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ABSTRACT OF THE DISSERTATION

pt. „Preparation of polymeric nanoparticles by nanoprecipitation, evaluation of their properties as potential drug carriers"

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This study aimed to develop a method for producing biocompatible polycaprolactone nanoparticles (PCL NP) capable of delivering active substances, with potential applications in drug delivery systems or medical diagnostics. The synthesis of nanoparticles was carried out using the nanoprecipitation method, analyzing the influence of process parameters such as phase composition, temperature, mixing method, and the use of additives on the physicochemical properties of the nanoparticles, including their size and colloidal stability.

The study also explored the integration of superparamagnetic iron oxide nanoparticles (SPIONs) with PCL NP, enabling the nanoparticles to acquire magnetic properties. Solutions for improving the separation and purification processes of the nanoparticles were also developed. The research included an assessment of the biocompatibility of the produced systems, including their potential for transporting model substances, cytotoxicity, and interactions with model cell lines. The controlled release capabilities of encapsulated active substances were also analyzed.

A key element of the research was developing a numerical model of the nanoprecipitation process, which supports the design and optimization of nanoparticles based on their properties and applications. The study results provide a foundation for further development of polymeric and hybrid nanoparticle production technologies, enabling their application in biomedicine.

Keywords: nanoprecipitation, polycaprolactone nanoparticles, microfluidic systems, drug delivery systems, magnetic nanoparticles, numerical model

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