

# **Lipid liquid crystalline nanoparticles as potential systems for imaging and drug delivery**

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## **SUMMARY**

The primary objective of the presented doctoral dissertation was to determine the usefulness of liquid crystalline lipid nanoparticles based on glyceryl monooleate and phytantriol, stabilized with Pluronic F127, as potential systems for bioimaging and drug delivery. The second objective of the conducted research was to obtain new stable lipidic systems of liquid crystalline nanoparticles based on glyceryl monooleate doped with glyceryl monolaurate and to determine their antibacterial properties.

In the first chapter of the dissertation, the current state of nanotechnology in biomedical applications was presented. The strategies for utilizing nanosystems in targeted therapies and drug delivery, including cancer therapies, were discussed. Furthermore, the advantages of liquid crystalline lipid nanoparticles in biomedicine, such as high biocompatibility, were emphasized.

The second chapter provides a literature review and theoretical description of the lipids and surfactants used in the study for the synthesis of liquid crystalline lipid nanoparticles, as well as the physicochemical properties of liquid crystalline lipid phases. Additionally, the significance of conducting biological analyses on nanosystems with potential medical applications was discussed. This chapter also covers the fundamentals and principles of the research techniques employed in the study.

The third chapter presents the objectives and tasks of the work that contributed to their achievement.

The fourth chapter contains a description of the materials used and the procedures applied to conduct the planned analyses.

In the fifth chapter, the research results are presented and compared with the literature data. The synthesis results and physicochemical properties of liquid crystalline lipid nanoparticles based on glyceryl monooleate and phytantriol, such as hydrodynamic diameter, zeta potential, and internal structure, are initially described. Subsequently, the influence of these systems on HeLa and MSU 1.1 cells was presented, analyzing proliferative activity, reactive oxygen species levels, cytoskeleton integrity, genotoxicity, and internalization pathways. This chapter also includes the optimization of synthesis conditions for new liquid crystalline lipid nanoparticles based on glyceryl monooleate doped with sodium monolaurate, along with their physicochemical properties. Finally, the chapter also presents preliminary results of the cytotoxicity analysis of the optimized system and demonstrates the bacteriostatic properties of the investigated system.

In the summary, all the obtained results are consolidated, potential applications of liquid crystalline lipid nanoparticles as drug carriers and contrast agents are indicated, and the need for further research to confirm the mentioned potential is emphasized.