on drying = 100 × (Wt – MW) / Wt

Viscosity

The CAP-2000 Brookfield viscometer was used to measure the viscosity. The test sample was collected in a dry, clean 250 ml beaker, and its viscosity was measured using spindle numbers 1 through 4 in accordance with the Viscometer's standard operating method. The viscosity of the sample was measured at 0.3, 0.6, 1.5, 3, 6, 12, 30, and 60 r.p.m. for each spindle. Moreover, their rheological properties were examined using a Brookfield viscometer at 250 C [22].

Spreadability

Spreadability is measured by sandwiching extra sample between two slides that were uniformly thickened by applying a fixed weight for a predetermined amount of time. The spreadability was defined as the amount of time needed to separate the two slides. Better spreadability is achieved when two slides can be separated in less time.

Spreadability was calculated by the following formula:

$$S=M \times L/T$$

Where,

S= Spreadability

M= Weight tide to the upper slide

L= Length of glass slide

T= Time taken to separate the slides

Extrudability

The amount of ointment that extruded from the tube as a percentage upon applying finger pressure was the basis for the evaluation of ointment formulation for extrudability in the recent study. Extrudability was improved by greater quantity extruded. A finger was used to apply pressure to a clean, lacquered aluminum collapsible 5 gram tube containing the formulation sample, which had a 5 mm nose tip hole. The amount of cream that extruded through the tip of a tube when pressure was applied was then used to determine the extrudability of the tube[23].

Solubility

Miscible with ethanol, ether, and chloroform; soluble in boiling water.

Washability

After applying the ointment to the skin, the degree of water washing was assessed.

Non-Irritancy Test

The ointment has been applied to human skin, and the results have been monitored.

Stability Studies

On October 27, 1993, the International Conference on Harmonization (ICH) released harmonized tripartite recommendations for stability testing of novel pharmacological substances and the product[24]. The herbal ointment underwent a four-week physical stability test at a range of temperatures, including 4°C, 25°C, and 37°C. The ointment was found to be physically stable at different temperature i.e. 4ºC, 25ºC, 37ºC [25, 26] .

3. Results & Discussion

The purpose of this study was to create and assess an ointment made from dried Curcuma longa (turmeric). The dried version of the Curcuma longa (turmeric) extract was consumed. Initially, a dry Curcuma longa (turmeric) extract was characterized. The reference and standard samples' colors, smells, solubility, melting points, and other characteristics have been identified. The fusion process was employed to prepare an ointment. Since it guarantees consistent blending of the turmeric extract with the ointment base, the fusion process has been used. & it doesn't change while being stored. Initially, a tiny amount of the base was rubbed over the powder to create a concentrated ointment base with the powder evenly distributed within. Next, using a spatula to rub in the remaining amount of base, the concentrated ointment is diluted. After analysis, the physico-chemical characteristics provided precise findings for assessment metrics like spread ability, viscosity, washability, drying loss, and others.

Table:1 Formulation of Curcumin Ointment

Ingredients	**F1 (gm)**	**F2 (gm)**	**F3(gm)**	**F4 (gm)**	F5 (gm)
Curcumin	0.5	0.5	0.5	0.5	0.5
Garlicjuice	0.25	0.25	0.25	0.25	0.25
Onionjuice	0.25	0.25	0.25	0.25	0.25
Vitamineoil	0.25	0.25	0.25	0.25	0.25
Bakingsoda	0.25	0.25	0.25	0.25	0.25
Hardparaffin	2.5	2.5	2.5	2.5	2.5
Wool fat	2.5	2.5	2.5	2.5	2.5
Cetosterylalcohol	2.5	2.5	2.5	2.5	2.5
Eucalyptusoil	-	0.2	-	-	-
Blackcuminoil	-	-	0.2	-	-
Terpentineoil	-	-	-	0.2	-
Piperineoil	-	-	-	-	0.2
Methylparaben	0.02	0.02	0.02	0.02	0.02
Propylparaben	0.02	0.02	0.02	0.02	0.02
White soft Paraffin	40.96	40.76	40.76	40.76	40.76
Total	50	50	50	50	50

Calibration curve of Curcumin: The UV absorption spectrum of curcumin showed a peak at 422nm in 6.8 pH phosphate buffer. Hence it was taken as ƛ max for the present study the values of absorbance of different concentrations of curcumin in 6.8 pH phosphate buffer are givenin a table. Agraph of absorbance vs concentration was plotted which indicated in compliance with beers law in the concentration range.

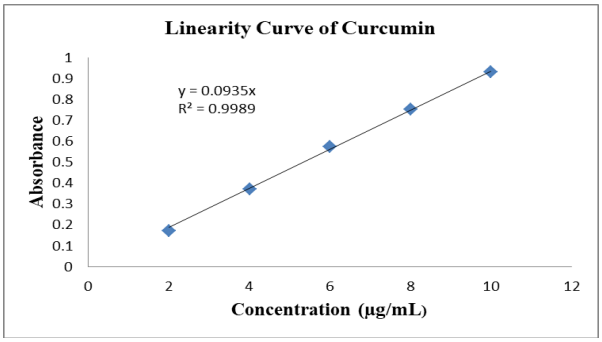

Figure:1 Linearity curve of Curcumin

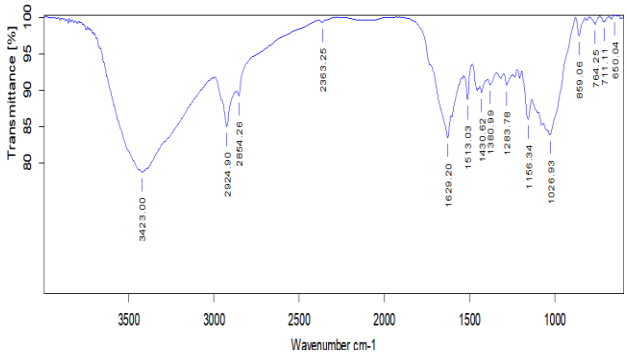

Figure 2:FT-IR Spectrum of Curcumin

Physico-chemical Evaluation Parameters: Physico-chemical characteristics of the various formulations (F1-F5) were examined. These formulations contain permeation enhancers. Evaluation parameters were shown in table no 2.

Table:2 Physico-chemical Evaluation Parameters

Evaluation Parameters	**F1**	**F2**	**F3**	**F4**	**F5**
Physical Appearence	orange-yellow colour Characteristic Odour	orange-yellow colour Characteristic Odour	orange-yellow colour Characteristic Odour	orange-yellow colour Characteristic Odour	orange-yellow colour Characteristic Odour
Consistency	Smooth	Smooth	Smooth	Smooth	Smooth
Testofnon-irritancy	Nonirritant	Nonirritant	Nonirritant	Nonirritant	Nonirritant

pH	5.9	5.4	6.6	6.9	6.2
Spread ability(g.cm/sec)	6.6	5.14	6.75	7.71	4.40
Viscosity	105cp	224cp	213cp	242cp	231cp
Losson drying(%)	48	25	39	29	20
Washability	Washable	Washable	Washable	Washable	Washable
Drug Content(%)	85.45	91.56	89.41	91.39	89.25
Pathogentest	Absent	Absent	Absent	Absent	Absent

F1: Formulation of Curcumin Ointment Without Permeation Enhancer, **F2**: Formulation of Curcumin Ointment with Eucalyptus Oil, **F3**:FormulationofCurcuminOintment with Black Cumin Oil, **F4**: Formulation of Curcumin Ointment with Terpentine Oil, **F5**: Formulation of Curcumin Ointment with Piperine Oil

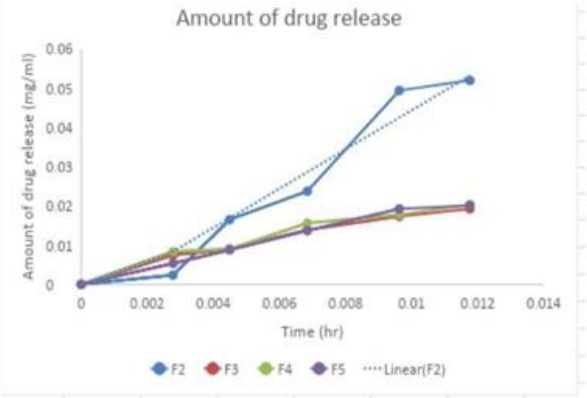

Figure: 3 Percentage cumulative drug release of F1-F5 formulations

The Curcumin ointment was prepared by fusion method. The formulation was carried out by using the ingredients such as Curcumin, onion juice, garlic juice, baking soda, vitamin E oil, natural permeation enhancers like piperine, eucalyptus, black cumin oil, terpentine oil. The standard calibration curve was used to determine the linearity of Curcumin with 6.8 pH phosphate buffer. Standard curve of concentration Vs absorbance was plotted. From the results it was clear that the regression coefficient (R^2) was 0.9998which indicated that the graph is linear. The FTIR study were carried out to determine the compatibility studies. Spectra for pure Curcumin shown (Figure-2) frequencies at 1026.93cm-1,1629.20cm-1,3423.00cm-1,which determines the presences of C-O, C=O, O-H, O-H stretching respectively. FTIR graph of Curcumin with piperine shown frequencies at 1163.10cm-1,1746.86cm-1 ,3405.80cm-1, representing the presence of O-H, C-O, C=O, O-H stretching respectively. FTIR graph of Curcumin with Eucalyptus shown frequencies at 1160.48cm-1 ,1745.47cm-1 ,3423.63cm-1, representing the presence of C-O, C=O, O-H stretching respectively. FTIR graph of Curcumin with terpentine oil shown frequencies at 1163.04cm-1, 1746.18cm-1, 3404.68 cm-1, representing the presence of C-O, C=O, O-H stretching respectively. FTIR graph of Curcumin with black cumin oil shown frequenciesat1163.29cm-1,1746.29cm-1,3418.71cm-1, representing the presence of C-O, C=O, O-H stretching respectively. Hence no interactions observed between the drug and the excipients used in the formulations. Ointment were evaluated for test of irritancy, pH, spread ability, drug content analysis, loss on drying, solubility, washability, pathogen test all of them comply with the standard references. Diffusion studies were performed to determine the amount of drug release. Drug release for all formulations were recorded. Stability test of the Curcumin ointment was carried out for three months at specified temperature and humidity conditions.

4. Conclusion

The aim of this study was to improve the diffusion profile thereby increase permeability. From the results concluded that: Curcumin corn caps were prepared by Curcumin ointment by fusion method. The compatibility studies by FTIR shown that the drug Curcumin with excipients like black cumin oil, eucalyptus oil, piperine oil, terpentine oil do not interact with any other chemical entity. The peaks obtained in each combination of drug and permeation enhancers are similar to the peaks of the drug's spectrum.Therefore,itindicatedthattherewasnoincompatibilitybetweendrugandexcipients. All the prepared formulations (F1-F5) were shown the acceptable and comparable evaluation results like physical appearance (orange-yellow colour), odour (characteristic odour),spread ability(6.6-8.0g.cm/sec), viscosity (105-245), loss on drying (20-50%), pathogen test (absent),drug content(85-92%), among all these formulations F2 (Figure3) was shown greater drug content of 91.56% hence it can be stated that F2 is having satisfactory results. In-vitro drug release of F2 was shown increase in diffusion rateand better permeability. Stability studies which were performed for three months and Curcumin ointmentis stable at determined temperature and humidity. The formulated ointment was successfully filled into the patches by placing ring on the patchso as to avoid ointment spilling. The formulation is useful for the effective treatment of foot corn.

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