INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Paper

A Review on Transdermal Patch of Turmeric Extract

A. B. Udar*, Mrunal Rasal, Atharva Rathor, Nikhil Raut

Dr Vithalrao Vikhe Patil Foundation's College of Pharmacy, Vadgaongupta (Vilad ghat), Post MIDC, Ahilyanagar.

ARTICLE INFO

Published: 16 Apr 2026
Keywords:
Formulation, Evaluation, Turmeric Transdermal Patches, Curcumin, Drug delivery, Bioavailability, Skin Permeation.
DOI:
10.5281/zenodo.19607009

ABSTRACT

This study focuses on developing and accessing turmeric-based transdermal patches for delivering curcumin through the skin, harnessing its known anti-inflammatory, antioxidant, and antimicrobial properties. The patches were prepared using the solvent casting method, with hydroxypropyl methylcellulose (HPMC) as the film-forming polymer, polyethylene glycol 200 (PEG 200) as a plasticizer for flexibility, and ethanol to enhance curcumin's permeation through the skin. Transdermal drug delivery systems (TDDS) offer an efficient way to deliver drugs, targeting the site of action and reducing the frequency of administration. The formulation of these patches aims to overcome the limitations of oral curcumin, improving its bioavailability. The patches were evaluated for their physical properties, including thickness, moisture content, drug content, and drug release profiles. Skin irritation tests were also conducted to ensure safety. The findings indicated that the turmeric-based transdermal patches provided sustained release and enhanced permeation of curcumin, improving its delivery and offering a non-invasive treatment option for inflammatory conditions.

INTRODUCTION

Turmeric (*Curcuma longa*) is a medicinal plant widely used in traditional healing systems, especially in Ayurveda and traditional Chinese medicine. Its primary active compound, **curcumin**, is responsible for most of its therapeutic effects. Curcumin has been extensively studied and is known to have powerful **anti-inflammatory**, **antioxidant**, **anticancer**, and **antimicrobial** properties. Because of these pharmacological benefits, curcumin holds significant potential in the prevention and treatment of various diseases, including arthritis, infections, cancers, and chronic inflammatory conditions.

***Corresponding Author:** A. B. Udar
Address: *Dr Vithalrao Vikhe Patil Foundation's College of Pharmacy, Vadgaongupta (Vilad ghat), Post MIDC, Ahilyanagar*
Email ✉: aradhanaudar111@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Despite its promising health benefits, curcumin faces major challenges when used in clinical or pharmaceutical applications. The main issue is its **poor bioavailability**, which means that only a small amount of curcumin actually reaches the bloodstream and tissues when taken by mouth. This is due to several factors:

1. **Low water solubility** – Curcumin does not dissolve well in water, which makes it difficult for the body to absorb it in the digestive tract.
2. **Rapid metabolism** – Once ingested, curcumin is quickly broken down by the liver into inactive forms.
3. **Fast elimination** – Curcumin is also rapidly cleared from the body, reducing the time it can exert any therapeutic effect.

Because of these limitations, even high oral doses of curcumin may not produce the desired health outcomes. To solve this problem, researchers are now exploring **alternative delivery systems** that can enhance curcumin's absorption and effectiveness. These include **transdermal patches**, **nanoparticles**, **liposomes**, and other advanced drug delivery techniques. Such systems aim to **bypass the digestive system**, protect curcumin from rapid metabolism, and allow for a **sustained and controlled release** of the compound into the body.

In summary, while curcumin offers great potential as a natural therapeutic agent, its clinical effectiveness depends largely on finding better ways to deliver it into the body. For a turmeric-based transdermal patch to be effective and user-friendly, several important factors must be considered during its formulation and design:

1. Enhanced Absorption (High Bioavailability):

Curcumin, the active compound in turmeric, must be efficiently absorbed through the skin. This can be improved by using penetration enhancers that help the compound cross the skin barrier and enter the blood stream or targeted tissues.

2. Sustained Drug Release (Controlled release):

The patch should be designed to release Curcumin gradually over a set period, ensuring a steady therapeutic effects without the need for frequent reapplication.

3. Skin Safety (biocompatibility):

All materials used in the patch must be gentle on the skin, causing no irritation, allergies or other adverse reaction. This is essential for long term or repeated use.

4. Strong Yet Comfortable Adhesion:

The patch should **stick well** to the skin to avoid sleeping or falling off, while also being **comfortable to wear**, without causing itching tightness or skin damage.

5. Stability of Curcumin:

To maintain its effectiveness, curcumin needs to be protected from environmental factors like light, heat and air, which can cause it to degrade over time. the patch formulation must preserve curcumin's potency throughout its shelf life.

6. Low Risk of Side Effects:

The transdermal system should end to reduce side effects, including skin irritation or allergic reactions. It should also avoid the gastrointestinal issues that can occur with oral curcumin.

7. Easy to Use:

The patch should be **simple to apply and remove**, without leaving sticky residue, damaging the skin, or causing discomfort. It should also be discreet and user friendly for daily use

8. Water Resistance:

For practicality, the patch should be **resistant to water** so user can bathe shower, or sweat during physical activity without compromising its effectiveness.

9. Target or systemic action:

Depending on the intended use, the patch can be tailored to deliver curcumin either locally (e.g. To treat joint inflammation) or systemically (to reduce inflammation throughout the body).

10. Affordability (cost effectiveness):

Finally, the patch should be produced in a way that balances high quality materials and performance with reasonable cost, making it accessible to a broad range of users.

These features, when carefully incorporated, can significantly enhance the therapeutic effectiveness, safety, and user satisfaction of curcumin-based transdermal patches.Transdermal drug delivery systems (TDDS) are designed to deliver medications through the skin and into the bloodstream. Transdermal drug delivery systems (TDDS) offer a compelling solution for overcoming the limitations of conventional oral administration. By delivering drugs directly through the skin, transdermal systems provide several advantages, such as avoiding the first-pass metabolism in the liver, improving patient compliance, and providing sustained and controlled release of the drug. Transdermal patches have become a popular method for the delivery of a wide variety of therapeutic agents, including those with low bioavailability.9 Transdermal patches consist of a backing layer, an adhesive layer, a reservoir layer, and a rate-controlling membrane. The medication is contained in the reservoir layer and is released through the rate-controlling membrane at a controlled rate.4 Transdermal patches can be used to deliver a wide range of medications, including pain medications, hormones, cardiovascular medications, and neurological medications. The formulation of turmeric-based transdermal patches, specifically designed to deliver curcumin, represents a novel approach in improving its therapeutic efficacy. These patches can potentially enhance the transdermal permeation of curcumin by using suitable excipients, including skin penetration enhancers and biocompatible polymers. Moreover, the development of turmeric-based patches could also provide localized treatment for conditions such as arthritis and other inflammatory diseases, where curcumin has shown promising therapeutic effects.

➢ **Advantages:**

1. Non-Invasive Application:

Transdermal patches provide a needle free and painless method for delivering medication, making them more comfortable for patients.

2. Controlled and Sustained Drug Release:

These systems are designed to release the drug gradually over a time, maintaining consistent therapeutic levels in the body.

3. Improve Bioavailability:

Since the drug bypass the digestive system and liver metabolism (first pass effects): More of the active compound reaches the blood stream.

4. Fewer side effects:

By avoiding the gastrointestinal track and maintaining steady drug levels, the risk of side effects especially digestive issues is released.

5. Better Patient Compliance:

Transdermal patches are easy to use and require less frequent dosing, increasing the likelihood and patients will follow their treatment plans correctly.

➢ **Disadvantages:**

1. Risk of Skin Irritation:

Prolonged contact with the patch or the presence of certain chemicals can cause redness, itching or allergic reactions in some individuals.

2. Limited Drug Options:

Only medications that are effective in small doses and can penetrate the skin are suitable for transdermal delivery, which limits the range of drugs. That can be used.

3. Inconsistent Absorption:

Factors like skin type, temperature, hydration and location in application can lead to variable drugs absorption rates between individuals.

4. Higher Manufacturing Cost:

The technology and materials using developing transdermal patches can make them more expensive than traditional dosage forms like tablets or capsules.

5. Adhesion Problems:

In some cases, patches may not stick well, especially during sweating, movement or exposure to water, leading to reduced effectiveness.

This balance of pros and cons is important to consider when choosing transdermal systems for drug delivery, particularly for compounds like curcumin that benefit from enhanced bioavailability.

PLANT PROFILE -TURMERIC PLANT

Turmeric (*Curcuma longa*), a member of the ginger family (Zingiberaceae), is a widely valued plant in traditional herbal medicine. Its name originates from the Arabic word **"Kourkoum,"** which means saffron, referencing its distinct bright yellow hue. Native to **Southeast Asia**, turmeric thrives in warm, humid environments and is predominantly cultivated in countries like **India, China, and Indonesia**. The plant features broad leaves and a short stem, but it's the **underground rhizomes** that are harvested and used for both medicinal and culinary purposes.

The most important compound in turmeric is **curcumin**, which not only gives the spice its characteristic yellow colour but also provides powerful **anti-inflammatory** and **antioxidant** effects. These properties have made turmeric a key ingredient in natural remedies for centuries.

Historically, turmeric has played a significant role in both **Ayurvedic** and **Traditional Chinese Medicine**. It has been used to treat a range of health issues, including **digestive disorders, joint pain, skin conditions,** and **respiratory ailments**. Even today, turmeric continues to be a popular natural remedy and is commonly used in cooking, particularly in Asian cuisine. Ongoing scientific studies continue to confirm and expand upon its potential health benefits.

In India, turmeric is commercially grown in two main varieties: **Madras** and **Alleppey**.

- **Madras turmeric**, which is preferred in **British and Middle Eastern markets**, contains **lower levels of curcumin** and essential oils, making it suitable for use in **curry powders** and **mustard preparations**.
- **Alleppey turmeric**, on the other hand, is favoured in the **United States** due to its **higher**

curcumin content. This variety is used not only as a **spice** but also as a **natural food colouring agent**, thanks to its rich pigment. These variations in curcumin content influence how turmeric is used around the world, whether for therapeutic applications, culinary purposes, or industrial processing.

DEVELOPMENT OF TURMETIC PLANT

Turmeric grows best in **tropical regions** with **warm temperatures**, **high humidity**, and **moderate rainfall**. Under ideal conditions, the plant reaches a height of approximately **3 feet (about 1 meter)**. It features **large, lance-shaped green leaves**, and its **flowers**, which bloom in clusters, range in colour from **yellow to purple**.

The most important part of the turmeric plant is its **rhizomes**—the thick, underground stems that store nutrients. These rhizomes are typically harvested **7 to 10 months** after planting, usually when the **leaves begin to dry out and die back**, signalling that the rhizomes have matured. After harvesting, the rhizomes undergo a multi-step process: they are **washed thoroughly**, then **boiled**, **dried**, and finally **ground into a fine powder**. This powdered form of turmeric is used widely in **cooking**, **traditional medicine**, and **cosmetic or health products** around the world.

➢ FEATURES OF TURMERIC PLANT

Table no. 1 Features of Turmeric Plant

Features	Description
Scientific name	Curcuma longa
Family	Zingaberaceae
Plant type	Perennial herb
Height	Grow up to 1m (3.3 feet)
Leaves	Large, oblong lance-shape leaves with long petioles
Stem	Short pseudo stem
Flowers	Small, yellow-orange blossom with waxy green or purple bracts
Rhizome	Underground, fleshy and orange-yellow, used for medicinal and culinary purposes
Active compounds	Curcumin responsible for its yellow colour and health benefits
Climate	Tropical, humid, and requires abundant rainfall
Growing region	Native to India and Southeast Asia; cultivated in tropical regions worldwide
Used	Culinary, medicinal, cosmetic, food colouring, supplements

Fig.no.1Different Parts of the Turmeric plant

Fig.no.2 Fresh Turmeric Rhizomes

Fig.no.3 Flower of Turmeric Plant

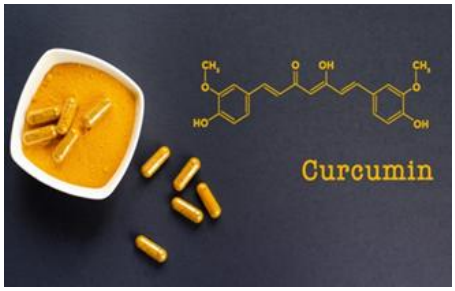

Fig no.4 Structure of Curcumin

➢ **Synonyms:**

Turmeric is also commonly known as **Indian Saffron**, **Yellow Ginger**, **Haldi** (in Hindi), and **Kunyit** (in Malay/Indonesian).

➢ **Biological Source:**

Turmeric refers to the dried or fresh **rhizomes** (underground stem) of the plant Curcuma longa Linn. Which belongs to the **Zingerberaceae** family (the ginger family)

➢ **Geographical source:**

Turmeric is native to **southern India** and **Indonesia** but it is widely grown throughout the maintained and islands of the Indian Ocean region. India is the world's **leading Andhra Pradesh, Tamil Nadu, Odisha, Karnataka, Maharashtra.** Among these **Andhra Pradesh** is the largest producer accounting for about **38% of the cultivation area** and nearly **58.5% of the total turmeric production in India.**

TAXONOMICAL CLASSIFICATION OF TURMERIC:

- **Kingdom:** Plantae
- **Clade:** Angiosperms (flowering plants)
- **Subkingdom:** Tracheobionts (vascular plants)
- **Division:** Magnoliophyta (also called angiosperms)
- **Order:** Zingiberales
- **Family:** Zingiberaceae (the ginger family)
- **Genus:** Curcuma
- **Species:** longa
- **Scientific Name:** *Curcuma longa*

➢ **CHEMICAL CONSTITUENTS:**

Carbohydrates (69.4%), protein (6.3%), fat (5.1%), Minerals (3.5%), α-phellandrene (1%), zingiberene (25%), sabinene (0.6%), cineole (1%), and sesquiterpenes (53%), mixture of three Curcuminoids [i.e., curcumin I ($C_{21}H_{20}O_6$, Diferuloylmethane, 94%), curcumin II

(C20H18O5, Demethoxycurcumin, 6%) and curcumin III (C19H16O4, bis-demethoxycurcumin, 0.3%)].

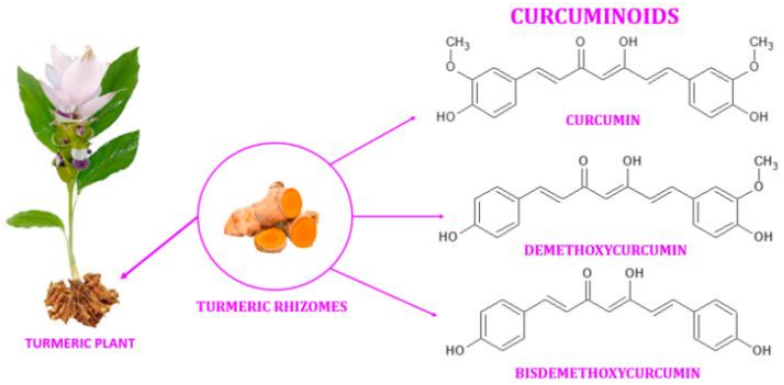

Fig no5 Turmeric Plant and main chemical constituents with structure

➢ **Uses:**

1. Medicinal Uses:

- **Anti-inflammatory:**

Turmeric is widely used to help ease inflammation-related conditions such as **arthritis**, **inflammatory bowel disease**, and other general inflammatory disorders.

- **Antioxidant:**

The key compound in turmeric, **curcumin**, works to neutralize harmful free radicals and supports the body's natural antioxidant defences, protecting cells from damage.

- **Digestive Health:** Turmeric promotes healthy digestion by stimulating the production of bile, which aids in breaking down fats. It also helps relieve common digestive issues like indigestion, blotting and gas.
- **Pain Relief:** It is often use as a natural remedy to reduce various types of pain, especially related to joints, arthritis and muscle soreness.

2. Cosmetic Uses:

- **Skincare:**

Turmeric is incorporated into face masks, scrubs, and creams due to its ability to **brighten the skin**, **reduce acne**, and improve overall complexion. Its **antimicrobial properties** also assist in wound healing and preventing infections.

3. **Food Colouring:**

- Turmeric serves as a **natural alternative** to artificial food dyes and is commonly used to add a vibrant yellow colour to products such as **mustard, cheese, butter, sauces,** and **beverages**.

4. Traditional Medicine:

- In both **Ayurvedic** and **Traditional Chinese Medicine (TCM)**, turmeric has a long history of use for treating digestive problems, detoxifying the liver, enhancing mental function, and strengthening the immune system.

5. Supplements

- Turmeric supplements, often standardized for **curcumin content**, are popular for managing chronic conditions like **heart disease, diabetes,** and **cancer**. Their benefits primarily come from anti-inflammatory and antioxidant effects.

6. Antimicrobial and Antiseptic:

- Due to its antiseptic qualities, turmeric is used in treating **wounds, minor cuts,** and **burns**.

It helps to reduce the risk of infection and promotes faster healing when applied topically.

7. Oral Health:

- Turmeric is sometimes included in **toothpastes** and **mouthwashes** because of its antibacterial properties. It helps in preventing **gum disease** and reducing **plaque build-up**, contributing to better oral hygiene.

➢ MATERIALS AND METHOD OF PREPARATION:

Table no.2 Ingredient used in formulation

Sr. No.	INGREDIENTS	QUANTITY	USES
1	TURMERIC EXTRACT	2 ML	ACTIVE COMPONENT ACT AS ANTI INFLAMMATORY
2	HPMC	1000MG	MATRIX POLYMER CONTROLLED RELEASE AGENT
3	PEG200	0.2ML	PLASTICIZER
4	MENTHOL	0.25MG	COOLING AGENT PENETRATION ANHANCER
5	METHYL PARABEN	0.25MG	PRESERVATIVE
6	GLYCERIN	2-4 DROPS	HUMECTANT SKIN MOSTURIZER
7	VIT E	0.25MG	ANTIOXIDANT
8	ETHANOL	QS	SOLVENT PENITRATION ANHANCER

➢ Compatibility of material with human body

Table no. 3 Compatibility with the Human body

INGREDIENTS	HUMAN BODY COMPATIBILLITY
HPMC	Safe, non-toxic, biocompatible; widely used in oral and topical form
PEG200	Low toxicity, safe, use in topical formulation
ETHANOL	Generally safe in small amounts; may cause irritation in high concentration
GLYCERINE	Safe, moisturizing; use in many skin care product
MENTHOL	Safe in limited doses; use in topical formulation, may cause irritation if overused.
TURMERIC EXTRACT	Natural, safe appropriate doses; has anti-inflammatory properties

➢ PROCEDURE FOR THE PREPRATION OF TURMERIC TRANSDERMAL PATCH:

- EXTRACTION PROCESS (SOXLET PROCESS)

The Soxhlet extraction process is a popular technique for extracting bioactive compounds, like curcumin from turmeric, using a solvent.

Materials Needed:

a) Turmeric powder
b) Solvent (e.g., ethanol, methanol, or acetone)
c) Soxhlet extractor apparatus
d) Heating source (heating mantle)
e) Round-bottom flask
f) Condenser
g) Thimble (to hold the turmeric powder)
h) Filter paper

i) Glass jar with tight lid

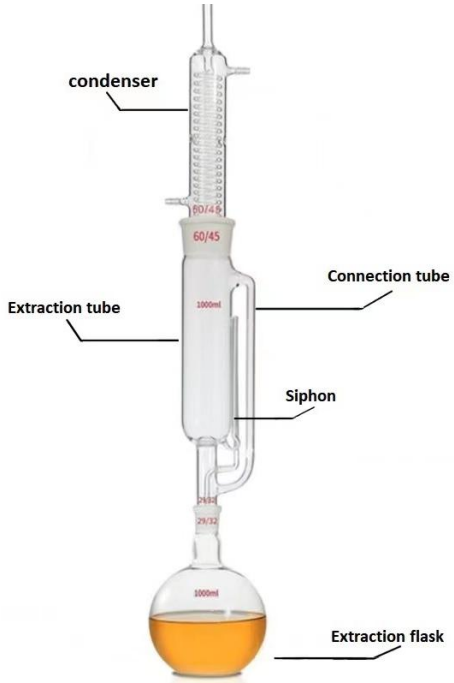

Fig.no.6 Soxhlet Appratus

1.Extraction of Turmeric Using Soxhlet Apparatus

Step 1: Preparation of Turmeric Powder

- If you're starting with fresh turmeric rhizomes, **dry them thoroughly** before grinding.
- Use a **grinder or mortar and pestle** to turn the dried rhizomes into a **fine powder**.
- The **smaller the particle size**, the greater the surface area for effective extraction.

Step 2: Assembling the Soxhlet Apparatus

Set up the following equipment:

- **Round-bottom flask (RBF)** – to hold the solvent.
- **Soxhlet extractor** – where the turmeric powder will be placed.
- **Condenser** – to cool the solvent vapours back into liquid form.

✔ Ensure all glass joints are sealed properly and the setup is securely clamped. Make sure the system is **vented safely** to avoid pressure build-up.

Step 3: Adding Solvent and Turmeric Powder

- Use a **1:20 ratio** of turmeric powder to solvent.
- Add **200 ml of ethanol** to the round-bottom flask.
- Weigh **10 mg of turmeric powder** and place it in a **thimble** (a porous container made of filter paper or cloth).
- Insert the thimble into the Soxhlet extractor. Do not overfill—leave space for solvent to circulate properly.

Step 4: Condenser Setup

- Connect the **condenser** to the top of the Soxhlet extractor.
- This part allows the ethanol vapours to **cool and condense**, ensuring they drip back onto the turmeric powder for continuous extraction.

Step 5: Start the Extraction Process

- Heat the round-bottom flask using a **heating mantle** or **water bath**.
- When ethanol reaches its **boiling point**, it will vaporize and rise up into the condenser.
- The **condensed solvent** will then drip into the extractor chamber and pass through the turmeric powder, **extracting curcumin** and other active compounds.
- The solvent carrying the extracted compounds will then **return to the RBF**, and the process repeats.

Step 6: Continuous Extraction

- Let the system run for **4–6 hours**, allowing multiple cycles of extraction.
- Monitor the system to **maintain consistent heating** and avoid boiling over or evaporation loss.

Step 7: Collect and Evaporate Extract

- After completing the extraction cycles, **collect the solution** from the round-bottom flask.
- From **10 mg of turmeric powder** and **200 ml of ethanol**, you typically obtain around **120 ml of turmeric extract**.
- This extract can then be **concentrated** further by evaporating excess ethanol, if needed, using a rotary evaporator or simple drying method.

Fig no. 7 Dried Turmeric Rhizomes

Fig.no 8 Grinding of Rhizomes

Fig.no 9 Turmeric powder

Fig.no 10 Final Turmeric Extract

2.Method for Preparing Turmeric-Based Transdermal Patches

Step 1: Preparation of the Polymer Solution: Take a measured quantity of Hydroxypropyl Methyl cellulose (HPMC). Dissolve it in ethanol while stirring continuously. Stir until a clear and uniform solution is obtained.

Step 2*:* Incorporation of Additives: Add methyl paraben (used as a preservative) into the polymer solution. Stir until it is completely dissolved. Next, add vitamin E (acts as an antioxidant) and menthol (serves as a penetration enhancer). Menthol should be pre-dissolved in a small volume of ethanol before adding to the solution. Continue stirring to ensure thorough mixing.

Step 3*:* Addition of Plasticizers: Add PEG 200 and glycerine as plasticizers to enhance the flexibility and elasticity of the patch. Mix well to ensure even distribution throughout the solution.

Step 4*:* Incorporation of Turmeric Extract: Add the liquid turmeric extract into the prepared polymer-additive mixture. Stir the mixture continuously to achieve a homogeneous distribution of the active ingredient (curcumin).

Step 5*:* Casting the Patch Pour the final solution into a clean petri dish or a glass plate lined with a backing membrane such as polyethylene sheet or aluminium foil. Allow the solution to spread evenly to ensure a uniform thickness of the film.

Step 6: Drying Leave the dried film to dry at room temperature undisturbed for 24 to 48 hours. Avoid direct sunlight, dust, or airflow during drying to prevent surface defects.

Step 7*:* Peeling and Cutting Once fully dried, carefully peel off the patch from the casting surface. Cut the dried film into desired sizes, such as 2 cm × 2 cm squares, using sterile scissors or a blade.

Step 8*:* Packaging: Store the finished patches in airtight containers or seal them in aluminium foil pouches to prevent exposure to moisture and air. Label properly and store in a cool, dry place until use.

➢ EVALUATION TEST:

1. Organoleptic Evaluation

Table no. 4 Organoleptic Characteristics of Turmeric Transdermal Patch

Parameter	Observation
Colour	Uniform yellow, characteristic of turmeric
Odour	Distinct turmeric aroma with a minty scent due to the presence of menthol
Texture	Smooth, flexible surface without grittiness
Flexibility	Patches bend easily without cracking or breaking
Adhesiveness	Adequate stickiness, allowing proper adherence to skin without premature detachment
Surface Appearance	Uniform surface without bubbles, cracks, or crystallization

2. Thickness Evaluation

To ensure consistency in the turmeric transdermal patches, their thickness was carefully measured. The blend of polymers used formed smooth, even films, and the casting technique helped in producing patches with a uniform structure. Only slight variations in thickness were observed, indicating that the patches were consistently prepared across all samples**.**

Method:

a) A **screw gauge** was used to measure the thickness of each patch accurately.
b) Multiple readings were taken, and the **average thickness** was determined for better reliability.
c) The minimal difference in thickness among the patches confirmed a uniform film formation

3. Weight Variation Test

To check how uniform the patches are in terms of weight, a simple weight variation test was carried out.

Method:

A) Three patches were picked from each batch, and each one was weighed separately using a digital weighing balance.

B) After recording the individual weights, the average weight was calculated to see is the patches were consistent.

This test helps confirm that each patch has been made a similar amount of material which is important for accurate dosing.

4. Percentage Moisture Content Test

Moisture content analysis was performed to understand how the composition of the patch materials affects water retention. Results showed that increasing the amount of hydrophilic (water-attracting) polymer led to higher moisture content in the films. In contrast, a higher amount of hydrophobic (water-repelling) polymer reduced moisture absorption. The overall moisture content across all formulations remained low, which is beneficial for improving the patch's stability and minimizing brittleness during long-term storage.

Method:

b) Three Patches from each formulation were selected and weighed individually to get the initial weight.

c) The patches were then placed in a desiccators containing calcium chloride and kept at room temperature for 24 hrs.

d) After 24 hrs, the patches were reweighed. The percentage of moisture content was calculated using the following formula.

Percentage Moisture Content (%) ={Initial Weight – Final Weight

5. Tack Test

The tack test is a crucial assessment used to evaluate the initial stickiness of transdermal patches. This test determines how well the patch adheres to the skin right after application, which is essential for proper drug delivery and patient comfort. The adhesive nature of the patch largely depends on the type of polymer used in its formulation.

6. Peel Strength Test

The peel strength test measures how strongly the patch adheres to a surface when pulled off, simulating its ability to stay attached to the skin during normal movement and use. This test is important for evaluating the durability of the patch's adhesive property.

7. pH Test

Method:

To assess the pH compatibility of the turmeric transdermal patch with human skin, a small patch section (1 cm^2) was immersed in **10 mL of distilled water**. The sample was left to soak at **room temperature for 2 hours**. The mixture was then gently stirred, and the pH of the solution was measured using a **calibrated digital pH meter**.

8. Skin Irritation Test

Method:

The test area (usually on the forearm or back) was first cleaned with mild soap and water, then allowed to dry completely. A turmeric transdermal patch was applied to the clean skin and secured using **hypoallergenic tape** to prevent shifting or exposure to water. The patch remained on the skin for **24 hours**. After this period, the patch was removed and the skin was carefully examined for any signs of irritation such as redness, swelling, itching, or rashes.

9. Stability Studies

Stability studies were conducted to evaluate how the patch's properties (such as drug content, adhesive strength, and physical integrity) are affected by **environmental factors** like temperature, humidity, and exposure to light over time. These studies are crucial for determining the appropriate storage conditions and shelf life of the transdermal patch.

Table no.5 Possible Consequences by Storage Condition of Patch

CONDITIONS	Possible consequences
TEMPRATURE	Drug degradation, patch deformation or melting, reduced adhesion
HUMIDITY	Moisture uptake, microbial growth
LIGHT EXPOSURES	Degradation of active ingredient, discoloration or yellow colour loss.

10.Storage Condition:

To verify the product's performance and integrity under specific, intended storage conditions. Different condition recommended from the stability study (room temperature, refrigerated, etc.).

REFERENCES

1. Kokate, C. K., A. P. Purohit, and S. B. Gokhale. Pharmacognosy.37th ed., NiraliPrakashan, 2007.
2. Yegnanarayan, R., A. P. Saraf, and J. H. Balwani. "Comparison of Anti-inflammatory Activity of Various Extracts of Curcuma longa (Linn)." Indian Journal of Medical Research, vol. 64, 1976, pp. 601–608.
3. Dhiman, S., T. G. Singh, and A. K. Rehni. "Transdermal Patches – A Recent Approach to New Drug Delivery System." Indian Journal of Pharmaceutical Sciences, vol. 3, suppl. 5, 2011, pp. 26–34
4. Rathore, Neha, SonamMahant, and AnishChandy. "Formulation of Diclofenac Sodium Transdermal Patch for Rheumatoid Arthritis." Panacea Journal of Pharmacy and Pharmaceutical Sciences, vol. 10, no. 1, 2021, pp. 28–47.
5. Saraswathi, R., et al. "Formulation and Evaluation of Transdermal Patches of Curcumin." Der Pharmacia Lettre, vol. 2, no. 5, 2010, pp. 117–126. Scholars Research Library.
6. Alhat, Sarika, and DeeptiWaghmare. "Formulation and Evaluation of Transdermal Patch of Curcumin." International Journal of Pharmaceutical and Phytopharmacological Research, vol. 27, no. 2, May 2023, pp. 795–808.
7. Hewlings, Susan J., and Douglas S. Kalman. "Curcumin: A review of its' effects on human health." Foods, vol. 6, no. 10, 2017, p. 92.
8. "Turmeric." Wikipedia, Wikimedia Foundation, https://en.wikipedia.org/wiki/Turmeric. Accessed 13 Apr. 2025.
9. Kumari, K., et al. "Curcumin-Based Transdermal Patches: An Innovative Approach for Enhanced Delivery." Journal of Drug Delivery and Therapeutics, vol. 13, no. 2, 2023, pp. 52–58. Elsevier.
10. Anto, R. J., Kuttan, G., Babu, K. V. D., Rajasekharan, K. N., and Kuttan, R. "Anti-inflammatory Activity of Natural and Synthetic Curcuminoids." Pharmaceutical and Pharmacological Communications, vol. 4, 1998, pp. 103–106.
11. Patil, Bhavana, et al. Formulation and Evaluation of Curcumin Transdermal Patches for the Treatment of Arthritis. International Journal of Novel Research and Development, vol. 9, no. 2, Feb. 2024, IJNRD2402233.
12. Goel, Ajay, Anushree B. Kunnumakkara, and Bharat B. Aggarwal. "Curcumin as 'Curecumin': From Kitchen to Clinic." Biochemical Pharmacology, vol. 75, no. 4, 2008, pp. 787–809.

13. Wakte, Pravin S., D. A. Patil, S. C. Bhangale, and D. B. Shinde. "Optimization of Microwave, Ultrasonic and Soxhlet Extraction of Curcumin from Curcuma longa." Separation and Purification Technology, vol. 79, no. 1, 2011, pp. 50–55.
14. Nayak, B. S., and A. C. Pinto. "Evaluation of Wound Healing Potential of Ethanol Extract of Curcuma longa in Rats."International Journal of Current Pharmaceutical Research, vol. 2, no. 2, 2010, pp. 36– 40.
15. Kumar, Rajeev, et al. "Formulation and Evaluation of Herbal Transdermal Patch." International Journal of Drug Development and Research, vol. 3, no. 3, 2011, pp. 255–264.
16. Shinde, Ajay J., Mohan G. Garala, and Dilipkumar B. More. "Development and Characterization of Transdermal Therapeutic System of Tramadol Hydrochloride." Asian Journal of Pharmaceutics, vol. 2, no. 4, 2008, pp. 265–269.
17. Mutalik, S., and N. Udupa. "Development of Membrane-Controlled Transdermal Drug Delivery System of Glibenclamide."Indian Journal of Pharmaceutical Sciences, vol. 68, no. 5, 2006, pp. 576– 581.
18. Jurenka, Julie S. "Anti-inflammatory properties of curcumin, a major constituent of Curcuma longa: A review of preclinical and clinical research." Alternative Medicine Review, vol. 14, no. 2, 2009, pp. 141–153.
19. Ravichandran, R. "Transdermal drug delivery system: A review." Asian Journal of Pharmaceutical and Clinical Research, vol. 6, no. Suppl 1, 2013, pp. 18–25.
20. Singh, Ranjit, et al. "Formulation and evaluation of transdermal patches of curcumin for wound healing." Journal of Drug Delivery and Therapeutics, vol. 5, no. 4, 2015, pp. 33–37.
21. Shinde, G. V., et al. "Development and evaluation of transdermal patches of curcumin for antiinflammatory action." International Journal of Pharmaceutical Sciences and Research, vol. 9, no. 4, 2018, pp. 1445–1450

HOW TO CITE: A. B. Udar, Mrunal Rasal, Atharva Rathor, Nikhil Raut, A Review on Transdermal Patch of Turmeric Extract, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 4, 2598-2611, https://doi.org/10.5281/zenodo.19607009