IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 12, April 2025
Impact Factor: 7.67

Photophysical and Photochemical Properties of Ru (III) and Pd (II) Schiff Base Complexes

Neetu Pradeep[a,b], Vijayakumary Raji[a,b], Ajmal Salih Rahim[a], Bijil K Babu[a], Vasudevan Arun[a, b]
[a] Department of Chemistry, Sree Narayana College, Punalur, Kollam, Kerala, India.
[b] Research Department of Chemistry, Sree Narayana College, Kollam, Kollam, Kerala, India
rajikkd@gmail.com

Abstract: *This paper discusses a comprehensive comparison of photo physics and photochemistry of Schiff base complexes based on Ru (III) and Pd (II) Schiff complexes regarding unique structural and electronic features responsible for their optical and photo redx behavior. Schiff base ligands that contain N_2 O_2 type donor atoms were used to synthesize the Ru (III) and Pd (II) complexes, and in turn create a stable coordination environment favorable for strong metal-ligand interactions. Photo physics, with respect to absorption and emission spectra and quantum yields, was probed in an effort to identify as clearly as possible the electronic transitions and excited-state behaviors that characterize these complexes. Photochemical analyses also proved useful for probing the stability and reactivity of these complexes under different irradiation conditions, under which Ru (III) and Pd (II) centers are quite distinct.*

Findings Our results show that MLCT bands in Ru (III) complexes are stronger than those of Pd (II) complexes, which reveal LC electronic transitions, indicative of a significant role of the metal center in exerting control on the character of the electronic transitions. The photo redox properties of the complexes were explored and proved that Ru (III) complexes enhance their ability to act in redox reactions by photoexcitation through presumption through the metal's variable oxidation states and relatively efficient ligand field stabilization. On the other hand, the oxidation states of Pd (II) complexes have stability. The electronic structure of ligands is mainly affected by photoexcitation. Besides the experimental data, the DFT and TD-DFT calculations provide further information about electron density distributions, orbital contributions, and the mechanisms of transitions.

Such photophysical and photo redox properties in the Ru (III) complexes suggest that redox active photocatalysts-based applications such as those to effect solar energy conversion or split water are better achieved via these complexes. For example, their application to optoelectronic devices as well as sensors appears great owing to the fact that stable electronic transitions have taken place in Pd (II) complexes that come with high quantum yield emission and especially for long-lived excited states. This detailed analysis would lay a foundation to design and exploit Schiff base metal complexes in more targetable fashions, thereby opening up a whole new range of Ru (III) and Pd (II) applications in advanced photocatalytic, sensing, and optoelectronic technologies..

Keywords: Schiff base complexes based on Ru (III) and Pd (II)

DOI: 10.48175/IJARSCT-25904