Biophysics of human hair, effects of lipid nanoparticle treatment

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Abstract

Introduction: Since 2000, lipid nanoparticles have attracted much attention. These nanoparticles are colloidal carriers and due to their small size, they have many advantages over other carriers. Some of the advantages are high physical and chemical stability, biocompatibility, high loading capacity. These factors have made these nanoparticles a good choice for hair care products.

Methods: Van Krevelen-Hoftyzer and Hoy models were used for mathematical modeling of the solubility parameter to select the best components before the synthesis of lipid nanoparticles. Lipid nanoparticles synthesized by high-pressure homogenization technique. Dynamic Light Scattering (DLS) was used to characterize the physicochemical properties of the nanoparticles, including mean particle size and zeta potential. Field Emission Scanning Electron Microscopy (FE-SEM), Bicinchoninic acid assay (BCA) and spectrophotometer were used to determine hair structure changes. Mechanical changes of hair investigated by tensile testing and cytotoxicity of nanoparticles evaluated by MTT assay.

Results and discussion: The nanoparticles are in nano-sized and have high stability due to their zeta potential. Lipid nanoparticles protect hair by forming a thin film on the hair cortex and adhesion ability due to van der Waals forces between nanoparticles and hydrophobic interactions between physiological lipids and cuticle lipid layer. Also, according to the mentioned modeling, which considers polarity, structural symmetry, hydrogen bonding, bond energy and molar volume of constituent components, lipid-surfactant solubility affects particle size and lipid-drug solubility affects drug trapping efficiency.

Conclusion: The use of magnetic water instead of deionized water can improve the moisture effect of nanoparticles. Altering the physiological lipids of the nanoparticles and the loaded active ingredient more efficient lipid nanoparticles can be synthesized.

Keywords: Human hair structure, Nanostructured lipid carriers, UV filtration, Physiological lipids, Keratin fibre

Reference