Abstract

Nowadays the necessity for designing and synthesizing novel imaging agents increases rapidly. The long wavelength, and thus, low energy, of excitation and emission, and the good specificity and stability are examples of essential characteristics of ideal diagnostic and therapeutic agents. In this work, the synthesis and photophysical studies of metal complexes for biological applications were performed and evaluated, and it contained the development of (a) a porphyrin probe for imaging and treatment and (b) a tripodal thermal sensor for imaging. The research and study of the two cases of complex is analyzed in the second and third chapters, respectively, which follow the introduction or literature review to the diagnostic and/or therapeutic agents which is given with examples in the first chapter.

The scope of the main project, which is analysed in the second chapter, was the development and synthesis of a porphyrin-based bio-probe capable of bacterial fluorescence imaging. The porphyrin moiety of a complex is also able to generate singlet oxygen and this effect can be used for treatment purposes (PDT, Photodynamic Therapy). Thus, the complex can act as a diagnostic and therapeutic (anti-bacterial in this case) agent simultaneously. A probe with such a dual capability is known as theranostic agent. A theranostic agent is crucial for the enhancement and expansion of personalised medicine. The studies and physical measurements of the proposed, synthesised porphyrin complex have proved its capability to be used as a theranostic probe. Furthermore, after coupling the porphyrin moiety firstly with a small protein part (ampetoid: antimicrobial peptoid) and secondly with a radionuclide (Gallium-68), the in vitro and in vivo studies have to be performed.
The aim of the project analysed in the third chapter was the development of a thermal sensor. Coordination of a tripodal ligand with a mixture of two lanthanides in various ratios was achieved and the photophysical measurements of the resulted complexes were evaluated. Lanthanide metals were chosen due to their unique photophysical properties that they offer when they are connected to an organic chomophoric ligand. Additionally, the preferred final luminophore product would obey a thermostable structure over a wide temperature range and it would be capable of effectively sensing the alterations in temperature. These properties were true for the ratio 99.5:0.5 for Terbium: Europium, and thus, the complex with such a consistency clarified the final product. Furthermore, the highly promising results after repeatedly photophysical (especially emission) measurements could conclude that the complex can be served as an ideal thermal sensor. Additional emission measurements at higher temperatures have to be done in order to confirm the ability of the proposed thermal sensor to be used for bio-imaging purposes.

In conclusion, two-kind of metal complexes for biological applications were synthesized and their photophysical properties were assessed. Both the bulky porphyrin complex and the smaller tripodal ligand have shown promising results for their proposed applications. Of course, a more detailed assessment is required to verify their capability.
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