DESCRIPTION FOR GENERAL PUBLIC

Nowadays, one of the main environmental problems which attract much attention is the removal of xenobiotic and non-biodegradable pollutants from water and wastewater. Most of them are organic compounds that have an aromatic structure, which determines their high stability. Conventional methods of wastewater treatment are not always effective and efficient, particularly in the case of organic dyes, which are one of the components of waste water from the textile industry.

Due to the risk for the environment and low effectiveness of currently used systems for the elimination of organic pollutants, there is still a strong demand for novel compounds that would minimize the amount of chemicals involved in the process and avoid toxic side effects. One possibility is the use of efficient and environmentally friendly catalysts based on transition metal complexes.

In recent years, in terms of catalytic activity, transition metals such as iron, cobalt, manganese, chromium and ruthenium have been studied intensively. A particularly interesting metal appears to be manganese, which is one of the most effective and benign to the environment in the catalytic oxidation of contaminants. So far many manganese complexes, both simple Mn(II) salts such as $MnCl_2$, $Mn(NO_3)_2$, $MnSO_4$ and with more complex salen or aromatic N-donor ligands, have been studied.

The aim of the proposed project is to investigate the possibility of applying a Mn complex with a porphyrin ligand to the degradation of model organic contaminants. In this study, a commercially available sulfonated derivative of a Mn(III) porphyrin catalyst, abbreviated as Mn^{III}(TPPS), will be used. It is postulated that in the reaction of Mn^{III}(TPPS) and inorganic peroxide (hydrogen peroxide) or organic peroxide (peracetic acid), the oxidized form of the porphyrin complex is produced as an oxo species. This form of the catalyst, described as (TPPS)Mn^{IV}=O or (TPPS)Mn^{V}=O, is believed to be an appropriate oxidizing agent capable of interacting with the dye and lead to its degradation. At the same time, the manganese complex, indulging oxygen, should return to its basic Mn^{III}(TPPS) form to close the catalytic cycle.

In the project, the examination of the catalytic ability of the described manganese complex in relation to the degradation of several organic dyes (such as orange II, methyl orange, sudan I, morin, chrysin) is planned. These dyes play an important role in the project as model environmental contaminants and were selected because of their frequent occurrence in waste water from the textile industry.

Studies on the mechanism of formation of the oxidized forms of the Mn(III) complex and organic pigments degradation will be conducted using a variety of spectroscopic and kinetic techniques (among others UV-Vis, stopped-flow). The planned studies will have a comprehensive character such that it will be possible to determine the optimal conditions (pH of the environment, type of buffer, concentration of the substrates and catalyst) for the most effective decomposition of the selected pigments. This systematic approach will allow a comparison of the selected systems with other catalytic systems based on transition metal complexes. As a longer perspective, these studies may have a positive impact on the design of novel, environmentally friendly catalytic systems, which could be applied in the purification of waste water from organic compounds.