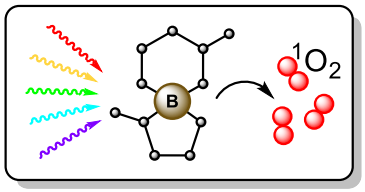

Efficient triplet photosensitizers derived from rigid organoboron structures as singlet oxygen generators

Singlet oxygen ($^1O_2$) is reactive oxygen species (ROS), harmful to organisms due to its powerful oxidation properties and lack of selectivity. The controlled use of its natural properties turns this dangerous individual into a universal oxidant which can be used in preparation of various types of chemical compounds, in medicine as antitumor agent or as a universal, non-invasive disinfectant and also for water purification purposes. Singlet oxygen can be generated using a sensitizing dye – a special chemical compound that upon light excitation can storage excess energy for short period of time (microseconds) enabling its directly transfer to oxygen molecule. The route is appealing because it only requires visible light, oxygen, and a sensitizer to produce singlet oxygen. Photosensitizer should be characterized by high absorption, photostability and high singlet oxygen quantum yield. Although selected groups of compounds such as porphyrins, phtalocyanines, fullerene-based conjugates and heavy-metal atom complexes fulfil aforementioned criteria, they may not be attractive for technology due to problems associated with their synthesis, processability, environmental hazardous and high cost of production. For these reasons small-molecule organic heavy atom-free photosensitizers constitute particularly interesting alternatives.

The main objective of current project is to create a new class of compounds that could play the role of highly efficient photosensitizers, and at the same time would be characterized by low harmfulness to the environment and low production costs. Due to their controlled structure-properties tunability and feasible synthesis, organoboron complexes seem to be ideal candidates for such applications, yet most of them do not show photosensitizing properties. On the course of recent researches we have proposed new strategy for structural design of efficient triplet state photosensitizers that can be easily adopted by numerous class of boron complexes. It employs *spriro* boracyclic complexes. Our initial results show that they are characterized by high stability and singlet oxygen generation efficiency. We would like to apply these systems as antibacterial and antifungal agents. The advantage of using singlet oxygen to fight microorganisms is the non-specificity of its action, which prevents the development of defense mechanisms and acquiring immunity. The introduction of appropriate functional groups to the molecular structure of the complex will enable their immobilization on solid substrates. We plan to determine if obtained in this manner materials could play a role of catalyst in the synthesis of organic compounds, as well as in the processes of purifying water from contaminants such as antibiotics, microorganisms and fungi. Moreover, we also plan to create a prototype of an intelligent foil. Such a foil, when irradiated, will produce singlet oxygen in its close vicinity. Singlet oxygen has a lifetime of a few microseconds, after which it goes back to triplet oxygen (ground state), hence it does not pose a direct threat to the environment and people, but can effectively destroy microorganisms in the vicinity of the foil. This method is non-invasive and does not require the use of additional disinfectants or special conditions (high temperature), but only exposure to visible light (not UV!), therefore it could be widely used, for example, in disinfecting documents.