Summary of the doctoral dissertation

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Synthesis and properties of new s-tetrazine derivatives associated directly and indirectly with selected heterocyclic moieties

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The research carried out as part of the doctoral dissertation covered the synthesis as well as the absorption and emission properties of new extended conjugated systems based on the *s*-tetrazine ring. The target products were divided into two main groups depending on the type of connection of heterocyclic motifs. In each of them the central core was the mentioned *s*-tetrazine. This ring was associated directly or via a 1,4-phenylene linker with the selected five-membered systems. Additionally, in each group three subgroups were distinguished depending on the introduced five-membered ring: 1,3,4-oxadiazole, 1,3,4-thiadiazole or 4*H*-1,2,4-triazole. All used heterocyclic compounds are characterized by a high nitrogen content, which is valuable both from the point of view of medicine and optoelectronics.

The synthetic pathways developed involved the use of commercially available materials and resulted in obtaining all the intended final products with satisfactory yields. In the case of directly conjugated systems, the most effective methodology comprised the initial formation of the *s*-tetrazine ring, and then the prepared precursors were cyclized to the selected five-membered unit. In the synthesis of products containing an additional 1,4-phenylene linker, the order was reversed. The preparation of the central *s*-tetrazine ring was carried out using the Pinner reaction, which was applied to intermediates based on the selected five-membered systems. In all cases, the possibility of introducing additional electron-donating and electron-withdrawing groups was investigated. The products containing 4*H*-1,2,4-triazole core were further differentiated by an aromatic or aliphatic substituent attached to the triazole nitrogen atom. The structure of all obtained compounds was confirmed based on standard spectroscopic methods. The last part of the research was the analysis of the luminescent properties of the title products. The influence of individual fragments of the structure on the position of absorption and emission bands as well as on the quantum yield of fluorescence was assessed. The type of connection of heterocyclic units, the nature of additional groups attached to terminal benzene rings, and the type of heteroatom in the five-membered rings were also analyzed.

The obtained results were described in five scientific publications in renowned journals and presented at numerous national and international conferences.