CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
S0503

Project Title
Ir (III) and Pt (II) Complexes as Efficient Singlet Oxygen Sensitizers

Abstract

Objectives/Goals
Although singlet oxygen (the first excited state of ground state oxygen) research has been of great interest to many research groups since the 1960s, little information is available on the photophysical properties of transition metal complexes that sensitize the production of singlet oxygen. Therefore, the goals of this project is to measure the singlet oxygen production of a series of iridium(III) and platinum(II) complexes and to characterize these compounds' properties.

Methods/Materials
Through time-resolved laser spectroscopy the singlet oxygen quantum yields and quenching rates (rate of singlet oxygen deactivation) of cyclometalated octahedral iridium(III) and square planar platinum(II) complexes were determined.

Results
Many of the complexes tested have high quantum yields (0.4-1.0) and slow quenching rates when compared to most sensitizers.

Conclusions/Discussion
The relatively high quantum yields of singlet oxygen are attributed to the geometry of the complexes and the electronic conjugation between then ligands and metal center. Singlet oxygen quantum yields also appear to correlate more with the choice of the cyclometalating ligand than the ancillary ligand of the compound. Singlet oxygen is believed to be the only product formed due to several factors including metal to ligand charge transfer and the unlikely occurrence of electron transfer in our system.
The results augment current understanding of transition metal photosensitizers and show promise for application of similar photosensitizers to photodynamic therapy. Particularly interesting is that these transition metal complexes can be easily altered to fit its biological application by changing the cyclometalating or ancillary ligands.

Summary Statement
This project characterizes a group of metal compounds that generate singlet oxygen.

Help Received
Used lab equipment at California State University, Los Angeles under the supervision of Dr. Matthias Selke.