Transdermal and Transmucosal Drug Delivery Technologies

Systemic therapy with pharmaceutical actives often causes severe side-effects, e.g. gastrointestinal bleedings in case of the most prominent representatives of non-steroidal anti-inflammatory drugs (NSAIDs) million fold used every day in the treatment of pain and inflammation. Therefore a local administration of e.g. NSAIDs is advantageous for the treatment of local pain or inflammation processes. However, the main hurdle to be overcome with such a local administration is penetration by the drug of the skin barrier.

Mechanism of skin penetration

The skin has an extremely good barrier function, and to improve topical bioavailability it is usually necessary to employ enhancement strategies. Based on the current scientific knowledge, it appears very likely that drug penetration into and through the skin involves a most complex interaction of various mechanisms and factors, such as diffusion processes of the active along chemical and/or electro-chemical gradients and sophisticated interactions of certain formulation ingredients with special components and structures of the skin.

Safety aspects of drug delivery systems

Overcoming the barrier function of the skin already poses a great challenge to modern drug delivery systems, but no less important are safety and tolerability aspects. In the past, many common drug penetration enhancement strategies turned out to destroy the natural barrier function of the skin and cause irritations and other partially severe side-effects.

Regulatory demands and production costs

However, even proven and superior efficacy and safety do not make a successful international drug delivery technology. New products have to comply with all international regulatory demands and allow production at competitive costs in comparison to even conventional ointments and gels.

Liposome technology

Since their discovery by Sir Alec D. Bangham in 1961, liposomes and their potential use as drug delivery vehicles have been investigated by almost all scientific groups in industry and academia. Nevertheless, until today only a few pharmaceutical liposomal products have been approved and marketed. Lack of stability and extraordinary high production costs have turned out to be the main obstacles for these promising new drug carriers. Nevertheless, there is still an interesting potential to use liposomes as vehicles for instance for oligonucleotides, DNA, RNA or other biologics.

Aqueous nano- and microemulsions

Microemulsions are clear, stable, isotropic liquid mixtures of oil, water and surfactant, frequently in combination with a cosurfactant. Microemulsions are highly dynamic systems in which contained substructures are subject to permanent destruction and rebuilding. Structures, as for instance detected by electron microscopy, thus simply reflect a momentary condition or structure. Over the last few years there has been a steadily increasing interest in the pharmaceutical use of microemulsions as drug delivery systems.

Microemulsions may offer the following features:
- much enhanced penetration and permeation of pharmaceutically active substances through the skin barrier
- creation of drug depots guaranteeing a long-term effect at the target site and thus reducing the frequency of dosing and the total treatment time
- improved benefit/risk ratio (reduction in side-effects by prevention of toxic plasma concentrations)
- higher product safety by more accurate dosage, due to the more exact spray system
- rapid penetration of the whole formulation into the skin without leaving a residual fatty surface film (making surgical dressing unnecessary)
- no need for additional gelling substances, known to inhibit drug penetration
- no need for additional preserving substances, causing further problems in patients with allergies
- no gastro-intestinal or hepatic first-pass effects
- minimal risk of gastro-intestinal side-effects

Non aqueous reversed micellar solutions

Special non-aqueous and non-greasy technologies offer the potential to formulate, for instance, pharmaceutical actives known to be sensitive to chemical degradation in aqueous solutions. So far such actives have been offered with either very greasy or fatty ointments or in solutions or gels with a very high alcohol content (irritation potential). Special newly developed non aqueous reversed micellar solutions are very elegant and cosmetically attractive technologies especially for dermatology (corticosteroids, antimycotics and biologicals).

Noninvasive rapid systemic drug delivery

Over the last ten years there has been a particular interest in delivering drugs via the buccal/transmucosal route. This route offers
- a very fast and direct systemic bioavailability
- thus avoiding the hepatic first-pass effect and degradation in the gastrointestinal tract,
- a relatively permeable mucosa with a rich blood supply,
- ease of administration,
- high patient acceptance for administration into the oral cavity,
- and safe administration since the virtual lack of Langerhans cells makes the oral mucosa tolerant to potential allergens.

With the development of new delivery technologies in the area of buccal/transmucosal delivery e.g. pain relievers can be released in a very fast way.

New drug delivery technologies offer the potential to develop new safe and effective pharmaceutical products with even well-known and classical actives.

Please contact us for further information on the most interesting potential of drug delivery systems.

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