*Proceedings of the 5th International Conference on Nanotechnology: Fundamentals and Applications*
*Prague, Czech Republic,August 11-13, 2014*
*Paper No. 238*

# Follicular Targeting of Spironolactone via Nanostructured Lipid Carriers (NLCs) for Treatment of Alopecia: In-vitro Characterization, Ex-vivo Permeation and Irritation Studies

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## Extended Abstract

Spironolactone (SL) is a well-known therapeutic agent that is used mainly for its diuretic ability (Rathnayake, Sinclar, 2010). Recently, it gained a lot of attention for treating alopecia due to its potent anti-androgenic properties (Rathnayake, Sinclar, 2010a; Batterink et al., 2010). Owing to the absence of a topical SL formulation in the market for treating alopecia, dermatologists prescribe SL oral tablets which possess dose dependent side effects. Currently, there is growing interest for localized therapy for hair and scalp disorder through follicular targeting of drug molecules to provide high local drug concentration within the target site which subsequently minimize systemic side effects/toxicity Hoffman, 2006). Accordingly, the objective of this study is to improve SL efficiency and safety in treating alopecia by preparing nanostructured lipid carriers (NLCs) with suitable size necessary for topical follicular targeting. The proposed NLCs were prepared by emulsion solvent diffusion and evaporation method using Compritol® 888 ATO as solid lipid and olive oil as liquid lipid. A complete $2^3$ factorial design was used to study the effect of three independent variables namely; the percent liquid lipid with respect to total lipid ($X_1$), surfactant concentration in aqueous phase ($X_2$) and percent Transcutol in liquid lipid ($X_3$) on entrapment efficiency (EE%), particle size (PS) and polydispersity index (PI). Formulations optimization was conducted using Design-Expert® software. The optimum NLCs formulations were further characterized by differential scanning calorimetry (DSC), powder X-ray diffractometry (PXRD), ex-vivo permeation and skin irritation histological studies. Results revealed that all of the prepared formulations were spherical in shape, with particle size ranging from 500-1381nm, and entrapment efficiency greater than 70%. DSC thermograms and XRD diffractograms revealed that spironolactone existed in amorphous form in SLN formulations. The drug release behavior from the NLCs displayed an initial burst release phase followed by sustained release of SL. These results indicated that NLCs are suitable for targeting SL into the hair follicles due to their high loading capacity and controlled drug release properties. In summary, the results of this research proves that the localized delivery of spironolactone to the human hair follicle is a feasible approach that circumvent its oral side effects. The adopted approach can be further used to treat other androgen-mediated skin disorders like acne and seborrhea.

### References

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