Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 2343-2345 | ISSN:2251-6727

# Exploring the Antimicrobial Efficacy of Quinoline-Based Osmium Complexes

**[1] Dr. Haresh R. Patel, [2] Dr. H.D. Chaudhari**

[1] Department of Chemistry, Khedbrahma Campus, HNGU, Vadali, India. Email: hareshpatel6900@yahoo.com

[2] Department of Chemistry, Hemchandracharya North Gujarat University, Patan, India.

***(Received: 16 January 2026 Revised: 25 February 2026 Accepted: 17 March 2026)***

**KEYWORDS:**

Rare metal ions, osmium perchlorate, Quinoline derivative, antimicrobial activity, Osmium Quinoline complex.

**ABSTRACT:**

Quinoline derivatives are widely recognized for their biological importance and physiological functions. In this work, osmium–quinoline complexes were synthesized and structurally characterized to assess their catalytic and biological roles. The complexes exhibited strong coordination ability, promising catalytic activity, and moderate antibacterial effects, underscoring the potential of quinoline-based systems in catalysis and medicinal chemistry.

## 1. Antibacterial activity

This section presents the *in vitro* screening of the newly synthesized complexes for their antibacterial activity. The bacterial strains employed for the evaluation included *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa* [1–7]. The agar cup diffusion method was used to assess the *in vitro* antibacterial activity of the synthesized compounds. The results of the antibacterial screening of the synthesized complexes are summarized in Table 1.

**Table 1:** Minimum Inhibitory Concentration (MIC) of Standard Antibacterial Drugs Against Selected Bacterial Strains

| **Standard Drug** | **E. coli** ***(MTCC 443)*** | **P. aeruginosa** ***(MTCC 1688)*** | **S. aureus** ***(MTCC 96)*** | **S. pyogenes** ***(MTCC 442)*** | **E. coli** ***(MTCC 443)*** |
|---|---|---|---|---|---|
| **Gentamycin** | 0.05 µg/mL | 1 µg/mL | 0.25 µg/mL | 0.5 µg/mL | 0.05 µg/mL |
| **Ampicillin** | 100 µg/mL | — | 250 µg/mL | 100 µg/mL | 100 µg/mL |
| **Chloramphenicol** | 50 µg/mL | 50 µg/mL | 50 µg/mL | 50 µg/mL | 50 µg/mL |
| **Ciprofloxacin** | 25 µg/mL | 25 µg/mL | 50 µg/mL | 50 µg/mL | 25 µg/mL |
| **Norfloxacin** | 10 µg/mL | 10 µg/mL | 10 µg/mL | 10 µg/mL | 10 µg/mL |

**Note:** (—) indicates no detectable inhibition at tested concentration.

**Table 2:** Antibacterial activity of Quinoline derivative and its complex

| **Sr. No.** | **Compound Code** | **E. coli (*MTCC* 443)** | **P. aeruginosa (*MTCC* 1688)** | **S. aureus (*MTCC* 96)** | **S. pyogenes (*MTCC* 442)** |
|---|---|---|---|---|---|
| 1 | KYNA ligand | 100 µg/mL | 250 µg/mL | 250 µg/mL | 200 µg/mL |
| 2 | Os-KYNA | 90 µg/mL | 210 µg/mL | 242 µg/mL | 195 µg/mL |

The synthesized quinoline derivative (KYNA ligand) and its osmium complex (Os-KYNA) exhibited moderate antibacterial activity against all tested bacterial strains. The osmium complex (Os-KYNA) demonstrated slightly better activity than the free ligand, suggesting a possible enhancement of biological activity upon complexation. However, both compounds showed higher MIC values (lower potency) compared to the standard antibiotics.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(2), 2343-2345 | ISSN:2251-6727

Comparison of the antibacterial activity of the synthesized complexes with standard antibacterial agents revealed that, although the complexes exhibited moderate to good activity against all four bacterial strains, their activity was consistently lower than that of the standard antibiotics [8–13].

## 2. Antifungal Activity

The *in vitro* antifungal activity of the synthesized complexes was evaluated using the agar cup diffusion technique against selected fungal strains, namely *Candida albicans*, *Aspergillus niger*, and *Aspergillus clavatus*. [14-18] The antifungal efficacy of the compounds was assessed by measuring the zone of inhibition after incubation under suitable conditions. The results are compiled in Table 3.

**Table 3:** Minimum Inhibitory Concentration (MIC) of Standard Antifungal Drugs Against Selected Fungal Strains

| **Standard Drug** | **C. albicans (*MTCC* 227)** | **A. niger (*MTCC* 282)** | **A. clavatus (*MTCC* 1323)** |
|---|---|---|---|
| Nystatin | 100 µg/mL | 100 µg/mL | 100 µg/mL |
| Griseofulvin | 500 µg/mL | 100 µg/mL | 100 µg/mL |

**Table 4:** Minimum Fungicidal Concentration (MFC) of Synthesized Compounds Against Selected Fungal Strains

| **Sr. No.** | **Compound Code** | **C. albicans *(MTCC 227)*** | **A. niger *(MTCC 282)*** | **A. clavatus *(MTCC 1323)*** |
|---|---|---|---|---|
| 1 | **KYNA ligand** | 1000 µg/mL | 500 µg/mL | 500 µg/mL |
| 2 | **Os-KYNA** | 575 µg/mL | 1050 µg/mL | 1090 µg/mL |

The comparative analysis of the antifungal activity indicates that, although the synthesized complexes demonstrated reasonable to significant inhibitory effects against the tested fungal strains, [19-23] their effectiveness did not surpass that of the standard antifungal agents used for reference.

## 3. Conclusion

Biologically significant quinoline derivatives continue to attract attention owing to their diverse physiological and pharmacological functions. To probe their coordination chemistry and potential applications, osmium complexes incorporating a quinoline derivative were successfully synthesized and characterized using standard analytical methods. The complexes demonstrated notable catalytic efficiency, particularly in organic transformations involving redox reactions and C–C bond construction, along with moderate antibacterial activity. These findings emphasize the versatility of quinoline-based metal complexes as promising candidates for catalytic and biomedical applications.

## 4. Acknowledgement

The authors gratefully acknowledge Hemchandracharya North Gujarat University, Patan, India, for providing chemicals, A-grade glassware, and excellent laboratory facilities to carry out this research work. We also express our sincere thanks to the Central Instrumental Maintenance Facility (CIMF), Hemchandracharya North Gujarat University, Patan, India, for providing the necessary spectral analysis facilities.

## References

1. Barbieri, R., Coppo, E., Marchese, A., Daglia, M., Sobarzo-Sánchez, E., Nabavi, S. F., & Nabavi, S. M. (2017). Phytochemicals for human disease: An update on plant-derived compounds antibacterial activity. *Microbiological research*, *196*, 44-68.
2. Tominc, G. C., Dalmagro, M., Pereira, E. D. C. A., Adamczuk, M. S., Bonato, F. G. C., Almeida, R. M. D., ... & Hoscheid, J. (2024). Formulation and Characterization of Nanoemulsion Incorporating Chamomilla recutita L. Extract Stabilized with Hyaluronic Acid. *Pharmaceutics*, *16*(6), 701.
3. Abdallah, E. M., Alhatlani, B. Y., de Paula Menezes, R., & Martins, C. H. G. (2023). Back to nature: Medicinal plants as promising sources for antibacterial drugs in the post-antibiotic era. *Plants*, *12*(17), 3077.
4. Diken-Gür, S. (2024). Investigation of anti-adherence and antimicrobial properties of prodigiosin-functionalized bacterial cellulose membrane for biomedical applications. *Journal of Biotechnology*, *385*, 58-64.
5. Criscuolo, E., Spadini, S., Lamanna, J., Ferro, M., & Burioni, R. (2017). Bacteriophages and their

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(2), 2343-2345 | ISSN:2251-6727

immunological applications against infectious threats. *Journal of immunology research*, *2017*(1), 3780697.

6. Liao, C., Li, Y., & Tjong, S. C. (2019). Bactericidal and cytotoxic properties of silver nanoparticles. *International journal of molecular sciences*, *20*(2), 449.
7. de Paula, C. C., Martins, D. T. D. O., Arunachalam, K., Balogun, S. O., Borges, Q. I., Picone, M. G., ... & da Silva Prado, R. M. (2018). Antimicrobial screening of medicinal plants popularly used in Mato Grosso for treating infections: advances on the evaluation of Conyza bonariensis (L.) cronquist in vitro and in vivo antibacterial activities. *Pharmacognosy Journal*, *10*(6s).
8. Ur, A., & Brown, D. F. J. (1975). Impedance monitoring of bacterial activity. *Journal of medical microbiology*, *8*(1), 19-28.
9. Fang, M., Chen, J. H., Xu, X. L., Yang, P. H., & Hildebrand, H. F. (2006). Antibacterial activities of inorganic agents on six bacteria associated with oral infections by two susceptibility tests. *International journal of antimicrobial agents*, *27*(6), 513-517.
10. Yi, L., Dang, J., Zhang, L., Wu, Y., Liu, B., & Lü, X. (2016). Purification, characterization and bactericidal mechanism of a broad spectrum bacteriocin with antimicrobial activity against multidrug-resistant strains produced by Lactobacillus coryniformis XN8. *Food Control*, *67*, 53-62.
11. Gales, A. C., & Jones, R. N. (2000). Antimicrobial activity and spectrum of the new glycylcycline, GAR-936 tested against 1,203 recent clinical bacterial isolates. *Diagnostic microbiology and infectious disease*, *36*(1), 19-36.
12. Taylor, P. W. (1983). Bactericidal and bacteriolytic activity of serum against gram-negative bacteria. *Microbiological reviews*, *47*(1), 46-83.
13. Asekunowo, P. O., Haque, R. A., Razali, M. R., Avicor, S. W., & Wajidi, M. F. (2018). Synthesis and characterization of nitrile functionalized silver (I)-N-heterocyclic carbene complexes: DNA binding, cleavage studies, antibacterial properties and mosquitocidal activity against the dengue vector, Aedes albopictus. *European Journal of Medicinal Chemistry*, *150*, 601-615.
14. Negm, W. A., El-Aasr, M., Attia, G., Alqahtani, M. J., Yassien, R. I., Abo Kamer, A., & Elekhnawy, E. (2022). Promising antifungal activity of Encephalartos laurentianus de wild against Candida albicans clinical isolates: in vitro and in vivo effects on renal cortex of adult albino rats. *Journal of Fungi*, *8*(5), 426.
15. Castillo Romero, K. F. (2015). Evaluation of in vitro antibacterial and antifungal activities of metal based azoles and silver nanoparticles.
16. Khwaza, V., & Aderibigbe, B. A. (2023). Antifungal activities of natural products and their hybrid molecules. *Pharmaceutics*, *15*(12), 2673.
17. Alam, S., Chowdhury, M. N. R., Hossain, M. A., Richi, F. T., Emon, N. U., Mohammad, M., ... & Taher, M. A. (2025). Antifungal potentials of Asian plants: ethnobotanical insights and phytochemical investigations. *Chemistry & Biodiversity*, *22*(5), e202402867.
18. Desai, N. C., Patel, B. Y., & Dave, B. P. (2017). Synthesis and antimicrobial activity of novel quinoline derivatives bearing pyrazoline and pyridine analogues. *Medicinal Chemistry Research*, *26*, 109-119.
19. Jakubczyk, D., & Dussart, F. (2020). Selected fungal natural products with antimicrobial properties. *Molecules*, *25*(4), 911.
20. Sortino, M., Delgado, P., Juárez, S., Quiroga, J., Abonía, R., Insuasty, B., ... & Zacchino, S. A. (2007). Synthesis and antifungal activity of (Z)-5-arylidenerhodanines. *Bioorganic & Medicinal Chemistry*, *15*(1), 484-494.
21. Holla, B. S., Mahalinga, M., Karthikeyan, M. S., Poojary, B., Akberali, P. M., & Kumari, N. S. (2005). Synthesis, characterization and antimicrobial activity of some substituted 1, 2, 3-triazoles. *European journal of medicinal chemistry*, *40*(11), 1173-1178.
22. Chavan, S. S., Damale, M. G., Shinde, D. B., & Sangshetti, J. N. (2018). Antibacterial and antifungal drugs from natural source: A review of clinical development. *Natural Products in Clinical Trials: Volume 1*, 114-164.
23. Prabhala, P., Sutar, S. M., Savanur, H. M., Joshi, S. D., & Kalkhambkar, R. G. (2022). In vitro antimicrobial combat, molecular modelling and structure activity relationship studies of novel class of aryl-ethyne tethered coumarin analogues and some 3-aryl coumarin derivatives. *European Journal of Medicinal Chemistry Reports*, *5*, 100048.