Abstract

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Title of thesis: Synthesis of novel azaphthalocyanines working as dark quenchers suitable for binding to the middle of an oligonucleotide chain

Azaphthalocyanines (AzaPcs) are analogues of well-known phthalocyanines with benzene rings replaced for pyrazine ones. AzaPcs can be used in many applications due to their interesting spectral and photophysical properties, e.g. as photosensitisers in photodynamic therapy or as fluorescence sensors. The alkylamino substituted AzaPcs can be used as dark quenchers of fluorescence in mono-labeled DNA hybridization probes (FRET probes) or double-labeled probes as well. The AzaPcs for this application have typically three quarters identical (bearing alkylamino groups responsible for quenching of fluorescence) and the last quarter is modified with a functional group for attaching to oligonucleotide probe.

The goal of this project was to synthesize unsymetrical AzaPc with a T-shape functional group carrying two hydroxy groups that can be used for attaching to oligonucleotide probe. The synthesis consisted of preparation of appropriately substituted pyrazine-2,3-dicarbonitriles by nucleophilic substitution and Sonogashira coupling. The precursors were then used for cyclotetramerization employing the Linstead method in 1:3 ratio to obtain a mixture of congeners of metal-free AzaPcs. Desired congener of AB_3 type was isolated by column chromatography. Finally, zinc cation was coordinated to the center of macrocycle. Prepared AzaPc was characterized from spectral point of view and its aggregation was in detail studied with a series of AzaPc of similar peripheral substitution.