

Abstract: Synthesis and Investigations of Ruthenium Complex Photocleavage Abilities

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Some transition metal complexes are biologically required however other transition metal complexes can be synthesized in laboratories then later brought into biological systems. In the Burgmayer lab, one research project focuses on the synthesis of ruthenium(II)polypyridyl complexes, a type of transition metal complex not found in the human body which is able to bind to DNA depending on its ligand. Since the ligands usually possess a planar geometry, they are easily able to intercalate, or slide between, DNA base pairs.

One distinct characteristic of these ruthenium(II)polypyridyl complexes is their ability to damage or “nick” DNA when excited by ultraviolet light, a process known as photocleavage. When DNA is damaged it cannot replicate and the practical application for these ruthenium(II)polypyridyl complexes is to eventually make the compounds selective for mutated DNA strands and prevent any further mutations, like cancer. In the Burgmayer lab, gel electrophoresis is used to test the ability for ruthenium(II)polypyridyl complexes to photocleave DNA. This test is able to separate the different forms of DNA so that when an image is taken, the gel shows the final position of the various forms (**Figure 1**). The goal of this summer’s research will involve two directions of ruthenium(II)polypyridyl investigations. For one, previous experiments will be completed on the degradation product of $[\text{Ru}(\text{bpy})_2(\text{L-pteridine})]^{2+}$ (called $[\text{Ru}(\text{bpy})_2(\text{L-alap})]^{2+}$) as well as other complexes which demonstrated strong photocleavage properties. The other half of the research will be to synthesize and test the photocleavage abilities of phenanthroline ligand variations to the previously made ruthenium(L-pteridine) complexes (**Figure 2**).

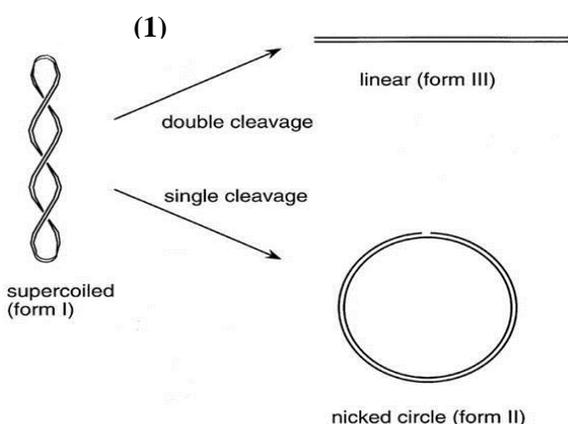


Figure 1. (1) Image depicting the three possible forms of DNA before and after ruthenium(II)polypyridyl photocleavage. The linear form is rarely seen for these particular complexes. (2) Image of an agarose gel depicting the three forms of DNA before and after photocleavage.

(1)

(2)

(3)

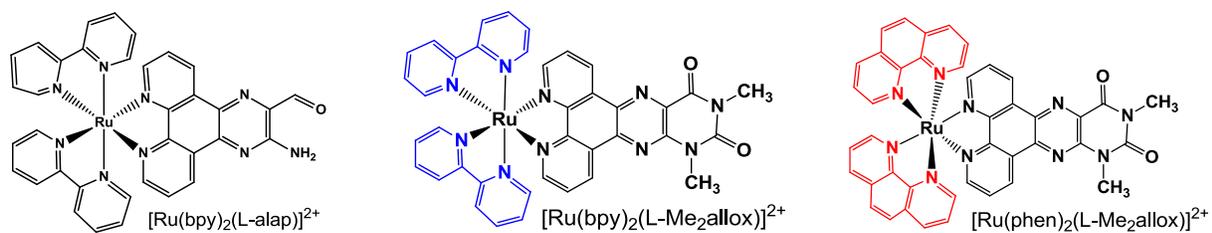


Figure 2. Images of (1) $[\text{Ru}(\text{bpy})_2\text{L-alap}]^{2+}$, (2) $[\text{Ru}(\text{bpy})_2\text{L-Me}_2\text{allox}]^{2+}$ and (3) $[\text{Ru}(\text{phen})_2\text{L-Me}_2\text{allox}]^{2+}$ which are examples of ruthenium(II)polypyridyl complexes. The difference between complexes (2) and (3) being the bipyridine ligands (blue) are replaced with phenanthroline ligands (red).