

CONTENTS

	Page
บทกั้ดย่อ	(3)
ABSTRACT	(10)
ACKNOWLEDGEMENT	(17)
THE RELEVENCE OF THE RESEARCH WORK TO THAILAND	(18)
CONTENTS	(19)
LIST OF TABLES	(22)
LIST OF ILLUSTRATIONS	(27)
ABBREVIATIONS AND SYMBOLS	(29)
1 INTRODUCTION	1
1.1 Introduction	1
1.2 Review of literatures	3
1.2.1 Chemical constituents from the genus <i>Garcinia</i>	3
1.2.2 Chemical constituents from <i>Garcinia dulcis</i>	29
1.2.3 Biological activities of <i>Garcinia dulcis</i>	41
1.2.4 Antioxidants	41
1.3 The objective	43
2 EXPERIMENTAL	44
2.1 Instruments and chemicals	44
2.2 Plant material	45
2.3 Chemical investigation of the green fruits	46
2.3.1 Extraction and isolation	46
2.3.2 Chemical investigation of Crude A	46

CONTENTS (Continued)

	Page
2.3.3 Chemical investigation of Crude B	48
2.3.4 Chemical investigation of Crude C	56
2.4 Chemical investigation of the ripe fruits	59
2.4.1 Extraction and isolation	59
2.4.2 Chemical investigation of Crude D	59
2.4.3 Chemical investigation of Crude E	63
2.4.4 Chemical investigation of Crude F	67
2.5 Chemical investigation of the flowers	68
2.5.1 Extraction and isolation	68
2.5.2 Chemical investigation of Crude G1	69
2.5.3 Chemical investigation of Crude H	72
2.5.4 Chemical investigation of Crude I	74
2.5.5 Chemical investigation of Crude J	75
2.5.6 Chemical investigation of Crude K	77
2.5.7 Chemical investigation of Crude L	79
2.5.8 Chemical investigation of Crude M	80
2.6 Chemical investigation of the seeds	81
2.6.1 Extraction and isolation	81
2.6.2 Chemical investigation of Crude N	82
2.6.3 Chemical investigation of Crude O	83
2.6.4 Chemical investigation of Crude P	84
2.7 Estimation of the antioxidative activity	88

CONTENTS (Continued)

	Page
2.7.1 Screening on the free radical scavenging activity of the crude extracts	88
2.7.2 Screening on the free radical scavenging activity of the pure compounds	90
2.7.3 Evaluation of inhibitory concentration (IC ₅₀)	93
3 RESULTS AND DISCUSSION	95
3.1 Structural determination of compounds isolated from the green fruits, ripe fruits, flowers and seeds of <i>G. dulcis</i>	95
3.2 Relationship of compounds from <i>G. dulcis</i>	297
3.3 Evaluation of antioxidation activity	301
3.3.1 Free radical scavenging activity of the crude extracts	302
3.3.2 Free radical scavenging activity of the pure compounds	303
3.3.3 Evaluation of inhibitory concentration (IC ₅₀)	305
3.4 Biological activities of known compounds	308
4 CONCLUSION	310
REFERENCES	312
APPENDIX	326
PUBLICATIONS	350
VITAE	351

LISTS OF TABLES

Table		Page
1	Isolated compounds from the genus <i>Garcinia</i> (2002-2004)	4
2	Isolated compounds from <i>Garcinia dulcis</i>	30
3	Fractions obtained from Crude A by QCC	327
4	Fractions obtained from Crude B1 by CC	327
5	Fractions obtained from Crude B2 by CC	328
6	Fractions obtained from Crude C1 by CC	328
7	Fractions obtained from Crude C2 by CC	329
8	Fractions obtained from Crude D by CC	329
9	Fractions obtained from Crude E by QCC	330
10	Fractions obtained from Crude F by QCC	330
11	Fractions obtained from Crude G1 by QCC	331
12	Fractions obtained from Crude H by CC	332
13	Fractions obtained from Crude I by QCC	332
14	Fractions obtained from Crude J by CC	333
15	Fractions obtained from Crude K by CC	333
16	Fractions obtained from Crude L by CC	334
17	Fractions obtained from Crude M by CC	334
18	Fractions obtained from Crude N by QCC	335
19	Fractions obtained from Crude O by CC	335
20	Fractions obtained from Crude P by QCC	336
21	The average absorption and % inhibition of the crude extracts (100 µg/mL)	116
22	The average absorption and % inhibition of the pure compounds (10 µM)	117

LISTS OF TABLES (Continued)

Table	Page
23 The average absorption and % inhibition of the samples solutions and standard antioxidants at various concentrations	121
24 The NMR spectral data of GD1	98
25 The NMR spectral data of GD2	102
26 The ¹ H NMR spectral data of GD2 and GD2(A)	103
27 The NMR spectral data of GD3	106
28 The NMR spectral data of GD4	109
29 The NMR spectral data of GD5	112
30 The ¹ H NMR spectral data of GD6	115
31 The NMR spectral data of GD7	117
32 The NMR spectral data of GD8	120
33 The NMR spectral data of GD9	123
34 The NMR spectral data of GD10	126
35 The NMR spectral data of GD11	128
36 The NMR spectral data of GD12	130
37 The NMR spectral data of GD13	132
38 The ¹ H NMR spectral data of GD14	134
39 The NMR spectral data of GD15	136
40 The NMR spectral data of GD16	139
41 The NMR spectral data of GD17	142
42 The NMR spectral data of GD18	145
43 The NMR spectral data of GD19	147

LISTS OF TABLES (Continued)

Table		Page
44	The NMR spectral data of GD20 at 380 K	152
45	The NMR spectral data of GD20 at 295 K	153
46	The NMR spectral data of GD20(A)	155
47	The NMR spectral data of GD21	158
48	The NMR spectral data of GD22	161
49	The NMR spectral data of GD23	163
50	The NMR spectral data of GD24	166
51	The NMR spectral data of GD25	168
52	The NMR spectral data of RD1	170
53	The NMR spectral data of RD2	173
54	The NMR spectral data of RD3	176
55	The NMR spectral data of RD4	179
56	The NMR spectral data of RD5	182
57	The NMR spectral data of RD6	184
58	The NMR spectral data of RD7	187
59	The NMR spectral data of RD8	190
60	The NMR spectral data of RD9	193
61	The NMR spectral data of RD10	196
62	The NMR spectral data of RD11	199
63	The NMR spectral data of RD12	201
64	The NMR spectral data of RD13	203
65	The NMR spectral data of RD14	206

LISTS OF TABLES (Continued)

Table	Page
66 The NMR spectral data of RD15	209
67 The NMR spectral data of RD16	212
68 The NMR spectral data of RD17	215
69 The NMR spectral data of FD1 at 390 K	218
70 The NMR spectral data of FD2	221
71 The NMR spectral data of FD3	223
72 The NMR spectral data of FD4	225
73 The NMR spectral data of FD5	227
74 The NMR spectral data of FD6	230
75 The NMR spectral data (major conformer) of FD7 at 300 K	234
76 The NMR spectral data (major conformer) of FD8 at 300 K	238
77 The NMR spectral data of FD9	241
78 The NMR spectral data (major conformer) of FD10 at 300 K	244
79 The NMR spectral data of FD11	248
80 The NMR spectral data of FD12	252
81 The NMR spectral data of FD13	255
82 The NMR spectral data of FD14	258
83 The NMR spectral data of FD15	261
84 The NMR spectral data of FD16	264
85 The NMR spectral data of FD17	267
86 The NMR spectral data of FD18	269
87 The NMR spectral data of FD19	271

LISTS OF TABLES (Continued)

Table		Page
88	The NMR spectral data of SD1	273
89	The NMR spectral data of SD2	275
90	The NMR spectral data of SD3	277
91	The NMR spectral data of SD4	279
92	The NMR spectral data of SD5	280
93	The NMR spectral data of SD6	282
94	The NMR spectral data of SD7	285
95	The NMR spectral data of SD8	287
96	The NMR spectral data of SD9	289
97	The NMR spectral data of SD10	291
98	The NMR spectral data of SD11	294
99	The NMR spectral data of SD12	296
100	% inhibition of test compounds and standard antioxidant (10 μ M)	303
101	IC ₅₀ values of test compounds and standard antioxidant	306

LISTS OF ILLUSTRATIONS

Figure		Page
1	<i>Garcinia dulcis</i> Kurz.	2
2	Extraction of Crudes 1, A, B and C from the green fruits of <i>G. dulcis</i>	336
3	Isolation of compounds GD1-GD4	337
4	Extraction of Crudes B1 and B2 from the green fruits of <i>G. dulcis</i>	337
5	Isolation of compounds GD5-GD10	338
6	Isolation of compounds GD11-GD20	338
7	Extraction of Crudes C1 and C2 from the green fruits of <i>G. dulcis</i>	339
8	Isolation of compounds GD8 and GD21-GD23	339
9	Isolation of compounds GD24 and GD25	340
10	Extraction of Crudes 2, D, E and F from the ripe fruits of <i>G. dulcis</i>	340
11	Isolation of compounds GD1, GD10, GD13, GD14, GD23 and RD1-RD6	341
12	Isolation of compounds GD2, GD20, GD21 and RD7-RD16	342
13	Isolation of compound RD17	342
14	Extraction of Crudes G1, G2, H, I, J, K, L and M from the flowers of <i>G. dulcis</i>	343
15	Isolation of compounds GD20, FD1-FD8	344
16	Isolation of compounds GD7, FD9-FD11	344
17	Isolation of compounds GD13, GD20 and RD8	345
18	Isolation of compounds GD8, GD14, GD20, RD6 and FD12-FD15	345
19	Isolation of compounds FD15-FD17	346
20	Isolation of compounds GD20, RD7, RD12, FD1 and FD18	346

LISTS OF ILLUSTRATIONS (Continued)

Figure		Page
21	Isolation of compounds GD20 and FD1	347
22	Extraction of compound GD2 , Crudes 3, 4, N, O and P from the seeds of <i>G. dulcis</i>	347
23	Isolation of compounds SD1 and SD2	348
24	Isolation of compound SD3	348
25	Isolation of compounds GD20 , RD12 and SD4-SD12	349
26	Radical scavenging activity of the crude extracts	302
27	Radical scavenging activity of pure compounds	305
28	IC ₅₀ of pure compounds	306

ABBREVIATIONS AND SYMBOLS

<i>s</i>	=	<i>singlet</i>
<i>d</i>	=	<i>doublet</i>
<i>t</i>	=	<i>triplet</i>
<i>m</i>	=	<i>multiplet</i>
<i>dd</i>	=	<i>doublet of doublet</i>
<i>br s</i>	=	<i>broad singlet</i>
g	=	gram
kg	=	kilogram
mg	=	milligram
μg	=	microgram
mM	=	millimolar
mL	=	milliliter
h	=	hour
min	=	minute
%	=	percent
nm	=	nanometer
cm ³	=	cubic centimeter
m.p.	=	melting point
cm ⁻¹	=	reciprocal centimeter (wave number)
δ	=	chemical shift relative to TMS
<i>J</i>	=	coupling constant
[α] _D	=	specific rotation
λ _{max}	=	maximum wavelength
ν	=	absorption frequencies

ABBREVIATIONS AND SYMBOLS (Continued)

ε	=	molar extinction coefficient
m/z	=	a value of mass divided by charge
$^{\circ}\text{C}$	=	degree celcius
MHz	=	Megahertz
ppm	=	part per million
c	=	concentration
MS	=	Mass Spectroscopy
EIMS	=	Electron Impact Mass Spectrometry
FABMS	=	Fast Atom Bombardment Mass Spectrometry
UV	=	Ultraviolet-Visible
IR	=	Infrared
NMR	=	Nuclear Magnetic Resonance
2D NMR	=	Two Dimentional Nuclear Magnetic Resonance
COSY	=	Correlated Spectroscopy
DEPT	=	Distortionless Enhancement by Polarization Transfer
HMBC	=	Heteronuclear Multiple Bond Correlation
HMQC	=	Heteronuclear Multiple Quantum Coherence
NOE	=	Nuclear Overhauser Effect Spectroscopy
CC	=	Column Chromatography
QCC	=	Quick Column Chromatography
PLC	=	Preparative Thin Layer Chromatography
CH_2Cl_2	=	dichloromethane
CHCl_3	=	chloroform
EtOAc	=	ethyl acetate

ABBREVIATIONS AND SYMBOLS (Continued)

Me ₂ CO	=	acetone
MeOH	=	methanol
TMS	=	tetramethylsilane
Acetone- <i>d</i> ₆	=	deuteroacetone
DMSO- <i>d</i> ₆	=	deuterodimethyl sulphoxide
CDCl ₃	=	deuteriochloroform
CD ₃ OD	=	deuteromethanol
D ₂ O	=	deuterium oxide
IC ₅₀	=	50% Inhibition Concentration
DPPH	=	2,2-diphenyl-1-picrylhydrazyl radical
BHT	=	butylated hydroxy toluene