INTRODUCTION

Transdermal delivery may be defined as the delivery of a drug through intact skin so that it reaches the systemic circulation in sufficient quantity to be beneficial after administration of a therapeutic dose. TDS provides a variety of advantages inherent in the transdermal route, including elimination of gastrointestinal absorption problems and hepatic first pass effect, reduction of dosage and dose interval, predictable and extended duration of activity, improved patient compliance, and quick termination by simple removal of the system from the skin surface, and possible self administration [Kenji Sugibayashi et al., 1994]. Various transdermal drug delivery technologies are described including the use of suitable formulations, carriers and penetration enhancers. The most commonly used transdermal system is the skin patch using various types of technologies. Transdermal technologies may be applied for several categories of pharmaceuticals used for the treatment of disorders of the skin or for systemic effect to treat diseases of other organs. Several transdermal products and applications include hormone replacement therapy, management of pain, angina pectoris, smoking cessation and neurological disorders such as Parkinson's disease [K.P.Sampath Kumar et al., 2010].

Transdermal Permeation

Skin is the most intensive and readily accessible organ of the body as only a fraction of millimeter of tissue separates its surface from the underlying capillary network. Skin was considered as an impermeable protective barrier, but later investigations were carried out which proved the utility of skin as a route for systemic administration. The various steps involved in transport of drug from patch to systemic circulation are as follow [Geeta Aggarwal et al., 2009].

- Diffusion of drug from drug reservoir to the rate controlling membrane.
- Diffusion of drug from rate limiting membrane to stratum corneum.
- Sorption by stratum corneum and penetration through viable epidermis.
- Uptake of drug by capillary network in the dermal papillary layer.
• Effect on target organ.

Basic Components of TDDS

- Polymer matrix / Drug reservoir
- Drug
- Permeation enhancers
- Pressure sensitive adhesive (PSA)
- Backing laminates
- Release liner
- Other excipients like plasticizers and solvents

**Polymer matrix / Drug reservoir:**

Polymers are the backbone of TDDS, which control the release of the drug from the device. Polymer matrix can be prepared by dispersion of drug in liquid or solid state synthetic polymer base. Additionally they should provide consistent and effective delivery of a drug throughout the product’s intended shelf life and should be of safe status [Guyot M, et al., 2000, Gabiga H et al., 2000, Minghetti P, et al., 1999].

- **Natural Polymers**: e.g. cellulose derivatives, gelatin, shellac, waxes, gums, and chitosan etc.
- **Synthetic Elastomers**: e.g. poly butadiene, poly isobutylene, silicon, nitrile, acrylonitrile, neoprene, butyl rubber etc.
- **Synthetic Polymers**: e.g. polyvinyl alcohol, polyvinylchloride, polyethylene, polypropylene, polyacrylate, polyamide, polyurea, poly vinyl pyrrolidone, polymethyl methacrylate etc.

**Drug**: The foremost requirement of TDDS is that the drug possesses the right mix of physicochemical and biological properties for transdermal drug delivery [Chung SJ, et al., 1999, Izumoto T, et al., 1992]. It is generally accepted that the best drug candidates for passive adhesive transdermal patches must be non ionic, of low molecular weight
(less than 500 Daltons), have adequate solubility in oil and water (log P in the range of 1-3), a low melting point (less than 200°C) and are potent (dose in mg per day) [Gordon RA et al., 2003].

**Permeation Enhancers:** These are the chemical compounds that increase permeability of stratum corneum so as to attain higher therapeutic levels of the drug candidate [Williams AC et al., 2004].

**Pressure sensitive adhesives:** A PSA is a material that helps in maintaining an intimate contact between transdermal system and the skin surface. It should adhere with not more than applied finger pressure, be aggressively and permanently tachy, exert a strong holding force. Additionally, it should be removable from the smooth surface without leaving a residue.

**Backing Laminate:** The most comfortable backing will be the one that exhibits lowest modulus or high flexibility, good oxygen transmission and a high moisture vapor transmission rate [Pfister WR et al., 1990, and Godbey KJ et al., 1996] Examples of some backing materials are vinyl, polyethylene and polyester films.

**Release Liner:** During storage the patch is covered by a protective liner that is removed and discharged immediately before the application of the patch to skin Typically, release liner is composed of a base layer which may be non-occlusive (e.g. paper fabric) or occlusive (e.g. polyethylene, polyvinylchloride). [Foco A et al., 2004].

**Other excipients:** Various solvents such as chloroform, methanol, acetone, isopropanol and dichloromethane are used to prepare drug reservoir [Khatun M et al., 2004]. In addition plasticizers such as dibutylphthalate, triethylcitrate, polyethylene glycol and propylene glycol are added to provide plasticity to the transdermal patch [Gondaliya D. et al., 2003]