

Iodide-Bridged Palladium(II) Complex Bearing Tetrabutylammonium Moiety as a Potential Antifungal Agent

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Structured Abstract

Background: Fungal infections pose a substantial risk to public health, especially for people with weakened immune systems. The emergence of antifungal resistance has made the treatment of fungal infections more complex, requiring the exploration of new antifungal drugs. Palladium (Pd) complexes have shown great potential as they possess distinct chemical properties and can effectively interfere with fungal growth by disrupting cellular surface and spore germination. This work investigates the possibility of iodide-bridged Pd(II) complex bearing tetrabutylammonium moiety; $[(N^nBu)_4]_2(Pd_2I_6)$ as a potential antifungal agent.

Methods: Treatment of N^nBu_4I with Pd powder in the presence of I_2 in acetone under mild conditions resulted in the formation of $(N^nBu_4)_2(Pd_2I_6)$ complex. This purity of the complex was confirmed using elemental (CHNS) and spectroscopy (FT-IR, NMR, UV-Vis) analysis. The antifungal investigation was conducted using the disk diffusion method on Muller-Hinton agar plates against *Candida utilis* fungus. $[(N^nBu)_4]_2(Pd_2I_6)$ was dissolved in dichloromethane (DCM) to generate solutions of different concentrations. The negative control was sterile distilled water, while the positive control was Gentamicin (10 μ g). Following the incubation period, the inhibitory zones (mm) were determined by employing triplicate analysis.

Results: The $(N^nBu_4)_2(Pd_2I_6)$ complexes are obtained in a high yield (89%) and purity. The solid-state FTIR spectrum exhibits a distinct absorption pattern 2956, 2867, 1457 and 1377 cm^{-1} attributed to tetrabutylammonium moiety. The existence of the dimeric Pd complex, $[Pd_2I_6]^{2-}$, was verified through the absorption observed at 340 nm in UV-Vis spectra. 1H NMR spectrum revealed a resonance of hydrogen in a primary and secondary alkyl group in tetrabutylammonium moiety at 0.99, 1.48 and 1.86 ppm, respectively. The overall formulation was confirmed with a good agreement of elemental analysis with calculated values. The antifungal assay demonstrates that $(N^nBu_4)_2(Pd_2I_6)$ has moderate antifungal activity against *Candida utilis* at the concentration of 4 mg/ml, resulting in a zone of inhibition measuring 10 ± 1 mm compared to Gentamicin (25 ± 1 mm).

Conclusion: The $(N^nBu_4)_2(Pd_2I_6)$ complexes were successfully synthesized and characterized using various techniques. These complexes displayed moderate antifungal activity against *Candida utilis*, rendering them a promising candidate for medication development.

Keywords: antifungal, *Candida utilis*, palladium complex, tetrabutylammonium

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