

TITLE: MMFF VS. PM3: COMPUTER MODELING OF RUTHENIUM AND RUTHENIUM-NITROSYL COMPLEXES TO IDENTIFY CHEMOTHERAPEUTIC AGENTS

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Abstract

The current study investigates the equilibrium and single point energy calculations of ruthenium and ruthenium-nitrosyl complexes in an effort to identify new chemotherapeutic agents. According to the American Cancer Society, nearly 50% of the 1.5 million cases of cancer diagnosed in 2005 will result in death. The development of new chemotherapeutic agents is essential for improving the selectivity of the drugs and lowering the harmful side effects. Current studies are investigating ruthenium based drugs for the enhanced selectivity and lowered toxicity compared to the cis-platin drugs currently on the market. Ruthenium-nitrosyls offer an additional advantage of containing a photo-labile nitric oxide unit for use in photodynamic therapy.

In an effort to understand the applicability of computer modeling, the results of the MMFF and PM3 equilibrium and single point energy calculations will be compared against characterized ruthenium and ruthenium-nitrosyl complexes for bond lengths, bond angles and relative stabilities. Ruthenium complexes will also be modeled for both the +2 and +3 oxidation states to compare with results of electrochemical studies. Representative cationic, neutral and anionic complexes will also be modeled for aqueous solution formation to mimic the transportation of the complexes in the blood to the target cancer cells. Additionally, the ruthenium complexes will be modeled for coordination to both N-7 and N-3 of guanine bases to probe DNA binding.

Daemen College Student-Faculty Interdisciplinary Research Think Tank Project
February 2007

The research goals are:

- To understand bonding models as applied to inorganic compounds.
- To compare calculated MMFF and PM3 energies, bond distances and bond angles to experimentally characterized complexes.
- To model the stability of the complexes using modern computer techniques.
- To determine the applicability of computer modeling in selection of new target chemotherapeutic ruthenium and ruthenium-nitrosyl complexes.
- To present the research outcomes at the Northeast Regional Meeting of the American Chemical Society and Daemen College Academic Festival.

Proposed Work

Computer Modeling

Molecular modeling software will be used to calculate energies formation, bond angles and bond distances. The MMFF and PM3 calculated energies will be compared to common experimental data to determine the viability of future modeling studies.

Expected Outcome

The work completed has been presented at the Northeast Regional Meeting of the American Chemical Society in Binghamton, NY.

Eric M. Majchrzak, Stephanie V. Harding and Matthew S. Ward, "Computer Modeling of Ruthenium and Ruthenium-Nitrosyl Complexes to Identify Chemotherapeutic Agents", 34th Northeast Regional Meeting of the American Chemical Society, Binghamton, NY: October 2006.