Technology and Health Care 15 (2007) 237–245
IOS Press

Iontophoretic drug delivery system: A review

Ajay Semalty[a,*], Mona Semalty[a], Ranjit Singh[b], Shailendra K. Saraf[b] and Shubhini Saraf[c]
[a]*Department of Pharmaceutical Sciences, H.N.B.G. University, Srinagar* (*UA*), *India*
[b]*Faculty of Pharmacy, NIEC, Lucknow* (*UP*), *India*
[c]*Faculty of Pharmacy, B.B.D.N.I.T.M. Lucknow* (*UP*), *India*

Received 25 September 2006
Revised /Accepted 8 January 2007

Abstract. Among the recent developments in the field of transdermal drug delivery, iontophoresis has emerged as a very promising tool for this purpose. Various studies have been performed on drug delivery through the skin using electric current. Iontophoresis has thereby been found to be effective in particular in transdermal protein and peptide drug delivery. This article reviews the principle, potential benefits, and applications of drug delivery based on iontophoresis. It focuses furthermore on current research and future trends in the field of iontophoretic drug delivery.

Keywords: Iontophoresis, transdermal drug delivery, iontophoretic systems

1. Introduction

The skin functions as a physical, chemical and microbial barrier for transdermal transport. It is divided into three layers, viz. the subcutaneous tissue, the dermis and the epidermis. The outermost bilayer of the skin, denoted as stratum corneum, represents generally the primary barrier for transport across the skin [31]. Yet, the skin permits the passive absorption of lipophillic low molecular weight drugs in quantities that may be sufficient to cause local or systemic effects.

Drugs with a short biological half life and a therapeutic value of less than 10 mg per day are suitable candidates for transdermal drug delivery [12]. However, skin irritation or contact dermatitis which may be caused by the drug, as well as the need for excipient and permeation enhancers may represent a limitation for transdermal drug delivery. Also the barrier function of the skin changes from one site to another on the same person, from person to person and with age [26].

For passive transdermal transport, it has been established that diffusion through the lipid layers is the dominant transport mechanism [41]. In order to penetrate the stratum corneum passively, i.e., by diffusion, a drug must have a number of necessary physicochemical properties. Factors that affect transdermal permeation are the lipophilicity, molecular weight, solubility and concentration of the drug. In turn, active transdermal transport can be supported electrically by applying an electric field across the skin. Electrically enhanced delivery is in particular of use for larger, hydrophilic molecules which is especially advantageous for peptide and oligonucleotide drug administration [14,18]. In consideration of all of these factors, iontophoresis has been put forward as a means for a controllable and reliable

*Address for correspondence: Dr. A. Semalty, Department of Pharmaceutical Sciences, H. N. B. Garhwal University, Srinagar-Garhwal – 246174, India. Tel.: +91 1346 211575; E-mail: semaltyajay@yahoo.co.in.

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