Abstract

Fluorescence spectroscopy is a versatile research method widely used in the natural sciences (chemical, biological, and medical), and its importance continues to grow with the development of spectroscopic research techniques. A prerequisite for its application is the presence of an appropriate dye with favorable spectroscopic properties, such as long-wavelength spectral characteristics, high fluorescence quantum yield, and resistance to photodegradation. An inspiration for designing new probes may be proteinogenic amino acids, which in their unmodified form exhibit limited spectral and photophysical properties, restricting their use in many fluorescence studies.

This dissertation focuses on the synthesis of new fluorescent labels whose structures are based on the scaffold of a proteinogenic amino acid - tyrosine.

While preserving the amino acid functional groups that enable its conjugation to various molecular structures, the side chain of the aromatic proteinogenic amino acid was modified via the Sonogashira-Hagihara reaction to enhance its chromophoric and fluorophoric properties. Through the introduction of a triple bond into the tyrosine side chain, the following substituents were incorporated in asymmetric and symmetric fashions: phenyl, anisole, dimethylaniline, benzaldehyde, nitrobenzene, diphenyl ether, pyridine, naphthalene, methoxynaphthalene, as well as a phenyl group conjugated to dimethylaniline via a triple bond. It was demonstrated that the applied structural modifications within the tyrosine side chain positively affected the spectroscopic properties compared to naturally occurring tyrosine. Moreover, selected compounds were insensitive to changes in pH and to the presence of oxidizing and reducing agents in the environment. All of the investigated derivatives were photostable.

The compounds did not exhibit significant cytotoxic effects toward the selected cell lines (HaCaT, MCF-7, and PC-3). Confocal fluorescence microscopy studies combined with the FLIM technique confirmed the ability of the selected derivatives to penetrate the cell membrane of MCF-7 cells.

The obtained fluorescent derivatives offer broad application potential in the life sciences.

Keywords: *fluorescent non-proteinogenic amino acids, acetylenic tyrosine derivatives, spectroscopic studies, biological activity of tyrosine derivatives.*