WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 14, 1392-1404. Research Article ISSN 2277–7105

THE STUDY OF TRANSDERMAL PATCHES USED FOR ECZEMA SKIN DISEASE

Namrata N. Patil*[1], Namrata R. Patil[2], Prachi S. Patil[3], Prajwal P. Patil[4], Ms. U. D. Khedkar[5]

[1,2,3,4]Students of Shree Saraswati Institute of Pharmacy, Tondavali.

[5]Asst. Prof. of Shree Saraswati Institute of Pharmacy, Tondavali.

Article Received on 15 June 2026,
Article Revised on 05 July 2026,
Article Published on 16 July 2026,

https://doi.org/10.5281/zenodo.21407744

***Corresponding Author**

Namrata N. Patil

Students of Shree Saraswati Institute of Pharmacy, Tondavali.

How to cite this Article: Namrata N. Patil*[1], Namrata R. Patil[2], Prachi S. Patil[3], Prajwal P. Patil[4], Ms. U. D. Khedkar[5]. (2026). The Study of Transdermal Patches Used For Eczema Skin Disease. World Journal of Pharmaceutical RESEARCH, 15(14), 1392–1404.

ABSTRACT

A transdermal drug delivery system (TDDS) is classified as a controlled drug delivery method, designed to deliver medications via the skin at a set and regulated pace. This method offers many advantages, including prolonged therapeutic effects, minimized side effects, improved bioavailability, augmented compliance with treatment, and easy cessation of medication. The skin's outermost layer, the Stratum corneum is crucial for regulating the transdermal absorption of many substances. Three primary Routes enable drug infiltration: appendageal, transcellular, and intercellular. When giving medications through this route, it is crucial to take into account various elements, such as the age and state of the skin, physicochemical characteristics and ecological factors. Key components of Transdermal Drug Administration Systems (TDDS) consist of a polymer matrix, a membrane, the drug, enhancers for penetration, and pressure-sensitive components. Glues, support sheets, and a separating layer. Transdermal patches are classified into types like reservoir systems, matrix structures, and micro-reservoir configurations, all designed to deliver active substances into the bloodstream through the skin. A consistent method is employed to assess different features, such as adhesion characteristics, in vitro medication release, and stability. The aim of examining the subject of transdermal drug delivery systems via patches aims to thoroughly assess the developments, difficulties, and possible uses of this groundbreaking medication delivery technique.

KEYWORDS: Stratum corneum, Penetration enhancer, Matrix system, Micro reservoir system, Reservoir system, Transdermal drug delivery system.

INTRODUCTION

A transdermal patch is employed to administer a precise amount of medication via the skin and into the bloodstream. Transdermal Patch products received FDA approval for the first time in 1981. Transdermal delivery systems are now accessible that include scopolamine (hyoscine) used for travel sickness, clonidine and nitroglycerin for heart conditions, fentanyl for long-term pain, nicotine to support quitting smoking. Transdermal administration offers regulated, continuous delivery of the medication, and enables ongoing administration of substances with brief biological half-lives and removes pulsed ingress into systemic circulation. TDDS provides numerous benefits compared to traditional injection and oral techniques.

It Decreases the burden that the oral method typically imposes on the gastrointestinal system and hepatic organ. It improves patient adherence and reduces negative side effects of a medication resulting from temporary overdose. It is handy, particularly evident in sections that need application just once a week. So straight forward dosing. a regimen supports patient compliance with medication therapy.

THE PRIMARY ELEMENTS OF A TRANSDERMAL PATCH INCLUDE

 Polymer matrix – foundational element of TDDS, regulating the release of the medication. Polymer must be chemically inert and must not break down during storage, must be non-toxic, expenses should not be elevated. E.g.- cellulose compounds, zein protein, gelatinous substances, shellac resin, wax materials, gums, polybutadiene, hydrin rubber, polyisobutylene, silicone rubber, nitrile rubber, acrylonitrile-butadiene, neoprene rubber, PVC ethanol, PVC, PE, PP, polyacrylate, polyamide, polyurea, polyvinylpyrrolidone, polymethyl methacrylate.

 Medication - The transdermal method is a highly appealing choice. For the medications with suitable pharmacological properties and characteristics chemistry.Transdermal patches provide numerous advantages for medications that experience substantial initial metabolic degradation, medications with limited therapeutic range, or medications with brief half-life, e.g., fentanyl. nitroglycerin etc.

 Permeation enhancers- boost the permeability of the stratum corneum in order to achieve increased therapeutic concentrations of the medication. These can be categorized into three

types: lipophilic solvent, surface-active. Agents and dual component systems. Sure! Please provide the text you would like me to paraphrase.

DMSO

 Adhesive - enhance the permeability of the stratum corneum to enable achieve elevated therapeutic concentrations of the medication that enhance permeability of the stratum corneum in order to achieve greater medicinal concentrations of the medication.

 Supporting laminates- must possess low modulus or high adaptability. Eg - vinyl, polyethene.

 Release liner - Safeguards the patch while in storage. The vessel is eliminated before utilization.

 Additional excipients such as plasticizers and solvents.

SKIN STRUCTURE

As the largest organ in the body, the skin serves as an essential barrier to protect the body from a variety of dangers and environmental influences. Its large surface area (an average person's 1.7 square meters) enables it to effectively protect the body from water loss, chemicals, allergens, ultraviolet (UV) radiation, and microorganisms. For general health and wellbeing to be maintained, this protective role is essential. Furthermore, the skin is involved in controlling body temperature, sensation, and vitamin D synthesis. By being exposed to sunlight. Maintaining the skin's health and supporting its functions requires proper care.

THE SKIN IS TYPICALLY DIVIDED INTO THREE MAIN CATEGORIES LAYERS

A. The topmost layer, referred to as the epidermis;

B. The central layer, known as the dermis; and

C. The deepest layer, referred to as the hypodermis

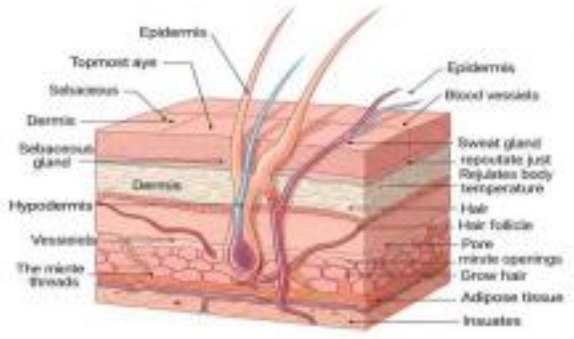

Figure no. 01: Structure of skin.

EPIDERMIS: The outermost layer of the skin is called the epidermis. It has no blood vessels and offers a waterproof barrier. Keratinocytes are cells in the epidermis that help make the skin tough and protective by producing the protein keratin. Melanocytes, which give skin its color, and Langerhans cells, which are essential for immune system components.

There are multiple sublayers of the epidermis, including:

1. Stratum corneum
2. Stratum granulosum
3. Stratum spinosum
4. Stratum basale

It varies in thickness across our body, with the soles of our feet and palms being around 0.8 mm thick. Layers of skin cells make up the epidermis. Keratinocytes are the majority of these cells. They comprise approximately 95% of the epidermis' cells.

DERMIS: The dermis, which is thicker than the epidermis and measures 3 to 5 mm, is situated beneath it. In addition to housing the skin's appendages and sensory receptors, the dermis is in charge of supplying nutrients to the epidermis.

It includes a variety of structures, including

1. Blood vessels
2. Hair follicles
3. Sweat glands
4. Sebaceous glands
5. Nerve endings
6. Collagen and elastin fibers

About 0.2 mm from the skin's surface are tiny blood vessels known as capillaries. Like drains, these capillaries remove the majority of anything that tries to penetrate the epidermis. This is crucial because it maintains a very low concentration of chemicals that enter the skin.

HYPODERMIS (SUBCUTANEOUS TISSUE): The hypodermis, or subcutaneous tissue, forms the innermost layer of the skin, made up of adipocytes (fat cells) and connective tissue. This layer acts as insulation, aiding in body temperature regulation and providing a protective cushion, safeguarding the body's organs and bones from injuries. When medications are used on the skin, such as creams or patches, they must penetrate these three layers to enter our bloodstream. Certain medications require disposal. Even further, penetrating our body's

bloodstream. However, for the majority of skin therapies, they merely need to penetrate the uppermost layer, the stratum corneum, and remain in the skin layers to be effective.

ECZEMA SKIN DISEASE

What is eczema?

Eczema is a condition that causes your skin to become dry, itchy and bumpy. This condition weakens your skin's barrier function, which is responsible for helping your skin retain moisture and protecting your body from outside element.

There are several types of eczema. Each type has unique triggers that can affect your skin's barrier function, including:

Atopic dermatitis.

Contact dermatitis.

Dyshidrotic eczema.

Neurodermatitis.

Nummular eczema.

Seborrheic dermatitis.

Stasis dermatitis.

ATOPIC DERMATITIS

The most prevalent type of eczema is called atopic dermatitis. Usually beginning between the ages of two months and five years, it usually becomes less severe or disappears by adulthood. However, symptoms may appear for the first time or flare up.

CONTACT DERMATITIS

Reactions to things you touch can cause contact dermatitis.

Two categories exist

Allergic Contact Dermatitis: The immune system's response to an irritant, such as metal or latex.

Irritant Contact Dermatitis: When a chemical or other material directly harms your skin.

DYSHIDROTIC ECZEMA

Your hands and feet may develop tiny blisters as a result of dyshidrotic eczema, commonly referred to as pompholyx.

NEURODERMATITIS

One to two eczema patches typically appear in people with neurodermatitis, also known as lichen simplex chronicus. The more you scratch, the worse the itching gets.

NUMMULAR ECZEMA

Round, coin-shaped spots appear on your skin as a result of nummular eczema, also referred to as discoid eczema. It may be extremely itchy and has a different appearance than other forms of eczema.

SEBORRHEIC DERMATITIS

Because it usually affects the scalp, seborrheic dermatitis is sometimes called scalp eczema. Commonly referred to as "cradle cap," seborrheic dermatitis in infants does not recur. However, seborrheic dermatitis is likely to be a persistent skin condition in adults and teenagers.

STASIS DERMATITIS

According to the American Academy of Dermatology, people with poor circulation are more likely to develop stasis dermatitis, which occurs when fluid seeps into the skin from weak veins.

TRANSDERMAL PATCHES

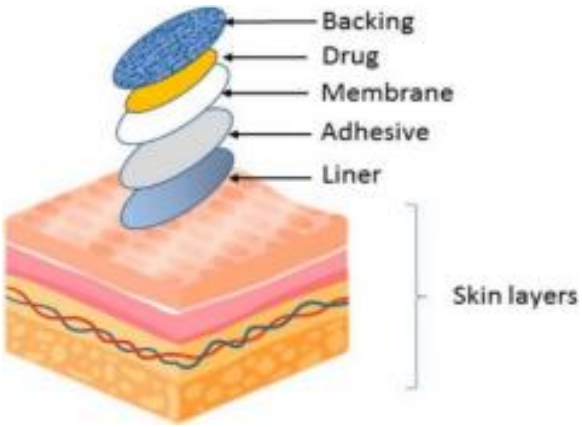

Figure no. 04.

Every pharmaceutical industry and researcher wants to create a safe and effective drug delivery system (1). Drug delivery via the transdermal route can produce both systemic and local therapeutic effects (2). Because it avoids gastrointestinal side effects and first pass metabolism, transdermal drug delivery is a desirable alternative to oral drug administration.

Additionally, it can overcome the low patient compliance that is linked to other drug delivery methods (3–6). Self-administered transdermal drug delivery enables the medication to enter intact skin over a predetermined amount of time, producing a local or systemic effect. Transdermal patches containing dissolved lipids can be used to deliver medications, giving them the necessary effectiveness.

TYPES OF TRANSDERMAL PATCHES

1. Single layer drug in adhesive patches
2. Multilayer drug in adhesive patches
3. Vapor drug in adhesive patches
4. Membrane moderated transdermal reservoir patches
5. Microresevoir transdermal patches

1. SINGLE LAYER DRUG IN ADHESIVE PATCHES

A reservoir made of a single layer of adhesive polymer is utilized for dispersion of drugs. The single layer is covered with an impermeable backing laminate. The drug is released from the backing laminate layer supporting the drug reservoir after being deposited in and adhering to the single polymer layer. One example of a single layer drug-in-adhesive transdermal patch is the transdermal product Daytrana, which contains Methylphenidate.

2. MULTILAYER DRUG IN ADHESIVE PATCHES

An adhesive and a drug reservoir layer make up multilayer transdermal patches. Layer that regulates the release of drugs over time. Multilayer systems include both a permanent backing laminate and a temporary protective layer. Drug delivery can be extended for up to seven days with multilayer patches, which are used to administer hormone therapy, pain medication, and medications that promote quitting smoking.

3. VAPOR DRUG IN ADHESIVE PATCHES

The single layer of adhesive polymer that makes up vapor transdermal patches has the ability to release vapor. There are several vapor dermal patches on the market, each with a distinct function. Nicoderm CQ, for instance, are transdermal patches that contain nicotine vapor and essential oils that, when released, can aid in quitting smoking. In 2007, this product made its debut on the European market. Another variety of vapor patches that contain essential oils are Al-tacura vapor patches, which can be applied in decongestion situations. There are other kinds of vapor patches on the market that act as sedatives or antidepressants.

4. MEMBRANE MODERATED TRANSDERMAL RESERVOIR PATCHES

A transdermal patch with a drug reservoir, a layer of backing composed of a porous polymeric membrane that regulates drug release over time, as well as an impermeable metallic plastic laminate. Polymeric materials, such as ethylene vinyl acetate copolymer and hypoallergenic adhesive polymer, are used to make the membrane. The transdermal patch's drug is regulated by its molecular dispersion within a polymer matrix component of the preparation. Commercial transdermal patches with modified drug release include Catapres®, which contains clonidine for three days, Transderm-Nitro, which contains nitroglycerin for one day, and Transderm Scop, which contains scopolamine for three days. Application for seven days.

5. MICRORESEVOIR TRANSDERMAL PATCHES

Matrix dispersion and a drug reservoir are combined in microreservoir transdermal patches. The drug is suspended in an aqueous solution of hydrophilic agents to create the reservoir. Polymer, followed by uniformly spreading the medication suspension across a lipophilic polymer. When a high shear mechanical force is applied during dispersion, thousands of tiny, impermeable spheres are formed. The profile of drug release adheres to a keeping the drug level in the plasma constant at a zero order rate of kinetic drug release. Crosslinking polymeric agents are usually added, since the drug dispersion needs to be thermodynamically steady.

ADVANTAGES

1. Transdermal drug delivery can be used as an alternative route of administration to accommodate patients who cannot tolerate oral dosage forms.
2. It is of great advantage in patients who are nauseated or unconscious.
3. Drugs that cause gastrointestinal upset can be good candidates for transdermal delivery because this method avoids direct effects on the stomach and intestine.
4. Drugs that are degraded by the enzymes and acids in the gastrointestinal system may also be good targets.
5. First pass metabolism, an additional limitation to oral drug delivery, can be avoided with transdermal administration.
6. Drugs that require relatively consistent plasma levels are very good candidates for transdermal drug delivery

DISADVANTAGES

1. Possibility of local irritation at the site of application.
2. Erythema, itching, and local edema can be caused by the drug, the adhesive, or other excipients in the patch formulation.
3. May cause allergic reactions.
4. A molecular weight less than 500 Da is essential.
5. Sufficient aqueous and lipid solubility, a log P (octanol/water) between 1 and 3 is required for permeate to transverse SC and underlying aqueous layers.

METHOD OF PREPARATION

METHODS OF PREPARATION FOR TRANSDERMAL PATCHES

1. Solvent Casting Method
2. Hot Melt Extrusion Method
3. Direct Compression Method
4. Solvent Evaporation Method
5. Electrostatic Spraying Method
6. Mercury Substrate Method
7. Rolling Solvent Method

1. SOLVENT CASTING METHOD

A polymer solution is prepared by dissolving the polymer in a suitable solvent. The drug and other excipients are added to the solution, and the mixture is stirred until uniform. The solution is then cast onto a backing membrane and dried to form a patch.

Advantages: Simple and cost-effective method, suitable for heat-sensitive drugs.

2. HOT MELT EXTRUSION METHOD

The polymer and drug are melted together and extruded through a die to form a patch. Advantages: Solvent-free process, suitable for large-scale production.

3. DIRECT COMPRESSION METHOD

The drug and excipients are mixed and compressed into a patch using a tablet press. Advantages: Simple and efficient method, suitable for large-scale production.

4. SOLVENT EVAPORATION METHOD

A polymer solution is prepared, and the drug is added to it. The solution is then poured onto a

backing membrane, and the solvent is allowed to evaporate, leaving a thin film.

Advantages: Suitable for heat-sensitive drugs, uniform drug distribution.

5. ELECTROSTATIC SPRAYING METHOD

A polymer solution is prepared, and the drug is added to it. The solution is then sprayed onto a backing membrane using an electrostatic charge.

Advantages: Uniform drug distribution, suitable for small-scale production.

6. MERCURY SUBSTRATE METHOD

In this method, a drug-containing polymer solution is poured onto a pool of mercury. The solvent evaporates, leaving a thin film of the drug-polymer matrix on the mercury surface. The film is then removed and cut into patches.

Advantages: Uniform thickness of the patch can be achieved.

7. ROLLING SOLVENT METHOD

In this method, a drug is dispersed in a polymer solution, and the mixture is rolled onto a backing membrane using a roller. The solvent evaporates, leaving a uniform drug-polymer matrix on the backing membrane.

Advantages: Provides uniform drug distribution and patch thickness.

FORMULATION

INGREDIENTS	QUANTITY	ROLE OF INGREDIENT
Curcumin powder extract	0.5gm	Anti-inflammatory and Antioxidant properties
Coconut oil	1ml	Moisturizing and anti-inflammatory agents
Tea tree oil	1ml	Anti-microbial and anti-inflammatory properties
HPMC (hydroxy propyl methyl cellulose)	1.5ml	Polymer for matrix formation
Eucalyptus oil	1ml	Anti-inflammatory and soothing properties
PEG (poly ethylene glycol)	2ml	Plasticizer to enhance flexibility

PROCEDURE

Transdermal Patch Formulation for Eczema using Solvent Casting Method.

Step 1: Preparation of the Polymer Solution

1. Weigh accurately 1.5 grams of HPMC and dissolve it in a suitable solvent (e.g., water,

ethanol, or a mixture).

2. Stir the solution on a magnetic stirrer until the polymer is fully dissolved.

Step 2: Incorporation of Active Ingredients

1. Add 0.5 gram of curcumin powder to the polymer solution and stir until well-dispersed. 2. Add 1 mL of coconut oil, tea tree oil, and eucalyptus oil each to the mixture. Stir well. 3. Add 2 ml of PEG as a plasticizer and mix thoroughly.

Step 3: Casting the Patch

1. Pour the mixture into Petri dishes or casting plates.

2. Ensure the mixture is evenly distributed.

Step 4: Drying the Patch

1. Place the Petri dishes in an oven or drying cabinet at 40-50°C for 24 hours. 2. Allow the solvent to evaporate completely, leaving a dry film.

Step 5: Cutting and Packaging

1. Once dry, carefully remove the patch from the Petri dish. 2. Cut the patch into desired sizes (e.g., 2x2 cm or 5x5 cm). 3. Package the patches in airtight containers or pouches to maintain stability.

EVALUATION PARAMETERS

1. Thickness

Measure the thickness of the patches using a micrometer.

2. Adhesion

Evaluate the adhesive properties of the patch.

3. Moisture Content

Determine the moisture content using a moisture analyzer.

4. in Vitro Drug Release

Study the release profile of curcumin and essential oils.

5. Stability

Assess the stability of the patch formulation over time.

CONCLUSION

Transdermal patches offer a promising approach for managing eczema by providing controlled and sustained delivery of therapeutic agents directly to the affected skin area. This delivery system can enhance patient compliance, reduce systemic side effects, and improve treatment outcomes. With ongoing research and development, transdermal patches may become a valuable addition to the treatment options for eczema, providing relief and improving the quality of life for individuals with this chornic skin condition.

REFERENCES

1. Allen LV, Popovich NG, Howard C. Ansel. Pharmaceutical dosage forms and drug delivery systems, 8th Edn. New Delhi: Wolter Kluwer Publishers, 2005; 298–9.
2. Gaur PK, Mishra S, Purohit S, Dave K. Transdermal drug delivery system- A review. Asian Journal of Pharmaceutical and Clinical Research, 2009; 2: 14-20.
3. Medically reviewed by Megan Slomka, MSN, APRN, FNP-C — Written by Stephanie Watson and Kimberly Holland — Updated on May 23, 2025.
4. M. R. Prausnitz and R. Langer, Transdermal drug delivery, Nat. Biotechnol, 2008; 26: 1261–1268. https://doi.org/10.1038/nbt.1504
5. Aggarwal G, Dhawan S. Development, Fabrication and Evaluation of Transdermal Drug Delivery System - A Review. Pharmainfo.net. 2009; 7(5).
6. Andersion RL, Cassidy JM, Variation in physical dimension and chemical composition of human stratum corneum, J Invest Dermatol, 1973; 61: 30-32.
7. Kumar, S. S., Behury, B., & Sachinkumar, P. (n.d.). Formulation and Evaluation of Transdermal Patch of Stavudine
8. Advances in transdermal drug delivery systems and clinical applications in inflammatory skin diseases. (2025). PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC12195946/
9. Cure for the itch: Current clinical standards and therapies in allergic eczema. (2025). PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC12003377/
10. Hypothesis: Platelet-rich plasma as an adjunct therapy for eczema targeting inflammation, skin barrier repair, and chronic recurrence. (2025). Frontiers in Immunology. https://www.frontiersin.org/journals/immunology/articles/10.3389/fimmu.2025.1692916/full
11. Advances in clinical applications of microneedle. (2025). Frontiers in Pharmacology. https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2025.1607210/full

12. Curcumin: A potential anti-photoaging agent. (2025). Frontiers in Pharmacology. https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2025.1559032/full
13. Cold atmospheric plasma in the treatment of autoimmune diseases: Mechanisms, applications, and prospects, 2025. PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC12344578/
14. Salutary effects of transdermal curcumin on multiple indices of health span in rodent models of normal aging and hypertension, 2025. PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC12397010/
15. Topical and transdermal delivery of nonsteroidal anti-inflammatory drugs (NSAIDs) for inflammation and pain: Current trends and future directions in delivery systems, 2023. MDPI. https://www.mdpi.com/2227-9717/13/3/907