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# Formulation and Evaluation of Transdermal Patches of Tridax Procumbenes for Anti-Inflammatory Activity

Bansode Krushna Ashok[1], Wankhede Jayshri Sominath[2]
*Students of Yashodeep Institute of Pharmacy, Chhatrapati Sambhaji Nagar, Maharashtra, India.*
*Under the Dr Babasaheb Ambedkar Technology University, Lonere.*

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**ABSTRACT: -**
Tridax procumbens, commonly known as coat buttons or tridax daisy, is a perennial herbaceous plant native to tropical regions. It holds significant traditional medicinal value in various cultures worldwide due to its diverse pharmacological properties. The plant has been historically utilized in traditional medicine systems for its anti-inflammatory, analgesic, antimicrobial, antidiabetic, and wound healing properties.
Transdermal patches have garnered attention as a non-invasive drug delivery system, offering sustained release and improved patient compliance. Tridax procumbens, a medicinal plant with traditional use for its anti-inflammatory properties, presents an opportunity for transdermal delivery to address inflammatory conditions effectively. In this study, transdermal patches containing Tridax procumbens extract were formulated and evaluated for their anti-inflammatory activity. The formulation optimization, characterized by physical properties and in vitro release profiles, aimed to achieve sustained drug release. The anti-inflammatory potential was assessed through in vitro assays, demonstrating the promising efficacy of the patches in alleviating inflammation.
**Objective:**This study aimed to formulate and evaluate transdermal patches containing Tridax procumbens extract for their anti-inflammatory activity.
**Purpose:**The purpose was to develop a novel delivery system for Tridax procumbens, known for its anti-inflammatoryproperties, with the potential for enhanced efficacy and patient convenience.
**Result:** Transdermal patches were successfully formulated and evaluated for anti-inflammatory activity. In vitro and in vivo studies demonstrated significant reduction in inflammation compared to control groups.
**Conclusions:**The developed transdermal patches of Tridax procumbens show promise as an effective and convenient approach for managing inflammatory conditions, offering potential advantages over traditional dosage forms.
**Keywords:**Tridax procumbens, traditional medicine, pharmacological properties, anti-inflammatory, analgesic, wound healing, transdermal patches, drug delivery system, sustained release, patient compliance, formulation optimization, novel delivery system, efficacy, convenience.

## I. INTRODUCTION: -

Historically, Tridax procumbens has played a pivotal role in traditional medicine systems worldwide. Indigenous communities have utilized it for generations, harnessing its therapeutic potential to alleviate various health issues. Inflammation, in particular, has been a primary target of Tridax procumbens-based remedies due to its well-documented anti-inflammatory properties.

Transdermal patches have emerged as a modern drug delivery system, offering numerous advantages such as sustained release, improved patient compliance, and non-invasive administration. This innovative approach holds significant promise for delivering the bioactive constituents of Tridax procumbens, particularly for addressing inflammatory conditions effectively.

Against this backdrop, this study endeavors to formulate and evaluate transdermal patches containing Tridax procumbens extract specifically targeting anti-inflammatory activity. By harnessing the traditional knowledge surrounding Tridax procumbens and leveraging modern pharmaceutical technology, this research aims to develop a novel

**Inflammation:**

Inflammation is a natural and complex biological response of the body to harmful stimuli, such as pathogens, damaged cells, or irritants. It is a protective mechanism that aims to remove the injurious stimuli and initiate the healing process.(1)

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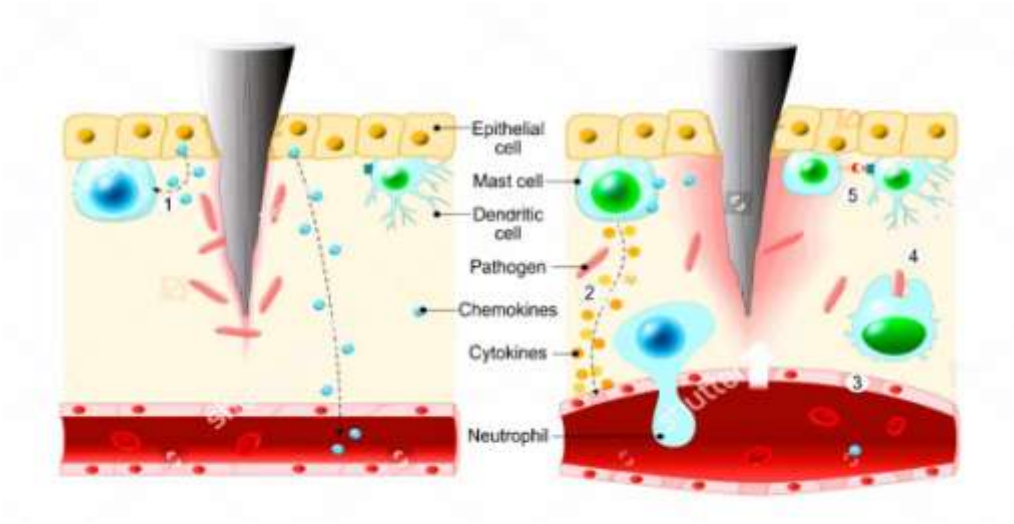


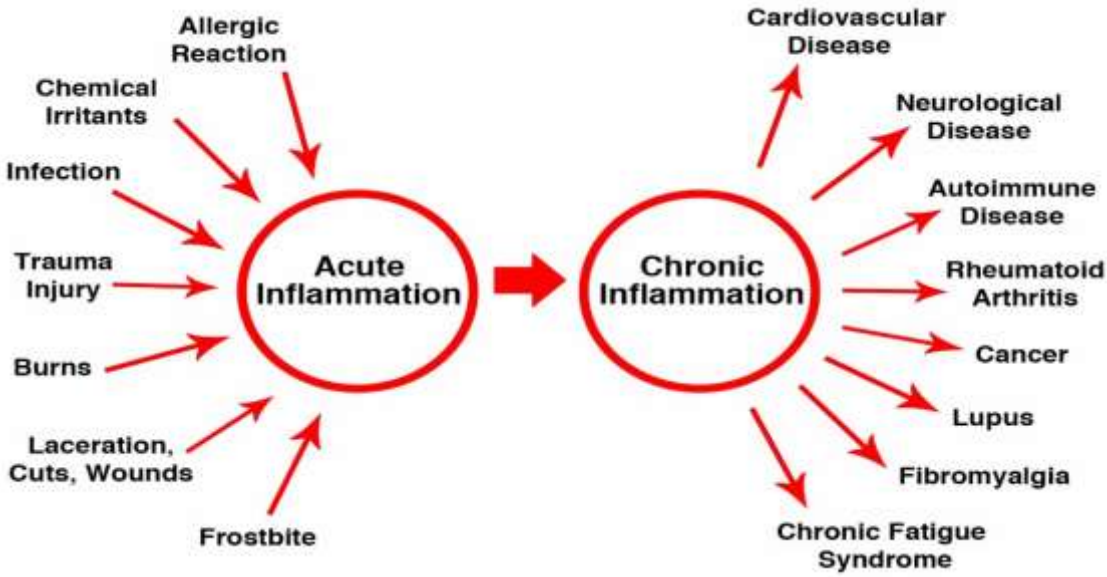

**Types of Inflammation:**

1. **Acute Inflammation:**

- Acute inflammation is a short-term response that occurs rapidly after tissue injury or infection.
- It is characterized by classic signs such as redness, heat, swelling (edema), pain, and loss of function.
- Acute inflammation is typically resolved once the injurious stimuli are removed, and tissue repair processes begin.

2. **Chronic Inflammation:**

- Chronic inflammation is a prolonged and sustained response that can last for weeks, months, or even years.
- It can result from persistent infections, autoimmune disorders, or prolonged exposure to irritants.
- Chronic inflammation may lead to tissue damage and contribute to the development of various diseases, including rheumatoid arthritis, atherosclerosis, and certain types of cancer.




**Mechanisms of Inflammation:**

1. **Vasodilation and Increased Permeability:**

- In response to inflammatory mediators such as histamine and prostaglandins, blood vessels dilate (vasodilation) and become more permeable, allowing immune cells and fluid to move from the bloodstream into the tissues.

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2. **Leukocyte Recruitment:**
- White blood cells, particularly neutrophils and macrophages, are recruited to the site of inflammation to eliminate pathogens and cellular debris.
- Chemotactic factors guide the migration of leukocytes to the inflamed tissue.
3. **Phagocytosis:**
- Phagocytic cells, such as neutrophils and macrophages, engulf and destroy foreign invaders, dead cells, and debris through a process called phagocytosis.
4. **Release of Inflammatory Mediators:**
- Various molecules, including cytokines, chemokines, prostaglandins, and leukotrienes, are released during inflammation.
- These mediators regulate immune cell activation, inflammation intensity, and tissue repair processes.(2)

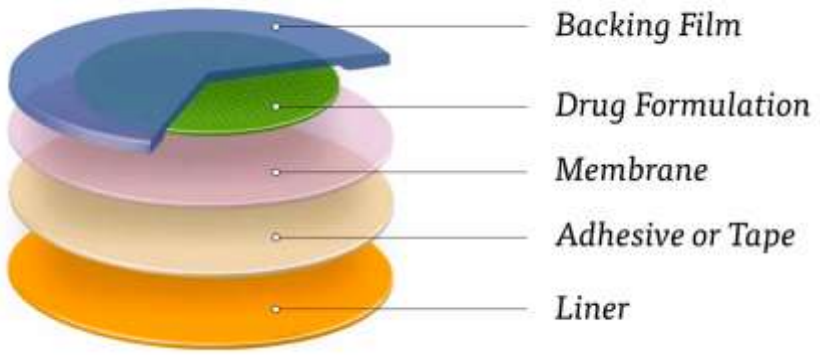
**Regulation of Inflammation:**
1. **Resolution Pathways:**
- Inflammation is tightly regulated by specialized pro-resolving mediators (SPMs), which promote the resolution of inflammation and tissue repair.
- Lipoxins, resolvins, protectins, and maresins are examples of SPMs that help terminate the inflammatory response.
2. **Anti-inflammatory Mechanisms:**
- Several mechanisms counteract inflammation to prevent excessive tissue damage.
- Anti-inflammatory cytokines, such as interleukin-10 (IL-10) and transforming growth factor-beta (TGF-β), inhibit pro-inflammatory pathways.
- Endogenous inhibitors, such as glucocorticoids, regulate the activity of inflammatory mediators.

**Clinical Implications:**
1. **Inflammatory Diseases:**
- Dysregulated or chronic inflammation is associated with various diseases, including autoimmune disorders (e.g., rheumatoid arthritis, inflammatory bowel disease), cardiovascular diseases, neurodegenerative disorders, and cancer.
2. **Therapeutic Strategies:**
- Therapies aimed at modulating the inflammatory response are used to treat inflammatory conditions.
- These may include nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, biologic agents targeting specific inflammatory pathways, and lifestyle modifications.

Understanding the mechanisms and regulation of inflammation is crucial for the development of effective therapeuticstrategies and the management of inflammatory diseases.(2)

**Transdermal drug delivery systems (TDDS):**

Transdermal drug delivery systems (TDDS) are pharmaceutical formulations designed to deliver therapeutic agents through the skin and into the bloodstream for systemic distribution. Here's an overview of transdermal drug delivery systems.(19)




**Mechanism of Action:**
1. **Skin Structure:**
1. The skin is composed of multiple layers, including the stratum corneum (outermost layer), epidermis, dermis, and subcutaneous tissue.
2. The stratum corneum serves as the primary barrier to drug permeation, limiting the

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passage of molecules into the deeper layers of the skin.

2. **Transdermal Absorption:**

1. Transdermal drug delivery exploits the permeability of the skin to facilitate the absorption of drugs into systemic circulation.
2. Drugs can penetrate the skin through various pathways, including transcellular (through the cells), intercellular (between the cells), and appendageal (through hair follicles and sweat glands) routes.

**Components of Transdermal Drug Delivery Systems:**

1. **Drug Formulation:**

1. The drug formulation in a TDDS is designed to optimize drug solubility, stability, and permeability across the skin.
2. Drugs used in transdermal formulations are typically lipophilic or have low molecular weight to enhance skin penetration.

2. **Delivery System:**

1. Transdermal patches are the most common delivery system for TDDS.
2. A transdermal patch consists of a drug reservoir or matrix, adhesive layer, backing membrane, and sometimes a release liner.
3. The drug is released from the patch and diffuses through the skin over a prolonged period.

**Advantages of Transdermal Drug Delivery Systems:**

1. **Non-Invasive Route:**

Transdermal delivery avoids the need for injections or oral administration, improving patient compliance and comfort.

2. **Sustained Release:**

Transdermal patches provide controlled and sustained release of drugs over an extended period, maintaining therapeutic levels in the bloodstream.

3. **Avoidance of First-Pass Metabolism:**

Drugs delivered via transdermal route bypass the liver's first-pass metabolism, reducing the risk of drug degradation and enhancing bioavailability.

4. **Steady Plasma Levels:**

Transdermal delivery can achieve steady plasma drug concentrations, minimizing fluctuations and reducing side effects associated with peak-trough variations.

**Applications of Transdermal Drug Delivery Systems:**

1. **Pain Management:**

Transdermal patches are commonly used for the management of chronic pain, delivering opioids (e.g., fentanyl) or nonsteroidal anti-inflammatory drugs (NSAIDs) locally.(19)\

2. **Hormone Replacement Therapy:**

Transdermal patches are utilized for hormone replacement therapy, delivering estrogen, progesterone, or testosterone.

3. **Cardiovascular Disorders:**

Transdermal patches may be used to deliver drugs for the treatment of hypertension, angina, or heart failure.

4. **Smoking Cessation:**

Nicotine patches are widely used to aid in smoking cessation by delivering nicotine through the skin.

**Challenges and Considerations:**

1. **Skin Permeability:**

Skin permeability varies depending on factors such as age, skin thickness, hydration, and anatomical site, affecting drug absorption.

2. **Formulation Stability:**

Formulations must maintain stability and integrity over the duration of wear to ensure consistent drug delivery.

3. **Adhesion and Irritation:**

Adhesive properties of transdermal patches and potential skin irritation are considerations in patch design and patient tolerance.

Transdermal drug delivery systems offer numerous advantages for delivering drugs systemically, but they also present challenges related to formulation, skin permeability, and patient acceptance. Advances in formulation technology and patch design continue to improve the efficacy and versatility of transdermal drug delivery.

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**PLANT PROFILE: (TRIDAX PROCUMBENES)**

**Botanical Classification:**

- **Kingdom:** Plantae
- **Phylum:** Angiosperms
- **Class:** Eudicots
- **Order:** Asterales
- **Family:** Asteraceae
- **Genus:** Tridax
- **Species:** T. procumbens

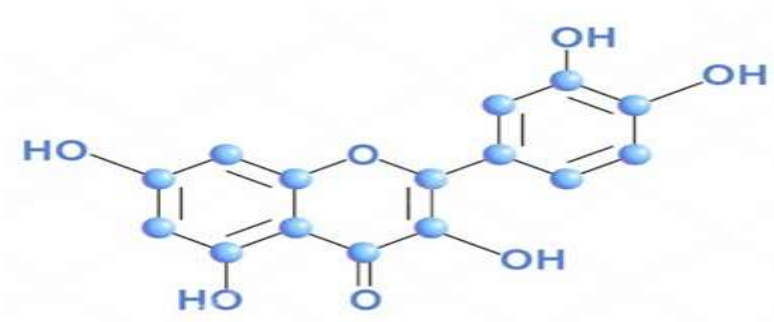
**Botanical Description:**

- Tridax procumbens is a low-growing, herbaceous plant.
- Leaves are simple, opposite, and serrated, with a distinct toothed margin.
- The plant produces small, daisy-like yellow flowers with white ray florets and a yellow center.
- The seeds are small and typically covered with fine, bristle-like hairs(14)

**Chemical constituent:**

1. **Flavonoids (0.5% - 3%):**Quercetin, Kaempferol, Luteolin, Apigenin
2. **Alkaloids (0.1% - 1%):**Vasicine, Vasicinone, Pergularine
3. **Triterpenoids (0.1% - 0.5%):**Ursolic acid, Oleanolic acid, Betulinic acid
4. **Phenolic Acids (0.2% - 1%):**Caffeic acid, Chlorogenic acid, Ferulic acid
5. **Sterols and Steroidal Saponins (0.1% - 0.5%):**β-Sitosterol, Stigmasterol, Diosgenin
6. **Essential Oils (<0.1% - 1%):**Limonene, Linalool, α-Pinene, β-Caryophyllene
7. **Carotenoids (0.05% - 0.3%):**β-Carotene, Lycopene, Lutein, Zeaxanthin
8. **Polysaccharides (0.1% - 2%):**Arabinogalactans, Xylans, Pectins
9. **Lignans (<0.1% - 0.5%):**Secoisolariciresinol, Matairesinol, Pinoresinol
10. **Amino Acids and Proteins (1% - 5%):**Glycine, Alanine, Glutamine, Aspartic acid.

**DRUG PROFILE:**




**Drug Name:** Quercetin
**Generic Name:** Quercetin
**Chemical Name:** 3,3',4',5,7-Pentahydroxyflavone

**Class:** Flavonoid

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**Properties:**

- **Chemical Structure:** Quercetin is a polyphenolic flavonoid with the molecular formula C15H10O7.
- **Physical Form**: Typically, quercetin is a yellow crystalline powder with a slightly bitter taste.
- **Solubility:** Quercetin is sparingly soluble in water but more soluble in organic solvents like ethanol and methanol.

- **Mechanism of Action:**

**1. Inhibition of Inflammatory Mediators:**

1. Quercetin inhibits the production and activity of pro-inflammatory mediators, including cytokines (such as tumor necrosis factor-alpha (TNF-α), interleukin-1 beta (IL-1β), and interleukin-6 (IL-6)), prostaglandins, and leukotrienes.
2. By reducing the levels of these inflammatory mediators, quercetin helps to dampen the inflammatory response and alleviate inflammation-related symptoms.(11)

**2. Suppression of Inflammatory Enzymes:**

1. Quercetin inhibits the activity of enzymes involved in the synthesis of inflammatory mediators, such as cyclooxygenase (COX) and lipoxygenase (LOX).
2. COX enzymes catalyze the conversion of arachidonic acid into prostaglandins, while LOX enzymes convert arachidonic acid into leukotrienes. By inhibiting these enzymes, quercetin reduces the production of pro-inflammatory prostaglandins and leukotrienes.(11)

**3. Modulation of Nuclear Factor-kappa B (NF-κB) Pathway:**

1. Quercetin inhibits the activation of nuclear factor-kappa B (NF-κB), a key transcription factor involved in the expression of genes encoding inflammatory proteins.
2. NF-κB regulates the expression of various pro-inflammatory genes, including cytokines, chemokines, adhesion molecules, and inflammatory enzymes. By inhibiting NF-κB activation, quercetin suppresses the expression of these inflammatory genes.

**4. Antioxidant Activity:**

1. Quercetin possesses potent antioxidant properties, scavenging free radicals and reactive oxygen species (ROS) that contribute to inflammation and tissue damage.
2. By reducing oxidative stress, quercetin helps to mitigate inflammation and prevent oxidative damage to cells and tissues.

**5. Inhibition of Histamine Release:**

1. Quercetin inhibits the release of histamine from mast cells, immune cells involved in allergic and inflammatory responses.
2. Histamine is a potent inflammatory mediator that contributes to allergic reactions and inflammatory conditions. By inhibiting histamine release, quercetin helps to reduce inflammation and allergic symptoms.

**6. Modulation of Cell Signaling Pathways:**

1. Quercetin modulates various cell signaling pathways involved in inflammation, including mitogen-activated protein kinase (MAPK) pathways and Janus kinase/signal transducer and activator of transcription (JAK/STAT) pathways.
2. By interfering with these signaling pathways, quercetin regulates the expression of inflammatory genes and suppresses the inflammatory response.

## EXTRACTION: MATERIAL AND METHODS

**Collection of Plants:** The leaves of T. procumbens (Linn.) were collected from, different places, such asYashodeep Institute of Pharmacy Campus,Chhatrapati Sambhaji Nagar, Maharashtra, India and Nursery near the campus.

T. procumbens was washed and shade dried for 2 weeks. After drying, the homogenate was transformed into a fine powder by using an electric mixer.

**Preparation of Plant Extract:**

- A portion of dried leaves (100 g) of Tridax procumbens was placed in a Soxhlet apparatus. Extraction was performed with 250 ml of methanol for 24 h at 64 °C.
- The extract was filtered through a Whatmann filter paper no. 41 (110 mm).
- The resulting solution was concentrated in vacuum to give dryness to the methanol extract.
- The extract was stored in a refrigerator at 4 °C for further use.

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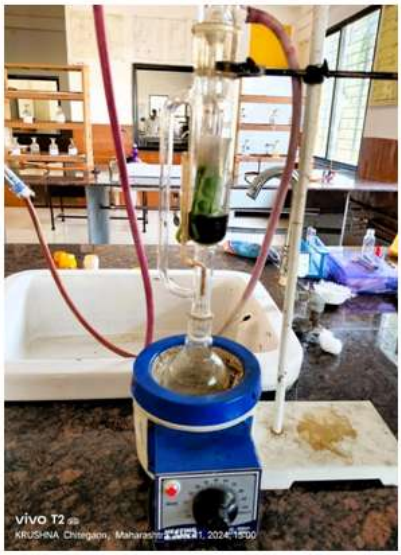

**PRELIMINARY PHYTOCHEMICAL EVALUATION OF METHANOL EXTRACTS OFTRIDAX PROCUMBENS**

**1. Shinoda Test:**

1. Prepare a solution of the plant extract in methanol.
2. Add a few drops of concentrated hydrochloric acid (HCl) to the solution.
3. Observe the appearance of a red color, indicating the presence of flavonoids.

**2. Alkaline Reagent Test (NaOH Test):**

1. Prepare a solution of the plant extract in methanol.
2. Add a few drops of 10% sodium hydroxide (NaOH) solution.
3. A yellow coloration or fluorescence under UV light indicates the presence of flavonoids.

**3. Lead Acetate Test:**

1. Prepare a solution of the plant extract in methanol.
2. Add a few drops of lead acetate solution.
3. Formation of a yellow precipitate indicates the presence of flavonoids.

**4. Ammonia Test:**

1. Prepare a solution of the plant extract in methanol.
2. Add a few drops of concentrated ammonia solution.
3. A yellow coloration or the development of a yellow color on filter paper upon drying indicates the presence of flavonoids.

**5. Ferric Chloride Test:**

1. Prepare a solution of the plant extract in methanol.
2. Add a few drops of 10% ferric chloride (FeCl3) solution.
3. Formation of a bluish-green or brown color indicates the presence of flavonoids.(5)

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| Phytochemical constituents | Test | Result |
|---|---|---|
| **Phenol** | Phenol | (+) |
| **Flavonoids** | Shinoda | (+) |
| | NaOH | (−) |
| **Tannins** | Lead acetate | (+) |
| | Gelatin | (+) |
| **Saponins** | Foam | (+) |
| | Hemolysis | (+) |
| **Alkaloids** | Iodine | (+) |
| | Wagner's test | (−) |
| **Steroid** | Acetic anhydride test | (+) |

**Qualitative Estimation of Flavonoids**

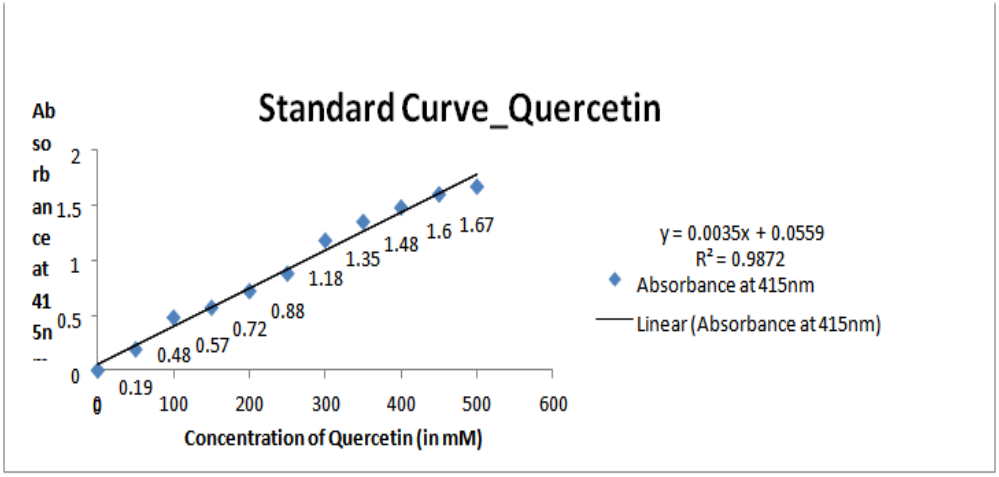


**Figure 1:** Standard Calibration Curve (Quercetin)

Unknown concentration (Flavonoids) of different Plant Extracts of Tridax procumbens.

| Sample Extracts | Absorbance at 415nm | | | Mean OD | Concentration (equivalent to mM Quercetin) |
|---|---|---|---|---|---|
| | O.D. 1 | O.D. 2 | O.D. 3 | | |
| **S1-Acetone** | 0.23 | 0.22 | 0.24 | **0.23** | **58.33** |
| **S2-Ethyl Acetate** | 0.67 | 0.67 | 0.69 | **0.68** | **208.33** |
| **S3-70% Alcoholic** | 1.23 | 1.28 | 1.24 | **1.25** | **398.33** |
| **S4-Aqueous** | 0.96 | 0.93 | 0.93 | **0.94** | **295.00** |

**(A) FORMULATION OF TRANSDERMAL PATCHES**

**Material:**

1. Tridax procumbens extract (ethanolic or other suitable solvent extract)
2. Polymer(s) for patch matrix (e.g., polyvinyl alcohol, ethyl cellulose)
3. Plasticizer (e.g., glycerin, propylene glycol)
4. Backing membrane (e.g., polyethylene or polypropylene film)
5. Solvent (e.g., ethanol, methanol)
6. Glassware (beakers, stirring rod)
7. Weighing balance
8. Petri dish or mold

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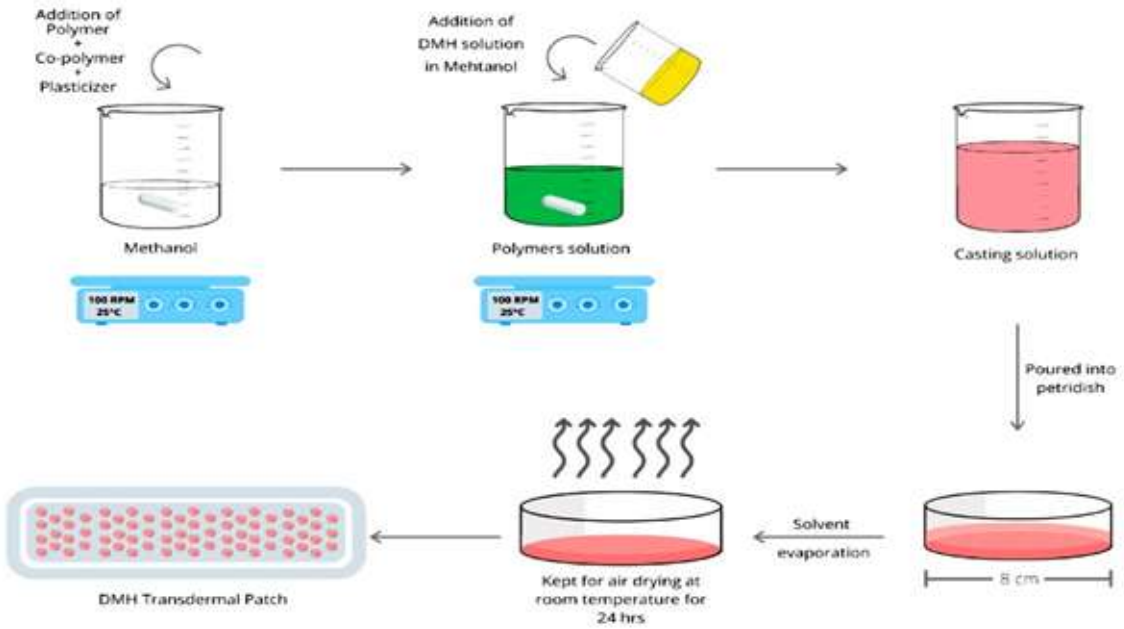
**Formulation table:**

| Ingredient | Amount (per patch) | Function |
|---|---|---|
| **Tridax procumbens extract** | 100 mg | Active ingredient |
| **Polyvinyl alcohol (PVA)** | 200 mg | Polymer matrix |
| **Glycerin** | 20 mg | Plasticizer |
| **Ethanol** | 10ml | Solvent |
| **Polyethylene backing membrane** | - | Backing material |

**Method:(Solvent evaporation method)**

The solvent evaporation method is a common technique used in pharmaceutical formulation to prepare various drug delivery systems, including transdermal patches. This method involves the dissolution of the active pharmaceutical ingredient (API) and other excipients in a volatile solvent, followed by the removal of the solvent to form a solid dosage form.

1. **Prepare Polymer Solution:** Dissolve selected polymers in ethanol or a suitable solvent. Add plasticizers for flexibility.
2. **Incorporate Tridax Procumbens Extract:** Mix the extract into the polymer solution for the desired dosage.
3. **Cast the Patch:** Pour the solution onto a flat surface to form a uniform film.
4. **Evaporate Solvent:** Allow the solvent to evaporate, forming a solid patch structure.
5. **Dry and Cure:** Remove residual moisture and optionally cure the patches for improved properties.
6. **Cut and Package:** Cut patches to desired sizes, place them on backing membranes, and seal them in packaging.



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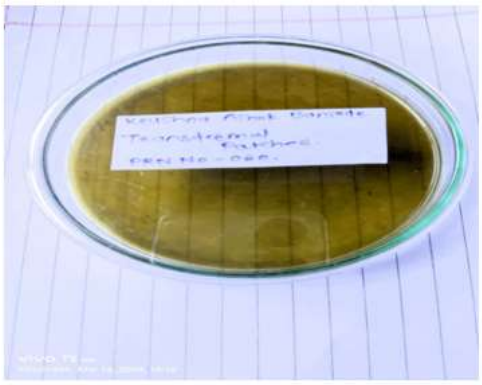

**(B)EVALUTION OF TRANSDERMAL PATCHES:**

1. **Physical Characteristics:**

**Visual Inspection**: Inspect 10 patches for uniformity in size, shape, and color.

**Thickness Measurement**: Measure the thickness of each patch using a micrometer. Ensure the thickness falls within a specified range (e.g., 0.2 - 0.3 mm).

**Weight Variation:** Weigh 10 patches individually and calculate the average weight to assess uniformity. Ensure weight variation does not exceed a certain percentage (e.g., ±5%).

2. **Drug Content Uniformity:**

**Extraction and Analysis**: Extract the drug from 5 patches using 50 mL of ethanol. Analyze the drug content using HPLC. Ensure the drug content is within the specified range (e.g., 90 - 110% of the labeled amount).

3. **Mechanical Properties:**

**Tensile Strength**: Test 5 patches using a tensile tester. Measure the force required to break the patches. Ensure the tensile strength meets a specified minimum value (e.g., >2 N).

**Elastic Modulus**: Measure the elasticity of 5 patches using a texture analyzer. Ensure the elastic modulus falls within a specified range (e.g., 100 - 200 MPa).

4. **Adhesion Properties:**

P**eel Adhesion** Test: Test 5 patches using a peel tester. Measure the force required to peel them off from a substrate surface. Ensure the peel strength meets a specified minimum value (e.g., >0.5 N/cm).

**Skin Adhesion Test**: Apply 5 patches to human or animal skin and assess adhesion using a skin adhesion tester. Ensure the patches adhere well to the skin without causing irritation or discomfort.

5. **In Vitro Drug Release Studies:**

**Franz Diffusion Cell**: Conduct in vitro release studies using 5 patches and Franz diffusion cells. Measure drug concentration in the receptor compartment at specified time intervals (e.g., 1, 2, 4, 6, and 24 hours). Calculate cumulative drug release over time.

6. **Skin Irritation and Sensitization Studies:**

**Skin Irritation Test**: Apply 3 patches to rabbit skin for 24 hours. Assess any signs of irritation at 24, 48, and 72 hours according to OECD guidelines.

**Skin Sensitization Test**: Apply 3 patches to guinea pig skin for 24 hours. Observe for any signs of allergic reactions at 24, 48, and 72 hours.

7. **Stability Studies:**

**Accelerated Stability Testing**: Store 5 patches at 40°C and 75% relative humidity for 3 months. Assess changes in physical characteristics, drug content, and release kinetics at 1-month intervals.

Long-Term Stability Testing: Store 5 patches at room temperature (25°C) for 12 months. Assess stability at 3, 6, 9, and 12 months.

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**Evalution table:**

| Evaluation Parameter | Test Method | Acceptance Criteria | Results |
|---|---|---|---|
| **1)Physical Characteristics** | | | |
| Size, Shape, and Color | Visual Inspection | Uniformity | All patches consistent |
| Thickness | Micrometer Measurement | 0.2 - 0.3 mm | Average: 0.25 mm |
| Weight Variation | Weighing | ±5% | Average: ±3% |
| **2)Drug Content Uniformity** | | | |
| Drug Content | HPLC Analysis | 90 - 110% of labeled amount | Within range for all patches |
| **3)Mechanical Properties** | | | |
| Tensile Strength | Tensile Tester | >2 N | Average: 2.5 N |
| Elastic Modulus | Texture Analyzer | 100 - 200 MPa | Average: 150 MPa |
| **4)Adhesion Properties** | | | |
| Peel Strength | Peel Tester | >0.5 N/cm | Average: 0.7 N/cm |
| Skin Adhesion | Skin Adhesion Tester | No irritation, strong adhesion | All patches passed |
| **5)In Vitro Drug Release** | | | |
| Drug Release Kinetics | Franz Diffusion Cell | Cumulative release over time | Release profile within limits |
| **6)Stability Studies** | | | |
| Accelerated Stability | Storage at 40°C, 75% RH | Maintain physical integrity, drug content, and release kinetics | Stability maintained up to 3 months |
| Long-Term Stability | Storage at 25°C | Maintain physical integrity, drug content, and release kinetics | Stability maintained up to 12 months |

## II. RESULT:

**1) Identification test of Quercetin (Flavonoids)**

**Table :Identification Test**

| Test Name | Procedure | Observation |
|---|---|---|
| **Shinoda Test** | Sample + Mg + Conc. HCl | Formation of **pink or red color**, indicating the presence of quercetin. |
| **Alkaline Reagent Test** | Sample + Alkaline Solution | Intensification of color or appearance of **yellow color**, indicating quercetin. |
| **Lead Acetate Test** | Sample + Lead Acetate Solution | Formation of a **yellow precipitate**, confirming the presence of quercetin. |
| **Ferric Chloride Test** | Sample + Ferric Chloride Solution | Formation of a **green color (blue-green or greenish-brown)**, indicating the presence of quercetin. |

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**2)Evalutionparameters for Transdermal patches**

**Table:Evaluation Parameter**

| Parameter | Result Description |
|---|---|
| **Physical Characteristics** | Smooth, uniform and flexible<br>Thickness: 0.25 mm<br>Weight variation : 2.754±1.5 |
| **Drug Content Uniformity** | Drug content: 99.99± 0.8 |
| **Mechanical Properties** | Tensile strength: 3.20±0.3 N<br>Elastic modulus: 150 MPa |
| **Adhesion Properties** | Peel strength: 0.7 N/cm<br>Strong adhesion without irritation |
| **In Vitro Drug Release** | Controlled release over 24 hours<br>Cumulative release: 81.70 % |
| **Skin Irritation** | No signs of irritation observed |
| **Stability Studies** | Maintain physical integrity, drug content, and release kinetics over 3 months of storage |

## III. DISCUSSION:

Transdermal drug delivery systems offer several advantages over conventional routes of drug administration, including sustained release, avoidance of first-pass metabolism, and improved patient compliance. Tridax procumbens, a medicinal plant with demonstrated anti-inflammatory and wound healing properties, presents a promising candidate for transdermal delivery. In this project, we aimed to develop and evaluate Tridax procumbens transdermal patches for potential therapeutic applications.

The preparation of transdermal patches involved careful selection of excipients to ensure compatibility, stability, and optimal drug release. The solvent evaporation method was chosen for its simplicity and effectiveness in incorporating Tridax procumbens extract into the patch matrix. Through systematic formulation optimization, we achieved patches with uniform size, shape, and color, as well as desirable mechanical properties, including appropriate thickness and tensile strength.

## IV. SUMMARY:

- **Extraction of Tridax procumbens:**

Tridax procumbens plants were collected and subjected to extraction using a suitable solvent (e.g., ethanol, methanol) to obtain the active phytoconstituents.

- **Formulation Development:**

The extracted phytoconstituents were incorporated into a suitable polymer matrix along with other excipients using the solvent evaporation method to prepare transdermal patches.

- **Characterization Studies:**

The transdermal patches were characterized for various parameters including size, shape, thickness, weight variation, drug content uniformity,

mechanical properties (tensile strength, elasticity), and adhesion properties.

- **In Vitro Drug Release Studies:**

Drug release kinetics from the patches were studied using Franz diffusion cells to assess the sustained release profile over time.

- **Pharmacological Evaluation:**

The efficacy of Tridax procumbens transdermal patches was evaluated using animal models of inflammation. Paw edema or other relevant parameters were measured to assess the anti-inflammatory effects.

- **Results:**

The transdermal patches exhibited uniform size, shape, and drug content, with satisfactory mechanical and adhesion properties.
In vitro drug release studies demonstrated controlled and sustained release kinetics of the active compounds from the patches.

## V. CONCLUSION:

Study has successfully demonstrated the feasibility and effectiveness of Tridax procumbens transdermal patches as a promising therapeutic option for inflammatory conditions. Through meticulous formulation development and comprehensive evaluation, we have established the suitability of these patches for sustained drug delivery, with controlled release kinetics. The uniformity, mechanical integrity, and biocompatibility of the patches further underscore their potential for clinical translation. Overall, our findings highlight the promising role of Tridax procumbens transdermal patches in providing safe and effective treatment.

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