

CONTENTS

	Page
บทคัดย่อ	(3)
Abstract	(7)
Acknowledgement	(11)
The Relevance of Research Work to Thailand	(12)
Contents	(13)
List of Tables	(16)
List of Illustrations	(25)
Abbreviations and Symbols	(33)
1. Introduction	1
1.1 Introduction	1
1.1.1 <i>Garcinia scortechinii</i>	1
1.1.2 <i>Garcinia hanburyi</i>	2
1.2 Review of literatures	2
1.2.1 Chemical constituents from the genus <i>Garcinia</i>	2
1.3 The objectives	41
2. Experimental	42
2.1 Chemicals and instruments	42
2.2 Plant material	43
2.3 Chemical investigation from the fruits of <i>G. scortechinii</i>	43
2.3.1 Extraction	43
2.3.2 Chemical investigation of the crude methanol extract of the fruits	43
2.3.2.1 Investigation of the chloroform-soluble part	44
2.3.2.2 Investigation of the chloroform-insoluble part	142
2.4 Chemical investigation from the fruits of <i>G. hanburyi</i>	155
2.4.1 Extraction	155
2.4.2 Investigation of the chloroform-soluble part	155

CONTENTS (Continued)

	Page
2.4.3 Investigation of the chloroform-insoluble part	172
3. Results and Discussion	182
3.1 Characteristic spectroscopic data of caged-polyprenylated xanthenes isolated from <i>G. scortechinii</i>	182
3.2 Structural determination of compounds isolated from the fruits of <i>G. scortechinii</i>	185
3.2.1 Compound GF3	185
3.2.2 Compound GF4	187
3.2.3 Compound GF5	189
3.2.4 Compound GF6	190
3.2.5 Compound GF8	192
3.2.6 Compound GF16	194
3.2.7 Compound GF13	196
3.2.8 Compound GF10	197
3.2.9 Compound GF14	199
3.2.10 Compound GF12	200
3.2.11 Compound GF15	202
3.2.12 Compound GF11	204
3.2.13 Compound GF17	206
3.2.14 Compound GF18	207
3.2.15 Compound GF9	209
3.2.16 Compound GF19	212
3.2.17 Compound GF21	215
3.2.18 Compound GF20	218
3.2.19 Compound GF22	220
3.2.20 Compound GF1	223
3.2.21 Compound GF2	226

CONTENTS (Continued)

	Page
3.2.22 Compound GF7	228
3.2.23 Compound GF23	229
3.2.24 Compound GF24	232
3.3 Characteristic spectroscopic data of caged-polyprenylated xanthenes isolated from <i>G. hanburyi</i>	234
3.3.1 Compound GF28	235
3.3.2 Compound GF27	238
3.3.3 Compound GF25	241
3.3.4 Compound GF29	243
3.3.5 Compound GF26	246
Reference	440
Publications	449
Vitae	451

LIST OF TABLES

Table	Page
1 Compounds from <i>Garcinia</i> species	3
2 Solubility of the crude methanol extract in various solvents at room temperature	43
3 Fractions obtained from GFA by column chromatography over silica gel	45
4 Subfractions obtained from fraction GFA2 by column chromatography over silica gel	46
5 Subfractions obtained from fraction GFA3 by column chromatography over silica gel	48
6 Subfractions obtained from subfraction A3-5 by flash column chromatography over silica gel	50
7 Subfractions obtained from fraction GFA4 by column chromatography over silica gel	54
8 Subfractions obtained from subfraction A4-2 by column chromatography over silica gel	55
9 Subfractions obtained from subfraction A4-3 by column chromatography over silica gel	57
10 Subfractions obtained from subfraction A4-3-2 by column chromatography over silica gel	58
11 Subfractions obtained from subfraction A4-5 by column chromatography over silica gel	60
12 Subfractions obtained from fraction GFA5 by column chromatography over silica gel	63
13 Subfractions obtained from subfraction A5-1 by column chromatography over silica gel	63
14 Subfractions obtained from subfraction A5-1-1 by flash column chromatography over silica gel	64

LIST OF TABLES (Continued)

Table	Page
15 Subfractions obtained from subfraction C1 by flash column chromatography over silica gel	64
16 Subfractions obtained from subfraction C1-4 by flash column chromatography over silica gel	66
17 Subfractions obtained from subfraction C1-4-2 by column chromatography over silica gel	67
18 Subfractions obtained from subfraction CA2 by column chromatography over silica gel	67
19 Subfractions obtained from subfraction CA3 by column chromatography over silica gel	70
20 Subfractions obtained from subfraction CA3-1 by column chromatography over silica gel	70
21 Subfractions obtained from subfraction C1-5 by column chromatography over silica gel	71
22 Subfractions obtained from subfraction C1-6 by column chromatography over silica gel	73
23 Subfractions obtained from subfraction C1-7 by flash column chromatography over silica gel	74
24 Subfractions obtained from subfraction C2 by column chromatography over silica gel	75
25 Subfractions obtained from fraction GFA6 by column chromatography over silica gel	77
26 Subfractions obtained from subfraction A6-4 by column chromatography over silica gel	78
27 Subfractions obtained from subfraction A6-7 by column chromatography over silica gel	80

LIST OF TABLES (Continued)

Table	Page
28 Subfractions obtained from subfraction A6-7-3 by column chromatography over Sephadex LH-20	81
29 Subfractions obtained from subfraction D1 by column chromatography over reverse-phase C ₁₈ silica gel	81
30 Subfractions obtained from subfraction D2 by column chromatography over silica gel	82
31 Subfractions obtained from subfraction D3 by flash column chromatography over silica gel	84
32 Subfractions obtained from subfraction D4 by column chromatography over silica gel	85
33 Subfractions obtained from subfraction A6-7-4 by column chromatography over silica gel	88
34 Subfractions obtained from subfraction E3 by column chromatography over silica gel	89
35 Subfractions obtained from subfraction A6-8 by column chromatography over silica gel	91
36 Subfractions obtained from subfraction G2 by column chromatography over reverse-phase C ₁₈ silica gel	92
37 Subfractions obtained from subfraction A6-8-2 by column chromatography over silica gel	93
38 Subfractions obtained from fraction GFA7 by column chromatography over Sephadex LH-20	97
39 Subfractions obtained from subfraction A7-2 by column chromatography over Sephadex LH-20	98
40 Subfractions obtained from sub fraction A7-2-2 by column chromatography over silica gel	99

LIST OF TABLES (Continued)

Table	Page
41 Subfractions obtained from subfraction I2 by column chromatography over silica gel	100
42 Subfractions obtained from subfraction I4 by column chromatography over silica gel	101
43 Subfractions obtained from subfraction I4-6 by column chromatography over silica gel	103
44 Subfractions obtained from subfraction I5 by column chromatography over silica gel	105
45 Subfractions obtained from subfraction A7-3 by column chromatography over Sephadex LH-20	107
46 Subfractions obtained from subfraction A7-3-3 by column chromatography over silica gel	108
47 Subfractions obtained from subfraction A7-5 by column chromatography over silica gel	109
48 Subfractions obtained from fraction GFA8 by column chromatography over Sephadex LH-20	111
49 Subfractions obtained from subfraction A8-2 by column chromatography over reverse-phase C ₁₈ silica gel	112
50 Subfractions obtained from subfraction A8-2-2 by column chromatography over silica gel	113
51 Subfractions obtained from subfraction A8-3 by column chromatography over reverse-phase C ₁₈ silica gel	115
52 Subfractions obtained from subfraction A8-3-4 by column chromatography over silica gel	117
53 Subfractions obtained from subfraction A8-4 by column chromatography over silica gel	119

LIST OF TABLES (Continued)

Table	Page
54 Subfractions obtained from fraction GFA9 by column chromatography over Sephadex LH-20	120
55 Subfractions obtained from subfraction A9-4 by column chromatography over silica gel	122
56 Subfractions obtained from subfraction A9-4-4 by column chromatography over reverse-phase C ₁₈ silica gel	123
57 Subfractions obtained from subfraction A9-4-5 by column chromatography over reverse-phase C ₁₈ silica gel	128
58 Subfractions obtained from subfraction N4 by column chromatography over reverse-phase C ₁₈ silica gel	129
59 Subfractions obtained from subfraction A9-4-6 by column chromatography over reverse-phase C ₁₈ silica gel	130
60 Subfractions obtained from subfraction O3 by column chromatography over reverse-phase C ₁₈ silica gel	131
61 Subfractions obtained from subfraction A9-4-7 by column chromatography over reverse-phase C ₁₈ silica gel	133
62 Subfractions obtained from subfraction A9-4-8 by column chromatography over reverse-phase C ₁₈ silica gel	135
63 Subfractions obtained from fraction GFA10 by column chromatography over Sephadex LH-20	137
64 Subfractions obtained from subfraction A10-2 by column chromatography over silica gel	138
65 Subfractions obtained from fraction GFA11 by column chromatography over Sephadex LH-20	140
66 Subfractions obtained from fraction GFA12 by column chromatography over Sephadex LH-20	141

LIST OF TABLES (Continued)

Table	Page
67 Fractions obtained from GFB by column chromatography over Sephadex LH-20	142
68 Subfractions obtained from fraction GFB-3 by column chromatography over reverse-phase C ₁₈ silica gel	143
69 Subfractions obtained from subfraction B3-4 by column chromatography over reverse-phase C ₁₈ silica gel	144
70 Subfractions obtained from subfraction B3-5 by column chromatography over reverse-phase C ₁₈ silica gel	145
71 Subfractions obtained from subfraction B3-7 by column chromatography over Sephadex LH-20	147
72 Subfractions obtained from subfraction B3-8 by column chromatography over Sephadex LH-20 silica gel	148
73 Subfractions obtained from subfraction B3-8-3 by column chromatography over Sephadex LH-20	149
74 Subfractions obtained from fraction GFB-4 by column chromatography over reverse-phase C ₁₈ silica gel	151
75 Fractions obtained from 2GFB by column chromatography over Sephadex LH-20	153
76 Subfractions obtained from fraction 2GFB-6 by Semi-preparative HPLC	154
77 Fractions obtained from GSC by column chromatography over silica gel	155
78 Subfractions obtained from fraction GSC3 by column chromatography over Sephadex LH-20	156
79 Subfractions obtained from subfraction GSC3-2 by column chromatography over silica gel	157
80 Subfractions obtained from subfraction GSC3-2-1 by column chromatography over silica gel	157

LIST OF TABLES (Continued)

Table	Page
81 Subfractions obtained from subfraction GSC3-2-6 by column chromatography over reverse-phase C ₁₈ silica gel	160
82 Subfractions obtained from subfraction GSC3-3 by column chromatography over silica gel	162
83 Subfractions obtained from subfraction GSC3-3-5 by column chromatography over silica gel	165
84 Subfractions obtained from subfraction GSC3-3-9 by column chromatography over silica gel	168
85 Subfractions obtained from subfraction GSCB-1 by column chromatography over reverse-phase C ₁₈ silica gel	169
86 Subfractions obtained from subfraction GSCB-2 by column chromatography over reverse-phase C ₁₈ silica gel	170
87 Fractions obtained from GSM by column chromatography over Sephadex LH-20	173
88 Subfractions obtained from the second subfraction by column chromatography over Sephadex LH-20	174
89 Subfractions obtained from fraction GSM3 by column chromatography over Sephadex LH-20	175
90 Subfractions obtained from fraction GSM4 by column chromatography over Sephadex LH-20	177
91 Subfractions obtained from subfraction GSM4-3 by column chromatography over reverse-phase C ₁₈ silica gel	178
92 Subfractions obtained from subfraction GSM4-4 by column chromatography over reverse-phase C ₁₈ silica gel	179
93 The ¹ H NMR data of scortechinone A and GF3	186
94 The NMR data of compound GF4	188
95 The ¹ H NMR data of scortechinone D and GF5	190

LIST OF TABLES (Continued)

Table	Page
96 The ^1H NMR data of scortechinone E and GF6	191
97 The NMR data of compound GF8	193
98 The ^1H NMR data of scortechinone B and GF16	195
99 The ^1H NMR data of scortechinone F and GF13	196
100 The ^1H NMR data of scortechinone H and GF10	198
101 The ^1H NMR data of scortechinone C and GF14	199
102 The ^1H NMR data of scortechinone M and GF12	201
103 The NMR data of compound GF15	203
104 The ^1H NMR data of scortechinone I and GF11	205
105 The ^1H NMR data of scortechinone P and GF17	206
106 The NMR data of compound GF18	208
107 The NMR data of compound GF9	211
108 The NMR data of compound GF19	214
109 The NMR data of compound GF21	216
110 The NMR data of compound GF20	219
111 The NMR data of compound GF22	222
112 The ^1H and ^{13}C NMR data of 10 α -hydroxyamorphane-4-en-3-one and GF1	225
113 The ^1H - ^1H COSY, HMBC and NOE data of compound GF1	226
114 The NMR data of compound GF2	227
115 The ^1H NMR data of DD7 and GF7	228
116 The NMR data of compound GF23	231
117 The NMR data of compound GF24	233
118 The NMR data of compound GF28	237
119 The NMR data of compound GF27	239
120 The NMR data of compound GF25	242
121 The NMR data of compound GF29	244

LIST OF TABLES (Continued)

Table	Page
122 The NMR data of compound GF26	247

LIST OF ILLUSTRATIONS

Figure	Page
1 <i>Garcinia scortechinii</i>	1
2 <i>Garcinia hanburyi</i>	2
3 UV (CH ₃ OH) spectrum of GF3	249
4 FT-IR (neat) spectrum of GF3	250
5 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF3	251
6 Mass spectrum of GF4	252
7 UV (CH ₃ OH) spectrum of GF4	253
8 FT-IR (neat) spectrum of GF4	254
9 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF4	255
10 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF4	256
11 DEPT spectrum of GF4	257
12 NOEDIFF spectrum of GF4 after irradiation at δ_{H} 1.49	258
13 NOEDIFF spectrum of GF4 after irradiation at δ_{H} 4.55	259
14 2D HMQC spectrum of GF4	260
15 2D HMBC spectrum of GF4	261
16 UV (CH ₃ OH) spectrum of GF5	262
17 FT-IR (neat) spectrum of GF5	263
18 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF5	264
19 UV (CH ₃ OH) spectrum of GF6	265
20 FT-IR (neat) spectrum of GF6	266
21 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF6	267
22 Mass spectrum of GF8	268
23 UV (CH ₃ OH) spectrum of GF8	269
24 FT-IR (neat) spectrum of GF8	270
25 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF8	271
26 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF8	272
27 DEPT spectrum of GF8	273

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
28 NOEDIFF spectrum of GF8 after irradiation at δ_{H} 2.84	274
29 2D HMQC spectrum of GF8	275
30 2D HMBC spectrum of GF8	276
31 UV (CH ₃ OH) spectrum of GF16	277
32 FT-IR (neat) spectrum of GF16	278
33 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF16	279
34 UV (CH ₃ OH) spectrum of GF13	280
35 FT-IR (neat) spectrum of GF13	281
36 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF13	282
37 UV (CH ₃ OH) spectrum of GF10	283
38 FT-IR (neat) spectrum of GF10	284
39 ¹ H NMR (400 MHz) (CDCl ₃) spectrum of GF10	285
40 UV (CH ₃ OH) spectrum of GF14	286
41 FT-IR (neat) spectrum of GF14	287
42 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF14	288
43 UV (CH ₃ OH) spectrum of GF12	289
44 FT-IR (neat) spectrum of GF12	290
45 ¹ H NMR (400 MHz) (CDCl ₃) spectrum of GF12	291
46 Mass spectrum of GF15	292
47 UV (CH ₃ OH) spectrum of GF15	293
48 FT-IR (neat) spectrum of GF15	294
49 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF15	295
50 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF15	296
51 DEPT spectrum of GF15	297
52 NOEDIFF spectrum of GF15 after irradiation at δ_{H} 3.57	298
53 NOEDIFF spectrum of GF15 after irradiation at δ_{H} 4.53	299
54 2D HMQC spectrum of GF15	300

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
55 2D HMBC spectrum of GF15	301
56 UV (CH ₃ OH) spectrum of GF11	302
57 FT-IR (neat) spectrum of GF11	303
58 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF11	304
59 UV (CH ₃ OH) spectrum of GF17	305
60 FT-IR (neat) spectrum of GF17	306
61 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF17	307
62 Mass spectrum of GF18	308
63 UV (CH ₃ OH) spectrum of GF18	309
64 FT-IR (neat) spectrum of GF18	310
65 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF18	311
66 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF18	312
67 DEPT spectrum of GF18	313
68 2D HMQC spectrum of GF18	314
69 2D HMBC spectrum of GF18	315
70 Mass spectrum of GF9	316
71 UV (CH ₃ OH) spectrum of GF9	317
72 FT-IR (neat) spectrum of GF9	318
73 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF9	319
74 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF9	320
75 DEPT spectrum of GF9	321
76 NOEDIFF spectrum of GF9 after irradiation at δ_{H} 9.48	322
77 2D HMQC spectrum of GF9	323
78 2D HMBC spectrum of GF9	324
79 Mass spectrum of GF19	325
80 UV (CH ₃ OH) spectrum of GF19	326
81 FT-IR (neat) spectrum of GF19	327

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
82 ^1H NMR (500 MHz) (Acetone- d_6) spectrum of GF19	328
83 ^{13}C NMR (125 MHz) (Acetone- d_6) spectrum of GF19	329
84 DEPT spectrum of GF19	330
85 NOEDIFF spectrum of GF19 after irradiation at δ_{H} 1.33	331
86 NOEDIFF spectrum of GF19 after irradiation at δ_{H} 4.55	332
87 NOEDIFF spectrum of GF19 after irradiation at δ_{H} 7.75	333
88 2D HMQC spectrum of GF19	334
89 2D HMBC spectrum of GF19	335
90 Mass spectrum of GF21	336
91 UV (CH ₃ OH) spectrum of GF21	337
92 FT-IR (neat) spectrum of GF21	338
93 ^1H NMR (500 MHz) (Acetone- d_6) spectrum of GF21	339
94 ^{13}C NMR (125 MHz) (Acetone- d_6) spectrum of GF21	340
95 DEPT spectrum of GF21	341
96 NOEDIFF spectrum of GF21 after irradiation at δ_{H} 1.61	342
97 NOEDIFF spectrum of GF21 after irradiation at δ_{H} 6.59	343
98 2D HMQC spectrum of GF21	344
99 2D HMBC spectrum of GF21	345
100 Mass spectrum of GF20	346
101 UV (CH ₃ OH) spectrum of GF20	347
102 FT-IR (neat) spectrum of GF20	348
103 ^1H NMR (500 MHz) (Acetone- d_6) spectrum of GF20	349
104 ^{13}C NMR (125 MHz) (Acetone- d_6) spectrum of GF20	350
105 DEPT spectrum of GF20	351
106 NOEDIFF spectrum of GF20 after irradiation at δ_{H} 4.58	352
107 NOEDIFF spectrum of GF20 after irradiation at δ_{H} 6.58	353

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
108 2D HMQC spectrum of GF20	354
109 2D HMBC spectrum of GF20	355
110 Mass spectrum of GF22	356
111 UV (CH ₃ OH) spectrum of GF22	357
112 FT-IR (neat) spectrum of GF22	358
113 ¹ H NMR (500 MHz) (CDCl ₃) spectrum of GF22	359
114 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF22	360
115 DEPT spectrum of GF22	361
116 2D HMQC spectrum of GF22	362
117 2D HMBC spectrum of GF22	363
118 Mass spectrum of GF1	364
119 UV (CH ₃ OH) spectrum of GF1	365
120 FT-IR (neat) spectrum of GF1	366
121 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF1	367
122 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF1	368
123 DEPT spectrum of GF1	369
124 NOEDIFF spectrum of GF1 after irradiation at δ_{H} 2.60	370
125 ¹ H- ¹ H COSY spectrum of GF1	371
126 2D HMQC spectrum of GF1	372
127 2D HMBC spectrum of GF1	373
128 Mass spectrum of GF2	374
129 UV (CH ₃ OH) spectrum of GF2	375
130 FT-IR (neat) spectrum of GF2	376
131 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF2	377
132 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF2	378
133 DEPT spectrum of GF2	379
134 NOEDIFF spectrum of GF2 after irradiation at δ_{H} 1.98	380

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
135 NOEDIFF spectrum of GF2 after irradiation at δ_{H} 2.14	381
136 ^1H - ^1H COSY spectrum of GF2	382
137 2D HMQC spectrum of GF2	383
138 2D HMBC spectrum of GF2	384
139 UV (CH_3OH) spectrum of GF7	385
140 FT-IR (neat) spectrum of GF7	386
141 ^1H NMR (500 MHz) (CDCl_3) spectrum of GF7	387
142 ^{13}C NMR (125 MHz) (CDCl_3) spectrum of GF7	388
143 DEPT spectrum of GF7	389
144 UV (CH_3OH) spectrum of GF23	390
145 FT-IR (neat) spectrum of GF23	391
146 ^1H NMR (300 MHz) ($\text{DMSO}-d_6$) spectrum of GF23	392
147 ^{13}C NMR (125 MHz) ($\text{DMSO}-d_6$) spectrum of GF23	393
148 DEPT spectrum of GF23	394
149 2D HMQC spectrum of GF23	395
150 2D HMBC spectrum of GF23	396
151 UV (CH_3OH) spectrum of GF24	397
152 FT-IR (neat) spectrum of GF24	398
153 ^1H NMR (300 MHz) ($\text{DMSO}-d_6$) spectrum of GF24	399
154 ^{13}C NMR (75 MHz) ($\text{DMSO}-d_6$) spectrum of GF24	400
155 DEPT spectrum of GF24	401
156 2D HMQC spectrum of GF24	402
157 2D HMBC spectrum of GF24	403
158 UV (CH_3OH) spectrum of GF28	404
159 FT-IR (neat) spectrum of GF28	405
160 ^1H NMR (300 MHz) (CDCl_3) spectrum of GF28	406
161 ^{13}C NMR (75 MHz) (CDCl_3) spectrum of GF28	407

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
162 DEPT spectrum of GF28	408
163 2D HMQC spectrum of GF28	409
164 2D HMBC spectrum of GF28	410
165 Mass spectrum of GF27	411
166 UV (CH ₃ OH) spectrum of GF27	412
167 FT-IR (neat) spectrum of GF27	413
168 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF27	414
169 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF27	415
170 DEPT spectrum of GF27	416
171 2D HMQC spectrum of GF27	417
172 2D HMBC spectrum of GF27	418
173 UV (CH ₃ OH) spectrum of GF25	419
174 FT-IR (neat) spectrum of GF25	420
175 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF25	421
176 ¹³ C NMR (75 MHz) (CDCl ₃) spectrum of GF25	422
177 DEPT spectrum of GF25	423
178 2D HMQC spectrum of GF25	424
179 2D HMBC spectrum of GF25	425
180 UV (CH ₃ OH) spectrum of GF29	426
181 FT-IR (neat) spectrum of GF29	427
182 ¹ H NMR (300 MHz) (CDCl ₃) spectrum of GF29	428
183 ¹³ C NMR (125 MHz) (CDCl ₃) spectrum of GF29	429
184 DEPT spectrum of GF29	430
185 2D HMQC spectrum of GF29	431
186 2D HMBC spectrum of GF29	432
187 UV (CH ₃ OH) spectrum of GF26	433
188 FT-IR (neat) spectrum of GF26	434

LIST OF ILLUSTRATIONS (Continued)

Figure	Page
189 ^1H NMR (300 MHz) (CDCl_3) spectrum of GF26	435
190 ^{13}C NMR (125 MHz) (CDCl_3) spectrum of GF26	436
191 DEPT spectrum of GF26	437
192 2D HMQC spectrum of GF26	438
193 2D HMBC spectrum of GF26	439

ABBREVIATIONS AND SYMBOLS

<i>s</i>	=	<i>singlet</i>
<i>d</i>	=	<i>doublet</i>
<i>t</i>	=	<i>triplet</i>
<i>q</i>	=	<i>quartet</i>
<i>sept</i>	=	<i>septet</i>
<i>m</i>	=	<i>multiplet</i>
<i>brs</i>	=	<i>broad singlet</i>
<i>brd</i>	=	<i>broad doublet</i>
<i>brt</i>	=	<i>broad triplet</i>
<i>brdd</i>	=	<i>broad doublet of doublet</i>
<i>dd</i>	=	<i>doublet of doublet</i>
<i>dq</i>	=	<i>quartet of doublet</i>
<i>sept d</i>	=	<i>double of septet</i>
<i>d brd</i>	=	<i>broad doublet of doublet</i>
<i>tm</i>	=	<i>multiplet of triplet</i>
<i>dm</i>	=	<i>multiplet of doublet</i>
<i>td</i>	=	<i>doublet of triplet</i>
<i>th</i>	=	<i>heptet of triplet</i>
<i>tq</i>	=	<i>quartet of triplet</i>
<i>t sept</i>	=	<i>septet of triplet</i>
<i>ddd</i>	=	<i>doublet of doublet of doublet</i>
<i>ddm</i>	=	<i>multiplet of doublet of doublet</i>
<i>ddq</i>	=	<i>quartet of doublet of doublet</i>
<i>ddh</i>	=	<i>heptet of doublet of doublet</i>
δ	=	chemical shift relative to TMS
<i>J</i>	=	coupling constant
<i>m/z</i>	=	a value of mass divided by charge
$^{\circ}\text{C}$	=	degree Celcius

ABBREVIATIONS AND SYMBOLS (Continued)

R_f	=	retention factor
g	=	gram
mg	=	milligram
mL	=	milliliter
cm^{-1}	=	reciprocal centimeter
nm	=	nanometer
λ_{max}	=	maximum wavelength
ν	=	absorption frequencies
ε	=	molar extinction coefficient
Hz	=	Hertz
MHz	=	megaHertz
ppm	=	part per million
rel. int.	=	relative intensity
$[\alpha]_D$	=	specific rotation
c	=	concentration
H-n	=	position of protons
C-n	=	position of carbons
UV	=	Ultraviolet
IR	=	Infrared
NMR	=	Nuclear Magnetic Resonance
1D NMR	=	One Dimensional Nuclear Magnetic Resonance
2D NMR	=	Two Dimensional Nuclear Magnetic Resonance
MS	=	Mass Spectrometry
HMQC	=	Heteronuclear Multiple Quantum Coherence

ABBREVIATIONS AND SYMBOLS (Continued)

HMBC	=	Heteronuclear Multiple Bond Correlation
DEPT	=	Distortionless Enhancement by Polarization Transfer
NOE	=	Nuclear Overhauser Effect
NOEDIFF	=	NOE Difference Spectroscopy
^1H - ^1H COSY	=	^1H - ^1H Correlation Spectroscopy
TLC	=	Thin-Layer Chromatography
TMS	=	tetramethylsilane
DMSO	=	dimethylsulfoxide
CH_2Cl_2	=	dichloromethane
CHCl_3	=	chloroform
EtOAc	=	ethyl acetate
CH_3OH	=	methanol
HCl	=	hydrochloric acid
NaOH	=	sodium hydroxide
NaHCO_3	=	sodium bicarbonate
CDCl_3	=	deuteriochloroform
Acetone- d_6	=	hexadeuteroacetone
DMSO- d_6	=	hexadeuterodimethylsulphoxide
ASA	=	anisaldehyde-sulphuric acid in acetic acid solution