# Abstract

**Charles University, Faculty of Pharmacy in Hradec Králové**

**Department of Pharmaceutical Chemistry and Pharmaceutical Analysis**

**Candidate:** Mgr. Michaela Beranová

**Supervisor:** doc. PharmDr. Miroslav Miletín, Ph.D.

**Title:** Studies on phthalocyanines and tetrapyrazinoporphyrazines – preparation, properties and potential biological applications.

Phthalocyanines (Pc) and their derivatives, tetrapyrazinoporphyrazines (TPyzPz), have been the subject of extensive research in various fields of science for almost a century. The macrocycle with its 18 π-electron conjugated double bond system carries very interesting photophysical and photochemical properties. These are high absorption and fluorescence emission in the near-infrared region (600 – 850 nm) and alternative ways of excited state energy release such as singlet oxygen production or fast intramolecular charge transfer. These characteristics and their extremely precise tuning due to their diverse but easy-to-prepare structures have made Pc and TPyzPz suitable candidates for applications in electrical engineering, materials industry, or medical disciplines. However, whether for photodynamic therapy of cancer and infectious diseases or the development of hybridization probes, they still exhibit undesirable properties that limit their potential applications. These are mainly low solubility in water and strong aggregation in most solvents. The research of these substances and their properties is also the subject of this dissertation, which builds on previous research, studies and long-standing experience of our AzaPc group.

The first section is devoted to the preparation of silica TPyzPz by template and complexation methods and the influence of peripheral substitution on the synthesis conditions. The possibility of axial substitution of the prepared complexes is also discussed.

The second part describes the problem of stability of the central cation of magnesium complexes Pc and TPyzPz. It examines the details of the demetallation mechanism and the exact progression with respect to the environmental conditions of the molecule. In addition to describing the difference in the effect of polar and non-polar solvent and acidic conditions, it also explores the possibility of protecting the molecules using different formulations (microemulsions and liposomes).

The third part deals with light-induced disruption of liposomes and controlled drug release from their cavity by photosensitizers from the Pc family of zinc and aluminum complexes. It investigates the properties of the molecules (size, nature of peripheral substitution and ability to produce singlet oxygen) on the ability to intercalate into the lipid bilayer of different types of prepared liposomes and on the ability of controlled release of their contents.

In the last part, this work deals with the post-synthetic preparation of conjugates of organic molecules such as TPyzPz, BODIPY, acridine and indocyanine with oligonucleotide chain (ON) by structural strain promoted azide-alkyne cycloaddition (SPAAC). It compares combinations of three parameters of this reaction (concentration of labeling solutions, position of modification on ON, and use of different solid phases in ON synthesis). This is possible because SPAAC allows the labeling process to proceed immediately after ON synthesis, i.e., before chain cleavage and deprotection. This avoids the usually necessary and lengthy precipitation from solution and purification by HPLC, increasing the potential use of this method in practice.