Synopsis of Original Research Paper

Development of a novel methodology to suppress phototoxicity of colored compounds

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When dye molecules are excited by UV or visible light, singlet oxygen ($^1O_2$) is generated via energy transfer from excited triplet state of the molecules. Because the photo-generated $^1O_2$ is known to cause damage to cells, it is important to establish methods to decrease the amount of generated $^1O_2$, or to erase $^1O_2$ by chemical reaction. We believe such methods will be useful not only in bioimaging but also in cosmetology. Hence, in this research, we studied on the singlet oxygen eliminating effect of lanthanide ions that are co-existent in the system. The idea was that when lanthanide ions that could accept energy from the excited dyes were present nearby, the ions would work as surrogate acceptors in place of molecular oxygen, whereby decreasing the efficiency of $^1O_2$ generation. In order to verify this hypothesis, we firstly synthesized several fluorescent compounds and their lanthanide complexes, and measured characteristic luminescence of $^1O_2$ at 1270 nm. The results indicated that $^1O_2$ generation is attenuated when the compounds chelate a specific kind of lanthanide ions, supporting our hypothesis. Also, we have demonstrated that some lanthanide ions are capable of decreasing the amount of generated $^1O_2$ through intermolecular interactions. As far as we are concerned, these findings are unprecedented, and worth further investigation.