

Doctoral dissertation

"Preparation and characterization of selected nanomaterials as molecules carriers."

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Abstract in English


The dissertation concerns the preparation of nanostructures with flake-like morphology, their functionalization and modification, as well as the investigation of their physicochemical and biological properties for potential use as molecular carriers. The study focuses on few-layered hexagonal boron nitride, carbon flakes as carbonizates of cobalt-based metal-organic frameworks, and mesoporous silica flakes.

The paper has a classical layout and is divided into two parts: theoretical and experimental. The theoretical part begins with an introduction to two-dimensional structures. Special attention is paid to hexagonal boron nitride materials, metal-organic type structures, and silica materials. Their types, structure, and properties are described. This part also presents typical methods of preparation, functionalization, and also application.

The last chapter of the theoretical part discusses the most important methods of characterization of the obtained materials: transmission (TEM), atomic force microscopy (AFM), Raman spectroscopy, X-ray diffractometry (XRD), thermogravimetric analysis (TGA), and all methods used to determine the cytotoxicity of the obtained materials and their composites with medicines.

The experimental part is divided into three parts. Each of them discusses a different type of flakes. In each one of the parts, the methods of synthesis, both basic materials and their functionalization/modification, are described. The analysis then includes a presentation of physicochemical characterization of the obtained materials and the results of biological properties studies.

Each of the obtained structures shows a set of properties that could potentially be used in biomedicine in the future, but this conclusion requires further research and additional modifications. Nevertheless, the conducted research can lay the foundation for more advanced scientific work, including *in vivo* studies.


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