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## A Review on: Formulation and Evaluation of Cream Containing Curcumin

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### Abstract

*As a member of the Zingiberaceae family, turmeric (Curcuma longa) is a common medicinal herb in India. Most notably, curcumin, the main ingredient in turmeric, possesses antioxidant potential among other biological characteristics. Taking turmeric may reduce the risk of several cancers, according to epidemiological observations. It also has anti-inflammatory, anti-angiogenic, antioxidant, wound-healing, and anti-cancer characteristics, among other biological benefits that help prevent disease in humans. This review highlights the most intriguing biological effects of curcumin.*

*A popular and widely used rhizomatous medicinal plant in India, curcuma longa, also known as turmeric, is a member of the Zingiberaceae family. Turmeric contains three compounds called curcuminoids: curcumin, demethoxycurcumin (DMC), and bisdemethoxycurcumin (BDMC). An alternative name for curcumin is Differentiuloylmethane (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), which is well known for its numerous biological properties, including anti-inflammatory, antiviral, antioxidant, anti-cancer, antibacterial, anti-asthmatic, anti-diabetic, anti-venom, anti-obesity, wound-healing, and more. Here we have reviewed the outcomes of these exercises as well as a number of clinical studies. Curcumin is a tautomeric compound that forms an enolic form in organic solvents and a keto form in water.*

**Keywords** - Curcuma longa, Curcuminoids, Anti-asthmatic, Curcumin, Cancer, Zingiberaceae, Pharmacological uses, Anticancer, Antidiabetic, Antioxidant

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### INTRODUCTION

Recently, there has been a lot of interest in curcumin, the primary bioactive ingredient in turmeric, due to its many pharmacological properties, which include antibacterial, antioxidant, and anti-inflammatory properties.

Because of these medicinal advantages, there is growing interest in incorporating curcumin into topical formulations—especially creams—to improve its bioavailability and therapeutic efficacy in the management of certain skin conditions.

Curcumin has limitations in its medicinal utilization due to issues including poor solubility and stability, despite its potential. A viable approach is to incorporate curcumin into a cream, which uses the lipid-based matrix to enhance skin penetration and sustain the compound's activity. This review paper discusses several excipients, preparation processes, and characterisation procedures in order to investigate formulation strategies and evaluation methods for creams containing curcumin. This paper will emphasize the potential of curcumin formulations in dermatological

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applications and offer suggestions for future research directions by offering insights into the present research landscape. [1,2]

Due to its many benefits, including antibacterial, reducing inflammation, antimutagenic, and antioxidant qualities Historically, curcumin has been utilized as a medicinal herb. Curcumin exhibits quick metabolism, quick excretion, and poor absorption. The bioavailability of curcumin has been increased by the addition of many substances. Piperine is the most intriguing since it enhances curcumin's bioavailability by blocking its metabolic route. The addition of piperine enhances the bioavailability of curcumin by 2000%. [3,4]

### **History of Curcumin**

Curcumin's history as a medicinal substance extends back thousands of years, when it was first used in conventional medical systems like Traditional Chinese Medicine and Ayurveda. Turmeric has been used as a spice and in medicine since ancient times, mostly to treat skin and inflammatory diseases.

The thorough study of curcumin's biological activity in the middle of the 20th century sparked modern interest in the herb. Early studies demonstrated Its antioxidant and anti-inflammatory qualities, which sparked a wave of interest in its possible uses in a variety of formulations, including topical treatments. [5]

In the latter half of the 20th century, curcumin formulations into creams and other topical dose forms began to gain popularity. Because of curcumin's low solubility and bioavailability, researchers have been looking into different formulation techniques. In an effort to improve skin penetration and stability, early studies concentrated on adding curcumin to lipid-based systems, such as emulsions and creams.

By the early 2000s, topical formulations containing curcumin were being delivered even more effectively because to developments in formulation technology, including the application of nanotechnology and vesicular systems like liposomes and ethosomes. Research started to show how well curcumin lotions worked for treating psoriasis, acne, and photoaging.

In order to maximize the physicochemical qualities of curcumin, recent research has broadened the range of curcumin formulations by adding different excipients, such as natural oils, polymers, and emulsifiers. In-depth assessment techniques have also been created, with an emphasis on variables like therapeutic efficacy, skin permeability, and stability.

Due to the increasing popularity of herbal medicine and the need for safe, natural dermatological treatments, there is a significant body of research being done on the composition and assessment of creams containing curcumin. Curcumin is positioned as a strong contender for upcoming advancements in skincare and therapeutic applications as the body of information continues to grow. [6,7]



*Figure 1: Curcumin*

## **Pharmacological Activity**

### **Antidiabetic Activity**

The key ingredient in turmeric, curcumin (*Curcuma longa*), has garnered a lot of interest since its many health advantages, which may include antidiabetic effects. Adding curcumin to topical creams creates new opportunities for the management of diabetes, especially for the treatment of skin-related issues that diabetic patients face.

It is commonly known that curcumin's general defensive qualities are strengthened by this feature. Curcumin may indirectly lessen oxidative stress-induced cell death by acting on cytoprotective/antioxidant enzymes such as heme oxygenase-1 (HO-1) and enhancing their activity. Curcumin has reportedly been shown to have anti-diabetic effects. Curcumin's antioxidant activity may be the cause of its anti-diabetic effects. Researchers discovered that curcumin inhibits vascular protein kinase C and reduces superoxide production, both of which are favorable effects on diabetes-induced endothelial dysfunction.<sup>[8]</sup>

### **Wound healing Activity**

Turmeric's (*Curcuma longa*) key ingredient, curcumin, has been known for many medicinal benefits, chief among them being the acceleration of wound healing. By utilizing its biological properties, the incorporation of curcumin into topical creams presents a novel way to accelerate the healing process of wounds.

The complex process of tissue repair during wound healing includes granulation, remodeling, and inflammation. Animal wound healing has been demonstrated to be enhanced by curcumin. The mechanisms by which curcumin promotes wound healing are as follows: Change-producing factor- $\beta$ 1 When compared to untreated wounds, immunohistochemistry localization showed that curcumin-treated wounds had more, changed collagen and a decrease in reactive oxygen.

Additionally, curcumin showed enhanced neovascularization, quicker reepithelialization, and increased migration of several cells into the wound bed, including fibroblasts, macrophages, and dermal myofibroblasts.<sup>[9]</sup>

### **Anti-arthritis Activity**

By inhibiting pro-inflammatory cytokines and enzymes, curcumin reduces joint inflammation and pain associated with arthritis. Its ability to modulate oxidative stress helps protect joint tissues from damage. Additionally, curcumin promotes cartilage health and may enhance overall mobility in affected individuals. Topical formulations enhance bioavailability, allowing for targeted relief at the site of inflammation. Clinical studies support curcumin cream's effectiveness in alleviating symptoms of osteoarthritis and rheumatoid arthritis, making it a promising natural alternative for arthritis management.<sup>[10]</sup>

It is believed that curcumin's immune-suppressive, anti-inflammatory, antiproliferative, and antioxidant qualities have lessened the suffering of people with rheumatoid arthritis. A decreased rate of apoptosis could be one of the main consequences of RA. The MTT experiment, fluorescence microscopy, and Annexin-V-based assay all demonstrated that the curcumin-exposed synovial fibroblasts experienced growth reduction and apoptosis induction. According to these findings, curcumin may be able to prevent the RA-induced hyperplasia of synovial fibroblasts.<sup>[11]</sup>

### **Anti-Alzheimer Activity**

Curcumin cream's antioxidant and anti-inflammatory qualities may help prevent Alzheimer's disease. It lowers oxidative stress and neuroinflammation, two important elements of the pathophysiology of Alzheimer's disease. Moreover, curcumin might inhibit the aggregation of amyloid-beta peptides, hence reducing the formation of plaque in the brain. By encouraging the

creation of brain-derived neurotrophic factor (BDNF), curcumin has been demonstrated to increase neurogenesis and cognitive performance. Formulated as a cream, curcumin can be given precisely and may have a higher bioavailability. Although research is ongoing, curcumin cream is a promising natural therapeutic option for Alzheimer's disease that enhances cognitive function.<sup>[12]</sup> This neurodegenerative brain illness is a chronic, progressive condition that mostly manifests as a loss of cognitive and behavioral functions. Curcuminoids have been found to be useful as medications to prevent Alzheimer's disease.<sup>[13]</sup>

#### **Anti-Parkinson Activity**

Because curcumin cream has neuroprotective, anti-inflammatory, and antioxidant qualities, it shows promise anti-Parkinson's efficacy. It helps reduce oxidative stress and inflammation in the brain, two things that cause neuronal damage in Parkinson's disease. Curcumin has the potential to improve mitochondrial performance and aid in the survival of dopaminergic neurons by modifying signaling pathways linked to neurodegeneration. Its potential therapeutic effects are further supported by its capacity to suppress the aggregation of alpha-synuclein, a protein linked to the pathology of Parkinson's disease. Curcumin can be applied locally when it is formulated as a cream, which may improve absorption and management of Parkinson's symptoms.<sup>[14]</sup>

Current research indicates that oligomeric forms of  $\alpha$ S are the deadliest, despite its ability to misfold and take on several geometries. Curcumin can protect cells from apoptosis, reduce intracellular ROS levels, and lessen the toxicity that is brought on by  $\alpha$ S}. Thus, curcumin may be used as an anti-Parkinson drug.<sup>[15]</sup>

#### **Anti-Inflammatory Activity**

Because curcumin can suppress pro-inflammatory cytokines and enzymes like COX-2 and LOX, it has a strong anti-inflammatory effect that is well-known. It relieves the symptoms of several inflammatory illnesses, including as arthritis and skin ailments, by decreasing inflammation. Moreover, curcumin has anti-inflammatory properties by scavenging free radicals and averting oxidative stress, which can worsen inflammation. Curcumin's localized benefits are amplified when applied topically, facilitating focused treatment at inflammatory locations. Because of this, curcumin cream presents a viable all-natural option for reducing inflammation and enhancing skin health.

Curcumin exhibits strong anti-inflammatory properties against both acute and chronic inflammation. In chronic tests, its effectiveness is half that of phenylbutazone; nevertheless, in the carrageenan oedema test, it is equivalent. Six participants in human trials have shown that curcumin is safe and has anti-inflammatory properties. In order to provide its anti-inflammatory actions, it might inhibit several different inflammatory molecules. Many transcription factors, cytokines, protein kinases, adhesion molecules, redox status, and inflammatory enzymes have all been shown to be regulated by curcumin.<sup>[16,17]</sup>

#### **Anti-Venom Activity**

By providing Defense against snake and other poisonous bites, curcumin cream shows promise as an anti-venom agent. Its antioxidant and anti-inflammatory qualities might lessen discomfort and swelling by lessening the tissue damage brought on by venom. A number of venom-associated enzymes, such as metalloproteinases and phospholipases, can be inhibited by curcumin, increasing toxicity. Furthermore, its capacity to regulate immune responses might facilitate healing and improve recuperation at the bite site.<sup>[18]</sup>

The metabolite curcumin from herbal plants has been shown to be effective against PLA2 in snake venom. Researchers looked at the structural relationships between Russell's viper PLA2 and

significant medicinal herbal components. Including tectoridin, acalyphin, stigmasterol, chlorogenic acid, and curcumin. In the molecular modelling studies, the active site amino acid residues of the venom PLA2 exhibited favourable interactions that could contribute to the inhibition.<sup>[19]</sup>

### **Anti-Angiogenesis Activity**

Since the growth and spread of cancers depend on the formation of new blood vessels, curcumin cream has strong anti-angiogenic properties. Curcumin obstructs a number of signaling pathways that are necessary for angiogenesis, including NF- $\kappa$ B and VEGF (vascular endothelial growth factor). In addition to reducing inflammation and oxidative stress, curcumin creates an environment that is unsuitable for the creation of blood vessels. This characteristic is very helpful in the treatment of inflammatory illnesses and cancer. Applying curcumin topically improves its localized effects, which makes it a good option for creating treatments meant to prevent angiogenesis and treat associated disorders.<sup>[20]</sup>

### **Antioxidant Activity**

Strong antioxidant activity found in curcumin cream is well known for assisting in shielding cells from oxidative stress and damage from free radicals. Curcumin bolsters the body's natural antioxidant defenses and neutralizes reactive oxygen species (ROS) by upregulating enzymes including glutathione peroxidase and superoxide dismutase. Through the reduction of inflammation, the prevention of premature aging, and the promotion of healing in a variety of skin problems, this protective action maintains the health of the skin. By enabling tailored delivery, the topical formulation maximizes its effectiveness at the application location. All things considered, curcumin cream is a great choice for reducing oxidative stress and boosting skin radiance.<sup>[21]</sup>

### **Anti-Bacterial Activity**

Both Gram-positive and Gram-negative bacteria are significantly inhibited by curcumin cream, among other pathogens. By rupturing bacterial cell membranes, curcumin prevents germs from growing and proliferating. Its usefulness in treating infections is further enhanced by its capacity to obstruct the production of bacterial biofilms. Furthermore, curcumin's anti-inflammatory qualities lessen the swelling and redness brought on by bacterial infections. Topical administration of curcumin cream facilitates targeted activity at the infection site, allowing for limited treatment. All things considered, curcumin cream offers a viable natural substitute for treating bacterial infections and enhancing skin health. Studies on the antibacterial qualities of curcumin demonstrate how efficient it is against periodontopathic bacteria, especially when it comes to preventing *Porphyromonas gingivalis* from growing and from acting on its enzymes. The Arg- and Lys-specific proteinases (KGP and RGP) that are generated by this bacterium are substantially reduced in activity by curcumin. Additionally, it inhibits *Streptococcus gordonii*'s biofilm formation and PIn a dose-dependent manner, *gingivalis* inhibits the formation of biofilms in about 80% of cases at concentrations as low as 20  $\mu\text{g/mL}$ .<sup>[22]</sup>

On the other hand, topical therapy using Curcumin - Polymyxin B is employed in clinical settings to manage or avert severe skin wound infections. It would combat isolated resistant bacteria in addition to extending its range of action to include Gram-positive bacteria. Dual medication therapy has numerous antimicrobial targets, therefore using the combination may help reduce the pressure from broad-spectrum antibiotics that causes selection and the formation of resistant isolates during treatments.<sup>[23]</sup>

The antibacterial activity and cell-antimicrobial interaction of curcumin nanoparticles are also enhanced by their tiny size and surface charge. The curcumin nanoparticles that were produced showed the strongest antibacterial efficacy against *Listeria monocytogenes*.



The fibers released curcumin faster and became more hydrophilic once PVP was added. Similarly, fibers containing curcumin were shown to contain curcumin in an amorphous state, and these mats showed antibacterial action against *S. aureus*. The dual spinneret electrospinning-prepared Curc/CA+Curc/PVP mat eradicated every germ in 4 hours. As wound dressings, fibrous polymers containing curcumin may have antimicrobial properties.<sup>[24]</sup>

### **Anti-Fungal Activity**

Curcumin cream exhibits significant antifungal properties against a range of fungal infections, such as *Aspergillus niger* and *Candida albicans*. Curcumin efficiently inhibits critical metabolic pathways and damages fungal cell membranes, hence suppressing fungal growth and biofilm formation. Its anti-inflammatory qualities also help to reduce the redness and irritation that are linked to fungal infections. Its topical composition makes it possible to apply it precisely where infections are, increasing its effectiveness there. Furthermore, curcumin is a safe substitute for traditional antifungal therapies due to its low toxicity. All things considered, curcumin cream offers a viable all-natural solution for treating fungus infections and enhancing skin health.

An essential component of a toolkit for preventing spoiling and fungal infections for a long time has been extracts and substances derived from various natural resources, particularly plants. Due to curcumin's extensive historical use in food products Numerous studies have been conducted to examine its potential to prevent fungal infections and degradation.<sup>[25]</sup>

Curcumin powder had a substantial inhibitory impact against fungal contaminations at doses of 0.8 and 1.0 g/L, according to a study on its inclusion in plant tissue culture. It was demonstrated that the previously documented antifungal activity was most likely mediated by downregulating desaturase (ERG3), which resulted in a notable decrease in the ergosterol levels in the fungal cell. Reduced ergosterol synthesis results in the accumulation of biosynthetic precursors, which in turn generates reactive oxygen species (ROS) that kill cells. Changes in membrane-associated ATPase activity characteristics and reductions in proteinase secretion may also significantly affect turmeric's antifungal efficacy.

It seems that finding new anti-candida chemicals is crucial because the disease is becoming more resistant to the antifungal drugs that are now being used.<sup>[26,27]</sup>

### **Anti-Viral Activity**

Promising antiviral activity of curcumin cream has been observed against many viruses, such as HIV, herpes simplex virus, and influenza. By blocking important enzymes and proteins involved in the viral life cycle, curcumin inhibits the reproduction of viruses and stops them from infecting host cells. Its antioxidant and anti-inflammatory qualities also aid in reducing the signs and symptoms of viral infections. The topical formulation improves effectiveness at the infection site by enabling targeted distribution. All things considered, curcumin cream provides a natural substitute for bolstering antiviral treatments and controlling symptoms, demonstrating its potential in the management of viral infections.<sup>[28]</sup>

The wide range of antiviral activity of curcumin, a plant derivative, has been demonstrated to be effective against a number of viruses, including adenovirus, coxsackie virus, herpes simplex 1 (HSV-1), human norovirus (HuNoV), influenza virus, papillomavirus virus (HPV), hepatitis B virus (HBV), hepatitis C virus (HCV), respiratory syncytial virus (RSV), and others. Respiratory syncytial virus infection has been shown to respond synergistically to graphene oxide with a curcumin functional. Respiratory syncytial virus (RSV), believed to be the primary viral pathogen of an infant's lower respiratory tract, has been associated with severe lung damage.

The creation of a graphene oxide (GO) composite functionalized with  $\beta$ -cyclodextrin (CD) showed good curcumin loading efficiency and antiviral efficacy. This means that the composite had preventive and therapeutic actions against viral 86 by directly inactivating the virus and preventing its attachment, preventing RSV from infecting host cells.<sup>[29]</sup>

### **Anti-Cancer Activity**

Curcumin cream has strong anti-cancer effects through a number of mechanisms, including apoptosis activation, cell proliferation reduction, and alteration of key signaling pathways implicated in tumor growth. It changes oncogene activity and boosts the expression of tumor suppressor genes, targeting a variety of cancer types, including as colorectal, prostate, and breast cancers. Furthermore, because of its antioxidant and anti-inflammatory qualities, curcumin lessens oxidative stress in the tumor microenvironment. With topical application, localized therapy is feasible, potentially increasing efficacy while lowering systemic side effects. Curcumin cream is a possible supplement to cancer therapy and prevention strategies, all things considered.<sup>[30,31]</sup>

### **Anti-Fibrotic Activity**

Because fibrosis is characterized by an excessive accumulation of extracellular matrix components, curcumin cream shows promising anti-fibrotic efficacy by preventing this accumulation. Important signaling pathways like TGF- $\beta$  and Wnt/ $\beta$ -catenin are modulated in order to lower collagen synthesis and fibroblast activation. Furthermore, curcumin's anti-inflammatory qualities aid in reducing the inflammatory reactions that fuel fibrotic processes. Curcumin aids in the resolution of fibrosis by encouraging apoptosis in activated myofibroblasts. Topical administration of curcumin enhances its therapeutic effects by enabling targeted distribution to afflicted areas. All things considered, curcumin cream provides a natural method of treating fibrotic disorders and enhancing tissue health.<sup>[32]</sup>

### **Hepatoprotective Activity**

Hepatoprotective efficacy of curcumin cream is demonstrated by its ability to reduce oxidative stress, inflammation, and toxicity-induced liver damage. Strong antioxidant characteristics aid in scavenging free radicals, shielding hepatocytes from oxidative damage. Additionally, curcumin inhibits the generation of pro-inflammatory cytokines that worsen liver damage via modulating inflammatory pathways. By increasing the expression of defensive enzymes and encouraging cell survival, it also aids in liver regeneration. Curcumin cream is a promising natural option for promoting liver health and preventing hepatic diseases since its topical administration allows for targeted impact on illnesses related to the liver. Its therapeutic promise in the therapy of liver disease may be improved by additional investigation.<sup>[33]</sup>

It also helps with bile secretion, vitamin storage, and fat and carbohydrate metabolism. It has been extensively studied since the 1970s and is essential for the detoxification of an organism's endogenous (waste metabolites) and/or exogenous (toxic chemicals) molecules as well as for the synthesis of advantageous compounds.<sup>[34]</sup>

### **Pharmacokinetic**

#### **Absorption**

The gastrointestinal tract's poor absorption of curcumin results in low bioavailability. Nevertheless, systemic absorption is still restricted; when given topically, it can pass through the skin and reach local tissues.

#### **Distribution**

Curcumin can permeate the dermis and epidermis after topical administration. Because of its lipophilic properties, it can penetrate epidermal layers that are high in lipids.

### Metabolism

Although topical treatment may lessen the degree of first-pass metabolism, curcumin is largely processed in the liver, allowing more active substance to reach the target tissues.

### Excretion

The main ways that metabolites are eliminated are through urine and feces. Compared to oral preparations, topically administered curcumin is less likely to experience significant systemic excretion.<sup>[35]</sup>

### Pharmacodynamics

#### Mechanism of Action

Antibacterial and antioxidant qualities are present in curcumin. Among the signaling pathways it affects that are connected to inflammation and oxidative stress reactions are NF-kB and Nrf2.

#### Medical Benefits

The efficaciousness of topical curcumin in treating wounds, acne, and psoriasis has been studied. Its anti-inflammatory qualities can aid in lowering swelling and redness.

#### Safety Profile

Generally regarded as safe for topical application, while some people may develop allergic reactions or skin irritation.

#### Formulation Considerations

Curcumin creams may contain penetration enhancers or be made with liposomes or nanoemulsions to improve absorption.<sup>[36]</sup>



**Figure 2: Turmeric Powder**

#### Taxonomical Classification

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Subclass	Zingiberidae
Order	Zingiberales
Family	Zingiberaceae
Genus	Curcuma
Species	Longa
Scientific Name	Curcuma Longa

**Table 1: Taxonomical Classification**



## **Applications of Cream**

Lessen the chance of becoming sunburned

Promote skin moisture retention.

Make the skin more velvety

It's important to lessen skin roughness.

Lessen the quantity of wrinkles

Attend to skin issues such as acne and scars.<sup>[37]</sup>

## **Ingredients of Curcumin Cream**

### **Active Ingredient**

Curcumin (extracted from turmeric).

### **Emulsifiers**

Cetyl alcohol, glyceryl stearate.

### **Oils**

Sweet almond oil, olive oil, or other lipid carriers.

### **Water Phase**

Distilled water, glycerine (humectant).

### **Thickening Agents**

Carbomer, xanthan gum.

### **Preservatives**

Phenoxyethanol, ethyl hexylglycerin.

### **pH Adjusters**

Triethanolamine or citric acid.<sup>[38]</sup>

## **Preparation Method**

### **Oil Phase Preparation**

Dissolve the oils and emulsifiers in a water bath that has been heated to between 70 and 75°C. Stir the curcumin into the oil phase until thoroughly mixed.

### **Water Phase Preparation**

Heat each component of the water phase separately to ensure that the thickening agents dissolve completely.

### **Emulsification**

Stir continually as you gradually add the water phase to the oil phase. Employ a high-shear mixer to achieve a complete emulsification.

**Cooling and Additives:** After letting the mixture cool, stir in the pH adjusters and preservatives. If needed, adjust the pH to between 5.5 and 6.5.<sup>[39]</sup>

### **Evaluation Parameter**

**The following criteria were used to assess curcumin cream**

### **Organoleptic Properties**

Color, fragrance, and other organoleptic characteristics were noted. The unique organoleptic qualities of curcumin cream improve user satisfaction. Due to curcumin, it usually has a vivid yellow-orange color that indicates its effectiveness. Its smooth and creamy texture makes it simple to apply to the skin. Its natural charm is enhanced by its typically earthy, slightly spicy aroma that is reminiscent of turmeric. The cream may feel chilly or calming when applied, offering a pleasing tactile feeling. It is also suitable for a variety of skin types because it absorbs somewhat rapidly and leaves a non-greasy finish. Together, these qualities produce a topical composition that is both enticing and potent.

### **Determination of pH**

A digital pH meter was used to measure the pH of a recently prepared emulsion at room temperature. Make sure the curcumin cream is at room temperature before measuring its pH. For measurement, use pH strips or a calibrated pH meter. Use distilled water to dilute a little portion of the thick cream. To measure pH, submerge the electrode of a pH meter into a cream or diluted sample. To measure pH using pH strips, dip the strip into the cream and compare the color change to the given scale. Note the pH value that is shown or that matches. Accuracy is ensured by taking numerous measurements, and the ideal pH range for skin stability and compatibility is usually between 4 and 7.

### **Determination of Homogeneity**

The uniformity of the herbal preparation was evaluated visually and tactilely. Examine the sample visually to ensure that the color and texture are consistent in order to assess the homogeneity of curcumin cream. Applying the cream to a level surface and looking for any separation or clumping allows you to perform a physical inspection. A more exacting technique is taking samples from various parts of the cream and comparing their color and particle dispersion. A rheological test can also evaluate the cream's flow characteristics and viscosity, demonstrating homogeneity. A well-mixed formulation is suggested by uniformity in these properties, but notable deviations might point to problems with the preparation procedure that require attention.<sup>[40]</sup>

### **Determination of Spreadability**

The term "spreadability" refers to the region that a topical application covers when applied to the affected skin area. The herbal mixture's spreading range affects how successful it is as medicine as well. Determining the produced formulation's spreadability is therefore crucial. Three grams of cream were sandwiched between the two glass slides and compressed to create a uniformly thin layer. The top slide was subjected to the necessary pressure for five minutes using a thousand-gram weight. The top slide was then raised with the aid of a thread that was fastened to the pan after adding roughly 10 grams of weight.

### **Washability**

The ease of removal of curcumin cream from surfaces or skin following application is referred to as its washability. A well-made curcumin cream should typically wash off with water and mild washing without leaving any noticeable residue or discoloration. Apply the cream to a small area, let it sit for a short while, and then wash it off with lukewarm water and a mild cleanser to determine washability. Examine the staining's ease of removal and any lingering effects. The cream is more enticing for everyday use without creating discomfort or skin irritation when it is washable, which guarantees user satisfaction and ease.

### **Spreadability**

When the spreadabilities of the created and marketed creams were compared, it was found that the formulated cream had the same spreadability as the marketed cream. The ease of application and dispersion of curcumin cream on the skin is referred to as its spreadability. The smooth texture of a cream with good spreadability makes it easy to apply without clumping. This characteristic improves the user experience by guaranteeing uniform coverage and efficient absorption for the greatest possible advantages.

### **Stability Studies**

The physical stability of the formulations was investigated by placing them in a glass or plastic container and heating them to 45°C in a humidity chamber. All day long, their appearance and physical stability were evaluated.<sup>[41]</sup>

## CONCLUSION

In an effort to increase curcumin's bioavailability, a number of treatments are currently being investigated. These include changing the curcumin's administration route and medium, inhibiting metabolic pathways by administering it concurrently with other drugs, and altering its structural makeup. Nevertheless, there are also some cutting-edge delivery methods, such as specified phospholipid complexes, liposomes, and nanoparticles, which aid in improving the drug's bioavailability and therapeutic value as well as the use of this intriguing natural substance.

To sum up, the development and assessment of creams containing curcumin offer a viable method of utilizing curcumin's medicinal advantages for a range of medical ailments. Its numerous qualities, such as its antibacterial, antioxidant, and anti-inflammatory capabilities, make it a strong contender for topical use. Curcumin's stability and bioavailability are increased by formulation process optimization, allowing for more focused distribution and increased efficacy. To completely comprehend the mechanisms of action, improve formulations, and validate clinical outcomes, more study is necessary. In the end, curcumin cream has a great deal of promise as a natural therapeutic choice for systemic and dermatological health applications, opening the door to creative therapeutic approaches.

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