C02-GT09: **Color Destruction in Mill Effluent via Biomimetic Methods**

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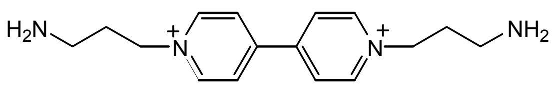
Highlight:
We have synthesized several porphyrin and viologen compounds that are known to produce singlet oxygen on exposure to light. Some of these have been attached to the surface of nylon fabric via surface-site amplifying polymers. Testing is in progress on their ability to produce singlet oxygen.

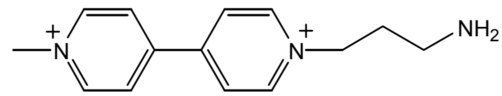
Summary:
Biological systems can produce or destroy most currently known organic compounds as evidenced by the vast array of chemistries displayed by bacteria, yeasts and fungi. The most widespread type of oxygenase enzymes in biological systems is the cytochromes P450, in which porphyrins are an essential component. This type of enzyme participates in degradation of many toxic substances both endogenous (i.e. in the body) and exogeneous. Examples of materials destroyed by the cytochromes P450 include various pesticides, carcinogens, solvents, drugs, etc. Biological systems also produce many useful chemicals. They often perform their syntheses in environmentally benign ways while using a minimum of energy and very simple starting materials. They produce few side products. However, keeping cell cultures alive and preventing them from mutating to produce undesirable materials is a daunting task. On the other hand, current chemical plants use vast amounts of energy and often produce environmentally damaging side products. This has lead to the development of biomimetic catalysts based on porphyrins and related compounds to carry out the chemical reactions with a goal of obtaining the best of both worlds. Recently, some synthetic iron and manganese porphyrins have been successfully used to mimick cytochrome P450 catalyzed chemical reactions. These materials work by generating singlet oxygen. Thus, we will simulate this effect by attaching singlet oxygen generating materials to the surface of a nylon fabric substrate. By attaching them to a fabric, we will prevent their leaching into the environment while simultaneously providing a large reactive surface area. We will attempt to use these materials to destroy colored components of mill effluents.

We have synthesized methyl propylamino viologen, dipropylamino viologen (Figure 1), zinc tetrahydroxyphenylporphyrin, zinc tetracarboxyphenylporphyrin (Figure 2), and the ethylene diamine derivatives of protoporphyrin IX and zinc protoporphyrin IX. In addition, we have grafted poly(acrylic acid) to the surface of nylon fabrics. Next, we grafted the ethylene diamine derivatives of protoporphyrin IX and zinc protoporphyrin IX to the grafted poly(acrylic acid). These materials are currently being examined for their ability to produce singlet oxygen and to destroy color from dyes in simulated mill effluent.

The next step is to graft the viologens to the surface and evaluate their performance. In addition, we will be studying the effect of these materials on bacterial cultures to determine whether the “cleaned” effluent is safer or more toxic to the microbes used in wastewater treatment.

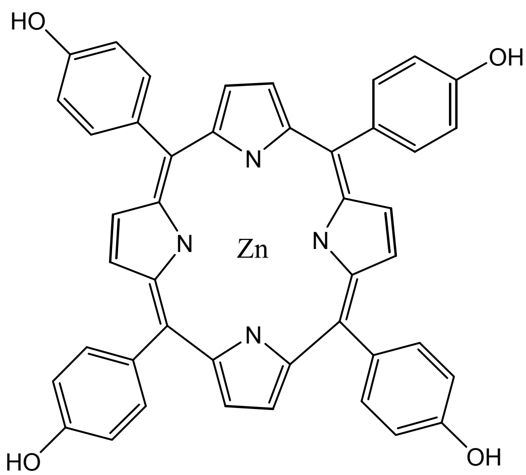


Dipropylamino Viologen

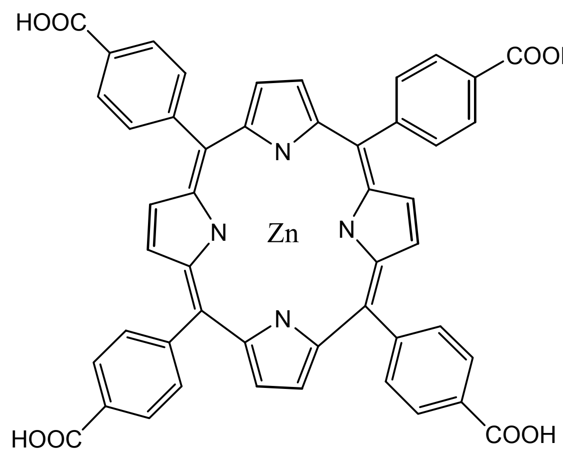


Methyl Propylamino Viologen

Figure 1.



Zinc Tetraphenylhydroxy Porphyrin



Zinc Tetraphenylcarboxy Porphyrin

Figure 2.