Acknowledgements

Abstract

List of Tables

List of Figures

Chapter 1      INTRODUCTION      1–37

1.1 Organotin compounds                                      1
1.2 Organotin compounds—a brief review                       2
1.3 Principle coordination geometries at the tin centre in organotin compounds  4
1.4 Organotin(IV) complexes with [O,O] donor ligands or carboxylates  5
    1.4.1 Methods of preparation                                5
1.5 Structural diversity of organotin(IV) carboxylates         7
1.6 Organotin(IV) complexes with [O,N,O] donor ligands        10
    1.6.1 Structure of diorganotin(IV) complexes with [O,N,O] donor ligands  10
1.7 Structure elucidation techniques                          12
    1.7.1 Infrared spectroscopy                                 12
    1.7.2 NMR spectroscopy                                      13
        1.7.2.1 $^1$H NMR spectroscopy                           13
        1.7.2.2 $^{13}$C NMR spectroscopy                        14
        1.7.2.3 $^{119}$Sn NMR spectroscopy                     15
    1.7.3 Mass spectrometry                                     16
    1.7.4 X-Ray crystallography                                19
        1.7.4.1 Crystal structure determination                  19
1.8 Applications of organotin compounds                       19
    1.8.1 Non-Biological applications                          19
1.8.1.1 Polymer stabilizer 20
1.8.1.2 Fire retardants 20
1.8.1.3 Catalysts 20
1.8.1.4 Water repellents 21
1.8.1.5 Natural fiber treatment 21
1.8.1.6 Glass melting 21
1.8.1.7 Precursors for forming SnO₂ films on glass 22
1.8.1.8 Electroplating 22

1.8.2 Biological applications 22
1.8.2.1 Leishmanicidal agent 22
1.8.2.2 Larvicidal agents 23
1.8.2.3 Antiviral agents 23
1.8.2.4 Veterinary application 23
1.8.2.5 Dentistry 23
1.8.2.6 Antifouling coatings 24
1.8.2.7 Crop protection 24
1.8.2.8 Antitumor activity 24

References 27

Chapter 2  EXPERIMENTAL 38–106

2.1 Chemicals 38
2.2 Instrumentation 38
2.3 General procedure for the synthesis of ligand 39
  2.3.1 From Tranexamic acid 39
  2.3.2 From Hydrazides 40
  2.3.3 From Dihydrazides 41
  2.3.4 Synthesis of noval ligands 42
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4</td>
<td>General procedures for synthesis of organotin(IV) complexes</td>
<td>47</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Di- and triorganotin(IV) complexes of [O,O] donor ligands</td>
<td>47</td>
</tr>
<tr>
<td>2.4.1.1</td>
<td>Procedure (I)</td>
<td>47</td>
</tr>
<tr>
<td>2.4.1.2</td>
<td>Procedure (II)</td>
<td>47</td>
</tr>
<tr>
<td>2.4.2</td>
<td>Diorganotin(IV) complexes of [O,N,O] donor ligands</td>
<td>48</td>
</tr>
<tr>
<td>2.4.2.1</td>
<td>Procedure (III)</td>
<td>48</td>
</tr>
<tr>
<td>2.4.2.2</td>
<td>Procedure (IV)</td>
<td>49</td>
</tr>
<tr>
<td>2.4.2.3</td>
<td>Procedure (V)</td>
<td>49</td>
</tr>
<tr>
<td>2.5</td>
<td>Synthesis of noval organotin(IV) complexes</td>
<td>50</td>
</tr>
<tr>
<td>2.6</td>
<td>Biological studies</td>
<td>102</td>
</tr>
<tr>
<td>2.6.1</td>
<td>Cytotoxicity</td>
<td>102</td>
</tr>
<tr>
<td>2.6.2</td>
<td>Antifungal activity</td>
<td>102</td>
</tr>
<tr>
<td>2.6.3</td>
<td>Antibacterial activity</td>
<td>103</td>
</tr>
<tr>
<td>2.6.4</td>
<td>Antiurease activity</td>
<td>103</td>
</tr>
<tr>
<td>2.6.5</td>
<td>Leishmanicidal activity</td>
<td>104</td>
</tr>
<tr>
<td>2.6.6</td>
<td>DNA binding studies</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>106</td>
</tr>
</tbody>
</table>

**Chapter 3**  
**RESULTS AND DISCUSSIONS**  

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Synthesis of organotin(IV) complexes</td>
<td>107</td>
</tr>
<tr>
<td>3.2</td>
<td>Infrared spectra</td>
<td>107</td>
</tr>
<tr>
<td>3.3</td>
<td>NMR Spectroscopy</td>
<td>109</td>
</tr>
<tr>
<td>3.3.1</td>
<td>$^1$H NMR spectroscopy</td>
<td>109</td>
</tr>
<tr>
<td>3.3.2</td>
<td>$^{13}$C NMR spectroscopy</td>
<td>129</td>
</tr>
<tr>
<td>3.3.3</td>
<td>$^{119}$Sn NMR spectroscopy</td>
<td>130</td>
</tr>
<tr>
<td>3.4</td>
<td>Mass spectrometry</td>
<td>151</td>
</tr>
<tr>
<td>3.5</td>
<td>Biological activity</td>
<td>156</td>
</tr>
<tr>
<td>3.5.1</td>
<td>Cytotoxicity</td>
<td>156</td>
</tr>
</tbody>
</table>
3.5.2 Antifungal activity 160
3.5.3 Antibacterial activity 172
3.5.4 Antiurease activity 184
3.5.5 Leishmanicidal activity 185
3.5.6 Evaluation of DNA binding parameters 186
  3.5.6.1 Cyclic voltammetry of selected compounds and their DNA adducts 186
  3.5.6.2 UV-vis absorption studies of diorganotin(IV) complex-DNA interactions 192

References 197

Chapter 4 CRYSTALLOGRAPHIC ANALYSIS 201–262

4.1 X-ray crystal structure of ligands 201
  4.1.1 X-ray crystal structure of H₂La 201
  4.1.2 X-ray crystal structure of H₂Lc 202
  4.1.3 X-ray crystal structure of H₂Lf 205
  4.1.4 X-ray crystal structure of H₂Lh 206
  4.1.5 X-ray crystal structure of H₂Lj 209

4.2 X-ray Crystal structure of organotin(IV) complexes 213
  4.2.1 X-ray crystal structure of complex (2) 213
  4.2.2 X-ray crystal structure of complex (9) 215
  4.2.3 X-ray crystal structure of complex (22) 218
  4.2.4 X-ray crystal structure of complex (25) 220
  4.2.5 X-ray crystal structure of complex (32) 225
  4.2.6 X-ray crystal structure of complex (36) 227
  4.2.7 X-ray crystal structure of complex (37) 233
  4.2.8 X-ray crystal structure of complex (39) 235
  4.2.9 X-ray crystal structure of complex (48) 239