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## Title:

# Schiff Base Complexes as Catalysts in Bromination Reaction of Phenol Red

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# Contents


General introduction ..... **Error! Bookmark not defined.**

References ..... **Error! Bookmark not defined.**

I. Literature review ..... **Error! Bookmark not defined.**

I.1.Introduction ..... **Error! Bookmark not defined.**

I.2. Vanadium haloperoxidases ..... **Error! Bookmark not defined.**

I.3. Schiff base complexes ..... **Error! Bookmark not defined.**

I.3.1. Schiff bases ..... **Error! Bookmark not defined.**

I.3.2. Reaction mechanism for Schiff base formation ..... **Error! Bookmark not defined.**

I.3.3. Classification of Schiff bases ..... **Error! Bookmark not defined.**

I.3.3.1. According to the chelation sites ..... **Error! Bookmark not defined.**

a. Monodentate Schiff base ..... **Error! Bookmark not defined.**

b. Bidentate Schiff bases ..... **Error! Bookmark not defined.**

c. Tridentate Schiff bases ..... **Error! Bookmark not defined.**

d. Tetradentate Schiff bases ..... **Error! Bookmark not defined.**

e. Polydentate Schiff bases ..... **Error! Bookmark not defined.**

I.3.3.2. According to symmetry ..... **Error! Bookmark not defined.**

b. Asymmetrical Schiff bases ..... **Error! Bookmark not defined.**

I.4. Applications of tetradentate Schiff base complexes ..... **Error! Bookmark not defined.**

I.5. Bromination reaction of phenol red ..... **Error! Bookmark not defined.**

1.6. Bromation of phenol red by Schiff bases complexes ..... **Error! Bookmark not defined.**

1.6.1 Bromation catalyzed by oxovanadium complexes ..... **Error! Bookmark not defined.**

I.6.2. Copper-complex-catalyzed bromination ..... **Error! Bookmark not defined.**

I.7. Conclusion ..... **Error! Bookmark not defined.**

References ..... **Error! Bookmark not defined.**

II. Synthesis and spectroscopic characterization of Schiff base complexes **Error! Bookmark not defined.**

II.1. Synthesis of Schiff base ligand ..... **Error! Bookmark not defined.**

II.2. Synthesis of the Schiff base complexes ..... **Error! Bookmark not defined.**

II.3. Physico-chemical measurements ..... **Error! Bookmark not defined.**

II.3.1. Purifications ..... **Error! Bookmark not defined.**

II.3.2. Melting point ..... **Error! Bookmark not defined.**

II.3.3. Molar conductivity ..... **Error! Bookmark not defined.**

II.3.4. UV–Visible absorption spectroscopy ..... **Error! Bookmark not defined.**

II.3.5. Infrared spectrometry ..... **Error! Bookmark not defined.**
II.4. Synthesis of the HL ligand ..... **Error! Bookmark not defined.**
II.5. Synthesis of complexes ..... **Error! Bookmark not defined.**
II.5.1. Synthesis of the copper complex $CuL_2$ ..... **Error! Bookmark not defined.**
II.5.2 Synthesis of the complex $VOL_2$ ..... **Error! Bookmark not defined.**
II.6. Characterization and identification of structures ..... **Error! Bookmark not defined.**
II.6.1. Molar conductivity ..... **Error! Bookmark not defined.**
II.6.2. Analysis by infra-red ..... **Error! Bookmark not defined.**
II.6.3. UV-Visible analysis ..... **Error! Bookmark not defined.**
II.7. Conclusion ..... **Error! Bookmark not defined.**
References ..... **Error! Bookmark not defined.**
III. Electrochemical study of Schiff bases complexes ..... **Error! Bookmark not defined.**
III.1. Cyclic voltammetry ..... **Error! Bookmark not defined.**
III.2. Imposed operating conditions ..... **Error! Bookmark not defined.**
III.2.1. Experimental setup ..... **Error! Bookmark not defined.**
III.2.2. General operating conditions ..... **Error! Bookmark not defined.**
III.3. Electrochemical behavior of the Schiff base ligand ..... **Error! Bookmark not defined.**
III.4. Electrochemical behavior of metal–Schiff bases complexes ..... **Error! Bookmark not defined.**
III.4.1. Study by cyclic voltammetry ..... **Error! Bookmark not defined.**
III.4.1.1. Schiff base copper complex ..... **Error! Bookmark not defined.**
a. Cu (II)/Cu(I) redox system ..... **Error! Bookmark not defined.**
b. Cu (III)/Cu (II) redox system ..... **Error! Bookmark not defined.**
III.4.1.2. Oxovanadium Schiff base complex ..... **Error! Bookmark not defined.**
III.5. Conclusion ..... **Error! Bookmark not defined.**
References ..... **Error! Bookmark not defined.**
IV. Structural and theoretical study ..... **Error! Bookmark not defined.**
IV.1. Introduction ..... **Error! Bookmark not defined.**
IV.2. Density functional theory (DFT) ..... **Error! Bookmark not defined.**
IV.3. Quantum chemistry calculations using DFT ..... **Error! Bookmark not defined.**
IV.4. Quantum chemistry parameters ..... **Error! Bookmark not defined.**
IV.4.1. Frontier molecular orbital energies (HOMO and LUMO) and the Energy Gap (ΔE) ... **Error! Bookmark not defined.**
IV.4.2. Dipole moment (μ) ..... **Error! Bookmark not defined.**
IV.4.3. Ionization potential (I) ..... **Error! Bookmark not defined.**
IV.4.4. Electron affinity (A) ..... **Error! Bookmark not defined.**

IV.4.5. Overall hardness (η) and softness (σ) ..... **Error! Bookmark not defined.**
IV.4.6. Electronegativity (χ) ..... **Error! Bookmark not defined.**
IV.4.7. Chemical potential (μ) ..... **Error! Bookmark not defined.**
IV.4.8. Total Electrophilicity (ω) ..... **Error! Bookmark not defined.**
IV.5. Optimized geometric structures ..... **Error! Bookmark not defined.**
IV.5.1. Bond lengths, angles and atomic charges ..... **Error! Bookmark not defined.**
IV.6. Mullikan atomic charges ..... **Error! Bookmark not defined.**
IV.7. Electronic parameters and molecular reactivity descriptors ..... **Error! Bookmark not defined.**
IV. 8. Spectral absorption analysis by TD-DFT ..... **Error! Bookmark not defined.**
IV.9. Correlation of vibration frequencies ..... **Error! Bookmark not defined.**
IV.10. Conclusion ..... **Error! Bookmark not defined.**
References ..... **Error! Bookmark not defined.**
V. Bromoperoxidase ..... **Error! Bookmark not defined.**
V.1. Bromoperoxidase reaction activity ..... **Error! Bookmark not defined.**
V.1.1. Introduction ..... **Error! Bookmark not defined.**
V.1.2. Preliminary studies ..... **Error! Bookmark not defined.**
V.1.3. Product analysis by UV–Visible spectroscopy ..... **Error! Bookmark not defined.**
V.1.3.1. UV–Visible spectroscopy ..... **Error! Bookmark not defined.**
V.1.4. Selection of experimental conditions ..... **Error! Bookmark not defined.**
V.1.4.1. Bromination in the absence of catalyst ..... **Error! Bookmark not defined.**
V.1.4.2. Bromination in the absence of oxidant ..... **Error! Bookmark not defined.**
V.1.4.3. Bromination in the presence of metal salts ..... **Error! Bookmark not defined.**
V.1.4.4. Bromination in the presence of the complexes ..... **Error! Bookmark not defined.**
V.1.4.5. Bromoperoxidase activity in the presence of the $CuL_2$ catalyst **Error! Bookmark not defined.**
a) Catalytic bromination assays to mimic vHPO activity ..... **Error! Bookmark not defined.**
V.1.4.6. Bromoperoxidase activity in the presence of the $VOL_2$ catalyst **Error! Bookmark not defined.**
b) Catalytic bromination assays to mimic vHPO activity ..... **Error! Bookmark not defined.**
V.2. Proposed catalytic mechanism ..... **Error! Bookmark not defined.**
V.3. Conclusion ..... **Error! Bookmark not defined.**
References ..... **Error! Bookmark not defined.**
General Conclusion ..... **Error! Bookmark not defined.**

**Résumé**

Dans ce travail, des complexes de cuivre(II) et d'oxovanadium(IV) dérivés de bases de Schiff ont été synthétisés et caractérisés par spectroscopie infrarouge (IR), spectroscopie UV-Visible, voltamétrie cyclique ainsi que par des calculs théoriques **DFT** et **TD-DFT**. Les études expérimentales et théoriques ont permis de déterminer leurs propriétés structurales, électroniques et électrochimiques. L'activité catalytique de ces composés a été évaluée dans la réaction de bromation oxydative du rouge de phénol en présence de peroxyde d'hydrogène (**$H_2O_2$**) et de bromure de potassium (**KBr**). Les résultats cinétiques obtenus révèlent une bonne efficacité catalytique pour les deux complexes étudiés, avec une performance supérieure du complexe **$CuL_2$**. Ces résultats mettent en évidence le potentiel de ces complexes comme catalyseurs dans les réactions d'oxydation assistées par le peroxyde d'hydrogène.

**Mots-clés :** Bases de Schiff, cuivre(II), oxovanadium(IV), spectroscopie IR, UV-Visible, DFT, TD-DFT, voltamétrie cyclique, catalyse, $H_2O_2$.

## Abstract

In this work, copper(II) and oxovanadium(IV) complexes derived from Schiff bases were synthesized and characterized using infrared (IR) spectroscopy, UV–Visible spectroscopy, cyclic voltammetry and theoretical **DFT** and **TD-DFT** calculations. The experimental and theoretical investigations provided insight into their structural, electronic and electrochemical properties. The catalytic activity of these compounds was evaluated in the oxidative bromination of phenol red in the presence of hydrogen peroxide (**$H_2O_2$**) and potassium bromide (**KBr**). Kinetic results revealed that both complexes exhibited good catalytic efficiency, with the **$CuL_2$** complex showing superior performance. These findings highlight the potential of these complexes as catalysts for hydrogen peroxide-assisted oxidation reactions.

**Keywords:** Schiff bases, copper(II), oxovanadium(IV), IR spectroscopy, UV–Visible spectroscopy, DFT, TD-DFT, cyclic voltammetry, catalysis, $H_2O_2$.

**ملخص**

في هذا العمل، تم تحضير معقدات لقواعد شيف المحتوية على النحاس الثنائي والأوكسوفاناديوم الرباعي، وتم توصيفها باستعمال مطيافية الأشعة تحت الحمراء، ومطيافية الأشعة فوق البنفسجية والمرئية، والحسابات النظرية المعتمدة على نظرية دالة الكثافة، بالإضافة إلى تقنية الفولتمترية الدورية. كما تم تقييم الخصائص التحفيزية لهذه المعقدات في تفاعل البرمنة التأكسدية لصبغة الأحمر الفينولي بوجود فوق أكسيد الهيدروجين وبروميد البوتاسيوم. وأظهرت النتائج الحركية أن كلا المعقدين يتمتعان بنشاط تحفيزي جيد، وكان معقد النحاس الثنائي الأكثر كفاءة. كما بينت العلاقة الخطية بين الامتصاصية وتركيز فوق أكسيد الهيدروجين أن هذه المعقدات تُعد مرشحة واعدة للكشف عن فوق أكسيد الهيدروجين

**الكلمات المفتاحية:** قواعد شيف، النحاس الثنائي، الأوكسوفاناديوم الرباعي، مطيافية الأشعة تحت الحمراء، مطيافية الأشعة فوق البنفسجية والمرئية، نظرية دالة الكثافة، الفولتمترية الدورية، التحفيز، فوق أكسيد الهيدروجي