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Next generation lipid nanoparticles for biomedical applications

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Abstract: Solid lipid nanoparticles (SLN) have gained huge interest in the field of biotechnology and drug delivery due to ability to load higher amount of lipophilic therapeutic moieties and ease of penetration through biological membranes. Our research group is focused on synthesis and characterization of solid and liquid lipids based next generation nanoparticle, also known as nanostructured lipid carriers (NLC), for improved physicochemical properties, enhance encapsulation efficiency and sustain the release of encapsulated therapeutic molecules. In our recent work, we have reported for the first time that careful optimization of solid and liquid content can provide a melting point which is required for thermoresponsive targeting (39-41°C) in various diseases. Thermoresponsive nature of these nanoparticles has been successfully evaluated in vitro for anti-inflammatory and anticancer drugs. In addition, these thermoresponsive lipid nanoparticles have shown potential to encapsulate theranostic metallic nanoparticles with different surface characteristics. To further evaluate thermoresponsive potential of lipid nanoparticles, we have extended our work to the synthesis of next generation lipid nanoparticles (as gel) for topical thermoresponsive drug release around inflamed skin temperature (32-34°C). Furthermore, lipid nanoparticles of short and medium chain fatty acids may also be interesting due to their antimicrobial properties. Another aim of our research group, also shown in this presentation, is to develop green methods for large scale production of nanoparticles that are feasible for our local pharmaceutical industry. These nanoparticles may also find application in drug-free treatment of infectious diseases due to free fatty acids on nanoparticle surface. In conclusion, we suggest next generation lipid nanoparticles as promising carrier system for sustained delivery of bioactive molecules, thermoresponsive targeting, antimicrobial activity as well as theranostic applications.

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