

Antibacterial Activity of Pd(II) complexes bearing 1,2-Bis(diphenylphosphino)ethane (dppe) Moiety

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Structured Abstract

Background: Antimicrobial resistance (AMR) in Malaysia is a major public health issue caused by antibiotic overuse in healthcare and agriculture. This causes multidrug-resistant infections, which reduce treatment efficacy and increase morbidity, death, and healthcare costs. Metal complexes, notably Pd(II) complexes, are becoming feasible alternative antibacterial agents due to their unique mechanisms of action, efficacy against multidrug-resistant pathogens, and capacity to circumvent antibiotic resistance. This study tests Pd(II) complexes bearing dppe ligand against human pathogenic microorganisms.

Methods: PdI₂(dppe) was synthesised through the reaction of (Ph₄P)₂[PdI₆] with dppe in acetone at ambient conditions. The complexes were characterized through Fourier Transform Infrared (FT-IR) spectroscopy, ¹H and ³¹P Nuclear Magnetic Resonance (NMR) spectroscopy, and Thermogravimetric Analysis (TGA). Elemental analysis was utilized to verify their chemical composition. The antimicrobial efficacy was evaluated employing the Kirby-Bauer Disc Diffusion Susceptibility Test Protocol, adhering to the standards set by the Clinical and Laboratory Standards Institute (CLSI), focussing on Gram-positive (*Bacillus subtilis*, *Bacillus cereus*, *Streptococcus pneumoniae*, *Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacterial strains. The assessment was performed at different concentrations utilizing chloramphenicol as the reference standard.

Results: PdI₂(dppe) was obtained as a yellow precipitate (85% yield). A singlet was detected in the ³¹P{¹H} NMR spectrum at 61.8 ppm, whereas the coordination of the five-membered ring dppe with the Pd centre was distinctly noted in the ¹H NMR spectrum via a triplet resonance at around 2.33 ppm. The total composition was further elucidated by IR spectra, elemental analysis, and TGA analysis. The initial antimicrobial evaluation indicated that PdI₂(dppe) exhibited moderate activity against the examined gram-positive bacterial strains, with inhibition zones between 12 and 21 mm, in contrast to chloramphenicol, which showed inhibition zones of 30 to 38 mm. An increase in the zone of inhibition was observed with higher concentrations, indicating a dose-dependent response. However, no zone of inhibition was found against the Gram-negative *E. coli* strains.

Conclusion: Synthesis and structural characterisation of Pd complexes successful. Initial antimicrobial tests reveal its promise as an antibacterial agent against pathogenic human bacterial strains, highlighting the need for more research into its biological applications and toxicity.

Keywords: palladium complex, dppe, antibacterial activity

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