

Abstract

„Analysis of spectroscopic properties in designing of cellular fluorescent probes.”

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Identifying the cause of a disease and the mechanism responsible for dysfunction in our organism is crucial for determination of an effective treatment pathway. The most primary changes are these at the cellular level. Fluorescent sensors enable us to get insight into a world of biological structures and to study cellular processes essential for proper functioning of our organism. Therefore, this group of compounds has gained considerable attention over the past years as safe tools useful for diagnostics and searching for new therapeutic targets.

The main goal of the PhD thesis was synthesis of new fluorophores based on a styrylquinoline scaffold and analysis of their properties. A big part of the research was biological tests which enabled to determine the application potential of the newly synthesized compounds as cellular dyes. The scope of work covered, among others, determination of characteristics of the compounds based on analysis of spectroscopic measurements. Additionally, to gain deeper understanding of spectroscopic nature of the dyes and to explain newly discovered relationships, theoretical calculations was carried out with use of Gaussian09 software and density functional theory (DFT). Moreover, biological experiments were performed to determine cytotoxicity of the compounds towards human colon cancer cell line HCT 116 and normal human dermal fibroblasts (NHDF). The place of dyes accumulation in a cell was determine as well. In the case of the lysosomal dye, the reason of significant change of emitted signal in acidic structures was also explained. Furthermore, an attempt was made to establish the mechanism of zinc ions binding to one of the compounds and to determine processes responsible for activation of the fluorescent response after chelation (CHEF, chelation – enhanced fluorescence). It is worth mentioning that good spectroscopic properties of obtained compounds and successfully performed cellular imaging experiments indicate their commercial potential.