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Synthesis, Characterisation and Evaluation of Novel Antibacterial Agents

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Abstract
Among the transition metal complexes, ruthenium-based complexes have been widely studied and some have displayed significant antibacterial activity. This can be due to their ability to; strongly bind nucleic acids and proteins, ligand exchange kinetics similar to those of their platinum counterparts, the prevalence of two main oxidation states (II and III) and the iron-mimicking property when bound to biological molecules. However, only very recently studies have shown significant interest in their antimicrobial properties. A series of novel octahedral Ru (II) complexes with varying auxiliary ligands, (L1) 2, 2'-bipyridine, and 1, 10-phenanthroline were synthesised bound to a series of systematically varied polypyridyl ligand (L2), of the form [Ru(L1)2L2](PF6)2.

Complex Characterisation
The complexes are prepared from starting materials such as 1,10 phenanthroline, phenadione, Ru[bpy]2Cl2 and Ru(phen)2Cl2 and all samples are characterised by electronic (UV/Vis, Fluorescence), vibrational (IR/Raman) and NMR (1H, 13C, COSY) spectroscopy. An example of the Raman spectrum and 1H NMR for Ru(phen)2Cl2 is presented below in figure 6 and 8 respectively.

The proton chemical shifts of [Ru(phen)2(L)]2+ were assigned by the aid of 'H–'H COSY spectra and by comparison with structurally similar complexes. Complexation of the phenanthroline auxiliary ligands gives a distinct proton signal, this large signal generated by the 2 aromatic protons on both phen moieties, was observed at ~8.41 ppm in all the [Ru(phen)2(L)2]2+ complexes assigned to protons at positions 4, 5, 24, 25 of the complex.

Biological Evaluation
• In previous studies [Ru(phen)p-FPIP]2+ and [Ru(phen)p-CPIP]2+ were observed to have the most effective interaction with CT-DNA of the series of Ru(II) complexes studied.
• They were found to have strong intercalation properties and tuneable photophysical properties.

Preliminary Antibacterial Evaluation Results

<table>
<thead>
<tr>
<th>Enterococcus faecalis</th>
<th>Gram-positive</th>
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<tbody>
<tr>
<td>MRSA</td>
<td></td>
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<tr>
<td>Escherichia Coli</td>
<td>Gram-negative</td>
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<tr>
<td>Pseudomonas Aeruginosa</td>
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</tbody>
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Methodologies
• Evaluation of Antibacterial Activity by 96 well-plate technique.

Conclusion
To date phenadione has shown the most antibacterial effectiveness for the gram-positive and gram-negative bacterial strains tested at different concentrations. The CPIP ligand shows effectiveness at higher concentrations than the phenadione on the same bacterial strain studied. However, it shown ineffective against MRSA.

The ruthenium complex tested has shown certain efficiency to the strain studied. However, it shown ineffective against MRSA.

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References