EVALUATION OF DESIGNED HERBAL TRANSDERMAL DRUG DELIVERY SYSTEM

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Summary

In present study, Transdermal Drug Delivery System (TDDS) of herbal drugs is used to check a feasibility of herbal drugs in such a novel drug delivery system. Fruits powder was successively extracted with petroleum ether and acetone using soxhlet apparatus. Blank polymeric film was developed by mercury substrate method using various combinations of polymers, copolymers, plasticizer and penetration enhancers. Incorporating acetone extract of *Momordica charantia* developed medicated polymeric film. TDDS patches were prepared using blank and medicated polymeric film. Combination of herbal extract and novel drug delivery system shows significant and improved activity.

Key words: Transdermal, mercury substrate method, *Momordica charantia*.

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Introduction

Transdermal drug delivery systems (TDDS) are defined as self-contained, discrete, dosage forms, which deliver the drugs through the skin at controlled rate to systemic circulation [(1)]. TDDS have advantages like steady infusion rate, low daily dose, self-administration, improved patient compliance, and increased therapeutic value therefore TDDS preferred for herbal drug formulation [(2)]. Diabetes is defined as a state in which homeostasis of carbohydrate and lipid metabolism is improperly regulated by insulin. This results primarily in elevated fasting and postprandial blood glucose levels. If this imbalanced homeostasis does not return to normalcy and continues for a protracted period, it leads to hyperglycemia that in due course turns into a syndrome called diabetes mellitus. [(3)] Diabetes mellitus is caused either by a lack of the hormone insulin (Type I diabetes) or the body's inability to use insulin (Type II diabetes also known as maturity-onset diabetes). [(4)] The early symptoms of untreated diabetes are related to elevated blood sugar levels, and loss of glucose in the urine. High amounts of glucose in the urine can cause increased urine output and lead to dehydration. [(5)] *Momordica Charantia* is plant grows in tropical regions.[(6)] It's a slender, climbing annual vine with long-stalked leaves and yellow, solitary male and female flowers borne in the leaf axils. The fruit appears as a warty gourd, usually oblong and resembling a small cucumber. [(7)] It contains many type of chemical constituent such as alkaloids, terpenoids and flavonoids. Various medicinal properties are claimed for *Momordica charantia* that include antidiabetic, abortifacient, anthelmintic, contraceptive. Unripe fruits successive acetone extracts was used for preparation TDDS.

Materials and Methods:

Preparation of extracts:

The plant material was collected from Pune and authenticated by botanical survey of India, Pune with Voucher Specimen No. SPM1P/BSI/WC/Tech/2006/525.

Fresh unripe fruits of *Momordica charantia* were cut into small pieces, dried in shade, and powdered further. Powder was further extracted successively in soxhlet apparatus with petroleum ether and subsequently with acetone. Prepared extracts are stored in airtight container.

Preparation of TDDS:

Development of blank polymeric film:

Mercury substrate method. [8]: The solution of polymer was poured into a glass ring of 5.5 cm diameter placed on the surface of liquid mercury kept in a Petri dish. The solvent was allowed to evaporate under ambient conditions (temperature 30 °C) for 24 hours. The films could be removed intact by slowly lifting the glass ring from the substrate.

Materials used: Eudragit RL100, Eudragit E100, Polyvinyl Pyrolidone (K30), Dibutyl phthalate, Dimethyl sulphoxide, Dichloromethane and Isopropyl alcohol. Mixture of Dichloromethane and Isopropyl alcohol in ratio 50:50 as a solvent system

Incorporation of suitable plasticizer: The film composed of 6:4 ratio of polymer: copolymer was selected for incorporation of plasticizer. Polymeric solutions along with 20%, 25%, and 30% w/w concentrations of dibutylphthalate and PEG 400 separately as plasticizers were casted into films.[9]

Incorporation of suitable penetration enhancer: The film composed of 6:4 ratio of polymer: copolymer along with 25%w/w concentration of dibutylphthalate as plasticizer was selected for incorporation of penetration enhancer.[9] Polymeric solutions along with 25% w/w concentration of dibutylphthalate and 5% w/w concentration of DMSO separately as penetration enhancer were casted into films.

Preparation of blank polymeric films: Batches each of four films, each composed of 6:4 ratio of polymer: copolymer along with 25%w/w concentration of dibutylphthalate as plasticizer and 5% w/w concentration of DMSO were prepared. Medicated polymeric films were prepared by incorporating acetone extract in the polymeric solution.

Observation tables

Observations of blank polymeric films of Eudragit RL100+PVP K30:

Eudragit RL100: PVP K30	Observation
5:5	Brittle film
6:4	Easily removed
7:3	Difficulty in removal

Observations of blank polymeric films of Eudragit E100+PVP K30:

Eudragit E100: PVP K30	Observation
5:5	Brittle film
6:4	Easily removed
7:3	Difficulty in removal

Observations of blank polymeric films of Eudragit RL100 + PVP K30 with different plasticizers:

Eudragit RL100: PVP K30	Dibutylphthalate (ml)	Observation
6 : 4	2.5	Semisolid in nature with high surface gloss
6 : 4	1	Easily removed but sticky in nature
6 : 4	0.7	Easily removed flexible with high surface gloss

Evaluation of Blank polymeric film:

Parameter	Observation
Colour	Colourless, transparent with high gloss
Texture	Smooth on both side
Flexibility	Flexible but not flaking

Evaluation of medicated polymeric film (10 mg dose):

Parameter	Observation
Colour	Green colour with high gloss
Texture	Smooth on both side
Flexibility	Flexible but not flaking

Evaluation of medicated polymeric film (20 mg dose):

Parameter	Observation
Colour	Dark Green with no gloss
Texture	Smooth on both side
Flexibility	Flexible but not flaking

Thickness uniformity blank polymeric film:

Film	Thickness of film (mm)					Mean
1	0.43	0.45	0.43	0.44	0.43	0.444
2	0.43	0.45	0.46	0.42	0.44	0.44
3	0.44	0.42	0.43	0.41	0.43	0.426

Mean thickness = 0.4408 mm

Thickness uniformity medicated polymeric film (10 mg):

Film	Thickness of film (mm)					Mean
1	0.51	0.51	0.52	0.54	0.53	0.522
2	0.53	0.54	0.52	0.55	0.51	0.53
3	0.54	0.52	0.53	0.54	0.53	0.532

Mean thickness = 0.5296mm

Thickness uniformity medicated polymeric film (20 mg):

Film	Thickness of film (mm)					Mean
1	0.55	0.56	0.54	0.57	0.55	0.554
2	0.52	0.54	0.55	0.57	0.55	0.546
3	0.51	0.53	0.54	0.54	0.53	0.53

Mean thickness = 0.5452 mm

Uniformity of Weight blank film:

Film	Weight (gm/cm^2)
1	0.0634
2	0.0622
3	0.0723

Mean weight = 0.0659 gm/cm^2

Uniformity of Weight medicated film (10 mg):

Film	Weight (gm/cm^2)
1	0.0671
2	0.0665
3	0.0689

Mean weight = 0.0675 gm/cm^2

Results and Conclusions

In the present scenario of newer drug delivery system. Herbal extracts, which are very useful today they are mostly given by oral route in the form of vati or in most popular form of syrups. Although transdermal drug delivery system has been tried for the synthetic drugs but not yet applied for the herbal drugs. It is due to the fact that the method for the estimation of active constituents of many of these drugs is not known and if it is known, the main hurdle in this is the pharmcokinetic data of these drugs is not available. Diabetes is disorder in which homeostasis of the carbohydrate and lipid metabolism was not maintained by Insulin, which is major increasing problem in the world. There are many synthetic drugs available to treat this but on the safer side herbal extracts are also very useful abundant in nature. Herbal extracts are given generally by oral route. It will make significant contribution to modify current developed TDDS or develop altogether new TDDS of the same drug to prepare TDDS showing sustained activity for longer duration of time. Today transdermal drug delivery system is one of the important novel drug delivery system so by incorporation of the herbal extract in the polymeric film herbal TDDS were prepared. Elaboration on release profile and characterization of pharmacokinetic data was untouched part of the project which can be undertaken in future.

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References

1. Misra AN, Transdermal Drug Delivery, Controlled and Novel Drug Delivery, CBS Publishers and Distributors, New Delhi, 1997, 100-129.
2. Suhonen TM, Bouwstra JA, Urtti A, Chemical enhancement of percutaneous absorption in relation to stratum corneum structural alterations. J Control Rel, 59 1999, 149-161.
3. Khandavilli S, Nair V, Panchagnula R, Polymers in transdermal drug delivery systems. Pharm Tech 2002, 62-80.
4. Hardman JG, Limbird LE, Goodman and Gillman's The Pharmacological basis of Therapeutics, Edn 10.,McGraw-Hill Medical Publishing Division, United States of America, 2001, 1679-1714.
5. Harsh M, Text Book of Pathology, Edn 5, Jaypee Publications, New Delhi, 2005, 842-853.
6. Grover JK, Yadav SP, Pharmacological actions and potential uses of *Momordica Charantia: a* review, J Ethnopharmacol 2004, 93,123-132.
7. Kokate CK, Purohit AP, Gokhale SB, Pharmacognosy, Edn 25, Nirali Prakashan, Pune, 2003, 97-132.
8. Aquil M, Sultana Y, Ali A, Matrix type transdermal drug delivery systems of Metoprolol tartrate: In vitro characterization, Acta Pharm, 53, 2003 119-125.
9. Gondaliya D, Pundarikakshudu K, Studies in formulation and Pharmacotechnical evaluation of controlled release transdermal delivery system of Bupropion. Pharm Sci Tech, 4, 2003, 1-9.