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# Formulation and Evaluation of Transdermal Patch of Curcumin

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**Keywords:** Rheumatoid Arthrits (RA), Curcumin, Patch, HPMC, Methyl cellulose

**ABSTRACT**

Currently, herbal drugs are the focus of numerous studies on novel drug delivery systems. The curcumin transdermal medication conveyance framework was developed and evaluated. Curcumin, the active component of curcuma longa (haldi), has a place in the family Zingiberaceae and is currently being used as an anti-inflammatory specialist against rheumatoid joint pain in this audit. Curcumin's transdermal patch makes use of a variety of polymer blends to improve therapeutic efficacy and reduce side effects. The depiction, dissolvability, and similarity studies completed the medication's detail concentrates. Three formulas were created by combining 20 milligrams of curcumin with a variety of polymer concentrations of hydroxy propyl methyl cellulose (HPMC), methyl cellulose (MC), and ethyl cellulose (EC), respectively. Solubility was tested in water, phosphate buffer pH 7.4, ethanol, DMSO, and tetrahydrofuran (THF), respectively. The formulation F1 Batch was found to have the highest level of compatibility across all evaluation tests. Three plans -F1, F2, and F3 - were tried. The formulation has an impact on the weight variation, drug content, patch thickness, moisture content, and folding endurance. The results of in vitro drug release studies are satisfactory.

## INTRODUCTION

The curcumin of Turmeric (Curcuma longa) and other Curcuma species. This tissue damage can cause enduring or ongoing pain, insecurity (absence of equilibrium), and distortion In rheumatoid, your immune system mistakenly attacks healthy cells in your body, causing painless swelling and inflammation in the affected areas. Rheumatoid arthritis, or RA, is a chronic inflammatory and autoimmune condition. Typically, RA targets multiple joints simultaneously [5]. RA frequently affects the hands, wrists, and knee joints. The covering of a joint impacted by RA becomes excited, making harm the joint tissue [7]. Curcumin is a characteristic polyphenol and the primary compound from the rhizome (misshapenness). RA can also affect the eyes, lungs, and heart.[1] Curcumin is an extract that is extracted from the roots of plants that belong to the families Araceae and Zingiberaceae [6]. Curcumin has a number of different pharmacological properties and only a few effects that are harmful. Curcumin has been linked to both the onset and progression of rheumatoid arthritis in previous studies [4]. It has been widely used for a variety of medical purposes, including the reduction of pain and inflammatory conditions in a variety of diseases.

Transdermal Patch: Transdermal patch is a device for delivering the therapeutic substances Transdermal through the skin for systemic effect at predetermined and controlled rate; comprising of backing membrane. Curcumin: Curcumin the active constituent of Curcuma longa has reported anti-inflammatory activity. Curcumin has low absorption from GIT as it is rapidly metabolized. Reasons for use of curcumin are its therapeutic efficacy, easy availability, low cost, less reported side effects.

### Formulation of curcumin patch

| Ingredient | Quantity | Role |
|---|---|---|
| curcumin | 20mg | API |
| HPMC | 1gm | polymer |
| Methyl cellulose | 1gm | binder |
| PVP | 167mg | polymer |
| Ethanol | 10ml | solvent |
| water | 10ml | solvent |
| Propylene glycol | 0.1ml | plasticizer |
| DMSO | 0.1ml | Penetration enhancer |
| glycerin | 1-2 drops | Lubricant, preservative |

## EXPERIMENTAL

### Material

Termeric was purchased from online market and then extract of termeric to get a curcumin, and all other chemical were analytical grade from my institute.[8]

### Method

1. Preformulation studies

It is one of the important prerequisite in development of drug pre-formulation studies were performed on the drug, which included solubility and compatibility studies.

Extraction process of crude curcumin extract from turmeric:

380ml of 99.5% ethanol + 20ml of distilled water dilute the solution and add a grind turmeric in above ethanol solution is 40gm of turmeric thoroughly mix, pour the solution in round round flask with the funnel on top of it, then attached the condenser to the round bottom flask and outlet of top of the round flask. sensitive to light to foil cover the condenser and round bottom flask keep away from sunlight then keep in the solution in heating mental at 50 degree Celsius for 2 ½ Hr , stop the heating, close the RBF filter it by using cloth then after filtering the hole solution centrifuge by 10 min REMI-3500 after that filter it again on measuring cyclinder, keep the solution in waiting for 3 days then it filtrate to give the curcumin.

**A.Description**

Curcumin was physically examined for colour and odour etc.

**B.Solubility**

Qualitative Solubility: Qualitative Solubility analysis for curcumin was done by dissolving 5mg of drug in 5 ml of solvent. Different solvents were used for solubility determination of different solvent like distilled water, 7.2 pH saline phosphate buffer, ethanol, chloroform, methanol, acetone to determine the solubility of drug.

Quantitative Solubility: Qualitative solubility analysis for curcumin was done by taking 5 ml of each solvent till saturation was attained. This is to determine the capacity of the solvent for dissolving drug in each solvent. Different solvent were used for the solubility determination like distilled water, 7.4 pH phosphate buffer , methanol , ethanol , mixture of buffer and ethanol. The concentration of drug measured by UV spectrophotometry technique.

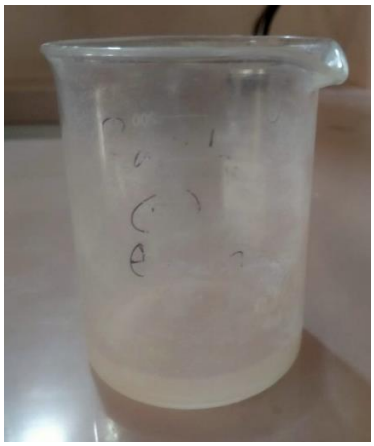

**Image : 1**

**C. Melting Point:**

Melting point determination of curcumin was done by using melting point apparatus. In this method the pre sealed capillary was filled with small amount of drug. Capillary and thermometer were placed in melting point apparatus. The temperature was noted when the drug started to melt till the drug completely melted. C. Interaction studies.

Drug polymer interaction study

Interaction of drug with polymer was confirmed by UV – visible interaction studies. The pure drug along with polymer was subjected to UV -visible studies.

**D. Preparation of sodium lauryl sulphate solution**

Accurately weight 500 mg sodium lauryl sulphate and transferred into 100 ml standard flask. Dissolve with distilled water and finally make up the volume.

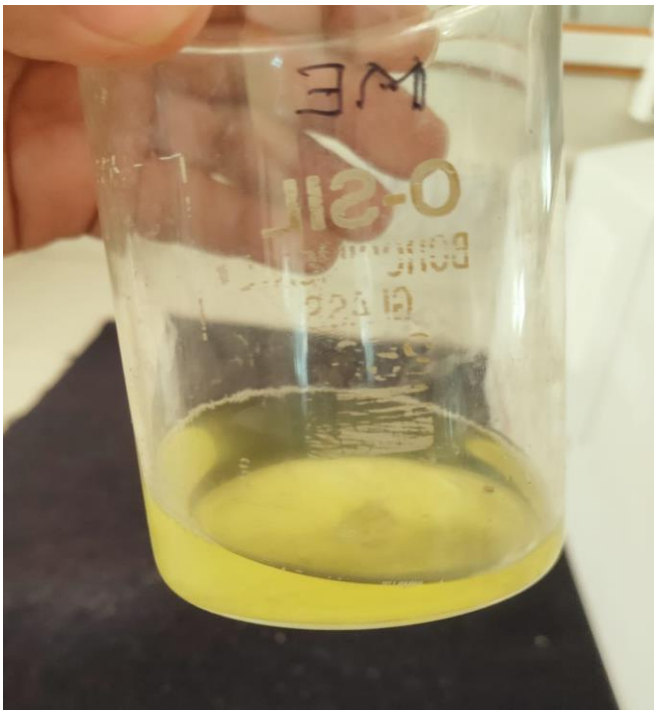

**Image : 2 solution of sodium lauryl sulphate**

**2. Preparation of Transdermal patches:**

**Solvent casting technique**

The transdermal patch prepared are of matrix diffusion controlled system. Solvent casting technique was used to prepare the transdermal patch.

**PROCEDURE**

Preparation of F1 patch

Accurately weight 1gm HPMC and 0.5 gm methyl cellulose and dissolved in 10ml distilled water and 10 ml of ethanol respectively.

For the F2 patch, weight 1gm of HPMC and 0.5gm of methyl cellulose and dissolve in 10ml of ethanol and 10 ml of distilled water, respectively.

Preparation of the F3 patch Accurately weighed 1 gram of methyl cellulose and 0.5 grams of HPMC. Also, broke down in 10ml of refined water and 10 ml of ethanol separately. In each

solution, 9 milliliters of HPMC solution and 1 milliliter of methyl solution were mixed separately. Each mixture should be thoroughly mixed with a few drops of glycerin. Broken up 20mg curcumin stirrer. poured into each mixture with care, and the mixture was left to stand for 24 hours.

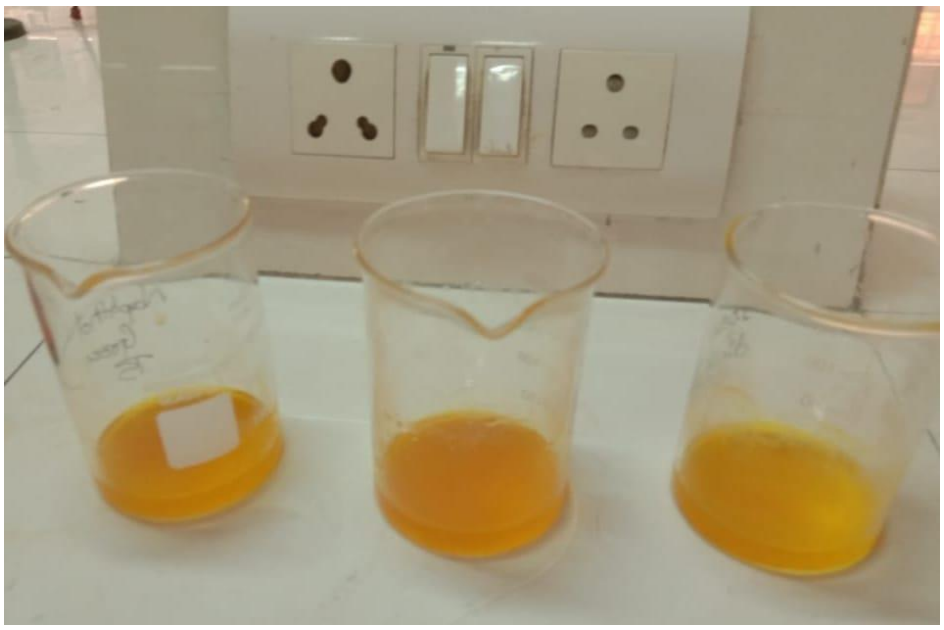

**Image: 3 Batches of formulation solution**

**Evaluation of Transdermal patches**

The prepared curcumin transdermal patches were evaluated as mentioned below.

1. Weight of the patch
2. Thickness of the patch
3. Percentage Moisture content
4. Percentage Moisture uptake
5. Folding endurance
6. Percentage flatness
7. In vitro drug release studies

Three patches from each batch were taken and weight of each patch was found by using electronic balance. Then average weight of single patch was determined.

Weight of patch was determined by weighing three films and the average value was taken as the weight of the film. All the formulations exhibited uniform weight with standard deviation values indicating the uniformity of the films prepared by solvent casting method.

**Table - I Weight of patch**

| Batch | Weight in mg | Mean |
|---|---|---|
| F1 | 269.12<br>272.23<br>253.59 | 264.98 |
| F2 | 222.45<br>258.10<br>249.95 | 243.45 |
| F3 | 249.39<br>235.89<br>222.89 | 236.06 |

**1. Thickness of the patch**

At various points on the patches, a screw gauge was used to determine the patch's thickness. A single patch's average thickness was determined.

The polymeric combinations showed good film-forming properties and the method of casting on good films. Low differences between thickness values were found in the thickness of films, which ensured uniformity of thickness of each film.

**Table- II Thickness of patches**

| Batch | Thickness in mm | Mean |
|---|---|---|
| F1 | 0.152<br>0.132<br>0.173 | 0.152 |
| F2 | 0.171<br>0.158<br>0.145 | 0.158 |
| F3 | 0.102<br>0.153<br>0.108 | 0.121 |

### 3. Percentage moisture content

Moisture content studies indicated that the increase in the concentration of hydrophilic polymer was directly proportional to the increase in moisture content and of the films, whereas increase in the concentration of hydrophobic polymer lead to the decrease in moisture content of the films. The moisture content of the prepared formulations was low, which could help the formulations remain stable and reduce brittleness during long-term storage.

The prepared films were weighed individually and kept in desiccator containing fused calcium chloride at room temperature for 24 hours. The film was again weighted and the percentage moisture content was calculated using the formula:

Percentage moisture content = [initial weight – final weight / final weigh] x100

**Table – II Percentage moisture content**

| Sr No | Initial weight | Final Weight | % Moisture content |
|---|---|---|---|
| F1 | 1.8363 | 1.6372 | 9.63% |
| F2 | 1.6310 | 1.4820 | 10.05% |
| F3 | 1.4667 | 1.3217 | 10.97% |

### 4. Percentage moisture uptake

The weighted films were kept in a desiccator at room temperature for 24 hours and then exposed to 84 % relative humidity using a saturated solution potassium chloride. Finally, the films were weighted and the percentage moisture uptake was calculated using the formula:

Percentage moisture uptake = [final weight-initial weight / initial weight] x100

**Table – III Percentage moisture uptake**

| Sr No | Initial weight | Final weight | % moisture uptake |
|---|---|---|---|
| 1 | 1.24114 | 1.2821 | 3.28 |
| 2 | 1.4629 | 1.4969 | 2.32 |
| 3 | 1.1276 | 1.1623 | 3.08 |

### 5. Percentage Flatness

Longitudinal strips cut from each film, one from the Centre and two from the either side the length of each strip without applying an additional pressure was measured and the variation in length because of non uniformity in flatness was measured by determining percent constitution equivalent to 100%.

**Table: V Percentage flatness**

| Sr NO | Initial length mm | Final length mm | % flatness |
|---|---|---|---|
| F1 | 6.0 | 6.0 | 100 |
| F2 | 6.2 | 6.23 | 99.99 |
| F3 | 5.2 | 5.2 | 100 |

### 6. Folding Endurance

The number times the films could be folded at the same place without breaking gave the value of folding endurance. It was expressed a number of times. The patches were folded at same place either to break the patches or to develop visible curve. It was done normally for the prepare.

Folding endurance test results indicated that the films would not break and would maintain their integrity with general skin folding when applied.

**Table-VI Folding endurance**

| Serial number | Thickness in mm | Folding endurance |
|---|---|---|
| F1 | 0.426 | >100 |
| F2 | 0.394 | >150 |
| F3 | 0.358 | >150 |

### 7. In vitro drug release studies

The fabricated film was placed on the egg membrane and attached to the diffusion cell such that the cell drug releasing surface toward the receptor compartment which was filled with 50 ml of sodium lauryl sulphate solution. The elution medium was stirred magnetically. The aliquots 5 ml were withdrawn at predetermined time intervals and replaced with same volume of sodium lauryl sulphate solution. The sample were analyzed for drug content using UV spectrophotometer at 429nm.

## RESULT AND DIISCUSSION

### 1. Description

Curcumin was physically examined for colour and odour etc. It is an orange yellow powder, with characteristic odour.

### 2. Solubility

Curcumin was insoluble in water, poorly soluble in buffer solution pH 7.4, and soluble in ethanol DMSO, and Tetrahydrofuran (THF).

### 3. Melting Point:

Melting point of drug was found to be 177°C which shows that drug is crystalline in nature because it has sharp melting point. Melting point of drug was found nearby to standard value of melting point of curcumin. So, it shows that the drug is pure.

### 4. Drug interaction studies

Interaction of drug with polymer was confirmed by carrying out UV-visible interaction studies. The UV-visible overlay spectrum of drug alone and drug with polymer were seen. It shows that there are no interaction found between the drug and polymer.

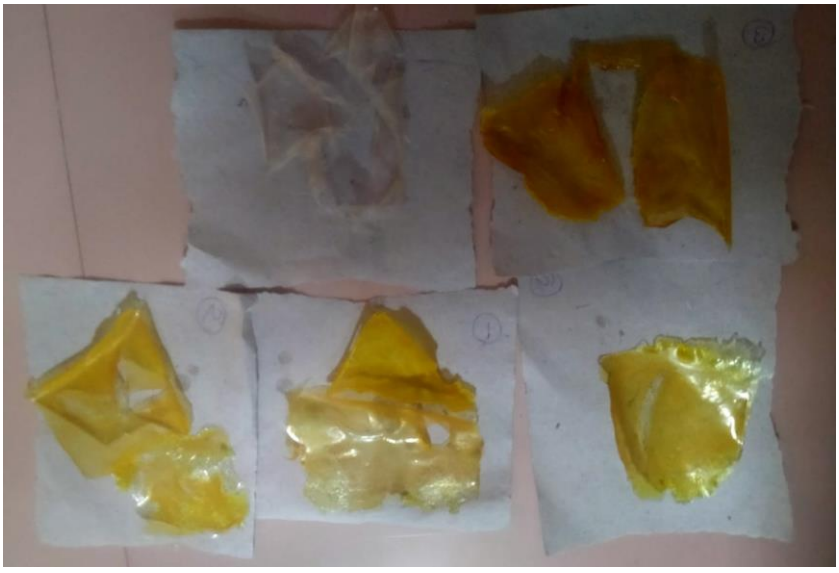

**Image : 4 Final product of curcumin patches**

## CONCLUSION

Curcumin patches were made synthetically by combining methyl cellulose (MC) and hydrophilic propyl methylcellulose (HPMC). The patches were smooth, flexible, and transparent. According to the solubility tests, curcumin is very soluble in DMSO, ethanol, and tetrahydrofuran. The UV-apparent interaction studies show that there is no interaction tracked down between the medication and polymer. The uniformity of the patches' weight and thickness across the various batches suggests that the drug's polymer solution is evenly distributed. However, neither the strength nor the integrity were adversely affected by the absorbed moisture. They maintain their stability thanks to their low moisture content, preventing them from becoming completely dry and brittle patches. The patch's flatness percentage indicates its excellent physical integrity, and its folding endurance demonstrates its excellent flexibility.

Through the present experimentation, it has found that the drugs of ayurvedic origin can be utilized in a better form with enhanced efficacy by incorporating in modern dosage forms with higher safety margins and minimal side effect. This experimentation is one of the first few attempts to utilize ayurvedic drugs through TDDS. Curcumin the active constituent of Curcuma longa has reported anti-inflammatory activity which has low absorption from GIT as it is rapidly metabolized. By using different polymer blends the amount of drug in the body may increase and increase the ant-inflammatory activity.

The patch's *in vitro* permeation studies were conducted with three distinct patches-F1 , F2, and F3-and HPMC and methyl cellulose concentration ratios of 1:1, 1:0.5,and 0.5:1 in the receptor compartment.

Consequence of *in vitro* penetration concentrates on shows that 1:1 focus proportion of HPMC and methyl cellulose bring good arrival of curcumin. The rate drug arrival of fix F1 - 82.20 %, F2 - 74.06% and F3 - 68.27%.

## CONFLICT AND INTREST

None

## ABBRIVATIONS

RA – Rheumatoid Arthritis

HPMC – Hydroxy propyl methyl cellulose

MC – Methyl cellulose

EC – Ethyl cellulose

THF – Tetrahydrofuran

DMSO – Dimethyl sulfoxide

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