

A metal-flavonoid strategy: New cobalt–naringin metal complex with broad pharmacological promise

Jugnu Goyal¹, Ritesh Jha², Kamya Goyal³, Shammy Jindal⁴ and Prabhakar Kumar Verma^{1*}

¹Department of Pharmaceutical Sciences, Maharishi Dayanand University, Rohtak, Haryana, India

²Department of Pharmaceutical Chemistry, ISF College of Pharmacy, Moga, Punjab, India

³Department of Pharmaceutical Chemistry and Analysis, ISF College of Pharmacy, Moga, Punjab, India

⁴Professor, Department of Pharmaceutics, ISF College of Pharmacy and Research, Moga, Punjab, India

ABSTRACT Naringin is a naturally occurring flavonoid glycoside recognized for its moderate biological activity and strong metal-chelating ability. Exploring this property, a new cobalt–naringin complex was synthesized with a yield of 44.37% and subsequently characterized using comprehensive spectroscopic and thermal analytical techniques to confirm its coordination behavior and stability. The biological potential of the synthesized complex was systematically investigated through antimicrobial, antioxidant, anthelmintic, molluscicidal, and anticancer assays. Antimicrobial activity was evaluated against representative Gram-positive and Gram-negative bacteria (*Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa*) as well as fungal strains (*Aspergillus niger* and *Candida albicans*). Antioxidant efficacy was assessed using standard free radical scavenging assays. The cytotoxic potential of naringin and complex was assessed against the Michigan Cancer Foundation-7 human breast cancer cell line using the MTT assay. Notably, it exhibited superior antimicrobial efficacy, particularly against *S. aureus* and *C. albicans*. The complex also showed improved antioxidant capacity, indicating increased free radical scavenging ability. Furthermore, *in vitro* anticancer evaluation indicated a markedly reduced half-maximal inhibitory concentration value for the cobalt complex, confirming its enhanced cytotoxicity. Overall, coordination of naringin with cobalt markedly improves its multifunctional biological performance, highlighting its promise as a potential candidate for further pharmacological development.

KEY WORDS Antimicrobial, Anticancer, Antioxidant, Naringin-cobalt metal complex, Naringin.

How to cite this article: Goyal, J., Jha, R., Goyal, K., Jindal, S. and Verma, P.K. A metal-flavonoid strategy: New cobalt–naringin metal complex with broad pharmacological promise. *Indian J. Heterocycl. Chem.*, **2026**, 36, 259–267. <https://doi.org/10.59467/IJHC.2026.36.259>