Optimization and characterization of lipid-based nanoparticles for topical therapy of psoriasis

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Abstract

Psoriasis is a common chronic, autoimmune and systemic inflammatory disease of the skin and joints and occurs in 2–3% of the population. It is characterized by well-demarcated thick erythematous plaques, red and scaly skin which most commonly appears on the elbows, knees, scalp and umbilicus area. Psoriasis is affected by genetic and environmental factors and is associated with co-morbidities counting: loss of quality of life, cardiovascular disease, among others [1–3]. The most important emerging treatments include topical treatments, phototherapy, systemic therapies and biological therapies, employed depending on the severity of the disease [4].
Lipid based carriers could be classified into particulate carriers and this type include solid lipid nanoparticles (SLNs) and nanostructured lipid nanoparticles (NLCs). In particular, NLCs consist of a mixture of solid and liquid lipids that produce nanosized carriers that interact better with skin cells making them very useful for improvement in dermal therapy. In this work, methotrexate was the drug selected for incorporation in the lipid-based nanoparticles as it is the 'gold standard in managing psoriasis' and has the ability to block certain enzymes which are involved in the autoimmune system [4].
The first step of this study was the optimization of some parameters for better development of NLCs in the following main criteria: average particle size between 200-300 nm and encapsulation efficiency of drug higher than 75%.
MTX-loaded NLCs were successfully prepared by hot emulsification/ high-shear homogenization using Witepsol E85 and lipid mygliol 812 as lipidic core and poly vinyl alcohol as surfactant. For this combination a 27-run, 3-factor, 3-level Box–Behnken design was employed to optimize the process according amount of surfactant, amount of drug and amount of liquid lipid. The characterization was conducted according to their physico-chemical properties such as: particle size, polydispersity index, surface potential and encapsulation efficiency. Size and polydispersity index are evaluated by dynamic light scattering and surface potential throughout a laser Doppler electrophoresis. For the encapsulation efficiency the concentration of non-incorporated MTX was determined by absorption spectroscopy..
The optimized nanoparticles were compared with another type of lipid nanoparticles, the SLNs, to identify the best carrier for MTX for this pathology.
The results of the current study warrant further exploration for the use of drug loaded NLCs as a controlled delivery system for topical therapy of psoriasis.

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