A REVIEW ON TRANSDERMAL DRUG DELIVERY SYSTEM

Ankush Rana¹*, Varunjot Kaur² and Shreya Kaushal²

¹Student of Pharmaceutical Science, Manav Bharti University, Solan (H.P.).
²Faculty of Pharmaceutical Science, Manav Bharti University, Solan (H.P.).

ABSTRACT

Transdermal drug delivery system is an essential part of novel drug distribution system. The topically administered medications in the form of patches which when applied to the skin deliver the drug. For operative TDDS the drug are easily able to penetrate the skin and easily reach the target site. TDDS avoids the first pass metabolism, less frequency of administration, reduction gastrointestinal side effects. Adverse effects are minimized due to steady and optimum blood concentration. It has greater bioavailability and efficacy of drug. The human skin is multi-layered organ composed of many histological layers. Skin is the largest organ in the body. Its major functions are protection of major or vital internal organs for the external influences, temperature regulations, control of water output and sensation. Polymer should be chemically non-reactive, should not decompose on storage, should be non-toxic, cost should not be high. E.g. - cellulose derivatives, zein, gelatin etc. Backing films play a vital role in the transdermal patch and the role of the film is to protect the active layer. Transdermal patches can be evaluated by interaction studies thickness, weight uniformity, drug content, in vitro study, moisture content, swelling index basic component of TDDS

KEYWORDS: TDDS, Peel adhesion, Shear strength.

INTRODUCTION

TDDS is an integral part of novel drug delivery system. Since the beginning of life on the earth human applied a lot of substances to their skin as cosmetics and therapeutic agents. It was a tenth century when the skin became used as route for long term drug delivery. Transdermal drug delivery is the one of the most reliable as well as effective technique.
transdermal route has become one of the most successful and innovative drug delivery systems.

**MATERIAL AND METHOD**

**Polymer**
Polymer backbone of TDDS, which control the release of the drug. Polymer should be chemically non-reactive, should not decompose on storage, should be nontoxic, cost should not be high. E.g.- cellulose derivatives, zein, gelatin, shellac, waxes, gums, Polybutadiene, hydrid rubber, polyisobutylene, silicon rubber, nitrile, acrylonitrile, neoprene, Polyvinyl alcohol, polyvinylchloride, polyethylene, polypropylene, polyacrylate, polyamide, polyurea, polyvinylpyrrolidone, polymethylmethacrylate

**Backing Films**
Backing films play a vital role in the transdermal patch and also while using the system. The role of the film is to protect the active layer and safeguard the stability of the system, and to affect skin permeation and tolerance, depending on occlusion or breathability. In order to avoid any type of incompatibility the release liner must be fully inert to the ingredients. It must also be flexible, comfortable and must have good affinity with the adhesive and excellent printability. The most common release liners are polypropylene, polyesters, PVC and nylon.

**Release Liners**
An anti-adherent coating will be covering the release liners. The role of the release liner is to protect the system when it is in the package, it will be removed just before the application of TDDS to the skin. Release liners play an important role in the stability, safety and affectivity of the patch. Care should be taken to choose the release liners. An incorrect release liner will not permit the easy release of the patch, and can interfere with the active(s) or other components, thereby reducing its shelf life. The most common films used as release liners are paper-based, plastic film-based and composite films. The two major classes of coating are silicones and fluro-polymers.

**Pressure Sensitive Adhesives**
For both types of TDDS, pressure-sensitive adhesives (PSAs) play an important role, by serving as the matrix that carries the active like additives and permeation enhancers and the means for making the patch stick to the skin. There are three categories in PSAs: rubber-
based, acrylic in the form of acrylic solutions, emulsion polymers or hot melts, and silicon PSAs. For each category there are several sub-categories that give the required flexibility to the patch.

**Penetration Enhancers**

These are the completely different chemical substances that belong to the same family by characteristics. They increase the permeation rate by several times of the active ingredient through the skin. This enhances the feasibility of a system, because most of the actives do not enter the skin in the required dosage through a relatively small area. Sometimes a combination of these ingredients is needed to create the correct enhancing effect. These are the agents which promote the skin permeability by altering the skin as a barrier to the flux of desired penetrate.

**EVALUATION PARAMETERS**

**Thickness**

The thickness of transdermal film is determined by travelling microscope, dial gauge, screw gauge or micrometre at different points of the film.

**Uniformity of Weight**

Weight variation is studied by individually weighing 10 randomly selected parches and calculating the average weight. The individual weight should not deviate significantly from the average weight.

**Drug Content Determination**

An accurately weighted portion of film (about 100 mg) is dissolved in 100 ml of suitable solvent in which drug is soluble and then the solution is shaken continuously for 24 hrs. in shaker incubator. Then the whole solution is sonicated. After sonicated and subsequent filtration, drug in solution is estimated spectrophotometrically by appropriate dilution.

**Moisture Content**

The prepared film are weighed individually and kept in a desiccators containing calcium chloride at room temperature for 24 hrs. The films are weighed again after a specified interval until they show a constant weight.
Swelling Index
Weighed pieces 1x1 cm² of film were immersed in distilled water; at 5, 10, 30, 60 min. Soaked films were removed from the medium at predetermined time, blotted to remove excess liquid and weighed immediately. The swelling index was calculated from the weight increase, as follows.

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\text{Swelling Index} = \frac{(W2-W1)}{W1}
\]
Where, W1 and W2 are the weight of the film before and after immersion in the medium, respectively.

EVALUATION OF ADHESIVES
Peel Adhesion Properties
Peel adhesion is the force required to remove an adhesive coating form a test substrate. This properties are affected by the molecular weight of the adhesive polymer, the type and amount of additives, and polymer composition. It is tested by measuring the force required to pull a single coated tape, applied to a substrate, at an 180° angle.

Figure 9: Peel Adhesion Test.

TACK PROPERTIES
Tack is ability of the polymer to adhere to substrate with little contact pressure. It is dependent on the molecular weight and composition of polymer as well as the use of tackifying resin in the polymer. Tests for tack include.

ROLLING BALL TEST
This test involves measurement of the distance that a stainless steel ball travels along an upward facing adhesive. The less tacky the adhesive, the further the ball will travel.
Quick-Stick (Or Peel-Tack) Test
The peel force requires breaking the bond between an adhesive and substrate is measured by pulling the tape away from the substrate at 90° at a speed at 12 inch/min. The force is recorded as the tack value and is expressed in ounce or grams per inch width with higher values indicating increasing tack.

Probe Tack Test
In this, the tip of probe with defined surface roughness brought in to contact with adhesive and when the bond is formed between the adhesive a probe, removal of probe at a fixed rate away from the adhesive which break the bond. The force required to break the bond is recorded as tack and it is expressed in grams.

Shear Strength Properties
Shear strength is the measurement of the cohesive strength of an adhesive polymer. It is affected by molecular weight as well as the type and amount of tackifier added. Shear strength or creep resistance is determined by measuring the time it takes to pull an adhesive coated tape off a stainless steel plate when a specified weight is hung from the tape which pulls the tape in a direction parallel to the plate.
RESULT AND DISCUSSION

The ultimate aim of the transdermal patch is to release its medicament into the systemic circulation. From the bloodstream it will go into the site of action and will elicit pharmacological action. In order to enter into the systemic circulation, the drug molecule after being diffused throughout the cell membrane has to permeate through the different layers of the skin in order to reach to the systemic circulation. The drugs need to cross the layer of skin and the drug will bind to the particular target receptor and will elicit pharmacological action. In the blood stream drug will release in ascertains rate while the drug reservoir release the drug slower to maintain steady state. It is a Simple technique for patient to use, and fully disposable. TDDS is a unique manufacturing techniques result in very low cost and more accurate, reliable delivery of drug to epidermis or dermis, circumventing the stratum corneum. In this route of administration are passive or active drug delivery profiles.

CONCLUSION

Due to the recent advances in technology and the incorporation of the drug to the site of action without rupturing the skin, membrane transdermal route is effective. This study provides valuable information regarding the formulation and evaluation aspects of transdermal drug delivery systems. TDDS is a realistic practical application as the next generation of drug delivery system. This article provides valuable information regarding the transdermal drug delivery systems, different type of patches, components and its evaluation process. The foregoing shows that TDDS have great potentials, being able to use for both hydrophobic and hydrophilic active substance into promising deliverable drugs. Many drugs have been formulated in TDDS form, such as hormonal therapy, wide range of analgesics, drugs of heart diseases, for avoiding GI effects and first pass metabolism. The better understanding of the skin physiology and anatomy helps us in further development in this
field. To optimize this drug delivery system, greater understanding of the different mechanisms of biological interactions, and polymer are required.

REFERENCES