Iontophoretic Materials

Fernanda Cunha[1,2], Maria Madalena Forte[2], Andrew Barnes[1], Roger Linford[3] and Walkiria Schlindwein[1]

[1.] Leicester School of Pharmacy, Faculty of Health and Life Sciences, De Montfort University, Leicester, LE1 9BH - UK
[2.] Laboratório de Materiais Poliméricos (Lapol) – Universidade Federal do Rio Grande do Sul (UFRGS) Porto Alegre – Brazil.
[3.] Research Office, De Montfort University, LE1 9BH - UK

An iontophoretic device is an electrically powered analogue of a passive skin patch, in which ionic drugs are passed transdermally into the bloodstream from an external reservoir. The reservoir needs to fulfil a number of conditions including

- skin compatibility (although protective gels can ameliorate this)
- a relatively high drug content which does not significantly evaporate or leak over time
- reasonable ionic conductivity so that the ionic drug will travel under an electrochemical field gradient
- dimensional stability so that this part of the device does not deform over time
- flexibility so that maximum contact with the skin is maintained.

These characteristics are very similar to those offered by a range of polymer electrolyte materials developed for Li Polymer battery applications[1], including batteries for medical applications[2]. The first polymer electrolytes to be developed were based on Poly (ethylene oxide), PEO[3] and a number of iontophoretic reservoir materials based on PEO have been developed [4-6].

During the past 30 years, the conductivities of PEO-based polymer electrolytes have been substantially increased by the incorporation of plasticizers and fillers, the development of co-polymers and the use of interpenetrating networks (IPNs)[7]. For example, an IPN based on a castor oil / polyethylene glycol polyurethane network with PMMA has been shown to be mechanically and thermally stable and to have acceptable conductivity and diffusion behaviour[5]. There is a slight problem with passive diffusion; it is hoped to report further studies to overcome this drawback.

A frequent problem associated with mixed morphology polymers such as unmodified PEO is a propensity to form insulating crystalline regions which degrade both the conductivity and the flexibility of the potential reservoir material. Studies of the electrochemical and mechanical properties of PEO-Lidocaine hydrochloride cast films relative to those of the "classic" PEO-LiCl polymer electrolyte materials have established that suitable drug concentrations can substantially affect the degree of crystallinity and T_m for the crystalline regions[6]. Lidocaine is both a local anaesthetic (popular in dentistry) and an antiarrhythmic drug and Li^+ , as well as being the optimum cation for battery use on account of its low mass and volume, is the drug of choice for the treatment of manic-depression.
Further work on the mechanical and conductivity properties of iontophoretic reservoir materials is in progress and will be reported at this meeting.

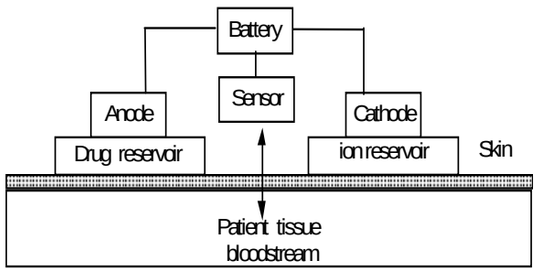

Fig 1: Schematic representation of an integrated iontophoretic system

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