FORMATION OF SINGLET OXYGEN FROM SiO$_2$-TMPYP ADDUCT NANOPARTICLES

Wenbing Li, Shavelle N. Courtney, Christine Tchounwou, Martha Taplin and Ruomei Gao

Department of Chemistry at Jackson State University, 1400 lynch street, Jackson, MS 39217, USA

Abstract: Singlet oxygen ($^1\text{O}_2$) is one of the most active intermediates involved in photosensitized oxygen reactions in chemical and biological systems. The generation of $^1\text{O}_2$ by a photoactivated sensitizer usually takes place via the energy transfer from the triplet state of a photosensitizer to ground state oxygen and can be monitored at its luminescence of 1270 nm. Its photooxidation in solution with the use of heterogeneous sensitizers facilitates the problem of dye recovery. $^1\text{O}_2$ photosensitization upon visible irradiation of SiO$_2$-5,10,15,20-Tetrakis(1-methyl-4-pyridinio)porphyrin tetra(p-toluenesulfonate) (TMPyP) adduct nanoparticles in aqueous solution has been studied in this work at different pHs. The stability of SiO$_2$-TMPyP colloidal solution and the extent of TMPyP adsorption on SiO$_2$ surface highly depend on pH. The complete aggregation of the SiO$_2$-TMPyP particles occurs at weak acidic conditions and can be separated from the solution at pH4. The singlet oxygen luminescence at 1270 nm was detected by a Ge photodiode detector (Applied Detector Corporation) which was cooled with liquid nitrogen. A time-resolved Nd:YAG laser(532 nm, 3-4 ns, 30 mJ, Polaris II-20, New Wave Research Merchantek Products) was used to quantitatively measure the production of $^1\text{O}_2$ generation by SiO$_2$-TMPyP colloidal solution using meso-tetrasulphonatophenyl porphyrin (TSPP) as reference ($\Phi_\Delta = 0.64$ in D$_2$O).

Keywords: Singlet oxygen, sensitizer, SiO$_2$-TMPyP nanoparticle

Acknowledgement: Supports from NSF-PREM program (DMR-0611539) and the Department of Chemistry at Jackson State University are gratefully acknowledged.