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Research Article

# Design and physico-chemical evaluation of cetirizine dihydrochloride transderml patches

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**ABSTRACT**

Transdermal therapeutic system of cetirizine dihydrochloride with different polymers like hydroxyl propyl methyl cellulose (HPMC), polyvinyl pyrolidine (PVP), ethyl cellulose(EC), either in individual or combination were used, with or without rate controlling membrane of 1%W/V of ethyl cellulose. All the patches were prepared by added 30%W/V of di butyl phthalate (DBP) as plasticizer to make the film flexible and free from brittleness and the solvent used was ethanol as common solvent. The prepared patches were evaluated for various physic-chemical parameters like thickness, weight variation, folding endurance, water absorption capacity, percentage moisture loss, percentage moisture absorption, weight variation, tensile strength & percentage elongation and drug content uniformity.

**Keywords:** Transdermal therapeutic system (TTS); cetirizine dihydrochloride (CTZ); hydroxy propyl methyl cellulose (HPMC)

## INTRODUCTION

To control the allergic diseases or disorders are public health concern in so many countries. Cetirizne dihydrochloride is non-sedative classification of antihistaminic drugs and used in the treatment and management of allergic conditions with the recommended dose of 5 mg twice a day or 10 mg once in a day. But management of allergic conditions needs the blood concentration of drug in a steady manner for better results, so alternate route of administration is adopted by prepared in transdermal therapeutic system of cetirizine dihydrochloride.

## MATERIALS AND METHODS

Cetirizine dihydrochloride was obtained as gift sample from micro labs ltd, Bangalore. HPMC K-10, PVP K-30, EC 14cps, ethanol, DBP were purchased from S.D fine chemicals Ltd, India. All other chemicals used were of analytical grade.

### Preparation of matrix patches

Polymers of ethyl cellulose, hydroxyl propyl methyl cellulose and polyvinyl pyrolidine were accurately weighed and dissolved individually or combinations in 5 ml of ethanol. The drug was then dispersed in the polymeric solution and then plasticizer of dibutyl phthalate was added. The solution was stirred to attain semisolid like consistency and casted on a glass substrate containing 'o' ring, the rate of evaporation of solvent from polymeric solution was controlled by placed an inverted funnel at room temperature for a day (Samanta, 2002; Kulkarni, 2002; Singh, 1993; Kanikannan, 1993). The formed films were separated. Formulation of cetirizine dihydrochloride of patches was given in table. No: 1.

### Preparation of rate controlling membrane

Ethyl cellulose 1% W/V was dissolved in ethanol of 5 ml, to this plasticizer of dibutyl phthalate was added, the solution was mixed to get the semisolid like consistency and casted on a glass substrate containing 'o' ring, the rate of evaporation of solvent from polymeric solution was controlled by placed a inverted funnel at room temperature for a day. The drug contained patch was fixed with rate controlling membrane by ethanol, then wrapped in aluminium foil and stored in a desiccator (Sankar, 2003).

### Physico – Chemical evaluation of transdermal patches

**Thickness:** Film thickness was measured by a screw guage at three different points on the film. Then an average reading was taken (Chowdary, 1992).

**Weight variation:** Each film was weighed individually, then the average weight of six films taken as the weight of the film (Koteshwar, 1992).

**Folding endurance:** Folding endurance of the film was determined by repeatedly folding a small strip

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| Formulation code | Thickness (mm) | Weight variation (mg) ± SD | Folding endurance (no) ± SD | Water absorption capacity (mg) ± SD | Percentage moisture loss ± SD | Percentage moisture absorption ± SD | Water vapor transmission rate gm.mm/cm$^2$. 24hrs ±SD | Tensile strength and percentage elongation Kgf/cm$^2$ | Drug content uniformity (mg) |
|---|---|---|---|---|---|---|---|---|---|
| C1 | 0.1 | 61.37 ± 0.31 | 218.50 ± 08.52 | 2.21 ± 0.03 | 3.93 ± 0.04 | 4.15 ± 0.04 | 6.03 x $10^{-5}$ ± 0.34 | 240.73 & 0.290 | 9.54 ±0.17 |
| C2 | 0.15 | 110.80 ± 0.07 | 237.00 ± 12.71 | 4.33 ± 0.03 | 4.21 ± 0.12 | 4.09 ± 0.03 | 1.72 x $10^{-4}$ ± 0.05 | 237.53 & 0.284 | 9.58 ±0.19 |
| C3 | 0.08 | 61.21 ± 0.05 | 216.83 ± 06.44 | 1.84 ± 0.03 | 3.29 ± 0.07 | 3.50 ± 0.05 | 3.87 x $10^{-5}$ ± 0.33 | 222.41 & 0.279 | 9.62 ± 0.24 |
| C4 | 0.13 | 110.25 ± 0.09 | 225.00 ± 04.28 | 3.16 ± 0.02 | 2.94 ± 0.04 | 3.09 ± 0.03 | 1.17 x $10^{-4}$ ± 0.05 | 200.32 & 0.279 | 9.62 ± 0.12 |
| C5 | 0.09 | 61.44 ± 0.13 | 222.33 ± 10.35 | 2.04 ± 0.04 | 3.57 ± 0.04 | 3.82 ± 0.05 | 4.95 x $10^{-5}$ ± 0.23 | 189.51 & 0.273 | 9.66 ± 0.23 |
| C6 | 0.12 | 110.43 ± 0.08 | 230.66 ± 07.76 | 4.23 ± 0.04 | 4.01 ± 0.05 | 3.87 ± 0.03 | 1.21 x $10^{-4}$ ± 0.05 | 222.01 & 0.282 | 9.79 ± 0.17 |
| C7 | 0.18 | 160.85 ± 0.12 | 242.00 ± 10.50 | 6.10 ± 0.20 | 3.93 ± 0.03 | 4.15 ± 0.03 | 2.13 x $10^{-4}$ ± 0.11 | 231.52 & 0.286 | 9.83 ± 0.12 |

measuring 2 x 2 cm size at same place till it breaks (Manvi, 2003).

**Water absorption capacity:** Three film units of each formulation were kept in an atmosphere of relative humidity RH = 82%. For one week and the difference in weight of the film was taken as the water absorption capacity for that film (Koteshwar, 1992).

**Percentage moisture loss:** The films were weighed accurately and kept in a desiccator containing anhydrous calcium chloride. After 3 days, the films were taken out and weighed (Kusumdevi, 2003).

$$Percentage\ moisture\ loss\ = \frac{Initial\ weight - Final\ weight}{Initial\ weight} \times 100$$

**Percentage moisture absorption:** The percentage moisture absorption was studied by placing preweighed six films in a desiccator containing 100ml of saturated solution of aluminium chloride, which maintained 79.5% RH. After 3 days, the films were taken out and weighed (Lewis shaila, 2006).

$$Percentage\ moisture\ absorption\ = \frac{Final\ weight - Initial\ weight}{Initial\ weight} \times 100$$

**Water vapor transmission rate:** The vials of equal diameter were used as transmission cells. These cells were washed and dried. About one gm of fused calcium chloride was taken in the cells and the films were fixed over the brim with the help of solvent. Then the cells were weighed accurately and kept in a closed desiccator containing saturated solution of potassium chloride [200ml]. The cells taken out and weighed after 1,2,3,4,5,6 and 7$^{th}$ day of storage. From increased in the weights, the rate of water vapor transmitted were calculated (Kulkarni raghavendra, 2000).

$$WVT\ Rate\ = \frac{WL}{S}$$

where

W – gm of water transmitted

L – Thickness of film

S – Exposed surface area of film.

**Tensile strength & percentage elongation:** The tensile strength and percentage elongation of film was measured by using tensile strength instrument. A film strips with the dimension [15 cm x 7.5 cm] and free from air bubbles (or) physical imperfection were prepared. This test was carried out with 50% humidity at 20$^{o}$C. The cross head speed employed were 100 mm / min, with full scale load range of 500 Kgf. The force and percentage elongation were measured, when the films were broken (Panigrah, 2002).

**Drug content uniformity:** The film units of each formulation were cut in to smaller pieces, placed in media and then dissolved and made up to 100 ml in volumetric flask. From this sample was taken and analyzed for drug content by U.V. Spectrophotometer at 239 nm after dilution (Gupta, 2009).

## RESULTS AND DISCUSSION

The prepared films of cetirizine dihydrochloride with polymers of hydroxyl propyl methyl cellulose, ethyl cellulose, poly vinyl pyrolidine either in combination or individual were found to be thin, flexible, smooth and transparent. The method adopted for casting the patch on the 'o' ring of glass substrate was found to be satisfactory.

The physico-chemical evaluation data of cetirizine dihydrochloride reveals that, no change in physical character of patches like appearance, color and flexibility when stored at room temperature. The thickness of the prepared patches was between 0.08 mm to 0.18 mm for formulation C3 & C7 respectively and found to be uniform in a patch at different surfaces, also thickness was increases with increasing concentration of hydrophilic polymers. Weight variation of patches was lowest value for formulation C4 as 0.23% and highest for formulation C5 as 0.72% remaining formulations were within these ranges. Folding endurance value were 216.83 ± 6.44 numbers for formulation C3 and 242 ± 10.50 numbers for formulation C7 other formulations were within these ranges, which shown that polymers of hydrophilic in nature and high in concentration were good in flexibility. Drug content uniformity of prepared patches were between the value of 9.54 ± 0.17 mg and 9.83 ± 0.12 mg, all the formulations were

containing above 95% of drug, which proves that the method adopted for formulation of the transdermal patches of cetirizine dihydrochloride was good. Water absorption capacity of prepared patches were found to be low with formulation C3 as 1.84 ± 0.03 % due to hydrophobic nature of polymer and high with formulation C7 as 6.10 ± 0.20 % due to high concentration of hydrophilic polymer. Percentage moisture loss of patches was found to be low with formulation C4 as 2.94 ± 0.04 % due to hydrophobic nature of polymer and high with formulation C2 as 4.21 ± 0.12 % due to high concentration of hydrophilic polymer. Percentage moisture absorption of patches were found to be low with formulation C4 as 3.09 ± 0.03 % due to high concentration of hydrophobic nature of polymer and high with formulation C7 as 4.15 ± 0.03 % due to high concentration of hydrophilic polymer. Water vapor transmission rate was low with formulation C3 as 3.87 x $10^{-5}$ ± 0.33 gm.mm/$cm^2$. 24hrs due to hydrophobicity of polymers reduces the permeability of moisture and high with formulation C7 as 2.13 x $10^{-4}$ ± 0.11 gm.mm/$cm^2$. 24hrs due to hydrophiicity of polymer. Tensile strength & percentage elongation of prepared patches was found to be low with formulation C3 as 196.66 & 20.42 Kgf / $cm^2$ due to low concentration of polymer and its hydrophobicity and high with formulation C7 as 230.31 & 28.78 Kgf / $cm^2$ due to high concentration of polymer and its hydrophilicity.

## CONCLUSION

The selection of polymers for the design of matrix type of transdermal patches formulation and rate controlling membrane of cetirizine dihydrochloride are difficult. In the present research we concludes that the drug cetirizine dihydrochloride along with the polymers of PVP, HPMC & EC and plasticizer of DBP produces smooth flexible patches with good tensile strength & percentage elongation.

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