

Imię i nazwisko doktoranta: Izabela Wojtczak

Streszczenie rozprawy doktorskiej w języku angielskim:

Dissertation title: „**Micro- nanostructured composites based on diatom biosilica functionalised with rare earth oxide nanoparticles (Ce, Tb) and silver nanoparticles**”

The dissertation topics focused on an innovative approach to creating nanocomposites using diatomaceous biosilica functionalised with rare earth oxide nanoparticles (Ce, Tb) and silver nanoparticles. The thesis combines an interdisciplinary approach from chemistry, biology and nanotechnology, aiming to create new materials with potential applications.

The main objective of the dissertation was to create and characterise nanocomposites with diatomaceous biosilica extracted from the diatom species *Pseudostaurosira trainorii* as the matrix, doped or chemically modified with cerium, terbium and silver ions. This research aimed to integrate the biosilica's structure with the doped elements' unique properties so that the resulting composites exhibit advanced catalytic, optical and antibacterial properties.

In the first experimental part, metabolic insertion doped the diatom biomass with cerium ions. This process was optimised regarding culture conditions, which allowed precise control of the distribution and amount of cerium(IV) oxide nanoparticles obtained in the biosilica structure. The results indicated that the nanocomposites obtained by this method were characterised by a homogeneous distribution of cerium(IV) oxide nanoparticles and a high specific surface area, which is essential for their functionality.

Subsequently, the biosilica was functionalised with mixed Ce-Tb oxide nanoparticles and terbium oxides, which were thoroughly characterised using various instrumental techniques, including SEM, TEM, XRD, TGA and FTIR. The research confirmed the effectiveness of the biosilica modifications and highlighted the potential applications of these materials in fields that exploit their unique optical and structural properties.

The final part of the study focused on the synthesis and characterisation of (AgAgClCeO₂)/DBioSiO₂ composites. These composites showed promising antibacterial

properties, suggesting their potential application in the medical field. The antibacterial properties of these composites were investigated in the context of different bacterial strains, highlighting their broad spectrum of activity.