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**APPENDICES**

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## APPENDIX A

**Table 1.** Sources and biological activities of secondary metabolites of endophytic fungi

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
1	Peramine	Pyrolopyrazine alkaloid	<i>Neotyphodium coenophialum</i>	<i>Festuca</i> spp.	Insect toxin	Tan and Zou, 1997
2	Ergobalasin	Ergot alkaloid	<i>Claviceps purpurea</i>	<i>Festuca</i> spp.	Neurotoxic	Powell <i>et al.</i> , 1990
3	Ergotamine		<i>Neotyphodium</i> spp.			Miles <i>et al.</i> , 1996
4	Ergosine					
5	$\beta$ -ergosine					
6	Ergovaline					
7	Ergostine					
8	Ergoptine					
9	$\beta$ -ergoptine					
10	Ergonine					
11	Ergocristine					
12	$\alpha$ -ergocryptine					
13	$\beta$ -ergocryptine					
14	Ergocormine					
15	Ergonovine					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
16	Lysergamide	Ergot alkaloid	<i>Claviceps purpurea</i>	<i>Festuca</i> spp.	Neurotoxic	Powell <i>et al.</i> , 1990
17	8-hydroxylysergamide		<i>Neotyphodium</i> spp.			Miles <i>et al.</i> , 1996
18	Isolysergamide					
19	Ergonovinine					
20	Phomopsichalasin	Cytochalasin	<i>Phomopsis</i> sp.	<i>Salix gracilostyla</i> var. <i>melanostachys</i>	Antimicrobial	Horn <i>et al.</i> , 1995
21	Cryptocin	Tetramic acid	<i>Cryptosporiopsis</i> cf. <i>quercina</i>	<i>Tripterygium</i> <i>wilfordii</i>	Antimycotic	Strobel <i>et al.</i> , 2000
22	Paxilline	Indole diterpene	<i>Neotyphodium lolii</i>	<i>Lolium perenne</i> ,	Causative agent	Mantle and Weedon, 1994
23	Lolitrein A	alkaloid		<i>Festuca</i> spp.		Munday- Finch <i>et al.</i> , 1997
24	Lolitrein B					
25	Lolitrein E					
26	Terpendole C					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
27	Lolitrein N	Indole alkaloid	<i>Neotyphodium lolii</i>	<i>Lolium perenne</i>	Neurotoxic	Munday-Finch <i>et al.</i> , 1998
28	Lolitrein					
29	Lolicine A					
30	Lolicine B					
31	Paspalitrein A	Indole alkaloid	<i>Phomopsis</i> sp.	<i>Cavendishia pubescens</i>	Causative agent	Bills <i>et al.</i> , 1992
32	Paspalitrein C					
33	Indole-3-acetic acid	Indole alkaloid	<i>Colletotrichum</i> sp.	<i>Artemisia annua</i>	Growth-promoting phytohormone	Lu <i>et al.</i> , 2000
34	6-isoprenylindole-3-carboxylic acid					
35	Indole-3-ethanol	Indole alkaloid	<i>Epichloa festucae</i>	<i>Festuca rubra</i>	Antifungal	Yue <i>et al.</i> , 2000
36	Methylindole-3-carboxylate					
37	Indole-3-carboxaldehyde					
38	Lolinine	Aminopyrrolizidine alkaloid	<i>Neotyphodium coenophialum</i>	<i>Festuca arundinacea</i>	Insecticidal	Casabuono and Pomilio, 1997
39	Loline					
40	Norloline		<i>Acremonium</i> sp.	<i>F. argentina</i>		
41	N-methyloline					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
42	<i>N</i> -formylnorloline	Aminopyrrolizidine alkaloid	<i>Neotyphodium coenophialum</i> , <i>Acremonium</i> sp.	<i>Festuca arundinacea</i> , <i>F. argentina</i>	Insecticidal	Strickland <i>et al.</i> , 1996
43	<i>N</i> -acetylnorloline					
44	<i>N</i> -formyllooline					
45	<i>N</i> -acetyllooline					
46	5,6-dehydro- <i>N</i> -acetyllooline					
47	Fusaricide	Pyridine alkaloid	<i>Fusarium</i> sp.	<i>Oxydendron arboreum</i>	Antiviral, Antifungal, Antitumor	McBrien <i>et al.</i> , 1996
48	Oxysporidinone	Pyridine alkaloid	<i>Fusarium oxysporum</i>	Unidentified	Antifungal	Breinholt <i>et al.</i> , 1997
49	Ergosterol	Steriod	<i>Colletotrichum</i> sp.	<i>Artemisia annua</i>	No data	Lu <i>et al.</i> , 2000
50	3 $\beta$ ,5 $\alpha$ ,6 $\beta$ trihydroxy ergosta-7,22-diene					
51	3 $\beta$ -hydroxyergosta-5-ene					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
52	3-oxoergosta-4,6,8 (14),22-tetraene	Steroid	<i>Colletotrichum</i> sp.	<i>Artemisia annua</i>	Antifungal	Lu <i>et al.</i> , 2000
53	3 $\beta$ -hydroxy-5 $\alpha$ ,8 $\alpha$ - epidioxyergosta-6,22- diene				No data	
54	3 $\beta$ -hydroxy-5 $\alpha$ ,8 $\alpha$ - epidioxyergosta-6,9 (11),22-triene				No data	
55	3-oxoergosta-4-ene				No data	
56	3 $\beta$ ,5 $\alpha$ -dihydroxy-6 $\beta$ - acetoxyergosta-7,22- diene				Antifungal	
57	3 $\beta$ ,5 $\alpha$ -dihydroxy-6 $\beta$ - phenylacetoxyergosta- 7,22-diene				Antifungal	
58	Herbarulide	Ketodivinyllac- tonic steroid	<i>Pleospora herbarum</i>	<i>Medicago lupulina</i>	Algicidal, Antimicrobial	Krohn <i>et al.</i> , 1999

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
59	2 $\alpha$ -hydroxydimeninol	Sesquiterpene	<i>Pestalotiopsis</i> spp.	<i>Taxus brevifolia</i>	No data	Pulici <i>et al.</i> , 1996,
60	Humulane derivative					Pulici <i>et al.</i> , 1997
61	Pestalotiopsin A					
62	Pestalotiopsin B					
63	Pestalotiopsin C					
64	Heptelic acid	Sesquiterpene	<i>Phyllosticta</i> sp. st 76	<i>Abies balsamea</i>	Toxic to spruce bud worm	Calhoun <i>et al.</i> , 1992
65	Hydroheptelic acid					
66	5-hydroxy-2-(1'-oxo- 5'-methyl-4'-hexenyl) benzofuran	Sesquiterpene	Unidentified	<i>Gaultheria procumbens</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1997
67	5-hydroxy-2-(1'- hydroxy-5'-methyl-4'- hexenyl)benzofuran					
68	Chokol A	Sesquiterpene	<i>Epichloe typhina</i>	<i>Phleum pratense</i>	Antifungal	Koshino <i>et al.</i> , 1989
69	Chokol B					
70	Chokol C					
71	Chokol D					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
72	Chokol E	Sesquiterpene	<i>Epichloe typhina</i>	<i>Phleum pratense</i>	Antifungal	Koshino <i>et al.</i> , 1989
73	Chokol F					
74	Chokol G					
75	Cyclonerodiol	Sesquiterpene	<i>Epichloe festuca</i>	<i>Festuca rubra</i>	Antifungal	Yue <i>et al.</i> , 2000
76	9 $\alpha$ -hydroxy-1,8(14),15-isopimaratrien-3,7,11-trione	Diterpene	Unidentified	<i>Abies balsamea</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1995
77	9 $\alpha$ -hydroxy-1,8(14),15-isopimaratrien-3,11-dione					
78	Subglutinol A	Diterpene	<i>Fusarium subglutinans</i>	<i>Tripterygium wilfordii</i>	Immunosuppressive	Lee <i>et al.</i> , 1995
79	Subglutinol B					
80	Guanacastepene	Diterpene	Unidentified st.CR115	<i>Daphnopsis americana</i>	Antibacterial	Brady <i>et al.</i> , 2001
81	Paclitaxel (Taxol)	Diterpene	<i>Taxomyces andreanae</i>	<i>Taxus brevifolia</i>	Anticancer, Antifungal	Stierle and Strobel, 1995



Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
81	Paclitaxel (Taxol)	Diterpene	<i>Pestalotiopsis microspora</i> <i>Pestalotiopsis microspora</i> <i>Pestalotiopsis guepinii</i> <i>Tubercularia</i> sp.st.TF5 <i>Sporormia minima</i> <i>Trichothecium</i> sp.	<i>Taxodium disticum</i> <i>Taxus wallachiana</i> <i>Wollemia nobilis</i> <i>Taxus mairei</i> <i>Taxus wallachiana</i> <i>Taxus wallachiana</i>	Anticancer, Antifungl	Li <i>et al.</i> , 1996  Strobel <i>et al.</i> , 1996, 1997 Wang <i>et al.</i> , 2000 Shrestha <i>et al.</i> , 2000
82	Geniculol	Irregular diterpene	<i>Geniculosporium</i> sp.	<i>Teucrium scorodonia</i>	Algicidal	Konig <i>et al.</i> , 1999
83	(3 <i>R</i> ,4 <i>S</i> ,4 <i>aR</i> )-4,8-dihydroxy-3-methyl-3,4,4 <i>a</i> ,5-tetrahydro-1 <i>H</i> -2-benzofuran-1-one	Isocoumarin	<i>Canoplea elegantula</i>	<i>Picea mariana</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1995

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
84	(3 <i>R</i> ,4 <i>R</i> ,4 <i>aR</i> )-4,8-dihydroxy-3-methyl-3,4,4a,5-tetrahydro-1 <i>H</i> -2-benzopyran-1-one	Isocoumarin	<i>Canoplea elegantula</i>	<i>Picea mariana</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1995
85	(3 <i>R</i> ,4 <i>aS</i> ,8 <i>S</i> ,8 <i>aR</i> )-8-hydroxy-3-methyl-3,4,4a,5,6,7,8,8a-octahydro-1 <i>H</i> -2-benzopyran-1-one					
86	(3 <i>R</i> ,4 <i>S</i> ,6 <i>R</i> )-3,4,4a,5,6,7-hexahydro-4,8-dihydroxy-3-methyl-1 <i>H</i> -2-benzopyran-1-one					
87	(3 <i>R</i> ,6 <i>R</i> )-3,4,4a,5,6,7-hexahydro-6,8-dihydroxy-3-methyl-1 <i>H</i> -2-benzopyran-1-one					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
88	(3 <i>R</i> ,4 <i>R</i> ,4 <i>aR</i> ,6 <i>R</i> )-4,8-dihydroxy-6,7-epoxy-3,4,4 <i>a</i> ,5,6,7-hexahydro-1 <i>H</i> -2-benzopyran-1-one (3 <i>R</i> ,4 <i>S</i> )-3,4-dihydro-4,8-dihydroxy-3-methyl-1 <i>H</i> -2-benzopyran-1-one	Isocoumarin	<i>Canoplea elegantula</i>	<i>Picea mariana</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1995
89	4-hydroxy-3-methyl-2-oxabicyclo[3.3.1]non-6-one	Isocoumarin	Unidentified mangrove forest st.2533	<i>Avicennia marina</i>	No data	Yongcheng <i>et al.</i> , 2001
91	Avicennin A	Isocoumarin	Unidentified mangrove forest st.2533	<i>Avicennia marina</i>	No data	Yongcheng <i>et al.</i> , 2001
92	Avicennin B	Isocoumarin	Unidentified mangrove forest st.2533	<i>Avicennia marina</i>	No data	Yongcheng <i>et al.</i> , 2001
93	Vermopyrone	Isocoumarin	Unidentified mangrove forest st.2533	<i>Avicennia marina</i>	No data	Yongcheng <i>et al.</i> , 2001
94	Rugulosin	Quinone	<i>Hormonema dematioides</i>	<i>Abies balsamea</i>	Toxic to spruce bud worm	Calhoun <i>et al.</i> , 1992
95	Altersolanol A	Quinone	<i>Phoma</i> sp.	<i>T. wallachiana</i>	Antibacterial	Yang, 1994

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
96	8,1',5'-trihydroxy-3',4'dihydro-1'H-[2,4']binaphthalenyl]-1,4,2'-trione	Quinone	Unidentified st.L.1930	<i>Larix laricina</i>	Toxic to spruce bud worm	Findlay <i>et al.</i> , 1997
97	Preussomerin J	Bispirobisnaphthalene	Mycelia sterilia	<i>Atropa belladonna</i>	Antimicrobial	Krohn <i>et al.</i> , 2001
98	Preussomerin K	thalene				
99	Preussomerin L					
100	Torreyanic acid	Quinone dimer	<i>Pestalotiopsis microspora</i>	<i>Torreya taxifolia</i>	Cytotoxic	Lee <i>et al.</i> , 1996
101	Cytoskyrin A	Bisanthra-	<i>Cytospora</i> sp.	<i>Conocarpus erecta</i>	Anticancer (act.) (Inactive)	Brady <i>et al.</i> , 2000
102	Cytoskyrin B	quinone				
103	Tricin	Flavone	<i>Neotyphodium typhnium</i>	<i>Poa ampla</i>	Insecticidal	Ju <i>et al.</i> , 1998
104	7-O-[ $\alpha$ -L-rhamno pyranosyl(1-6)- $\beta$ -D-glucopyranosyl]tricin					
105	7-O-[ $\beta$ -D-glucopyranosyl]tricin					

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
106	Isoorientin	Flavone	<i>Neotyphodium typhnium</i>	<i>Poa ampla</i>	Insecticidal	Ju <i>et al.</i> , 1998
107	Phomoxanthone A	Xanthone dimer	<i>Phomopsis</i> sp. st. BCC1323	<i>Tectona glandis</i>	Antimalarial, Antitubercular, Cytotoxic	Isaka <i>et al.</i> , 2001
109	Diceranol A	2,2'-dimeric	<i>Phomopsis longicolla</i>	<i>Dicerandra frutescens</i>	Antimicrobial, Cytotoxic	Wagenaar and Clardy, 2001
110	Diceranol B	tetrahydro- xanthone				
111	Diceranol C					
112	Leucinoastatin A	Oligopeptide	<i>Acremonium</i> sp.	<i>Taxus baccata</i>	Phytotoxic, Anticancer, Antifungal	Strobel <i>et al.</i> , 1997
113	Echinocandin A	Cyclopeptide	<i>Cryptosporiopsis</i> sp., <i>Pezicula</i> sp.	<i>Pinus sylvestris</i> , <i>Fagus sylvatica</i>	Antimicrobial	Noble <i>et al.</i> , 1991
114	Echinocandin B					
115	Echinocandin D					
116	Echinocandin H					
117	Cryptocandin	Cyclopeptide	<i>Cryptosporiopsis</i> cf. <i>quercina</i>	<i>Tripterygium wilfordii</i>	Antifungal	Strobel <i>et al.</i> , 1999

Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
118	1,3- <i>O</i> -di- <i>trans-p</i> -coumaroyl glycerol	Phynolic glyceride	<i>Epichloe typhina</i>	<i>Phleum pratense</i>		Koshino <i>et al.</i> , 1988
119	1,2- <i>O</i> -di- <i>trans-p</i> -coumaroyl glycerol					
120	Chokorin					
121	<i>p</i> -hydroxybenzoic acid	Phenolic acid			Antifungal	
122	<i>p</i> -hydroxyphenylacetic acid				Antifungal	
123	<i>trans-p</i> -coumaric acid				Antifungal	
124	<i>cis-p</i> -coumaric acid				Antifungal	
125	Tyrosol	Phenol			Antifungal	
126	2-hydroxy-6-methyl benzoic acid	Phenolic acid	<i>Phoma</i> sp.	<i>Taxus wallachiana</i>	Antibacterial	Yang <i>et al.</i> , 1994
127	Colletotric acid	Tridepside	<i>Colletotrichum gloeosporioides</i>	<i>Artemisia mangolica</i>	Antimicrobial	Zou <i>et al.</i> , 2000
128	Cytonic acid A		<i>Cytonaema</i> sp.	<i>Quercus</i> sp.	Antiviral	Guo <i>et al.</i> , 2000
129	Cytonic acid B					

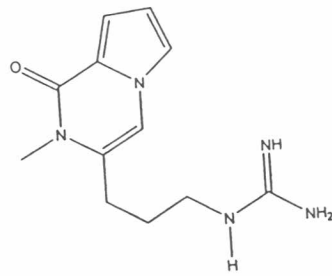
Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
130	Phomodiol	Aliphatic compound	<i>Phomopsis oblonga</i>	<i>Salix</i> spp.	Antifungal	Horn <i>et al.</i> , 1994
131	Phomopsolide B	Aliphatic compound	<i>Phomopsis</i> spp.	<i>Salix</i> spp.	No data	Horn <i>et al.</i> , 1996
132	CR 377	Pentaketide	<i>Fusarium</i> sp.	<i>Selaginella pallescens</i>	Antifungal	Brady and Clardy, 2000
133	Cytosporone A	Octaketide	<i>Cytospora</i> sp., <i>Diaporthe</i> sp.	<i>Conocarpus erecta</i> , <i>Forsteronia spicata</i>	Cytotoxic Cytotoxic	Brady <i>et al.</i> , 2000
134	Cytosporone B					
135	Cytosporone C					
136	Cytosporone D					
137	Cytosporone E					
138	2-methyloctanoic acid 6-oxo-2-propenyl-3,6-dihydro 2H-pyran-3-yl ester	Ester	Unidentified	<i>Larix laricina</i>	Antibacterial	Findlay <i>et al.</i> , 1997
139	Khafrefungin	Ester	Unidentified	Costa Rican Plant	Antifungal	Mandala <i>et al.</i> , 1997

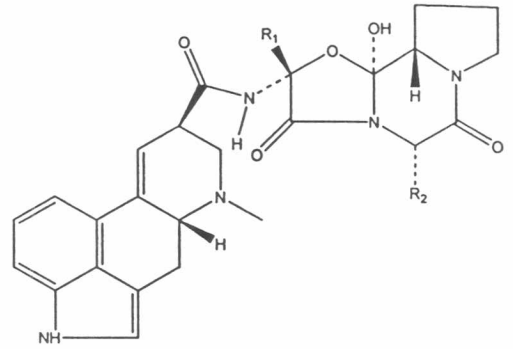
Table 1. (continued)

No.	Compounds	Types	Endophytic fungi	Host plants	Activities	References
140	Sequoiatone A	Ester	<i>Aspergillus parasiticus</i>	<i>Sequoia sempervirens</i>	Antitumor	Stierle <i>et al.</i> , 1999, 2001
141	Sequoiatone B				Antitumor	
142	Sequoiatone C				Cytotoxic	
143	Sequoiatone D				Cytotoxic	
144	Sequoiatone E				Cytotoxic	
145	Sequoiatone F				Cytotoxic	
146	Ambuic acid	Cyclohexenone	<i>Pestalotiopsis</i> spp.	<i>Taxus</i> spp.	Antifungal	Li <i>et al.</i> , 2001
147	Jesterone	Cyclohexenone	<i>Pestalotiopsis jesteri</i>	<i>Fragaria bodenii</i>	Antimycotic	Li <i>et al.</i> , 2001
148	Hydroxyjesterone					





[1] Peramine



[3] Ergotamine  $R_1=Me, R_2=PhCH_2$

[4] Ergosine  $R_1=Me, R_2=Bu^i$

[5]  $\beta$ -ergosine  $R_1=Me, R_2=sec-Bu$

[6] Ergovaline  $R_1=Me, R_2=Pr^i$

[7] Ergostine  $R_1=Et, R_2=PhCH_2$

[8] Ergoptine  $R_1=Et, R_2= Bu^i$

[9]  $\beta$ -ergoptine  $R_1=Et, R_2= sec-Bu$

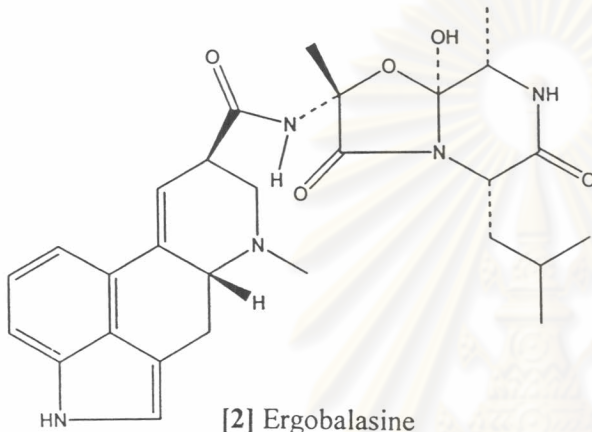
[10] Ergonine  $R_1=Et, R_2= Pr^i$

[11] Ergocristine  $R_1= Pr^i, R_2=PhCH_2$

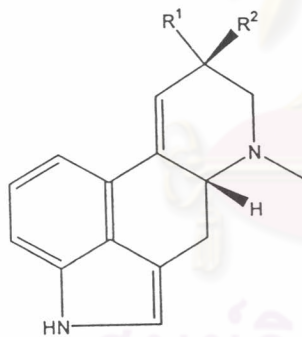
[12]  $\alpha$ -ergocryptine  $R_1= Pr^i, R_2=Bu^i$

[13]  $\beta$ -ergocryptine  $R_1= Pr^i, R_2=sec-Bu$

[14] Ergocornine  $R_1=R_2= Pr^i$

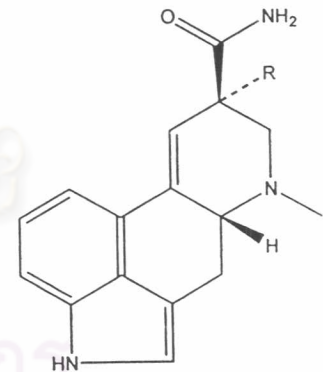
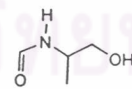


[2] Ergobalasin



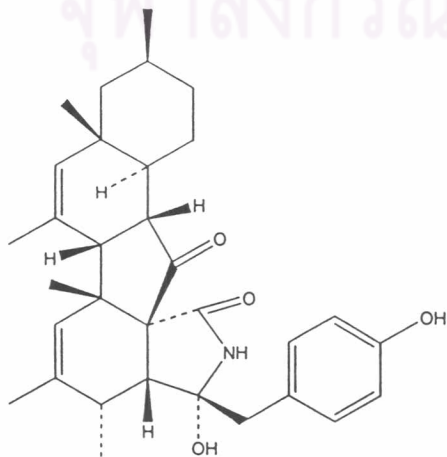
[15] Ergonovine  $R_1=H, R_2=$

[19] Ergonovinine  $R_2=H, R_1=$

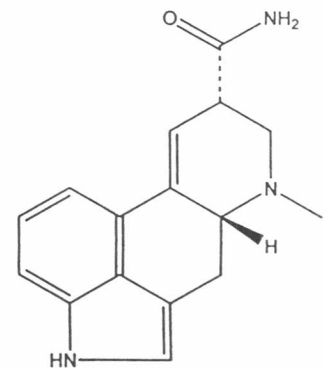


[16] Lysergamide  $R=H$

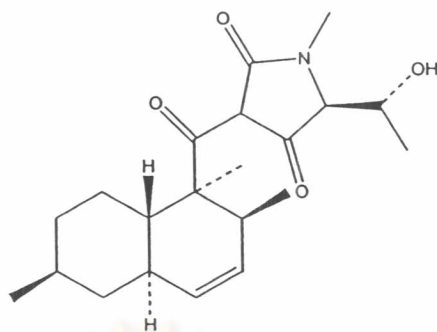
[17] 8-hydroxylysergamide  $R=OH$



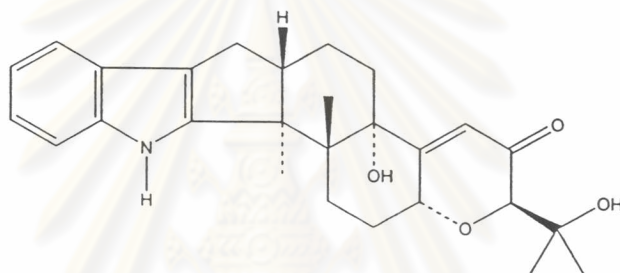
[20] Phomopsichalasin



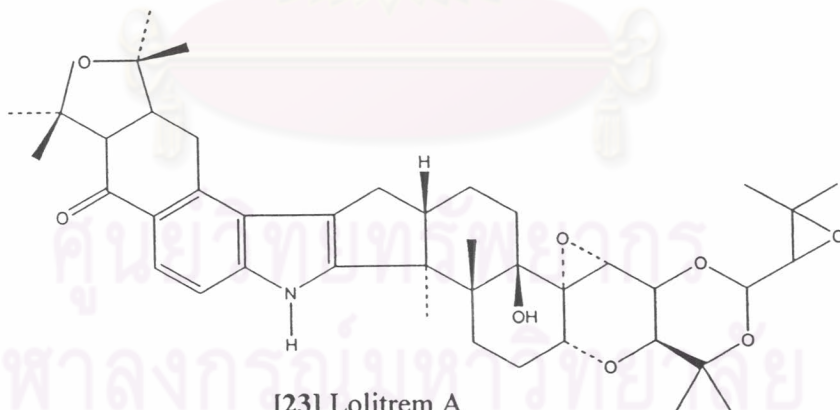
[18] Isolysergamide



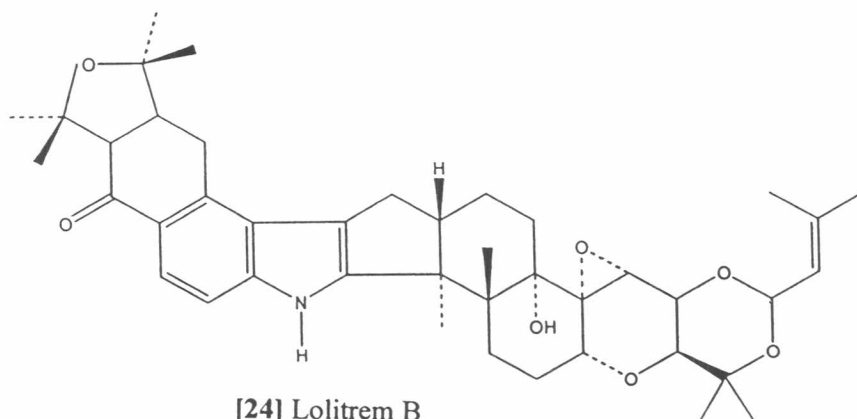
[21] Cryptocin



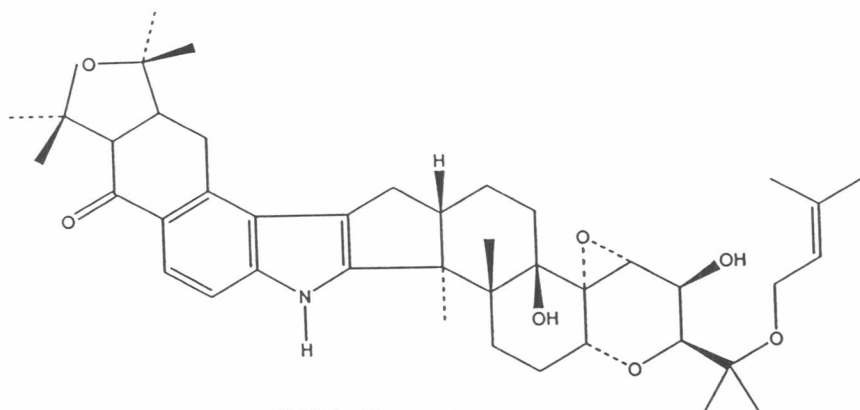
[22] Paxilline



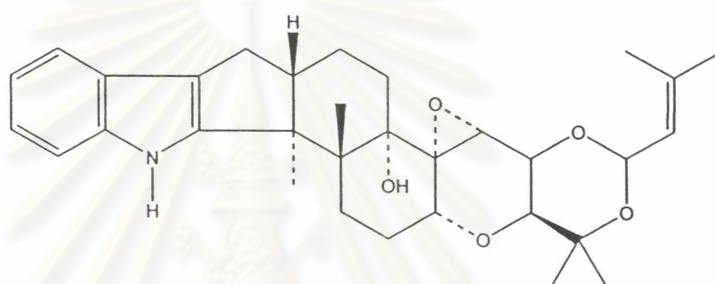
[23] Lolitrem A



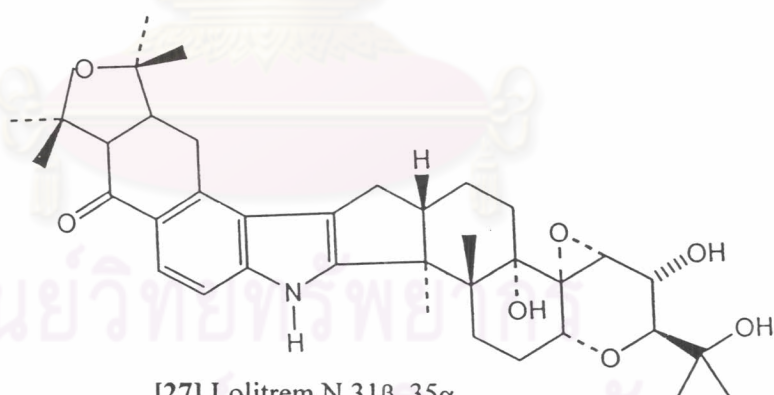
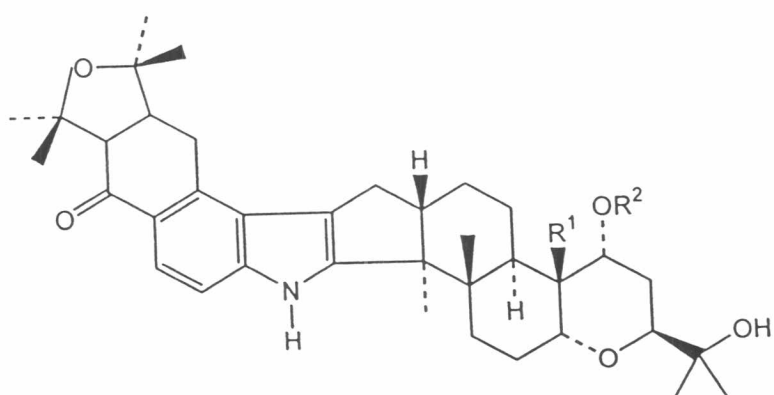
[24] Lolitrem B

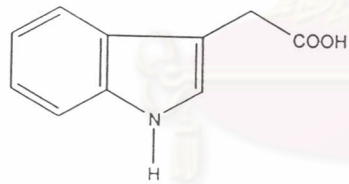
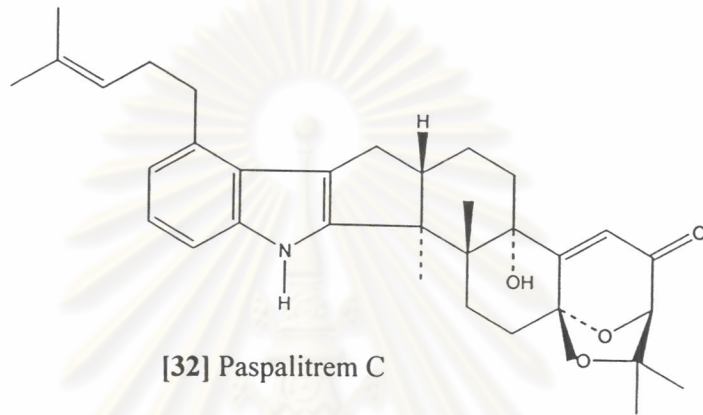
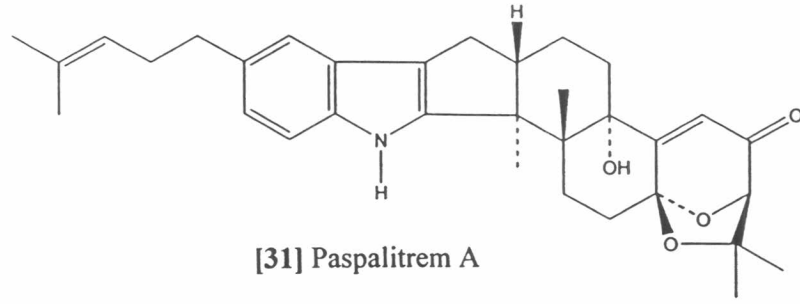


[25] Lolitrem E

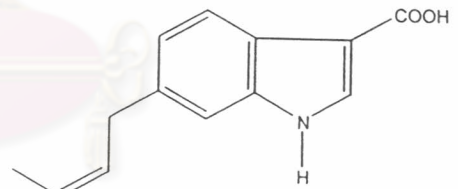


[26] Terpendole C

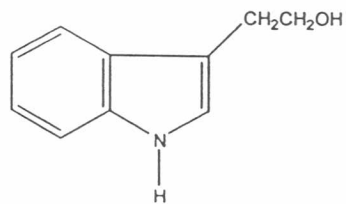
[27] Lolitrem N 31 $\beta$ , 35 $\alpha$ [28] Lolitriol 31 $\alpha$ , 35 $\beta$ [29] Lolicine A  $R^1=Me$ ,  $R^2=H$ [30] Lolicine B  $R^1=CHO$ ,  $R^2=H$



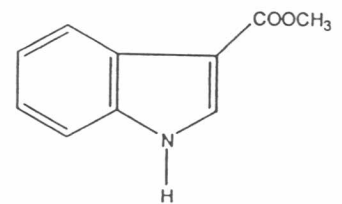
[33] Indole-3-acetic acid



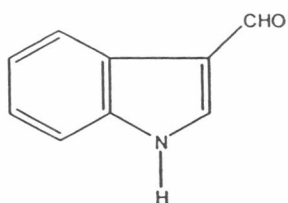
[34] 6-isoprenylindole-3-carboxylic acid



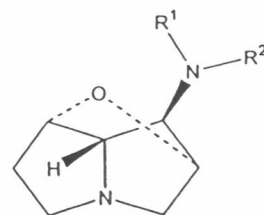
[35] Indole-3-ethanol (IEtOH)



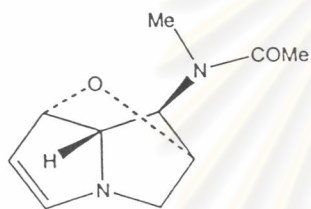
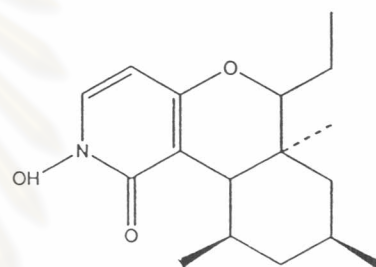
[36] Methylindole-3-carboxylate



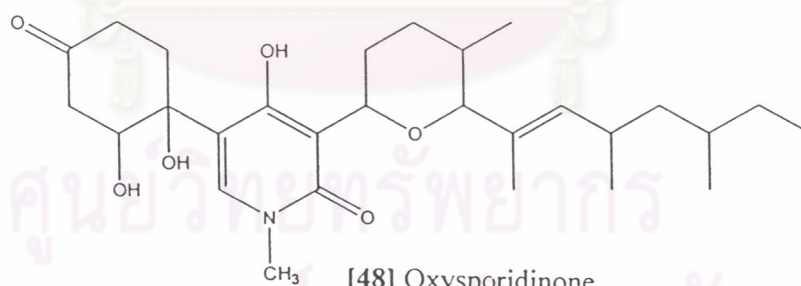
[37] Indole-3-carboxaldehyde



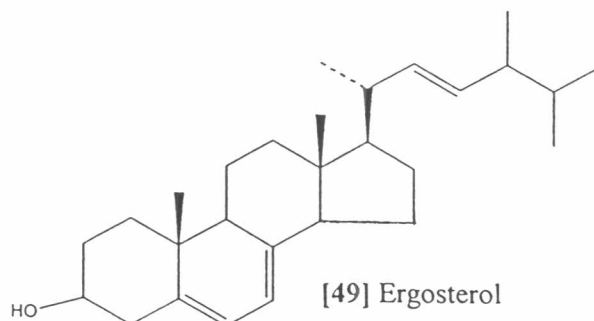
- [38] Loline  $R^1=Me, R^2=COMe$   
 [39] Loline  $R^1=H, R^2=Me$   
 [40] Norloline  $R^1=R^2=H$   
 [41] *N*-Methyloline  $R^1=R^2=Me$   
 [42] *N*-formylnorloline  $R^1=H, R^2=CHO$   
 [43] *N*-acetylnorloline  $R^1=H, R^2=Ac$   
 [44] *N*-formylloline  $R^1=Me, R^2=CHO$   
 [45] *N*-acetylloline  $R^1=Me, R^2=Ac$

[46] 5,6-dehydro-*N*-acetylloline

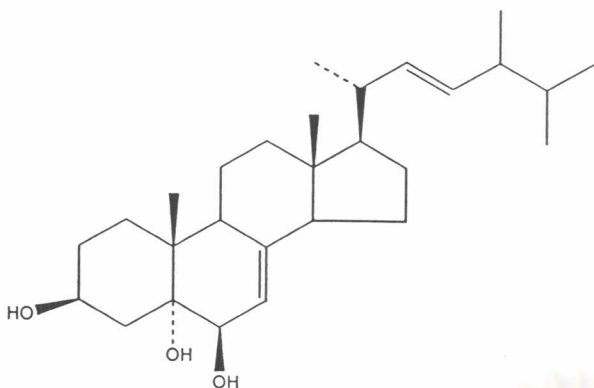
[47] Fusaric acid



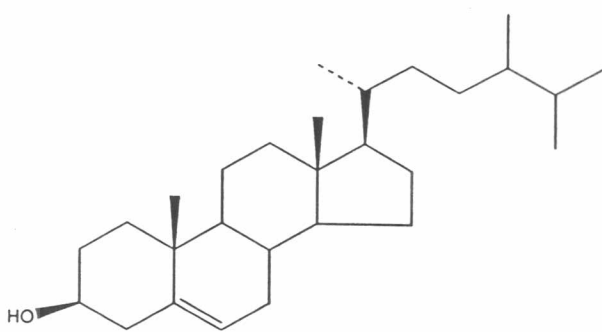
[48] Oxysporidinone



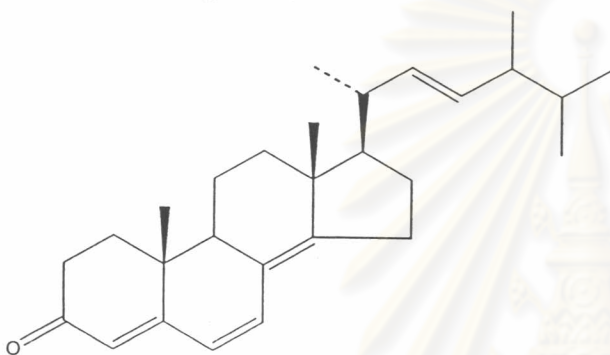
[49] Ergosterol



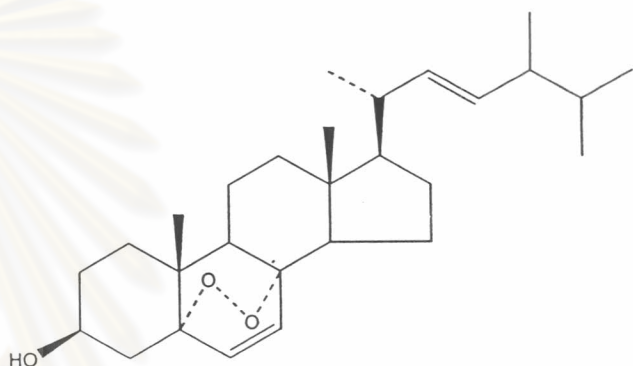
[50] 3β,5α,6β trihydroxy ergosta-7,22-diene



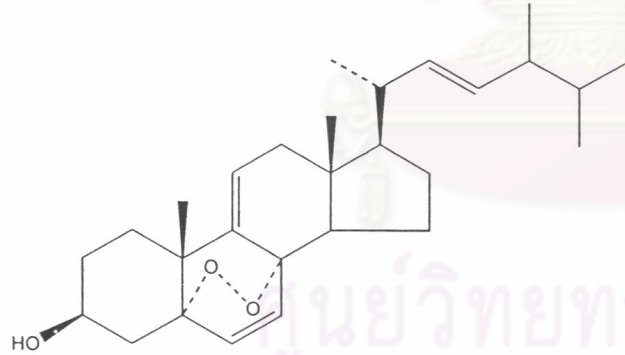
[51] 3β-hydroxyergosta-5-ene



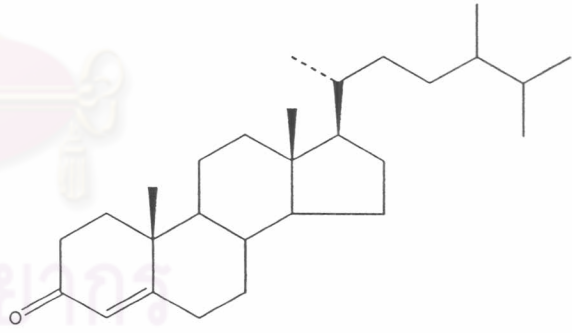
[52] 3-oxoergosta-4,6,8(14),22-tetraene



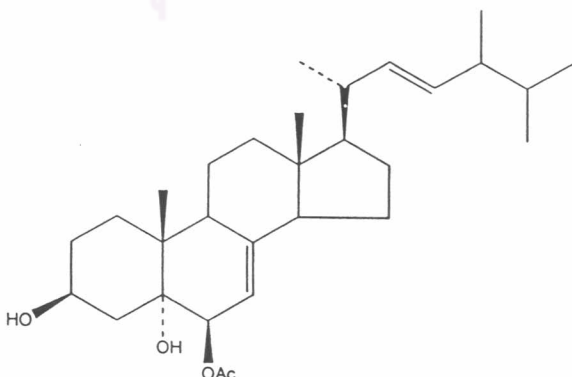
[53] 3β-hydroxy-5α,8α-epidioxyergosta-6,22-diene



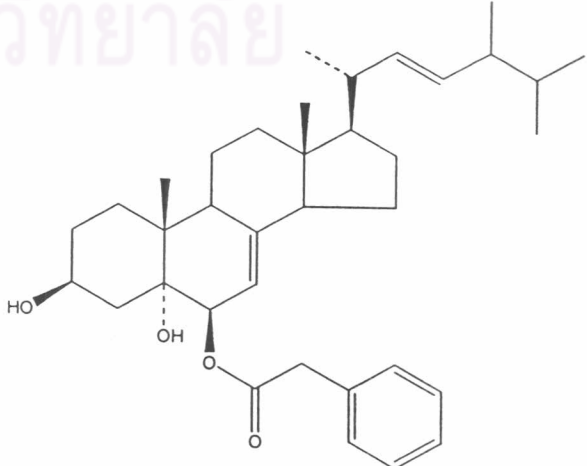
[54] 3β-hydroxy-5α,8α-epidioxyergosta-6,9(11),22-triene



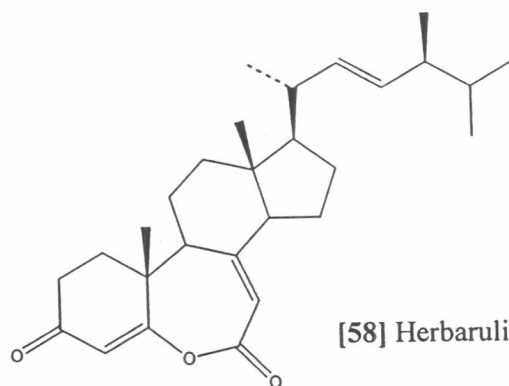
[55] 3-oxoergosta-4-ene



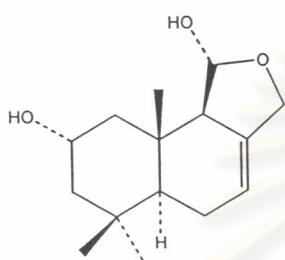
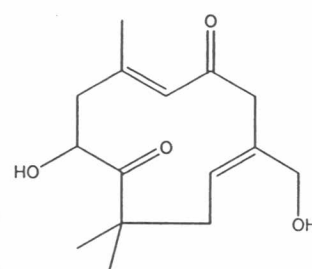
[56] 3β,5α-dihydroxy-6β-acetoxy ergosta-7,22-diene



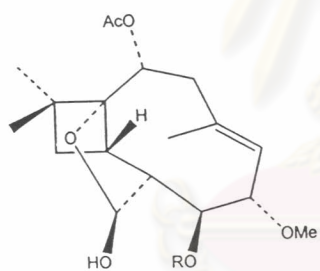
[57] 3β,5α-dihydroxy-6β-phenyl acetoxyergosta-7,22-diene



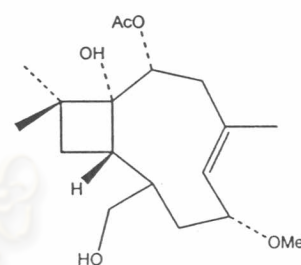
[58] Herbarulide

[59] 2 $\alpha$ -hydroxydimeninol

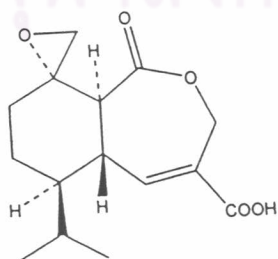
[60] Humulane derivative



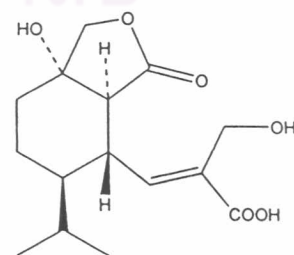
[61] Pestalotiopsin A R=H  
 [63] Pestalotiopsin C R=Me



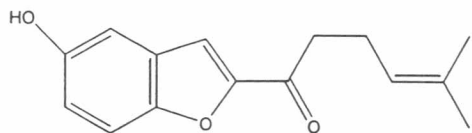
[62] Pestalotiopsin B



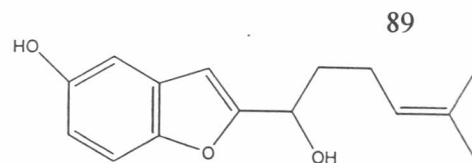
[64] Heptelidic acid



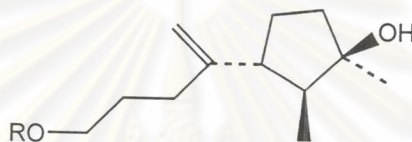
[65] Hydroheptelidic acid



[66] 5-hydroxy-2-(1'-oxo-5'-methyl-4'-hexenyl)benzofuran

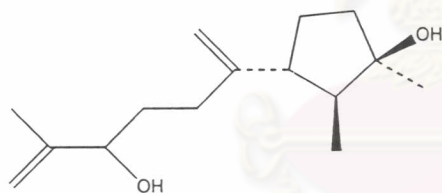


[67] 5-hydroxy-2-(1'-hydroxy-5'-methyl-4'-hexenyl)benzofuran

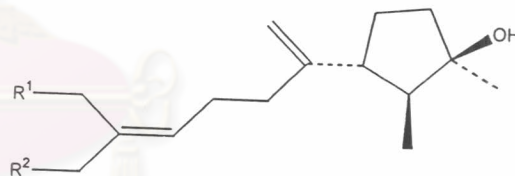


[68] Chokol A R=H

[73] Chokol F R=Ac

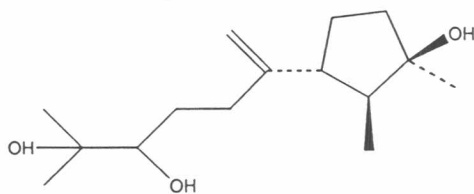


[69] Chokol B

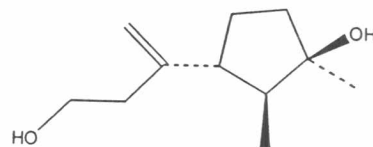


[70] Chokol C R<sup>1</sup>=H, R<sup>2</sup>=OH

[71] Chokol D R<sup>1</sup>=OH, R<sup>2</sup>=H

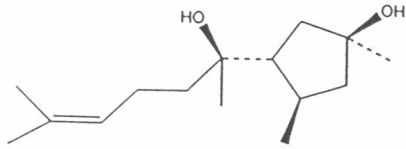


[72] Chokol E

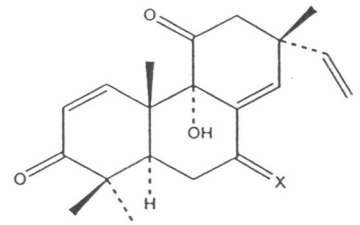
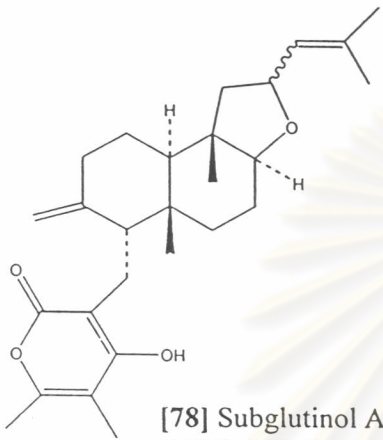


[74] Chokol G



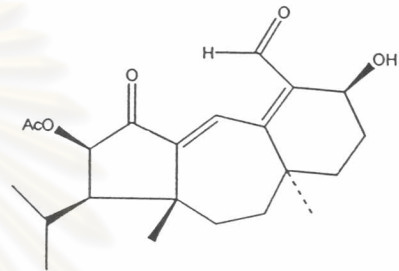


[75] Cyclonerodiol

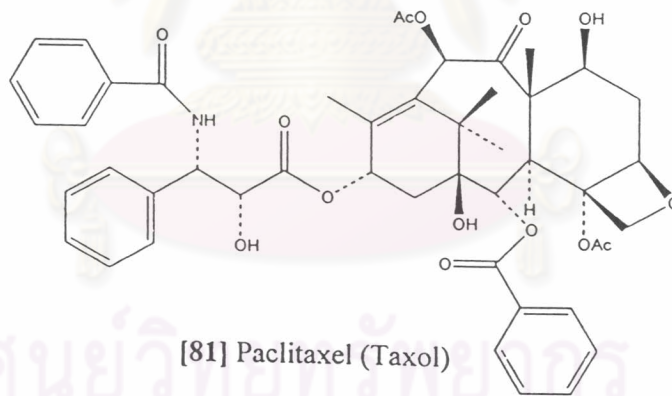
[76] 9 $\alpha$ -hydroxy-1,8(14),15-isopimaratrien-3,7,11-trione X=O[77] 9 $\alpha$ -hydroxy-1,8(14),15-isopimaratrien-3,11-dione X=H<sub>2</sub>

[78] Subglutinol A 12R

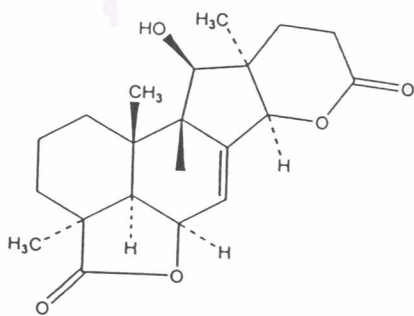
[79] Subglutinol B 12S



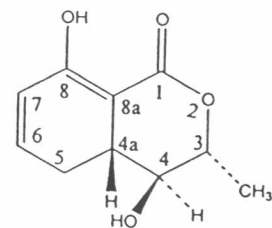
[80] Guanacastepene

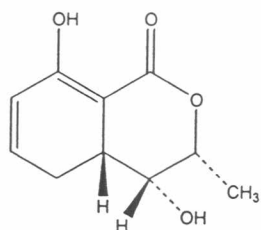


[81] Paclitaxel (Taxol)

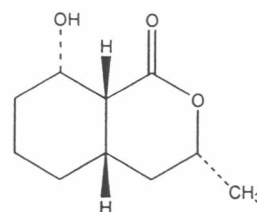


[82] Geniculol

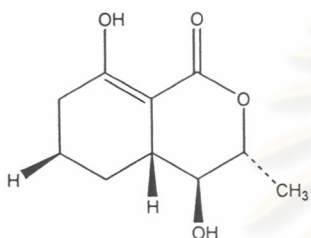
[83] (3*R*,4*S*,4*aR*)-4,8-dihydroxy-3-methyl-3,4,4*a*,5-tetrahydro-1*H*-2-benzofuran-1-one



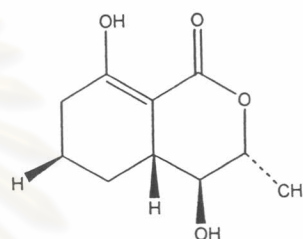
[84] (3*R*,4*R*,4*aR*)-4,8-dihydroxy-3-methyl-3,4,4*a*,5-tetrahydro-1*H*-2-benzopyran-1-one



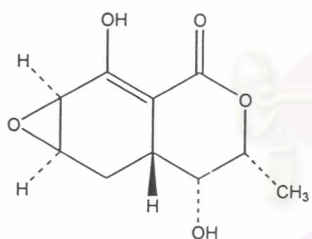
[85] (3*R*,4*aS*,8*S*,8*aR*)-8-hydroxy-3-methyl-3,4,4*a*,5,6,7,8,8*a*-octahydro-1*H*-2-benzopyran-1-one



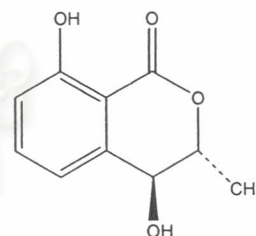
[86] (3*R*,4*S*,6*R*)-3,4,4*a*,5,6,7-hexahydro-4,8-dihydroxy-3-methyl-1*H*-2-benzopyran-1-one



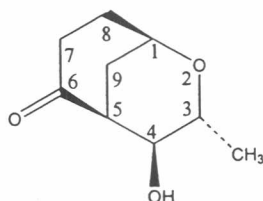
[87] (3*R*,6*R*)-3,4,4*a*,5,6,7-hexahydro-6,8-dihydroxy-3-methyl-1*H*-2-benzopyran-1-one



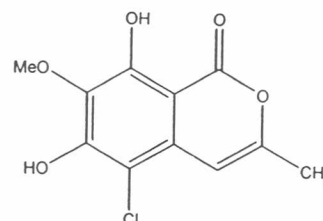
[88] (3*R*,4*R*,4*aR*,6*R*)-4,8-dihydroxy-6,7-epoxy-3,4,4*a*,5,6,7-hexahydro-1*H*-2-benzopyran-1-one



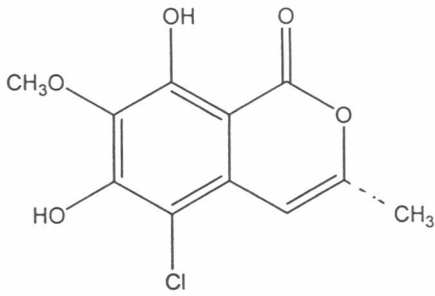
[89] (3*R*,4*S*)-3,4-dihydro-4,8-dihydroxy-3-methyl-1*H*-2-benzopyran-1-one



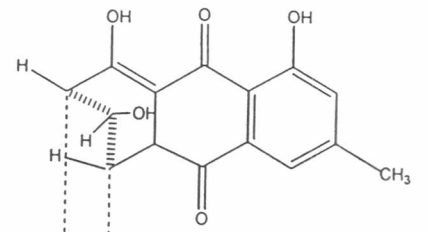
[90] 4-hydroxy-3-methyl-2-oxabicyclo[3.3.1]non-6-one



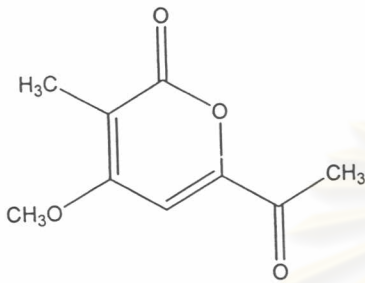
[91] Avicennin A



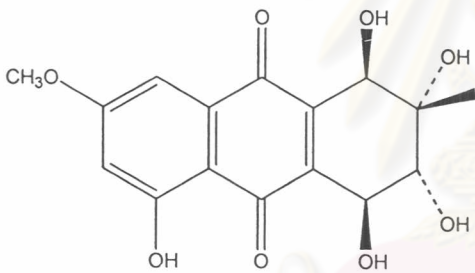
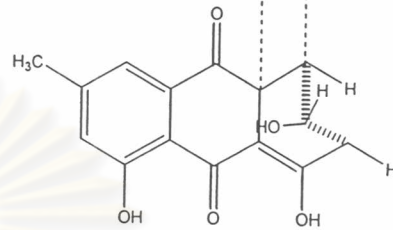
[92] Avicennin B



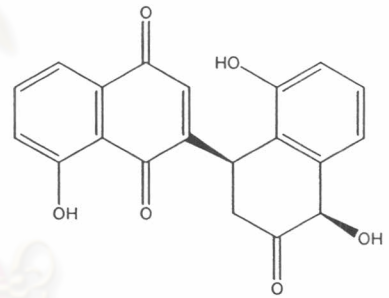
[94] Rugulosin



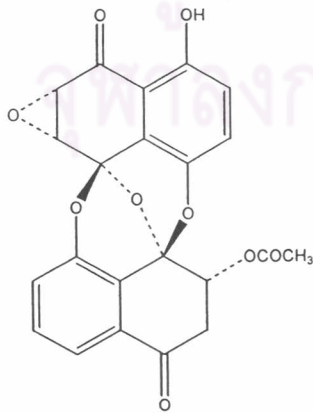
[93] Vermopyrone



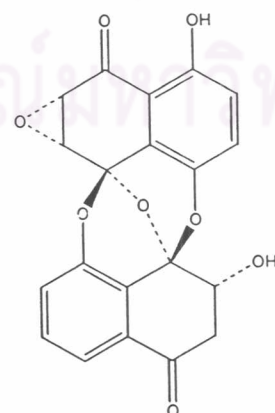
[95] Altersolanol A



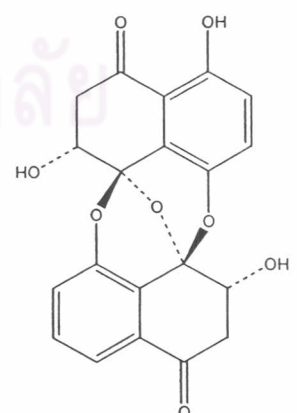
[96] 8,1',5'-trihydroxy-3',4'dihydro-1'H-[2,4']  
binaphthalenyl-1,4,2'-trione



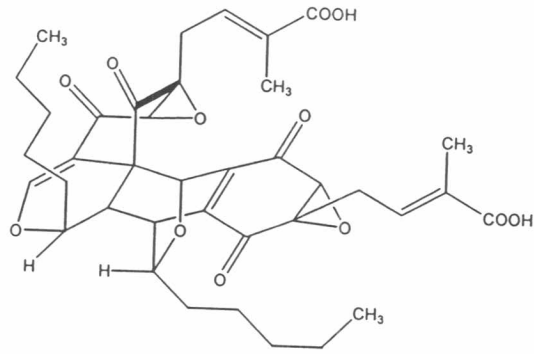
[97] Preussomerin J



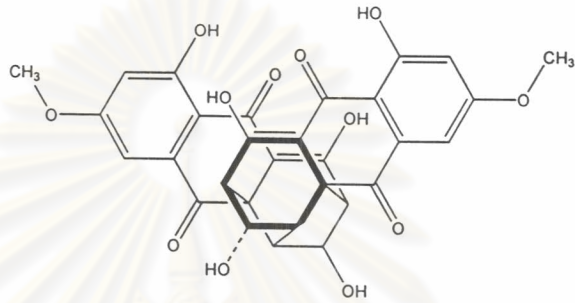
[98] Preussomerin K



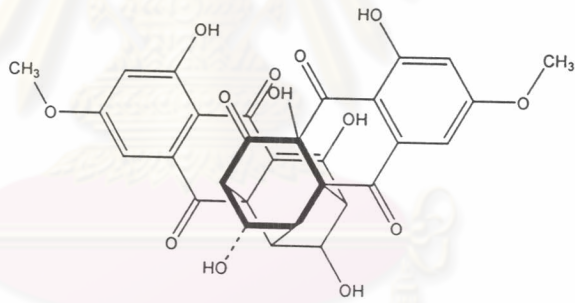
[99] Preussomerin L



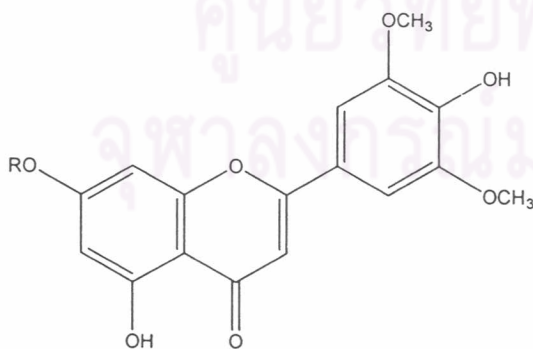
[100] Torreyanic acid



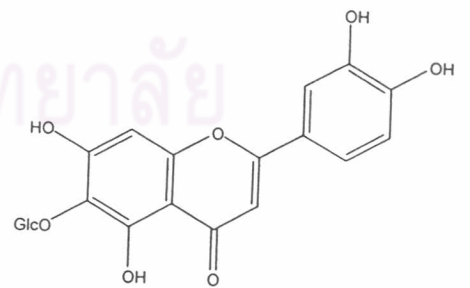
[101] Cytoskyrin A



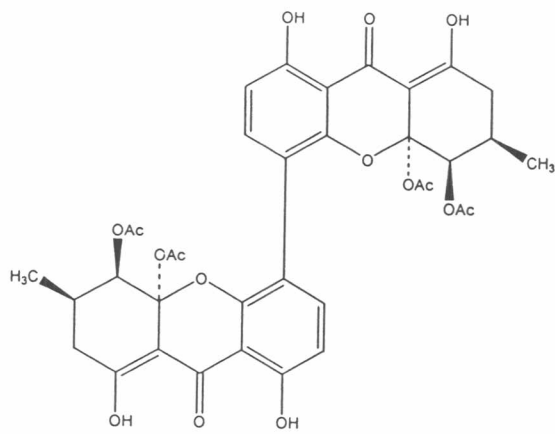
[102] Cytoskyrin B



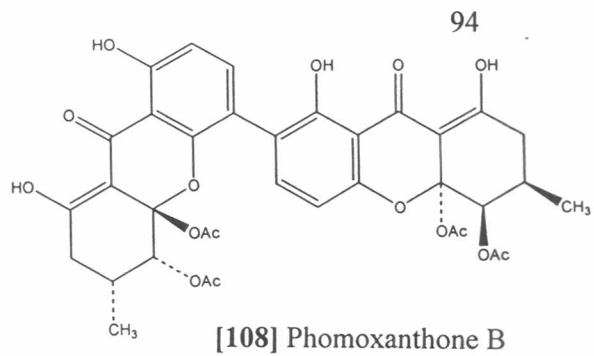
[103] Tricin R=H

[104] 7-O-[ $\alpha$ -L-rhamnopyranosyl](1-6)- $\beta$ -D-glucopyranosyl]tricin R=Rha-Glc[105] 7-O-[ $\beta$ -D-glucopyranosyl]tricin R=Glc

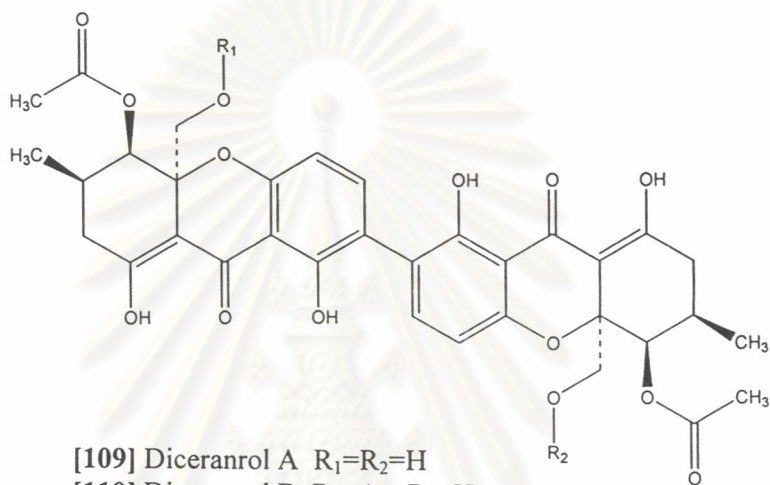
[106] Isoorientin



[107] Phomoxanthone A



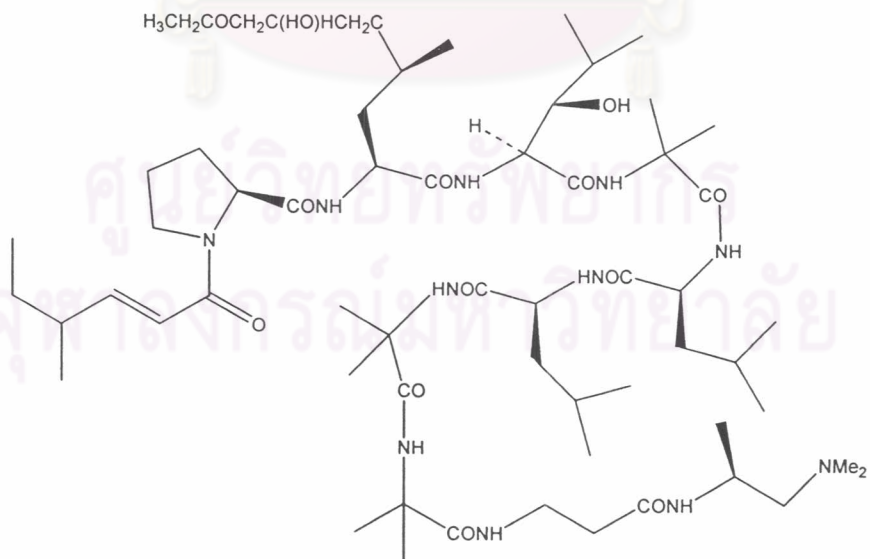
[108] Phomoxanthone B



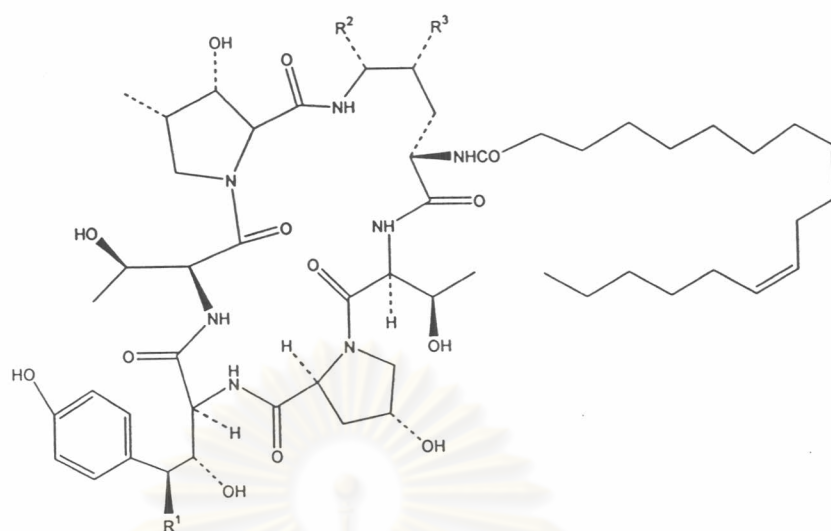
[109] Diceranrol A  $R_1=R_2=H$

[110] Diceranrol B  $R_1=Ac, R_2=H$

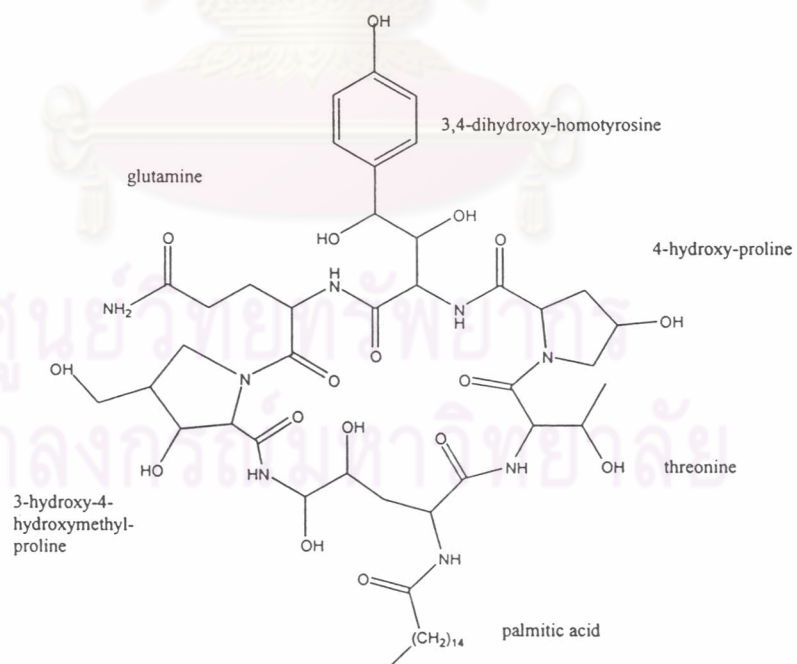
[111] Diceranrol C  $R_1=R_2=Ac$



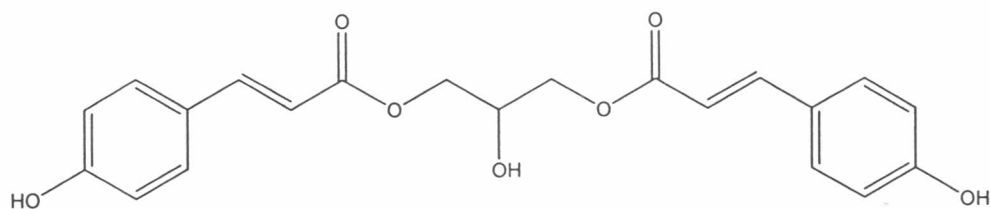
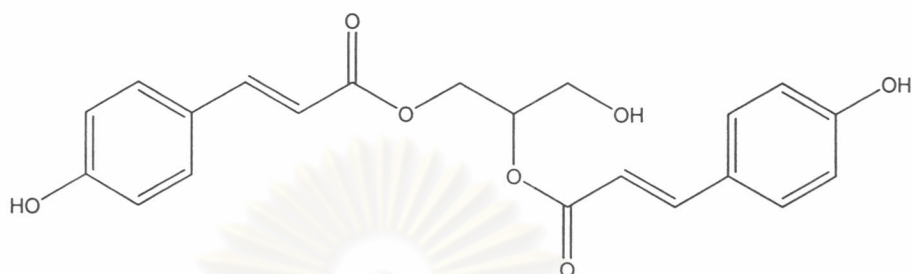
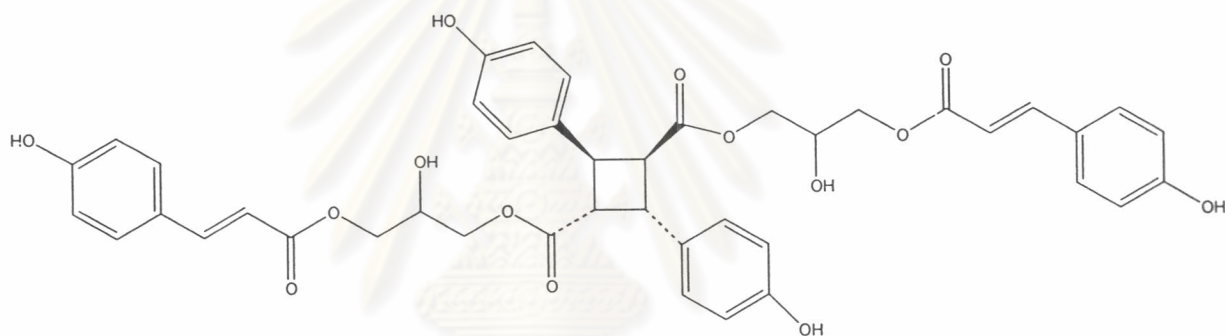
[112] Leucinostatin A



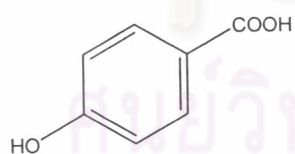
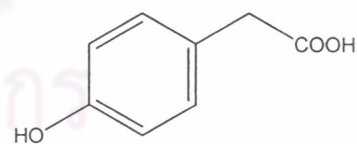
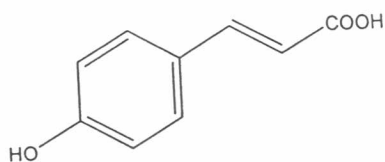
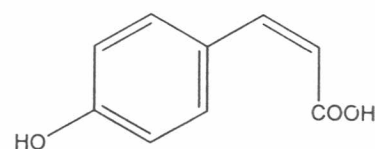
- [113] Echinocandin A  $R^1=R^2=R^3=OH$   
 [114] Echinocandin B  $R^1=H, R^2=R^3=OH$   
 [115] Echinocandin D  $R^1=R^2=R^3=H$   
 [116] Echinocandin H  $R^1=R^2=OH, R^3=OMe$

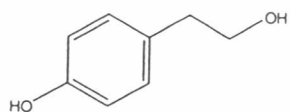


[117] Cryptocandin

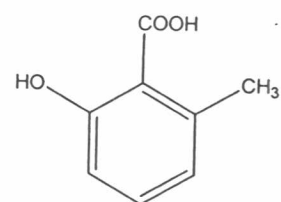
[118] 1,3-*O*-di-*trans-p*-coumaroylglycerol[119] 1,2-*O*-di-*trans-p*-coumaroylglycerol

[120] Chokorin

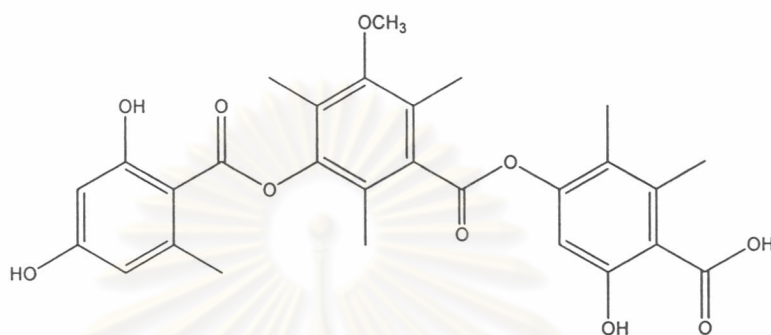
[121] *p*-hydroxybenzoic acid[122] *p*-hydroxyphenylacetic acid[123] *trans-p*-coumaric acid[124] *cis-p*-coumaric acid



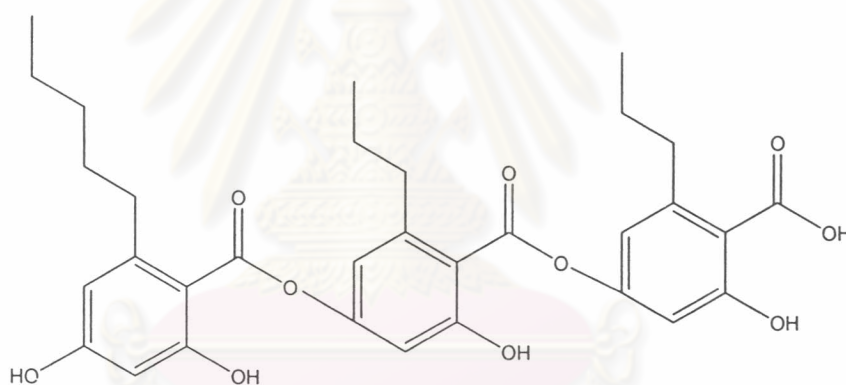
[125] Tyrosol



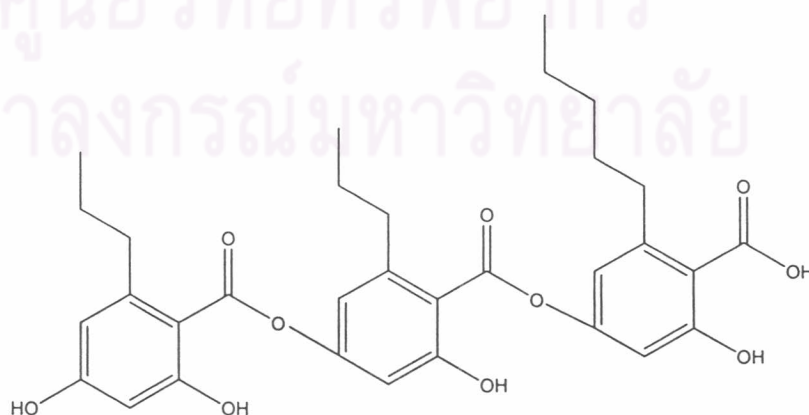
[126] 2-hydroxy-6-methylbenzoic acid



[127] Colletotric acid

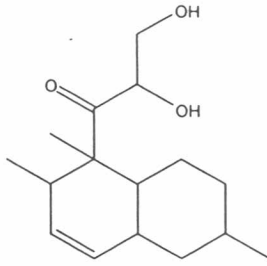


[128] Cytonic acid A

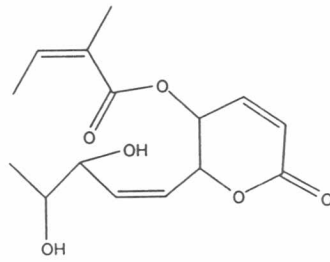


[129] Cytonic acid B

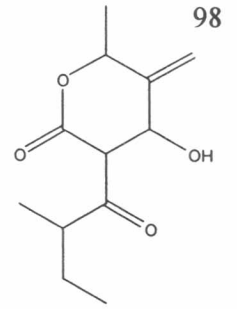




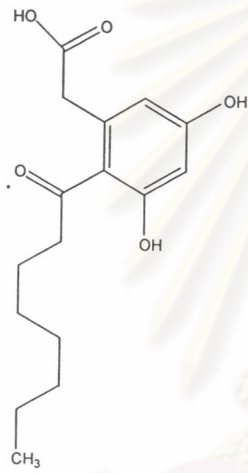
[130] Phomodiol



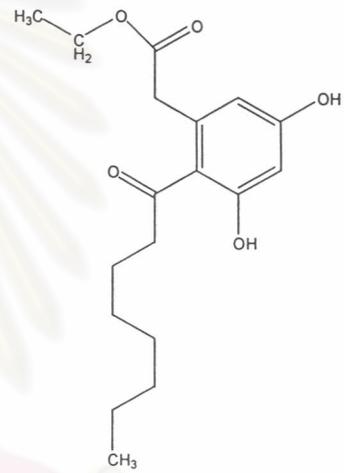
[131] Phomopsolide B



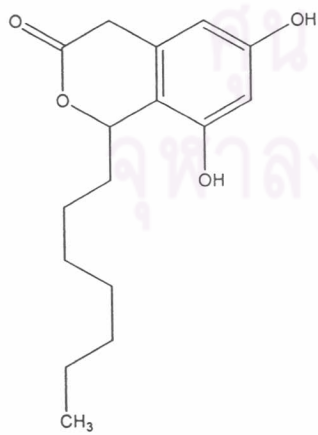
[132] CR 377



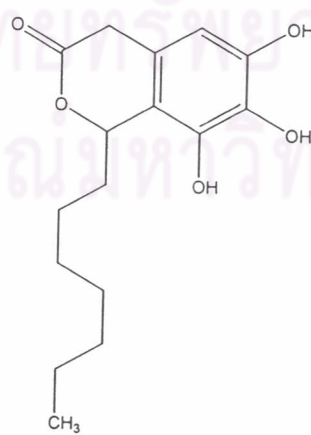
[133] Cytosporone A



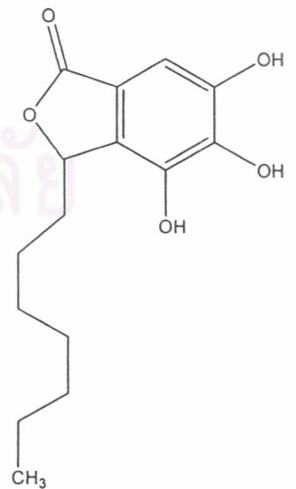
[134] Cytosporone B



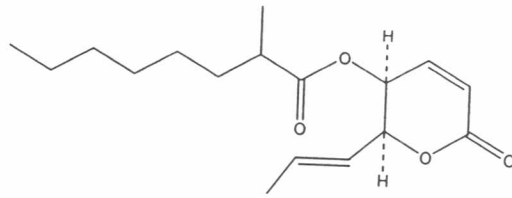
[135] Cytosporone C



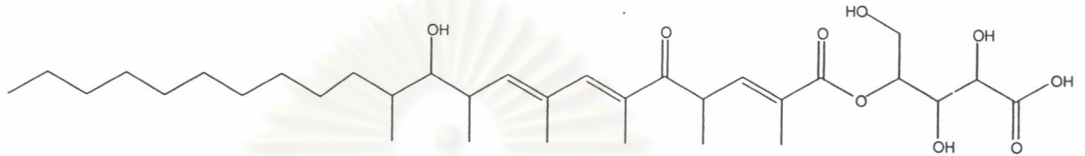
[136] Cytosporone D



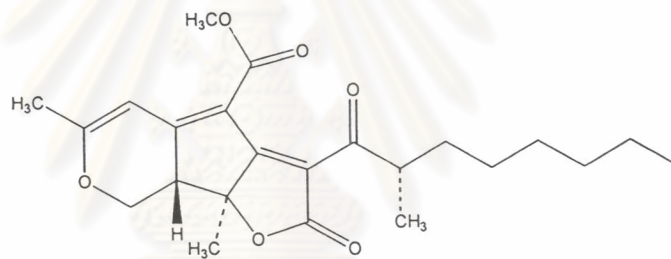
[137] Cytosporone E



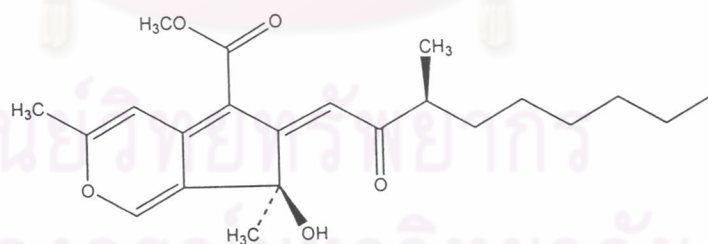
[138] 2-methyloctanoic acid 6-oxo-  
2-propenyl-3,6-dihydro-2H-pyran-3-yl ester



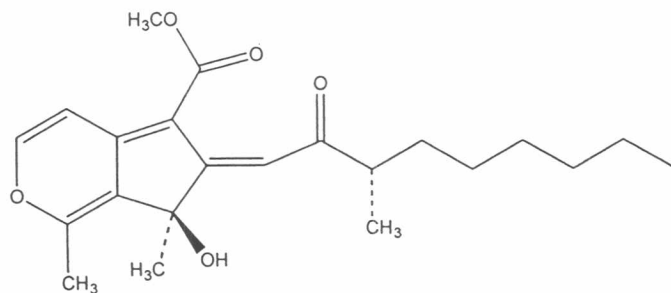
[139] Khafrefungin



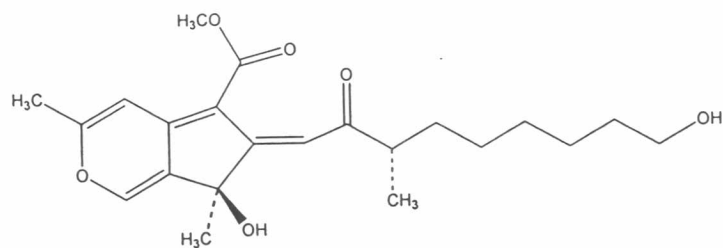
[140] Sequoiatone A



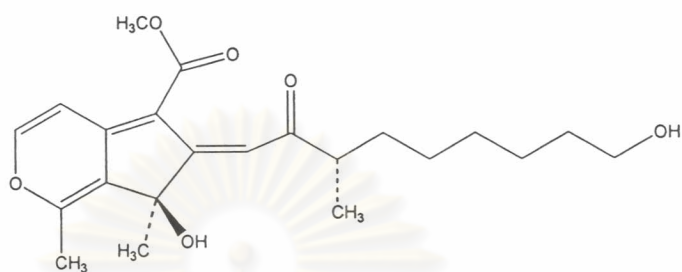
[141] Sequoiatone B



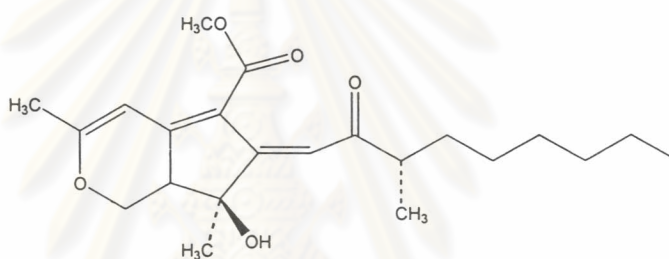
[142] Sequoiatone C



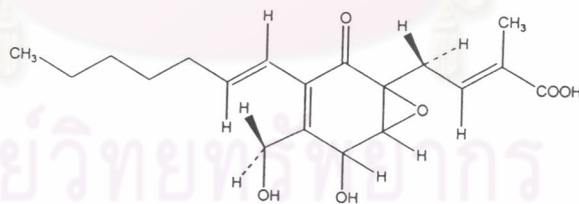
[143] Sequoiatone D



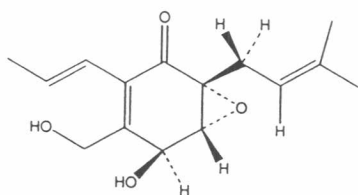
[144] Sequoiatone E



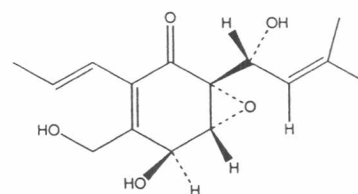
[145] Sequoiatone F



[146] Ambuic acid



[147] Jesterone



[148] Hydroxyjesterone

## APPENDIX B

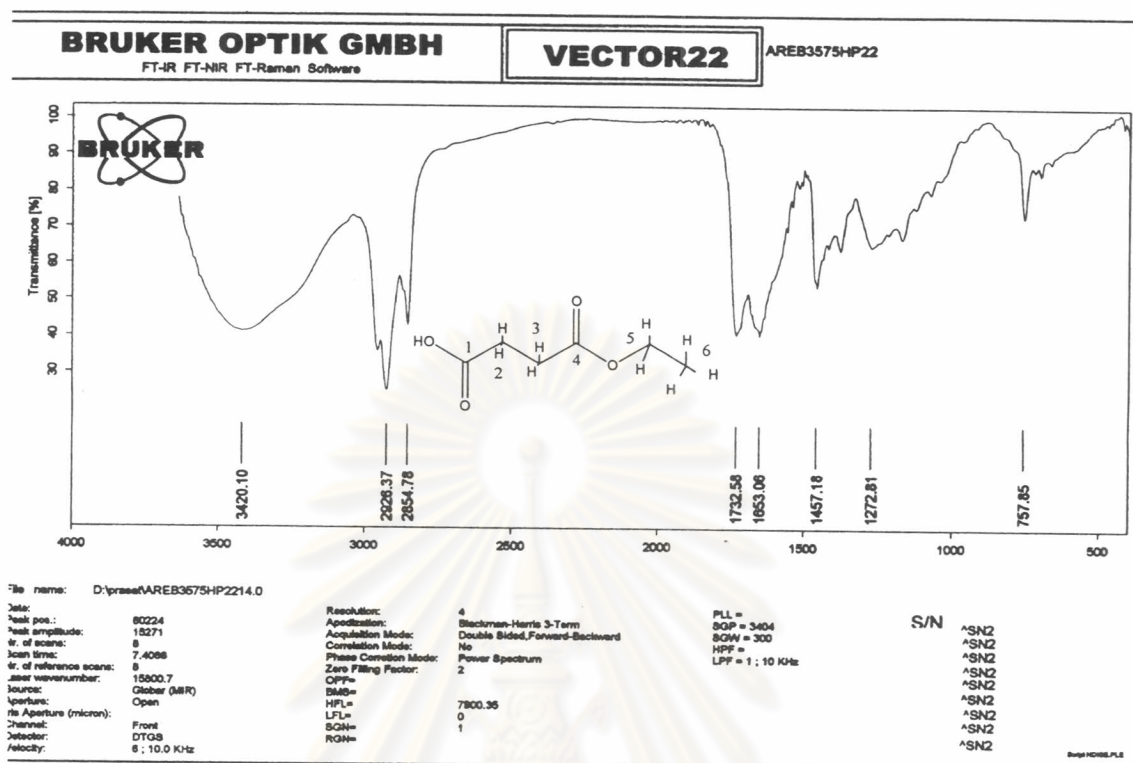


Figure 7 IR spectrum of compound AREB 3575 HP22

TEST BY: \_\_\_\_\_  
 12/9/02 17:18:31 Page 1 of 1

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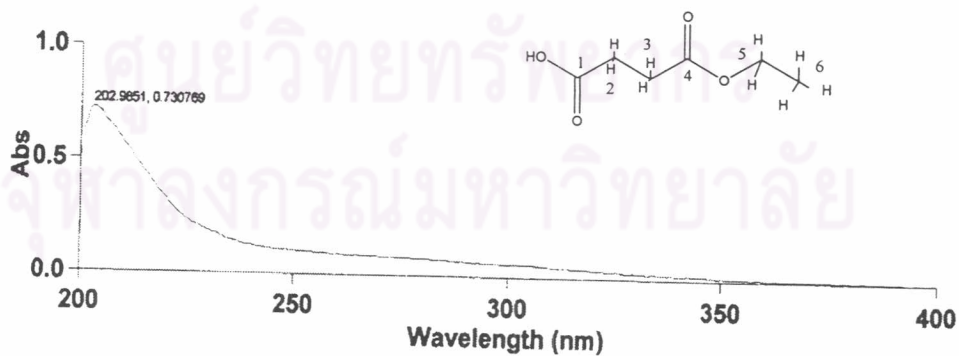


Figure 8 UV spectrum of compound AREB 3575 HP22 in methanol

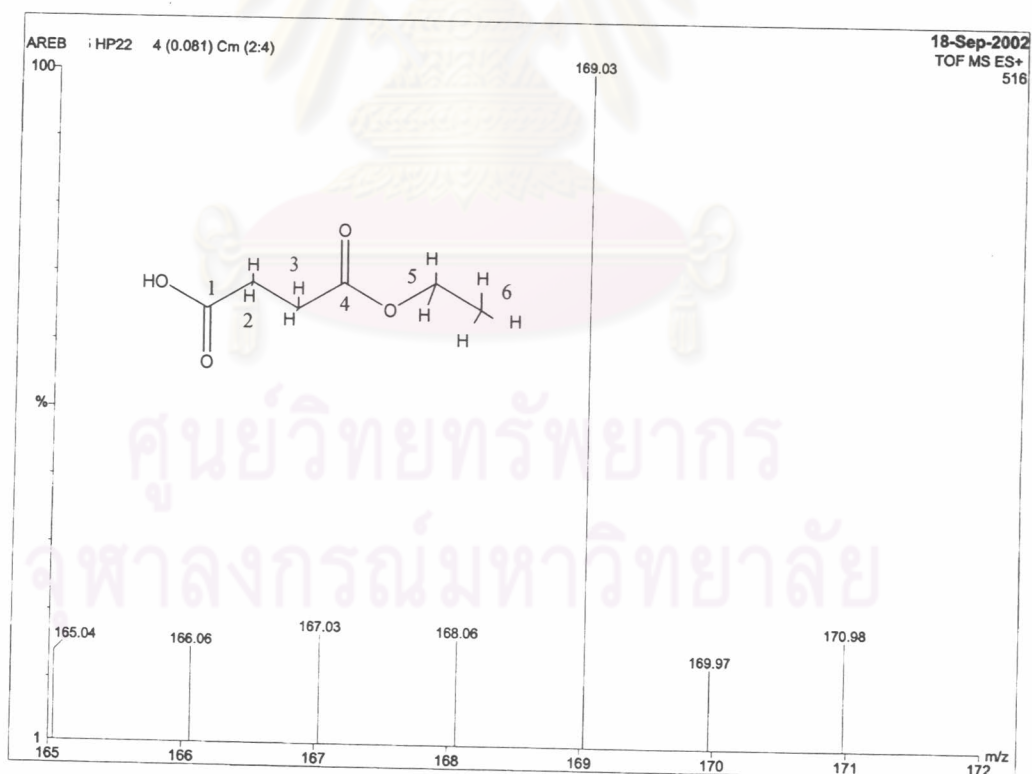
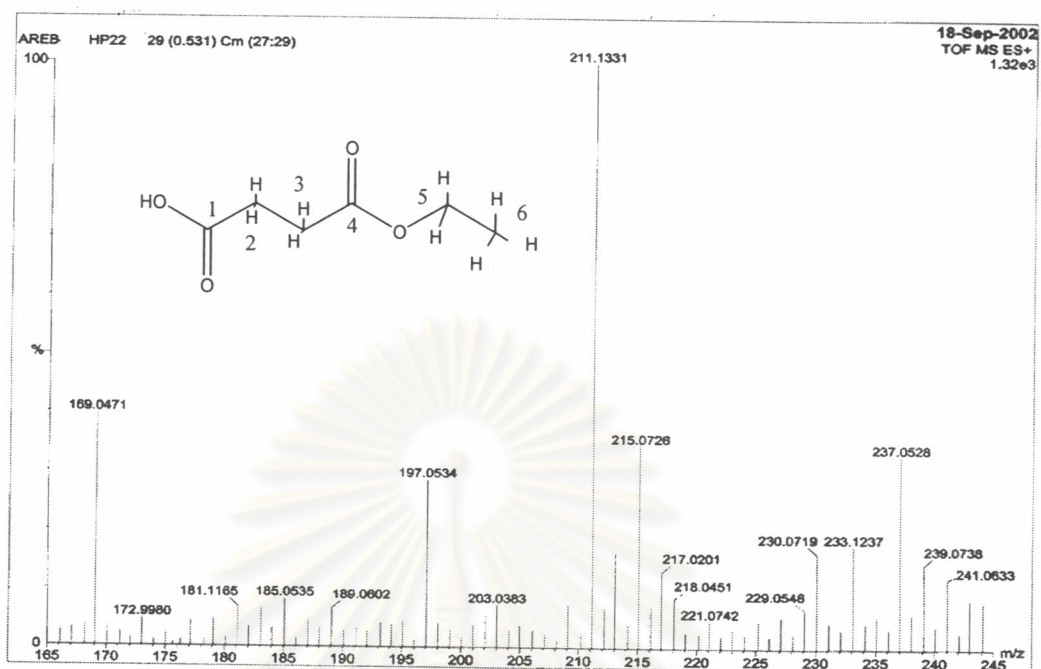


Figure 9 ESI-TOF mass spectrum of compound AREB 3575 HP22

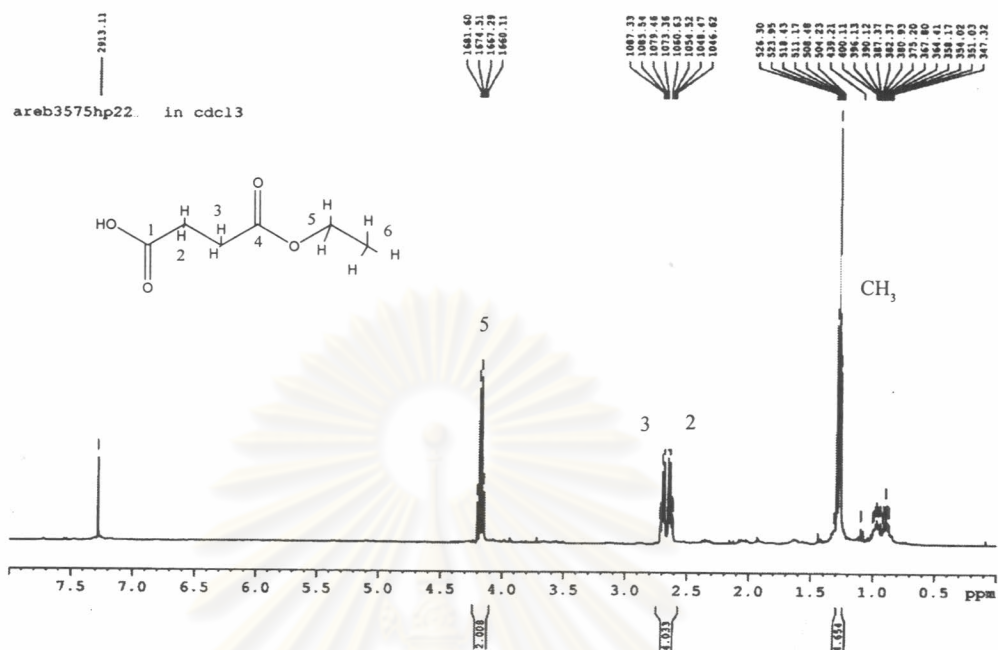


Figure 10 500 MHz  $^1\text{H}$ -NMR spectrum of compound AREB 3575 HP22

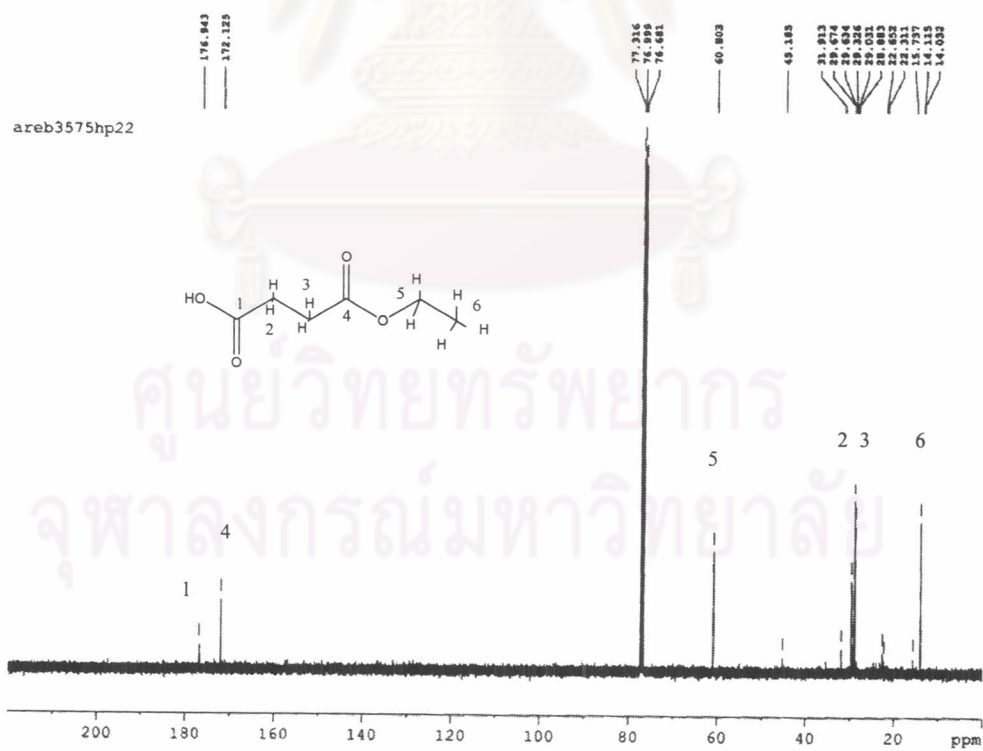


Figure 11 125 MHz  $^{13}\text{C}$ -NMR spectrum of compound AREB 3575 HP22

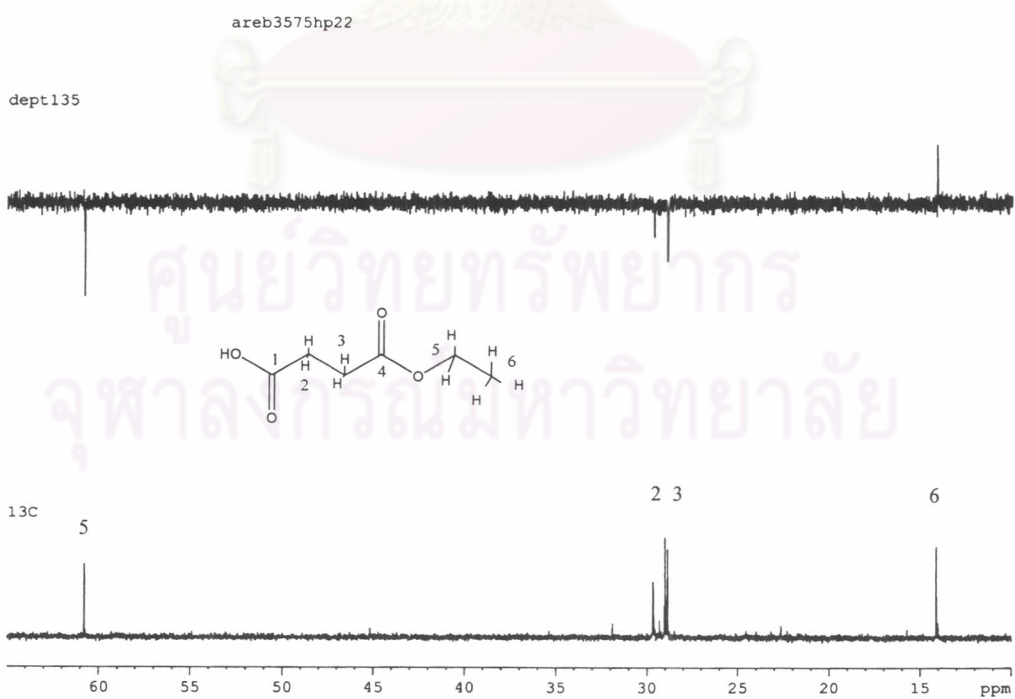
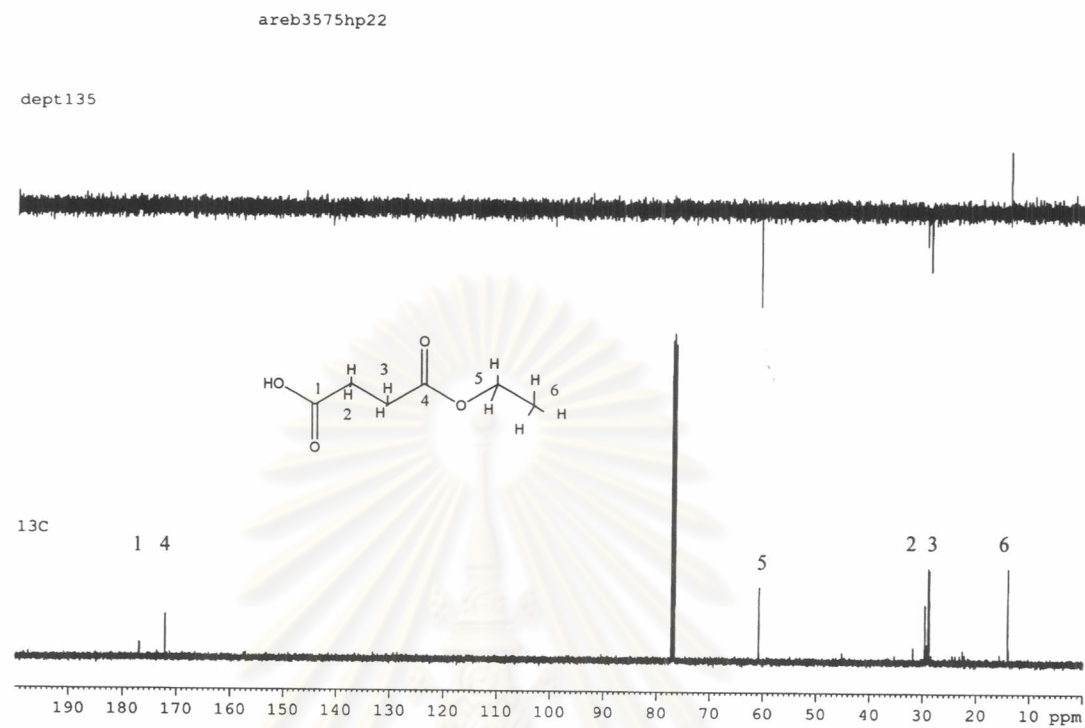


Figure 12 DEPT 135 spectrum of compound AREB 3575 HP22

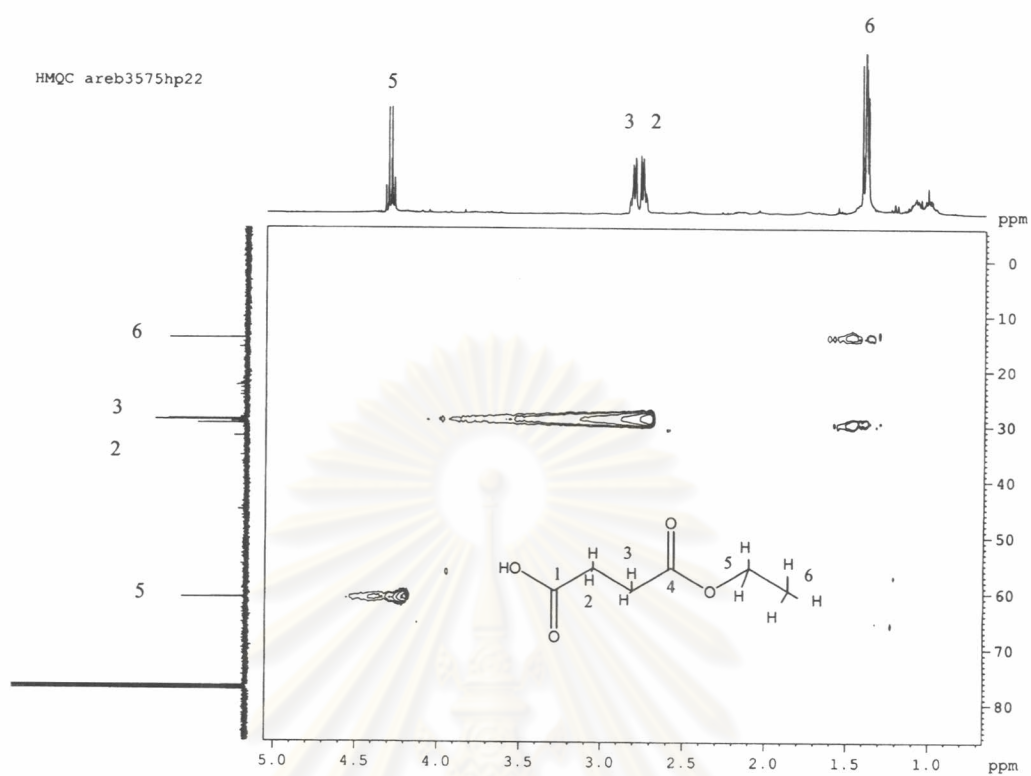
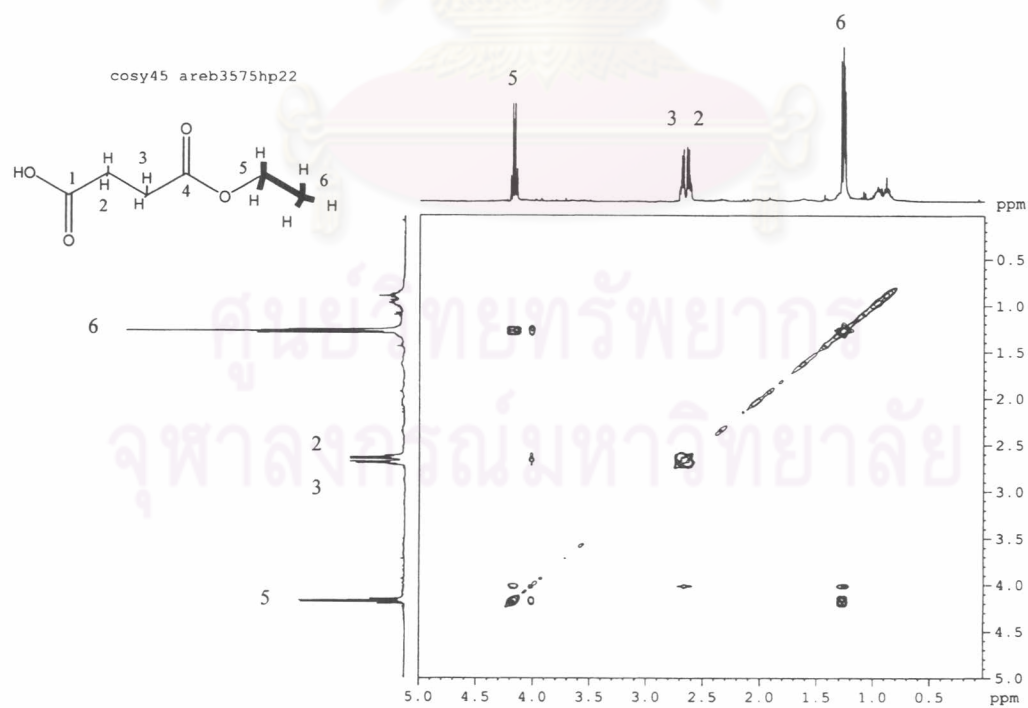


Figure 13 HMQC spectrum of compound AREB 3575 HP22

Figure 14  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of compound AREB 3575 HP22



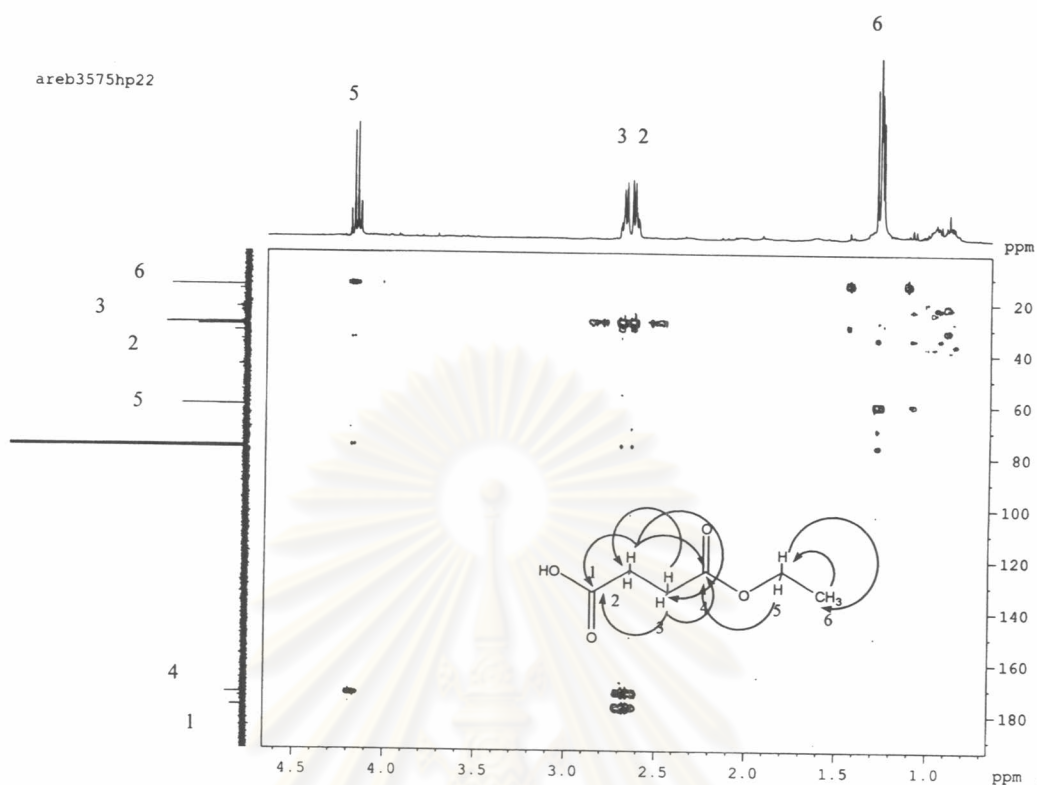


Figure 16 HMBC spectrum ( $^nJ_{\text{HC}} = 8 \text{ Hz}$ ) of compound AREB 3575 HP22

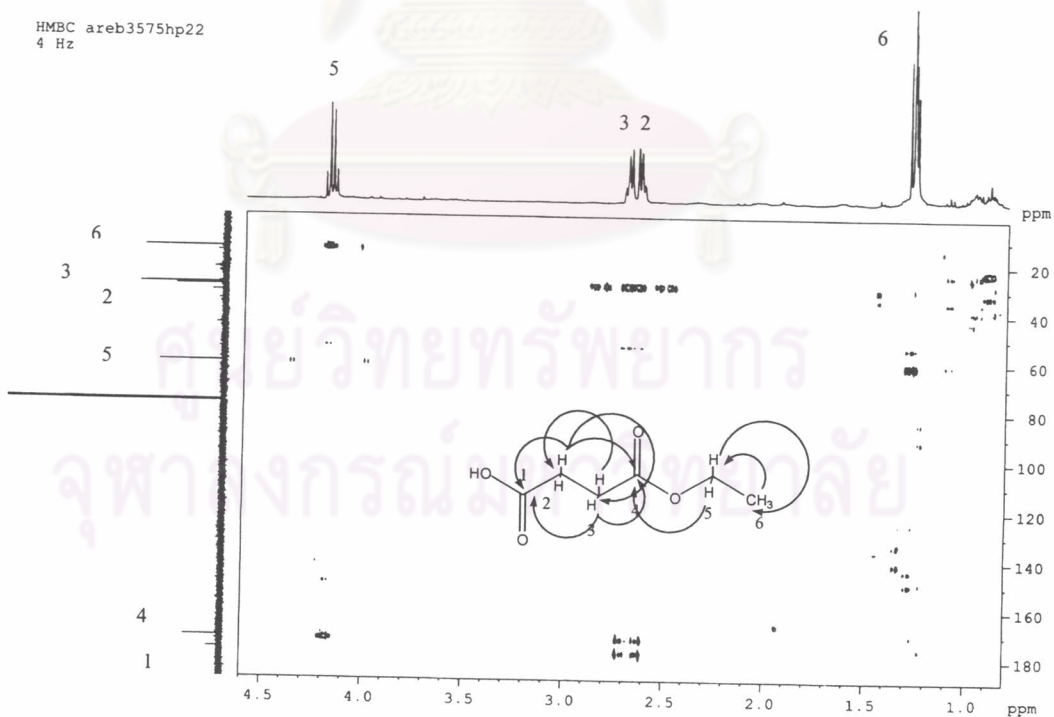


Figure 17 HMBC spectrum ( $^nJ_{\text{HC}} = 4 \text{ Hz}$ ) of compound AREB 3575 HP22

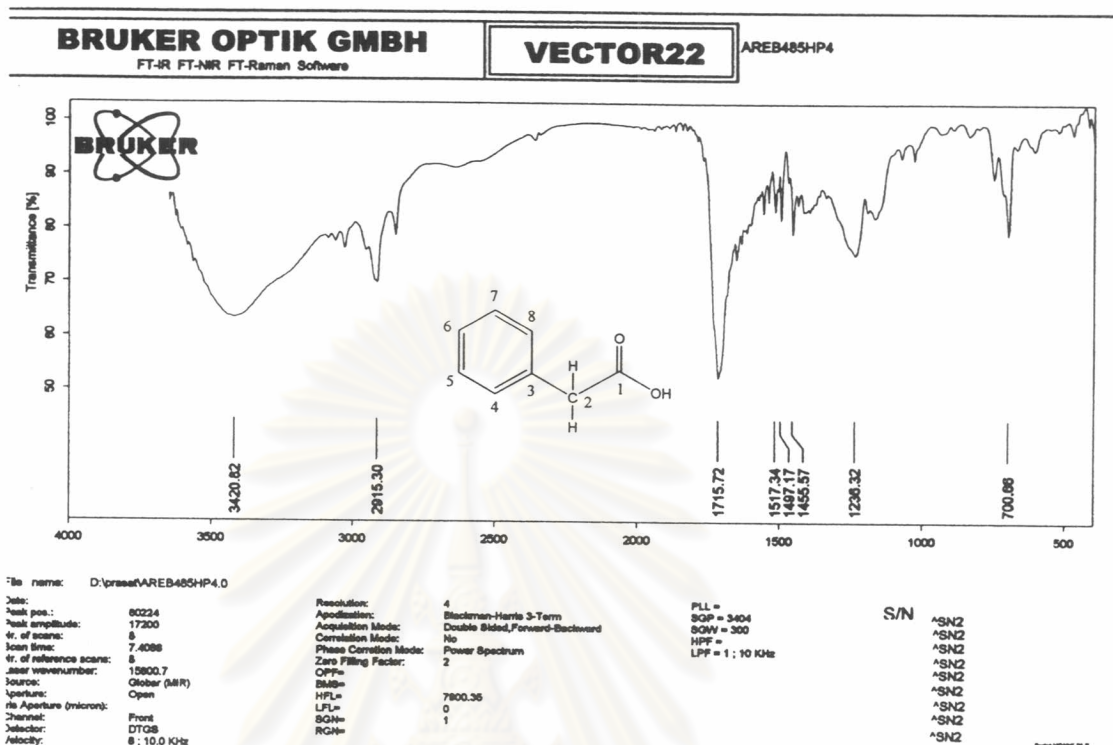


Figure 19 IR spectrum of compound AREB 485 HP4

TEST BY: \_\_\_\_\_

12/9/02 16:22:04 Page 1 of 1

BIOTEC

Instrument Serial Number EL96033097

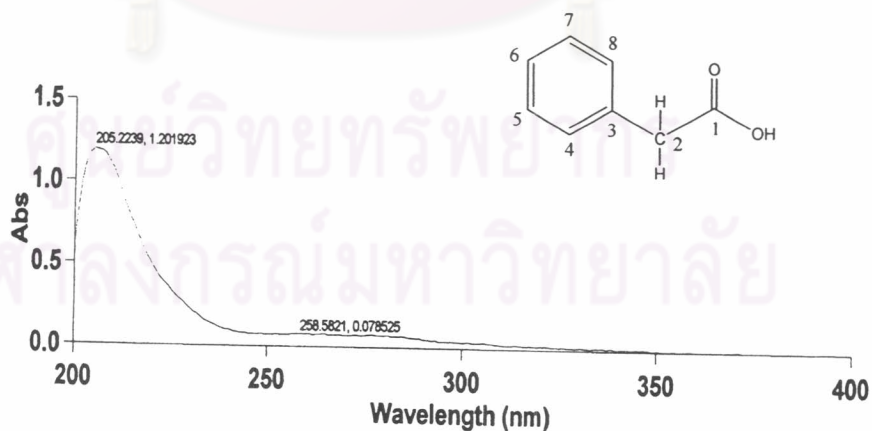


Figure 20 UV spectrum of compound AREB 485 HP4 in methanol

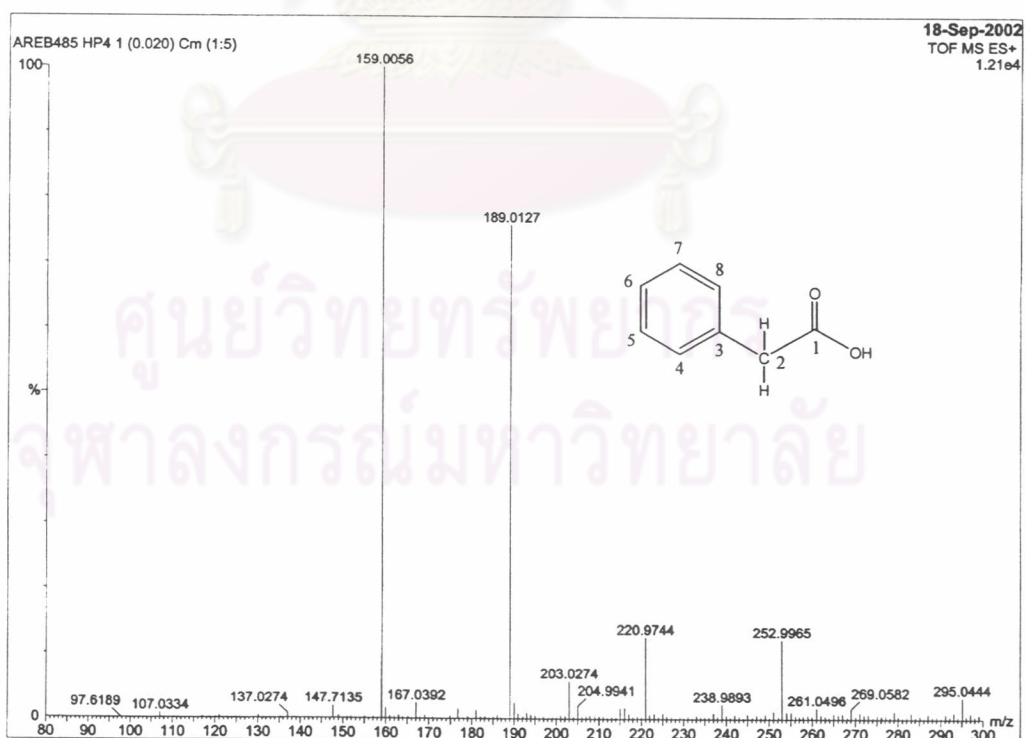
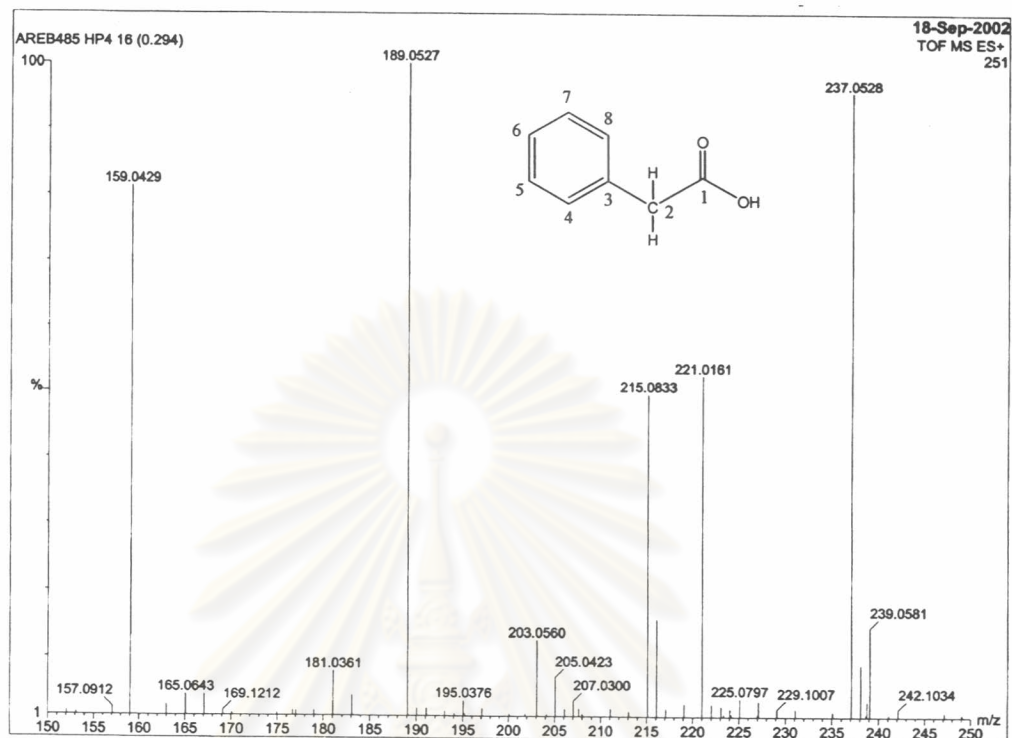


Figure 21 ESI-TOF mass spectrum of compound AREB 485 HP4

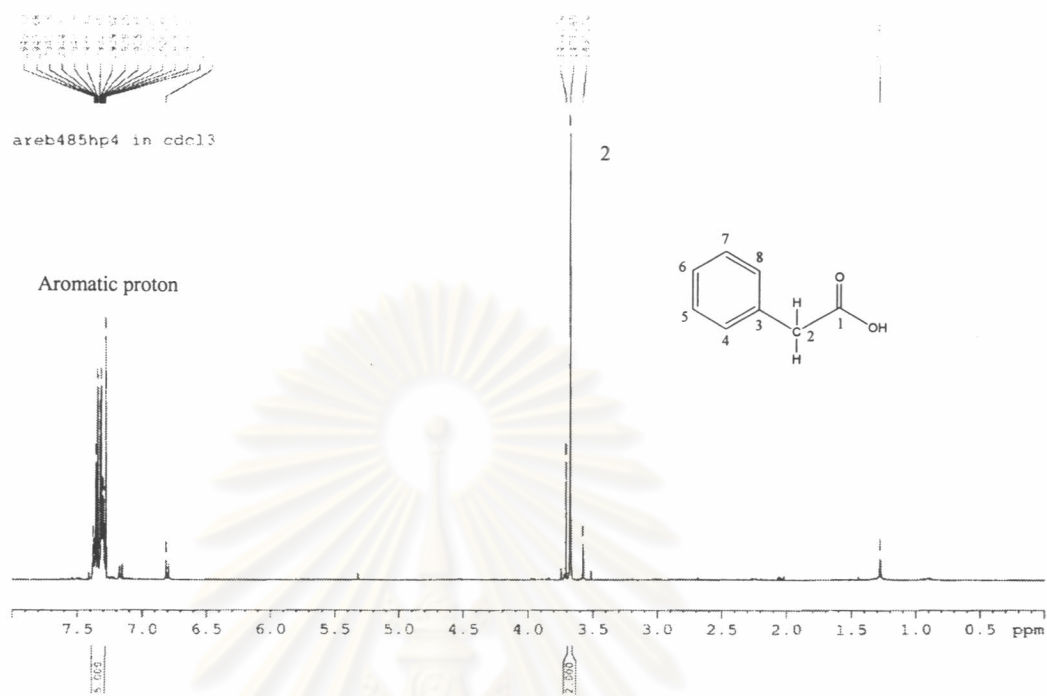


Figure 22 500 MHz  $^1\text{H}$ -NMR spectrum of compound AREB 485 HP4

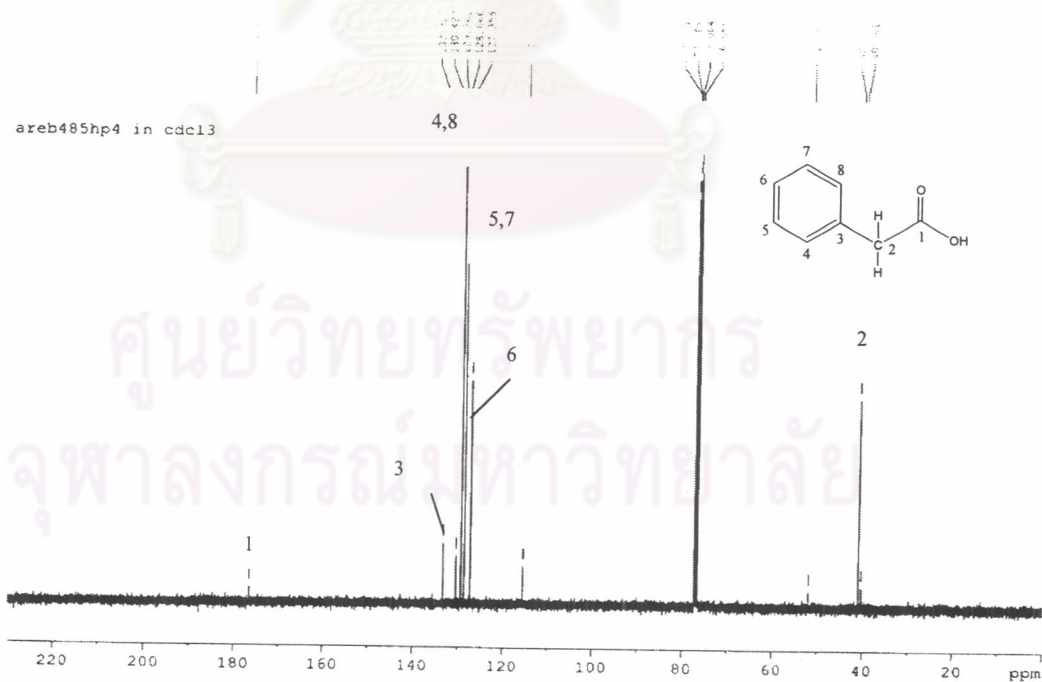
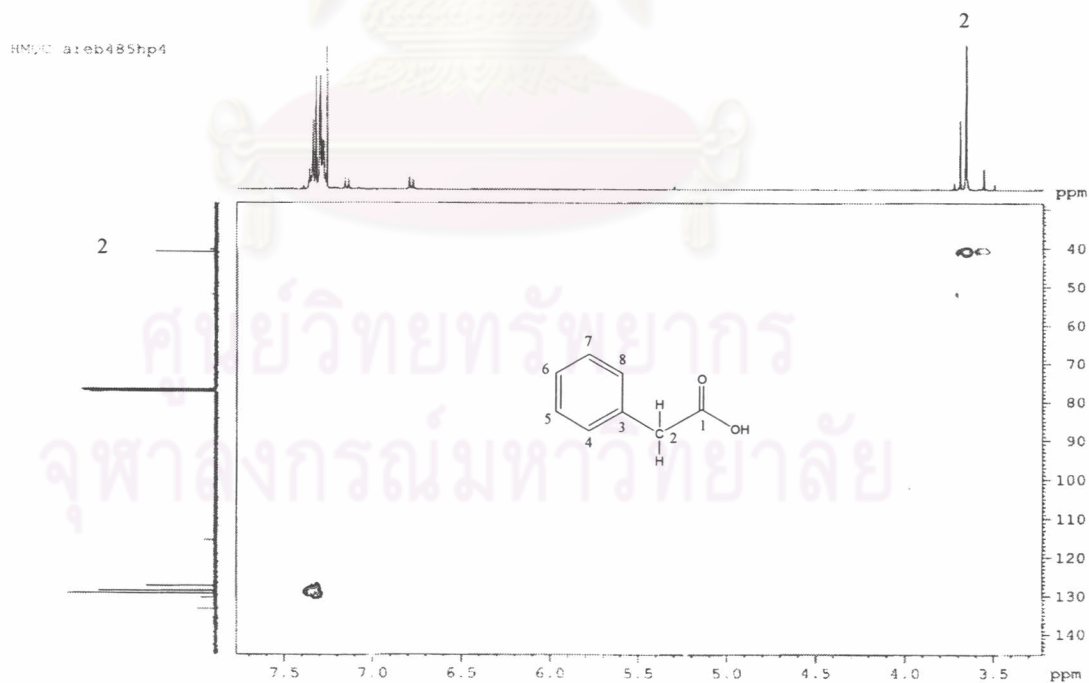
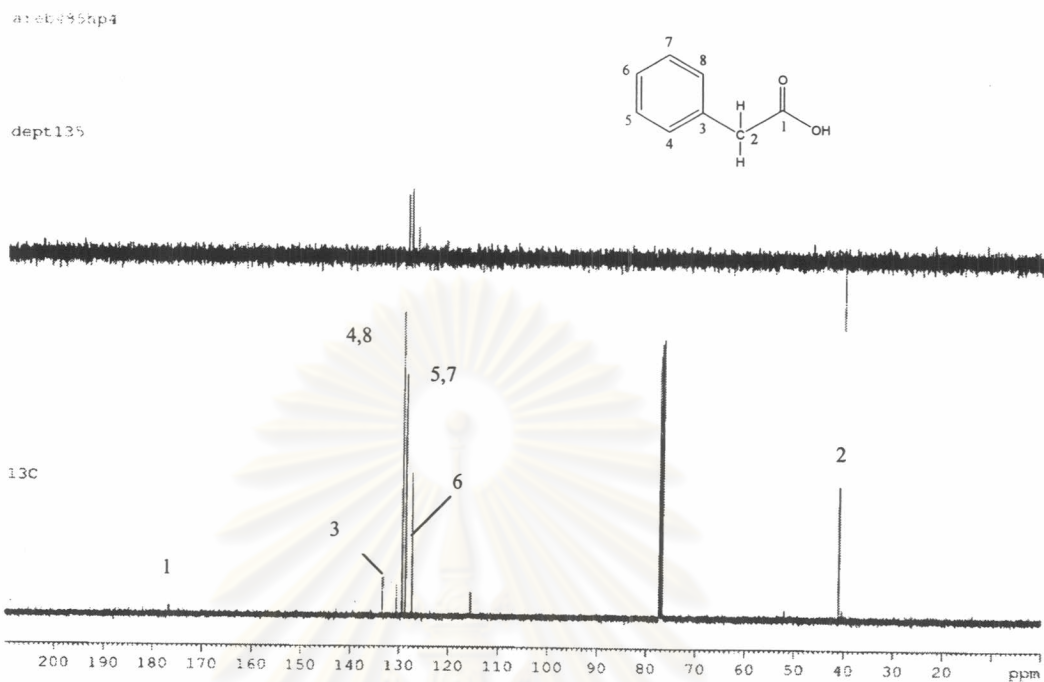


Figure 23 125 MHz  $^{13}\text{C}$ -NMR spectrum of compound AREB 485 HP4



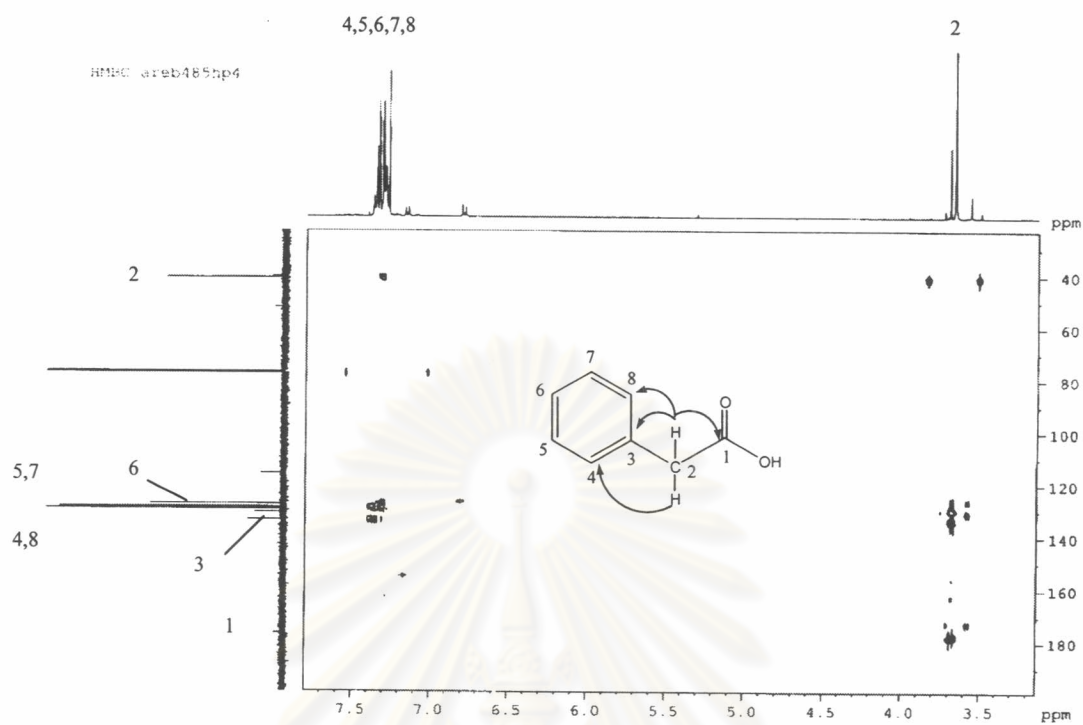


Figure 26 HMBC spectrum of compound AREB 485 HP4

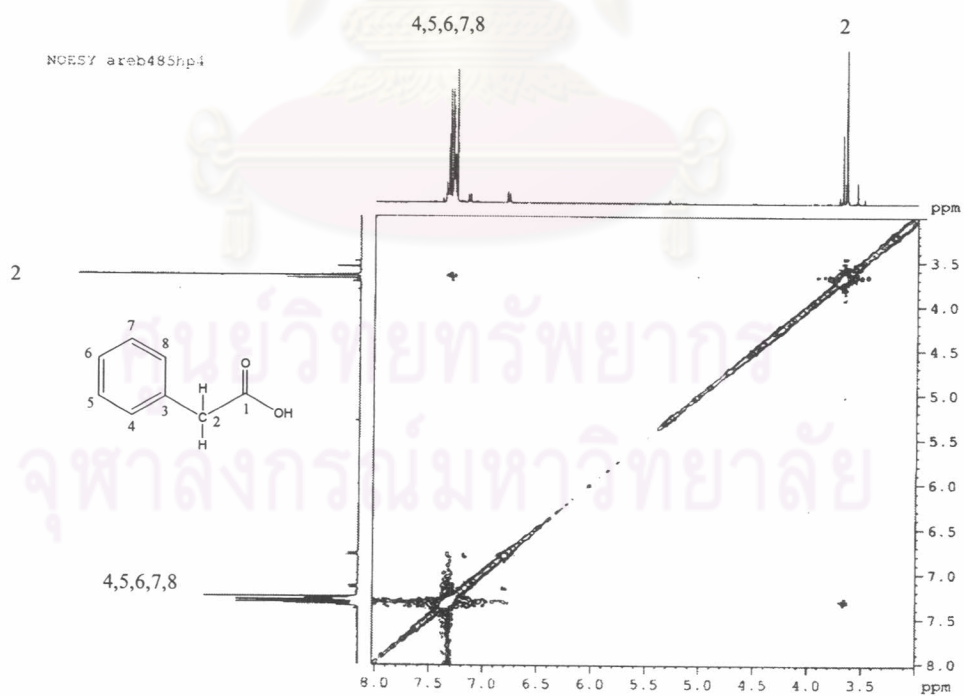


Figure 28 NOESY spectrum of compound AREB 485 HP4

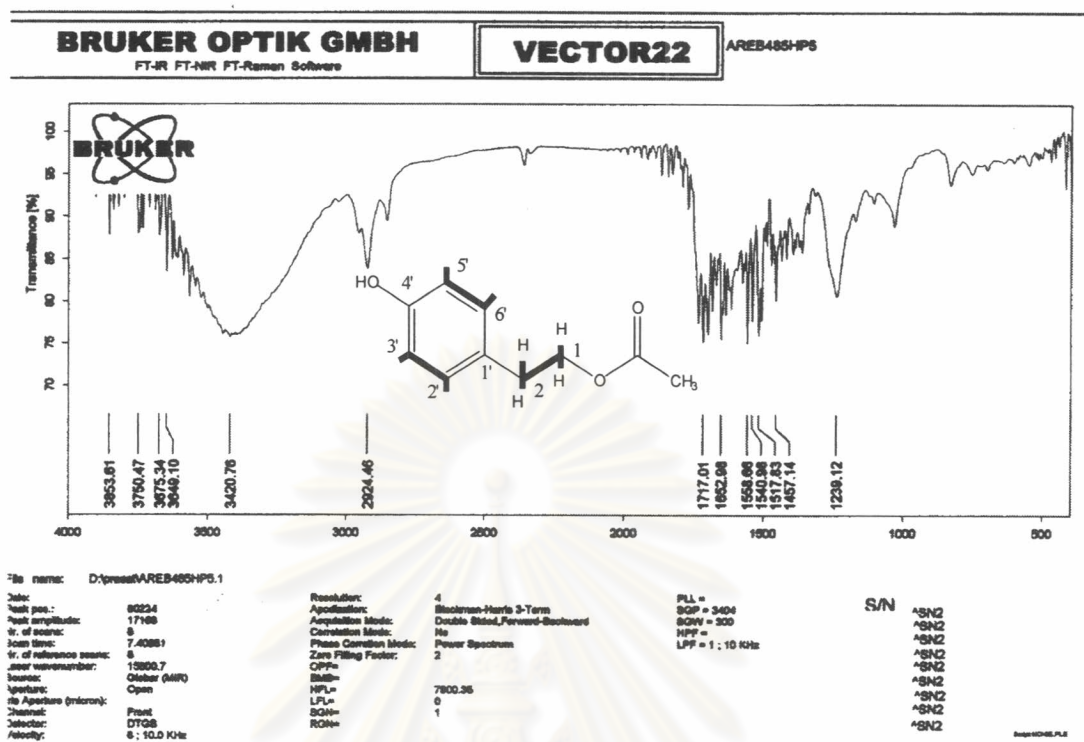


Figure 29 IR spectrum of compound AREB 485 HP5

TEST BY: \_\_\_\_\_

12/9/02 15:56:55 Page 1 of 1

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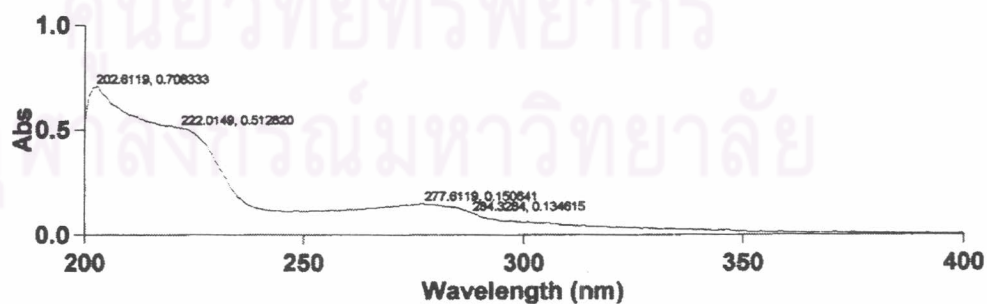
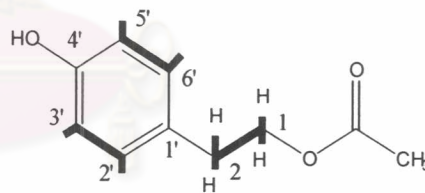


Figure 30 UV spectrum of compound AREB 485 HP5 in methanol

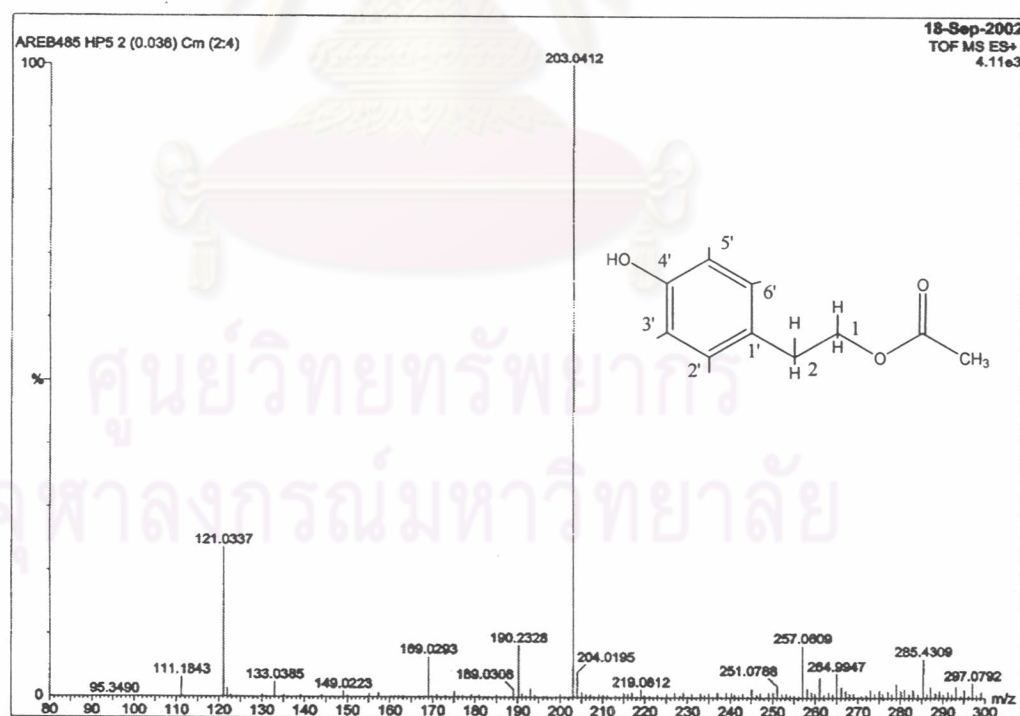
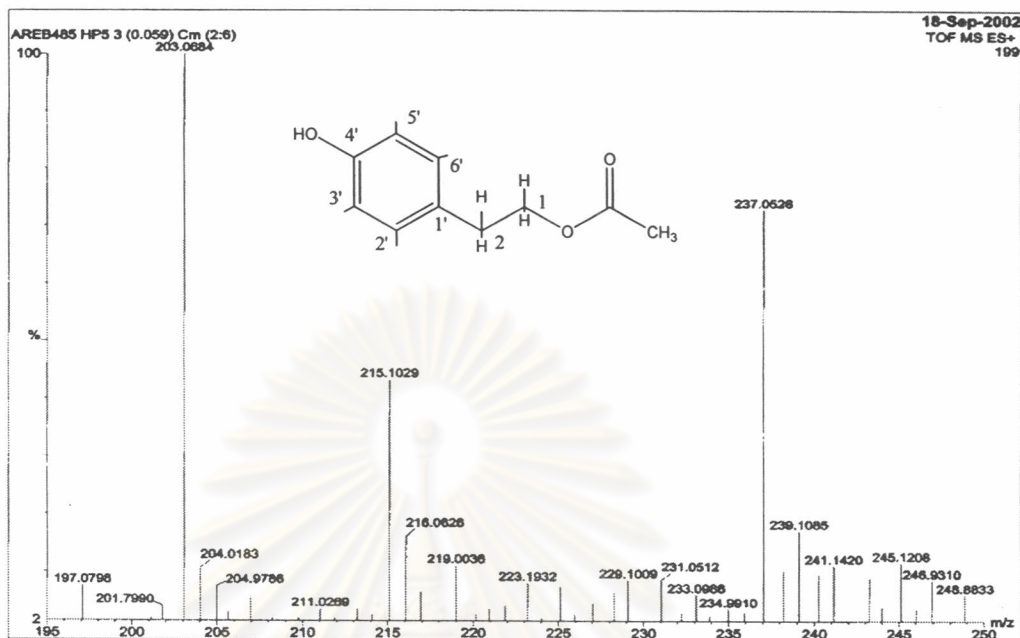
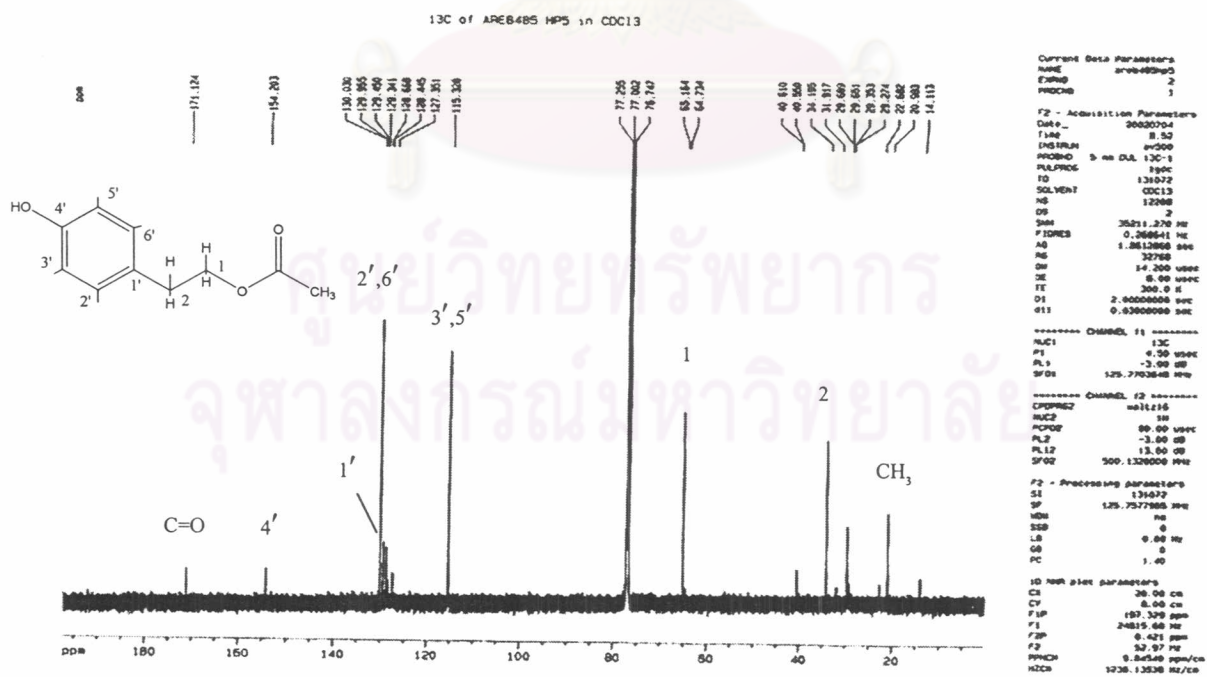
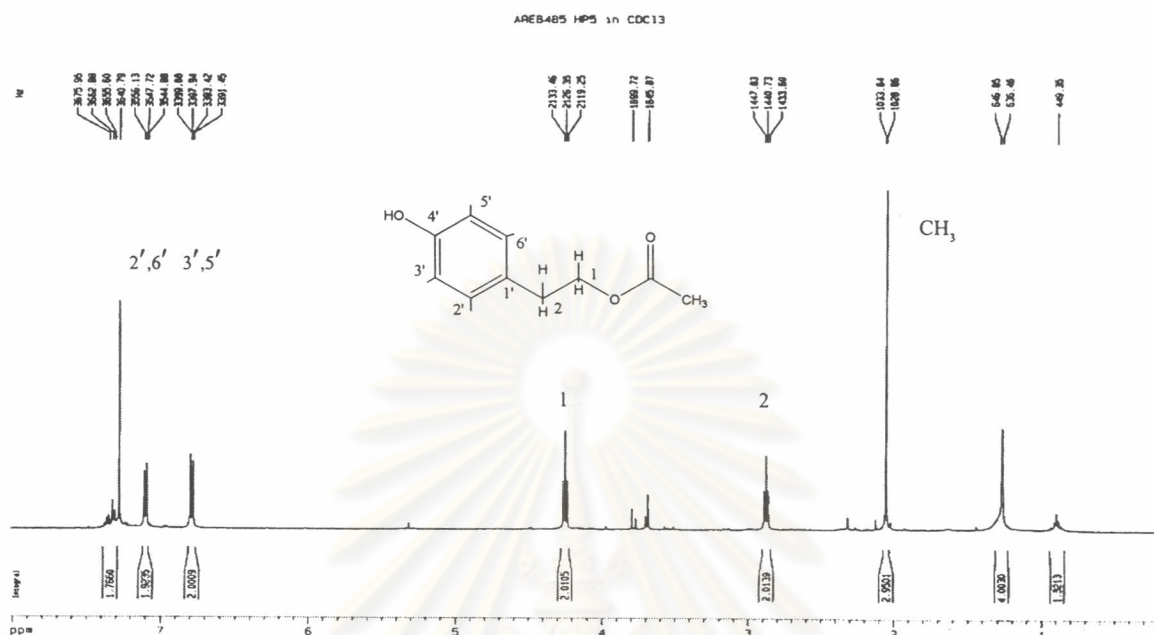


Figure 31 ESI-TOF mass spectrum of compound AREB 485 HP5





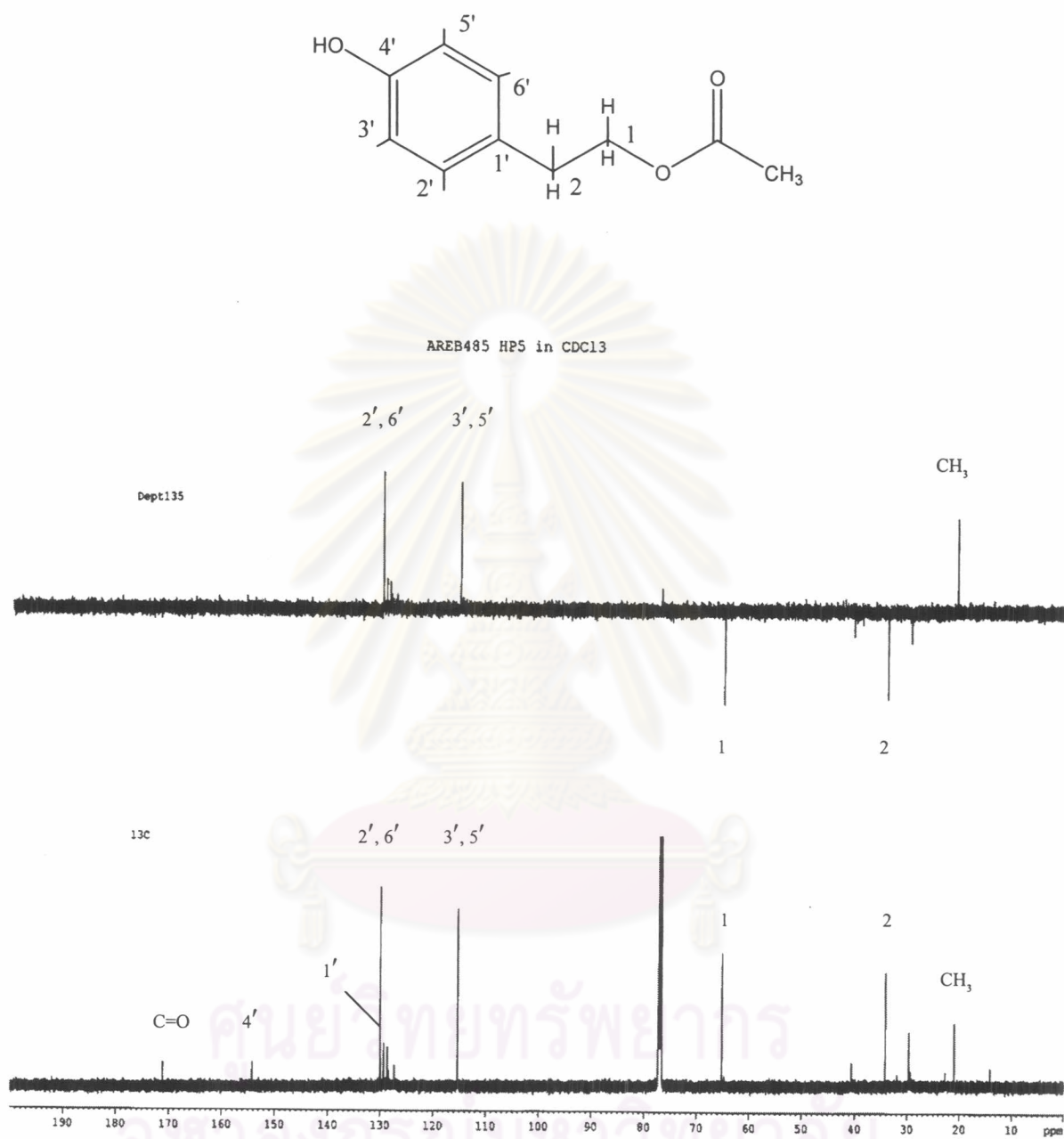


Figure 34 DEPT 135 spectrum of compound AREB 485 HP5

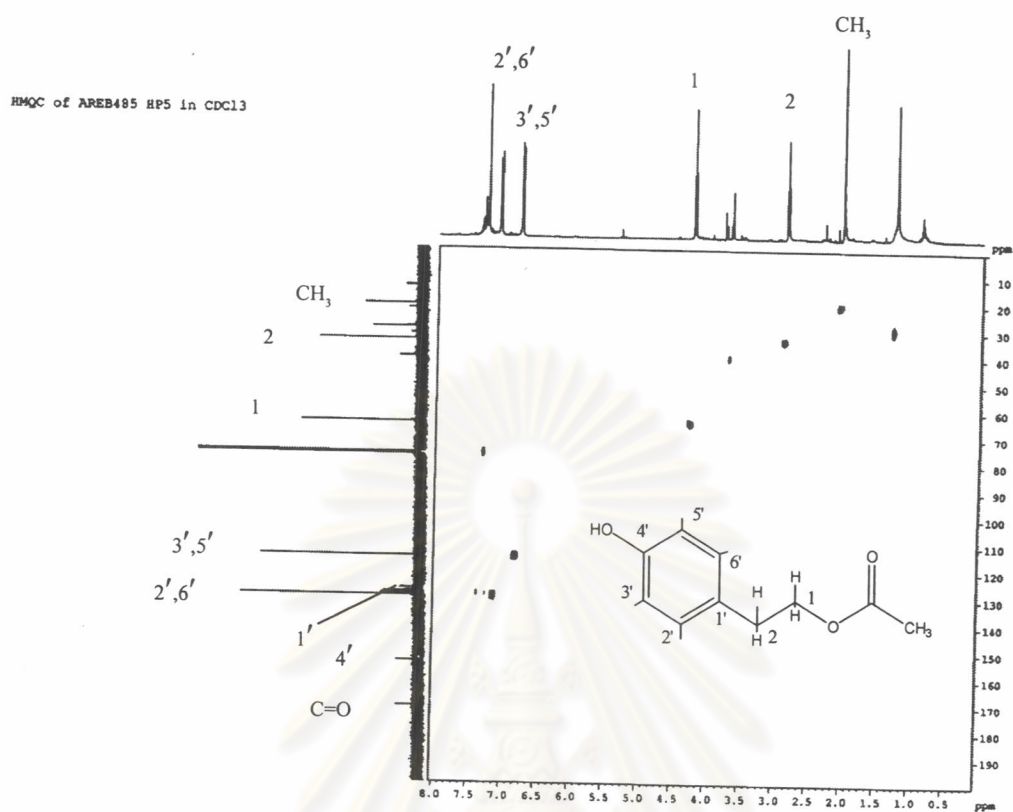


Figure 35 HMQC spectrum of compound AREB 485 HP5

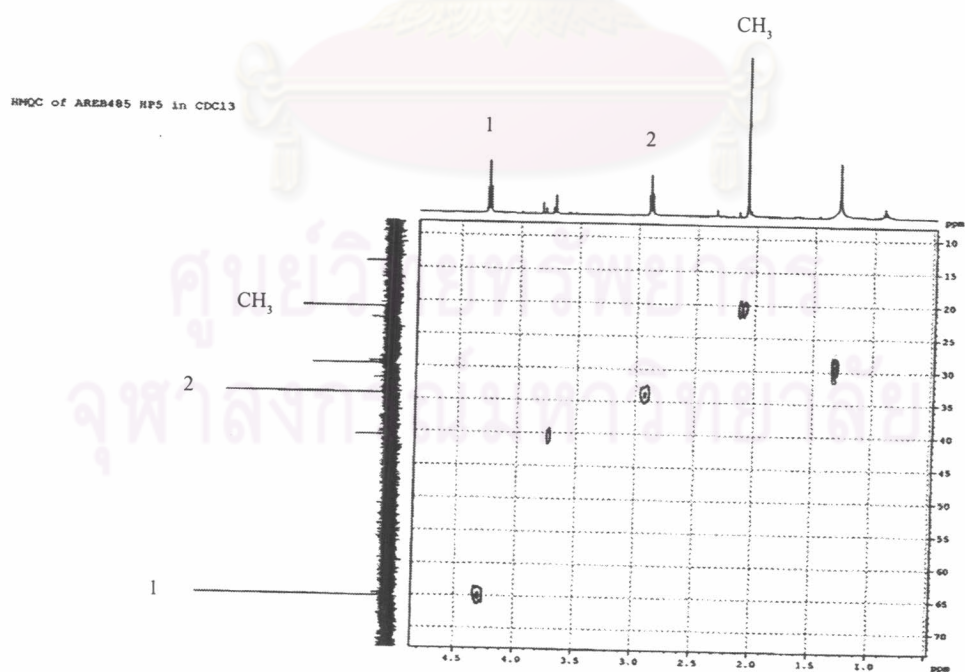


Figure 36 HMQC spectrum (partial expanded:  $\delta$ H 0.5-4.8 ppm,  $\delta$ C 8-73 ppm) of compound AREB 485 HP5

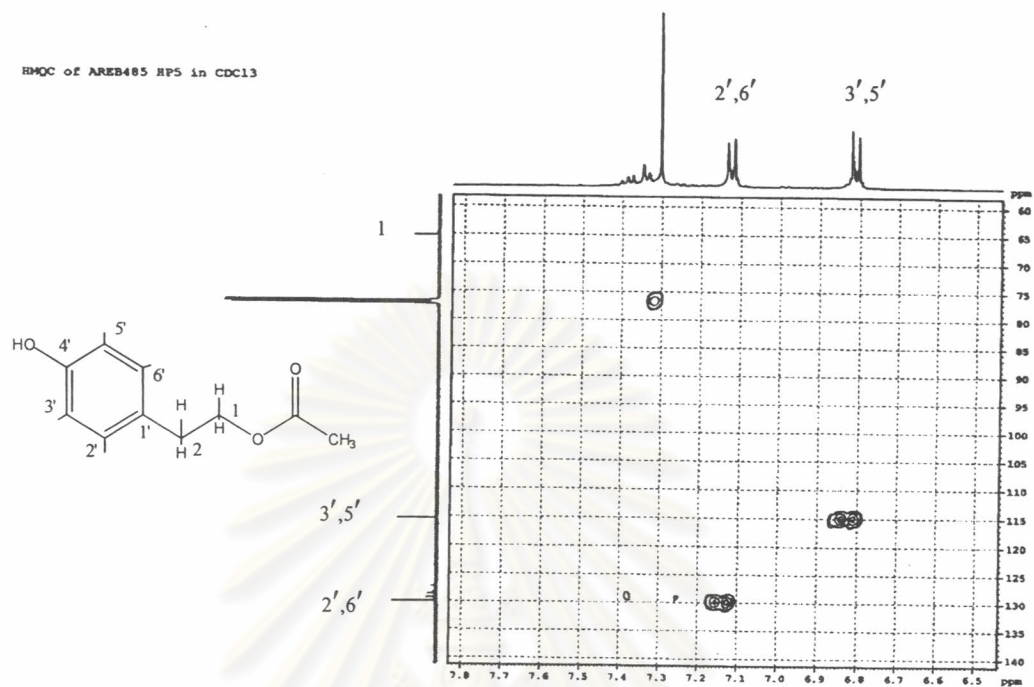


Figure 37 HMOC spectrum (partial expanded:  $\delta$ H 6.5-7.8 ppm,  $\delta$ C 60-140 ppm) of compound AREB 485 HP5

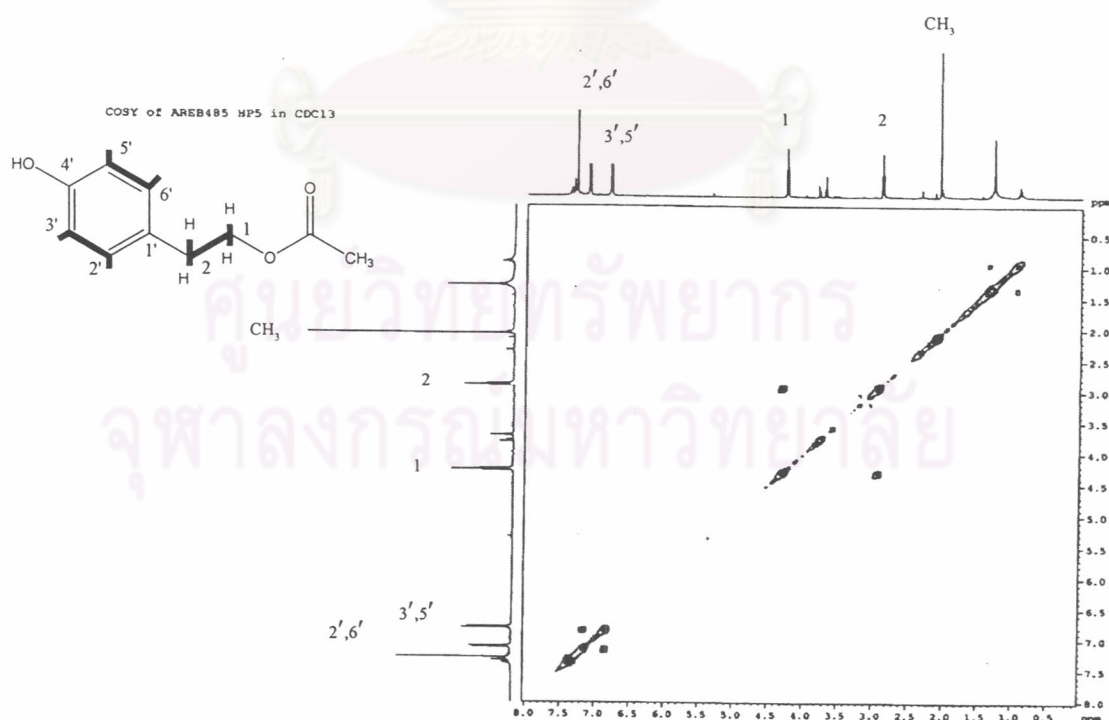


Figure 38 <sup>1</sup>H-<sup>1</sup>H COSY spectrum of compound AREB 485 HP5

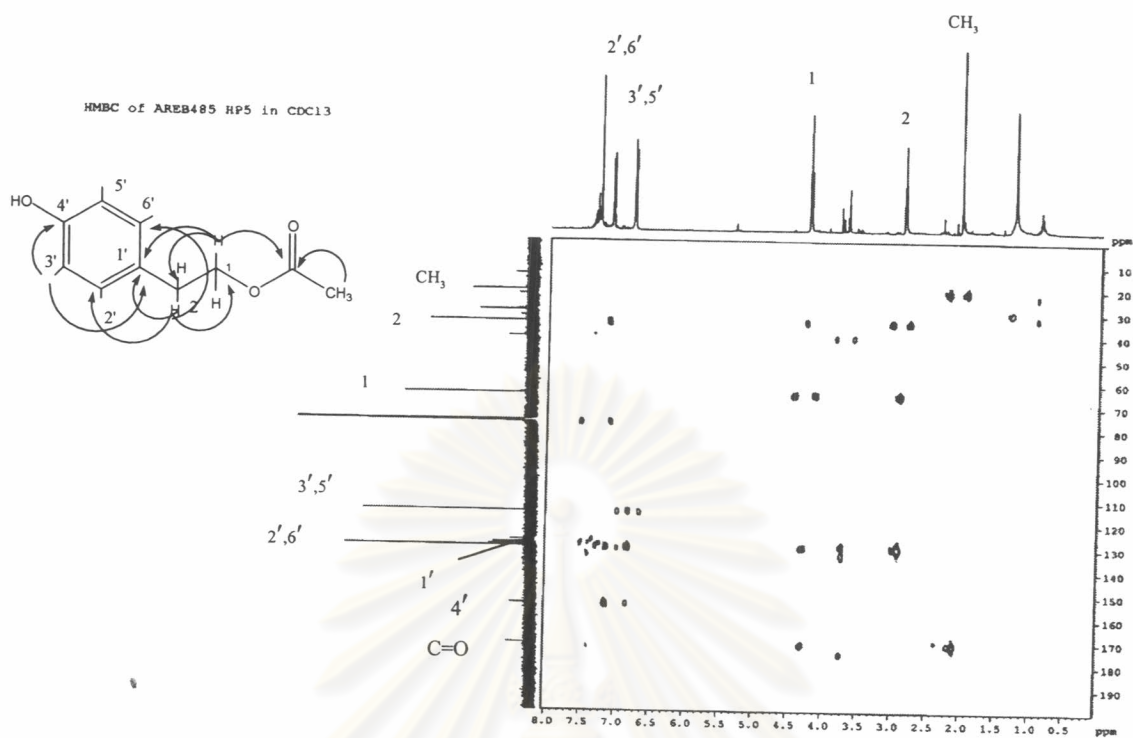


Figure 40 HMBC spectrum of compound AREB 485 HP5

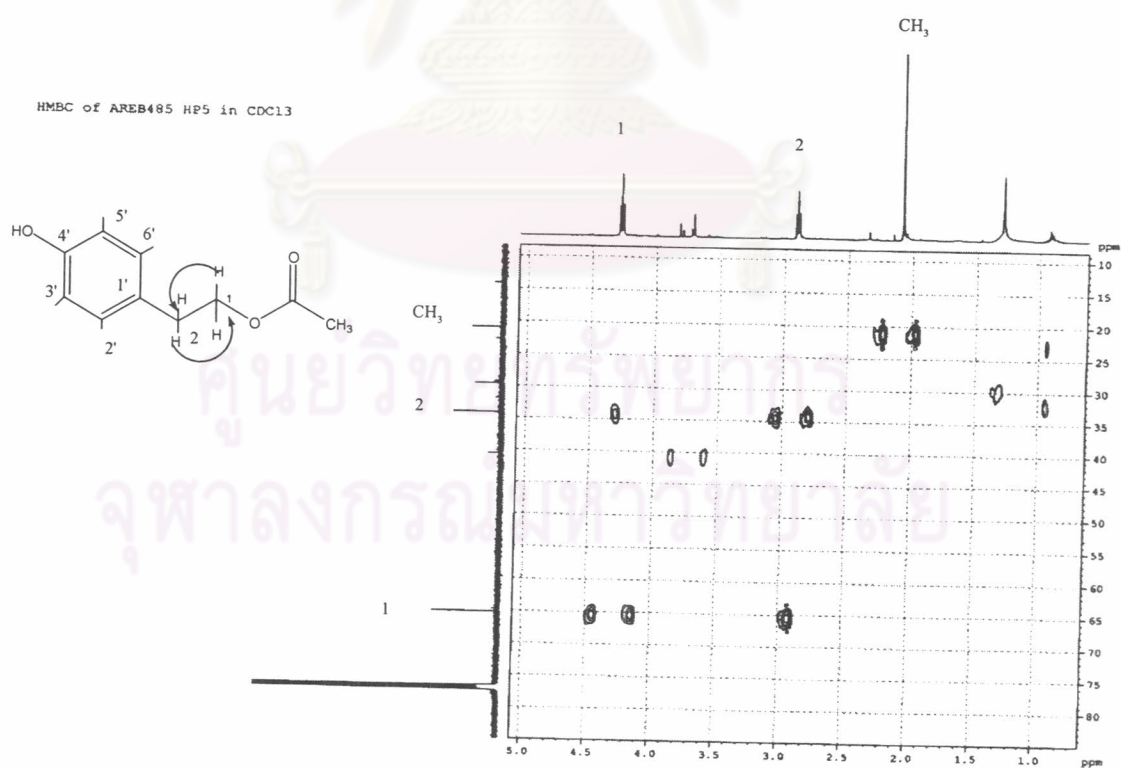


Figure 41 HMBC spectrum (partial expanded:  $\delta$ H 0.5-5 ppm,  $\delta$ C 10-85 ppm) of Compound AREB 485 HP5

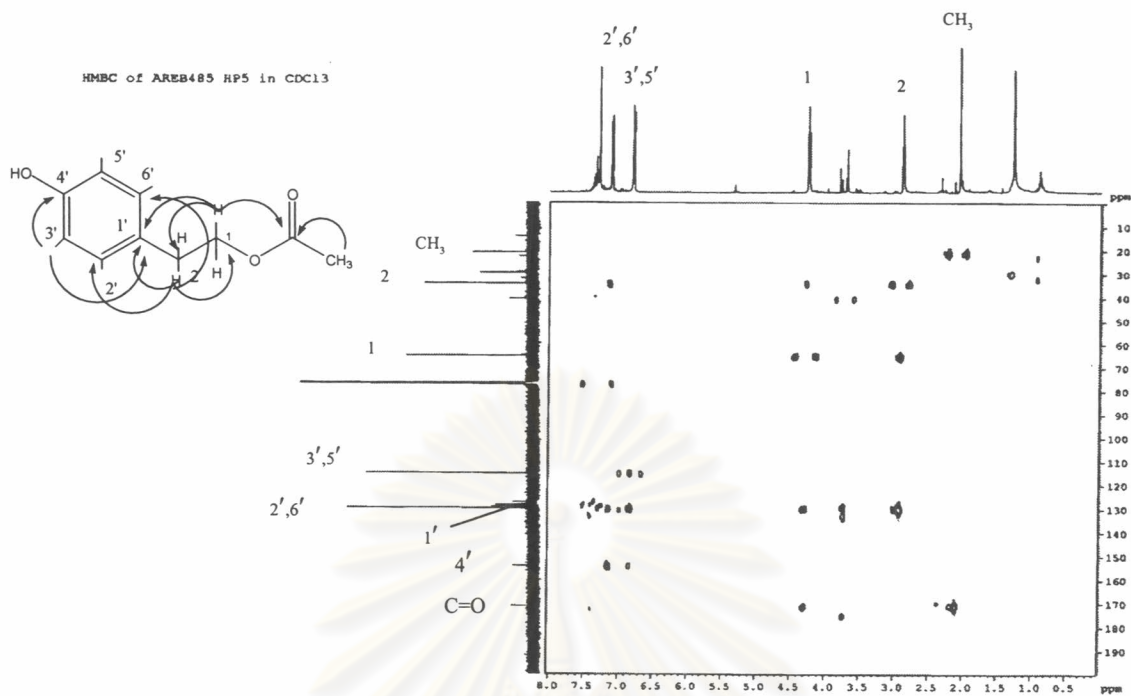
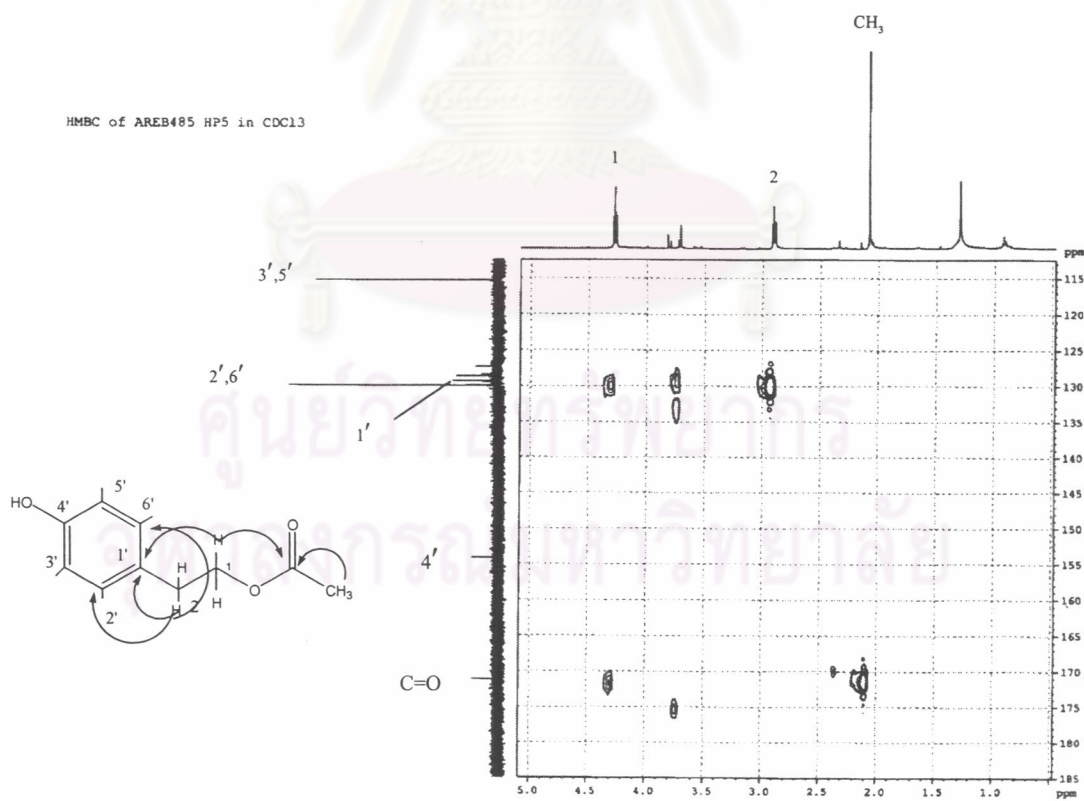


Figure 40 HMBC spectrum of compound AREB 485 HP5

Figure 42 HMBC spectrum (partial expanded:  $\delta$ H 0.5-5 ppm,  $\delta$ C 115-185 ppm) of compound 485 HP5

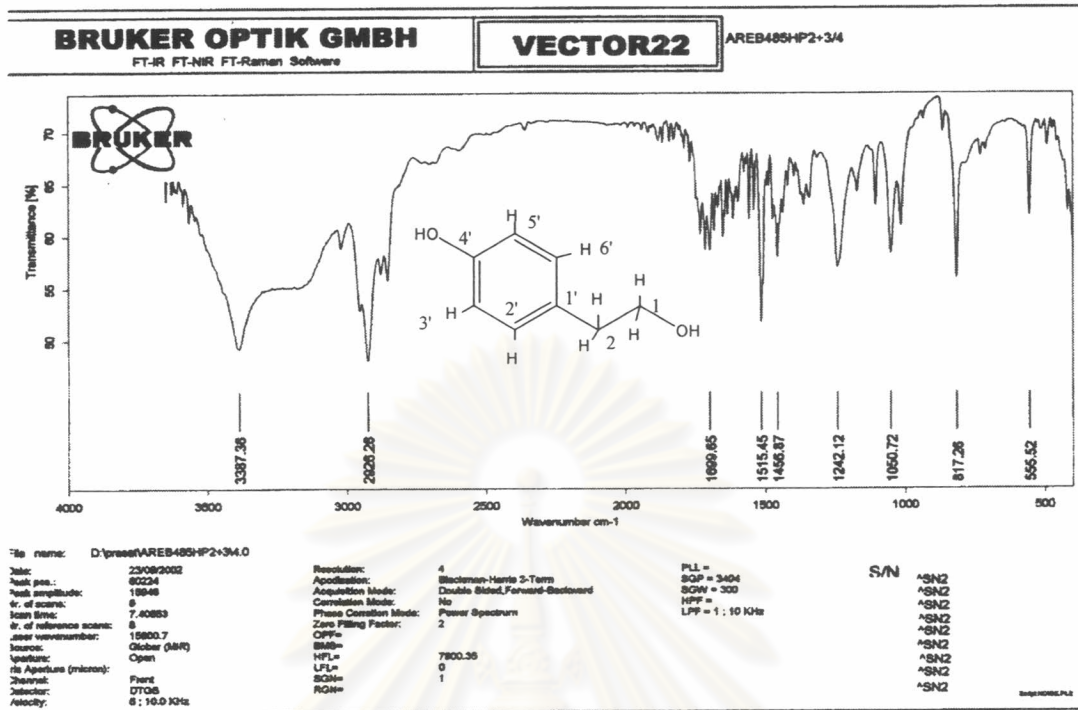


Figure 44 IR spectrum of compound AREB 485 HP2+3/4

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12/9/02 16:43:06 Page 1 of 1

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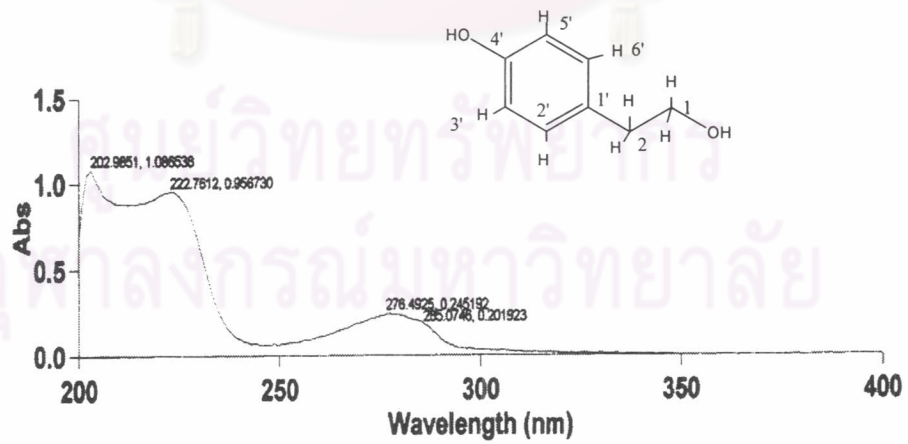


Figure 45 UV spectrum of compound AREB 485 HP2+3/4

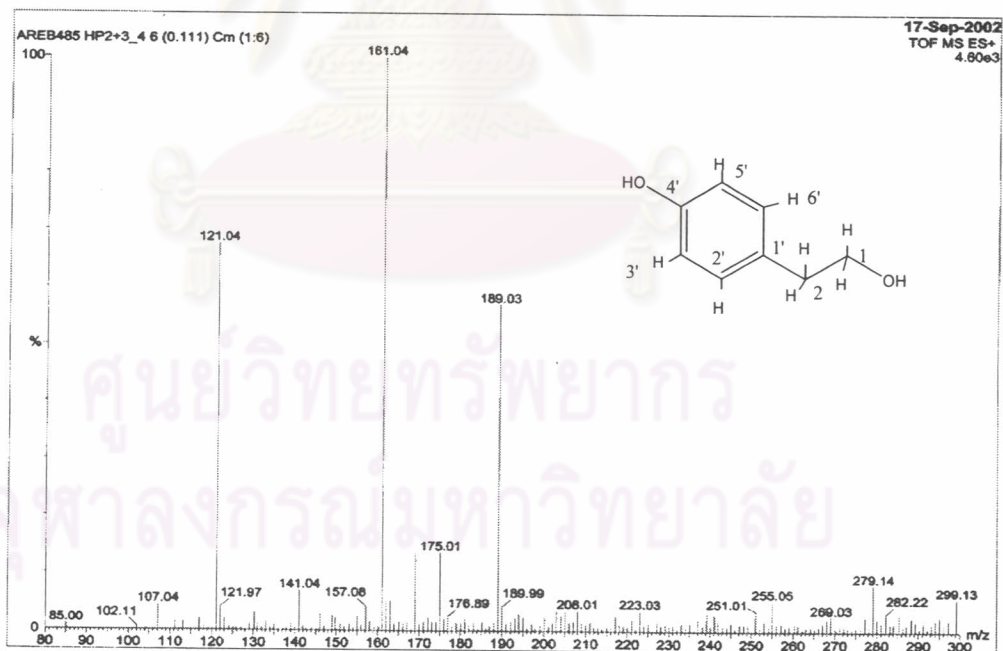
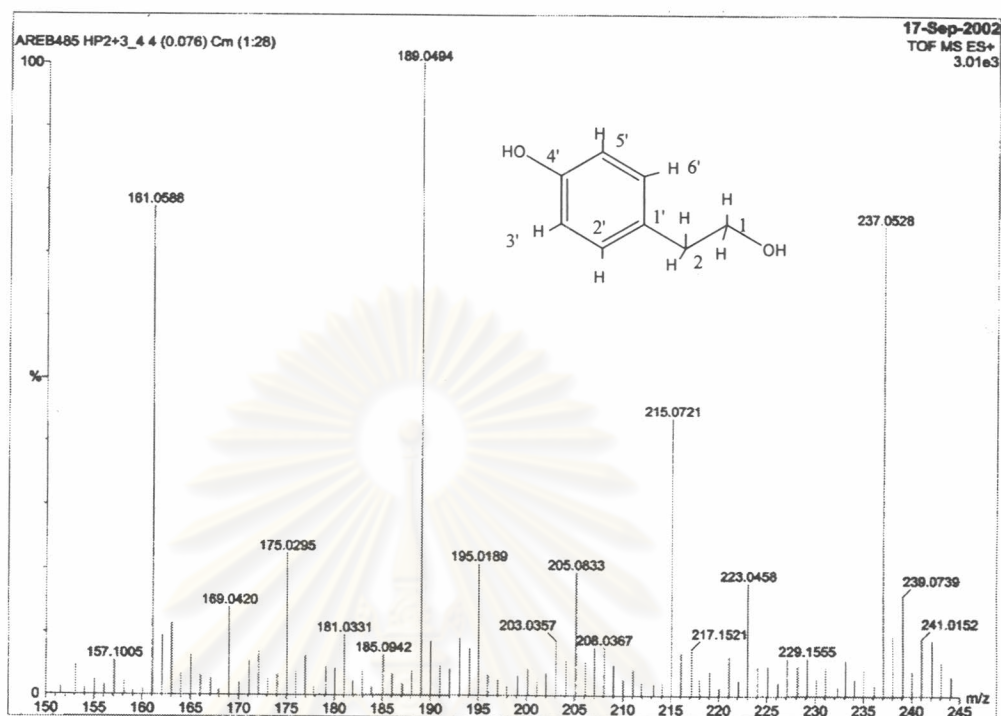
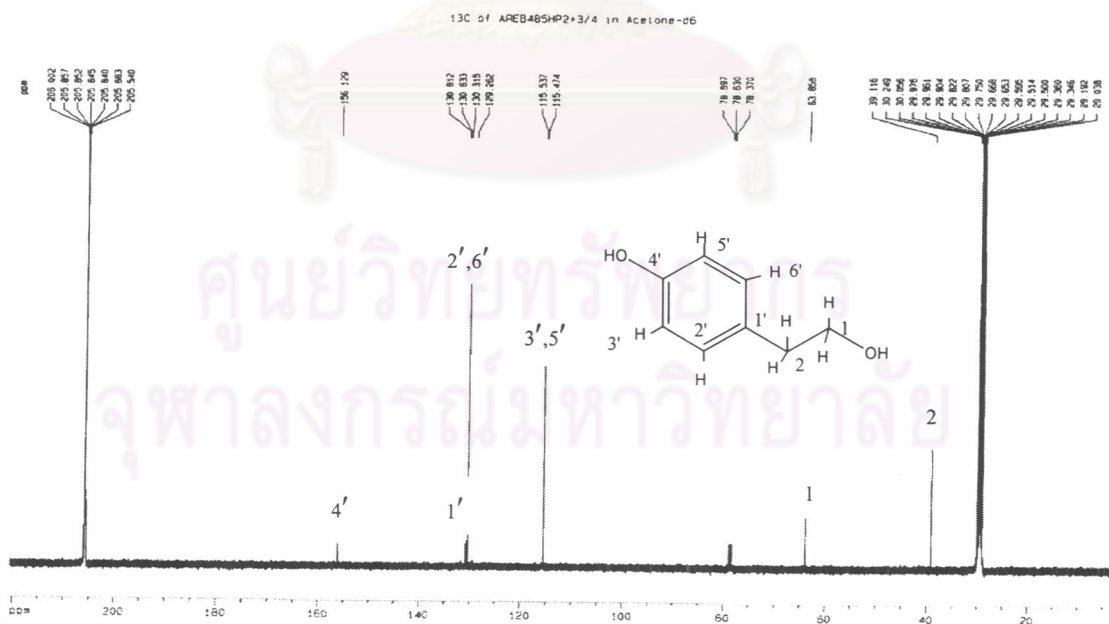
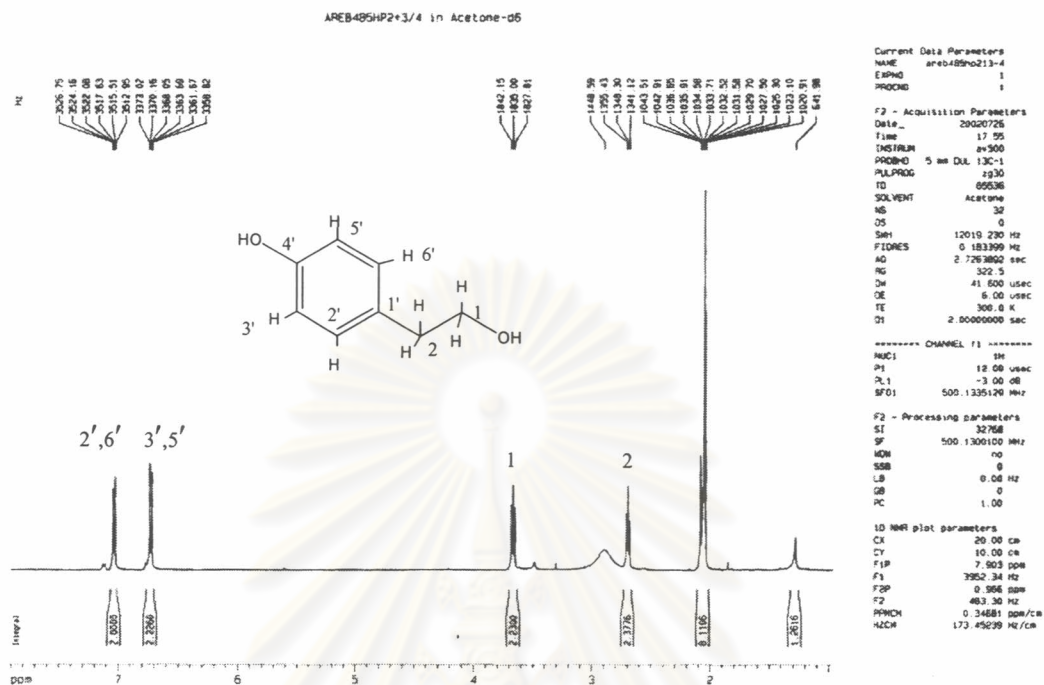


Figure 46 ESI-TOF mass spectrum of compound AREB 485 HP2+3/4





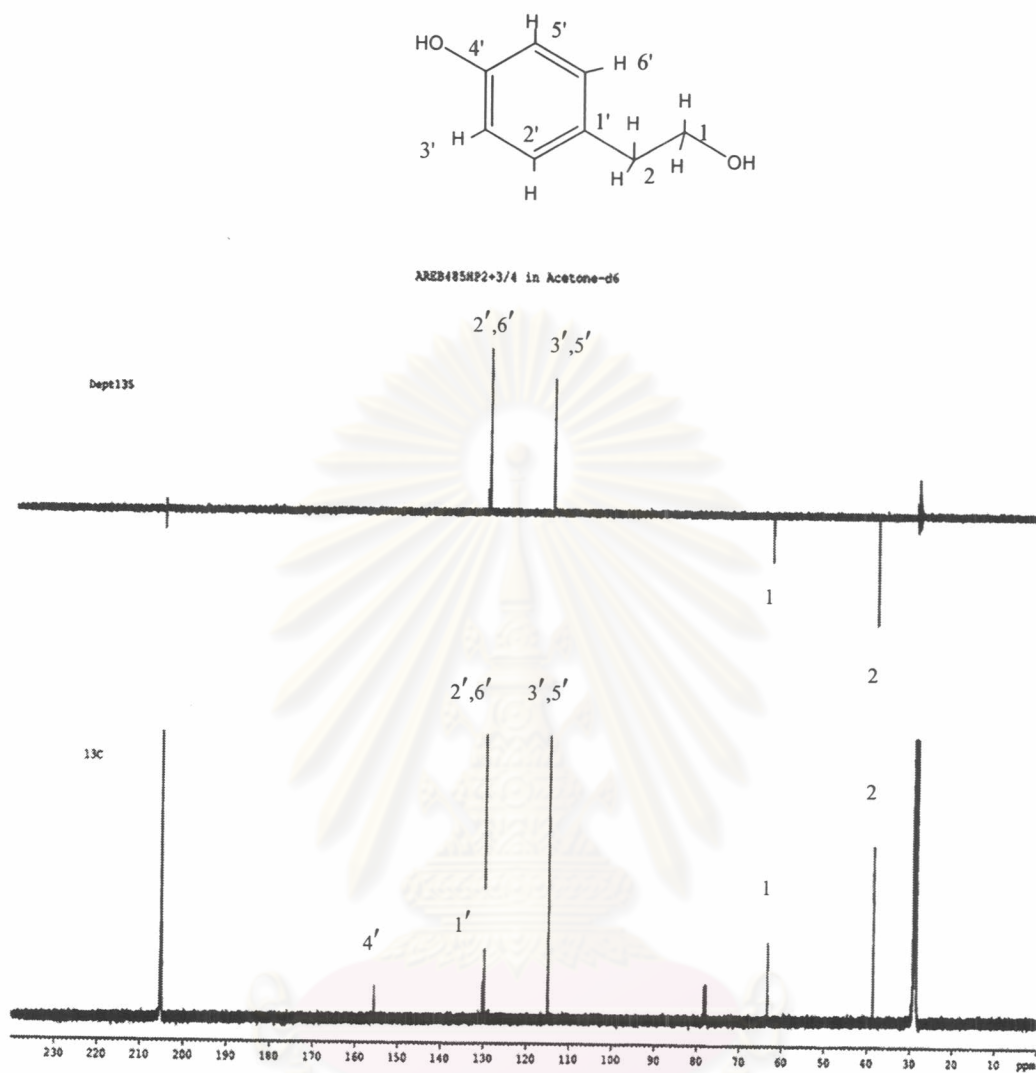


Figure 49 DEPT 135 spectrum of compound AREB 485 HP2+3/4

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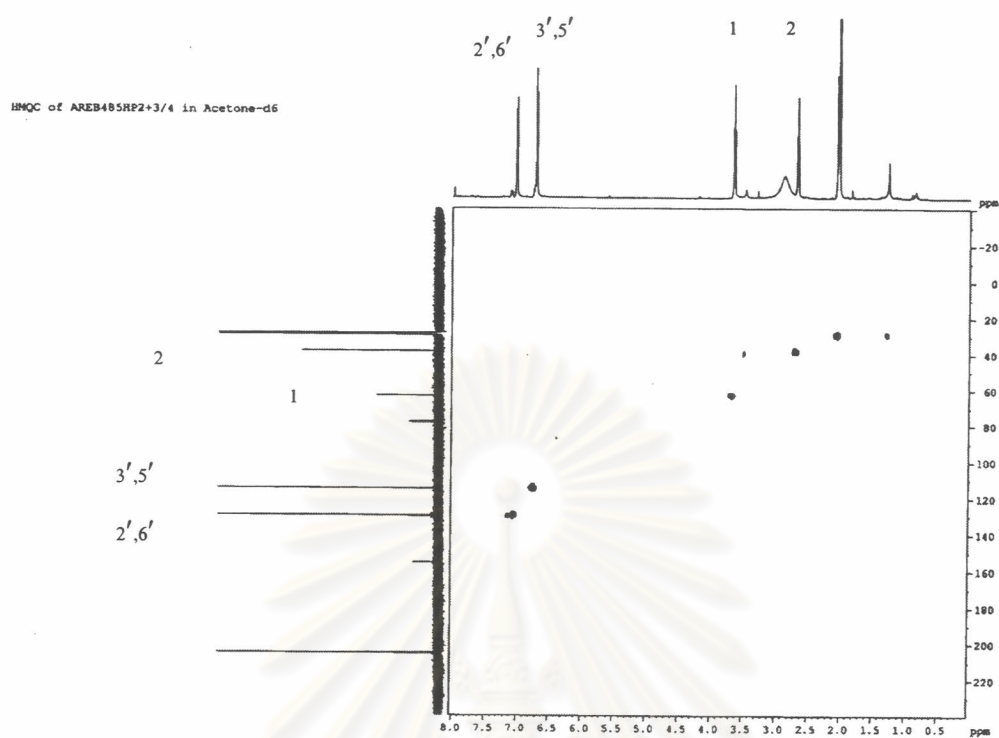


Figure 50 HMOC spectrum of compound AREB 485 HP2+3/4

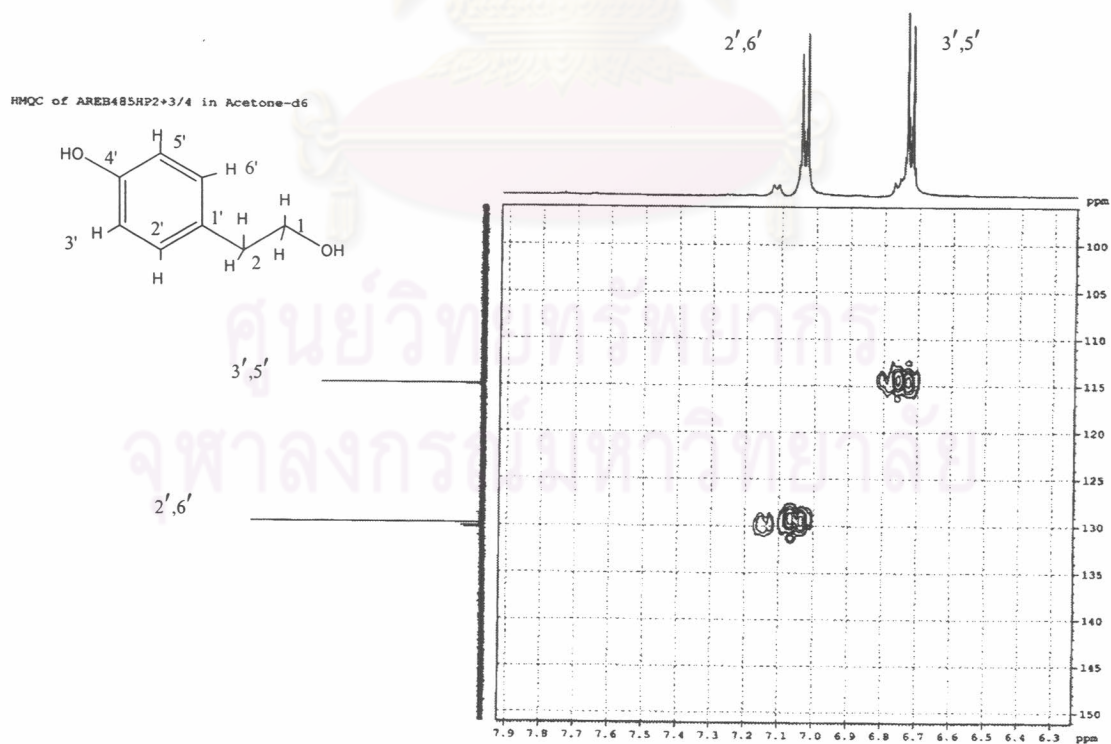


Figure 51 HMOC spectrum (partial expanded:  $\delta$ H 6.3-7.9 ppm,  $\delta$ C 95-150 ppm) of compound AREB 485 HP2+3/4

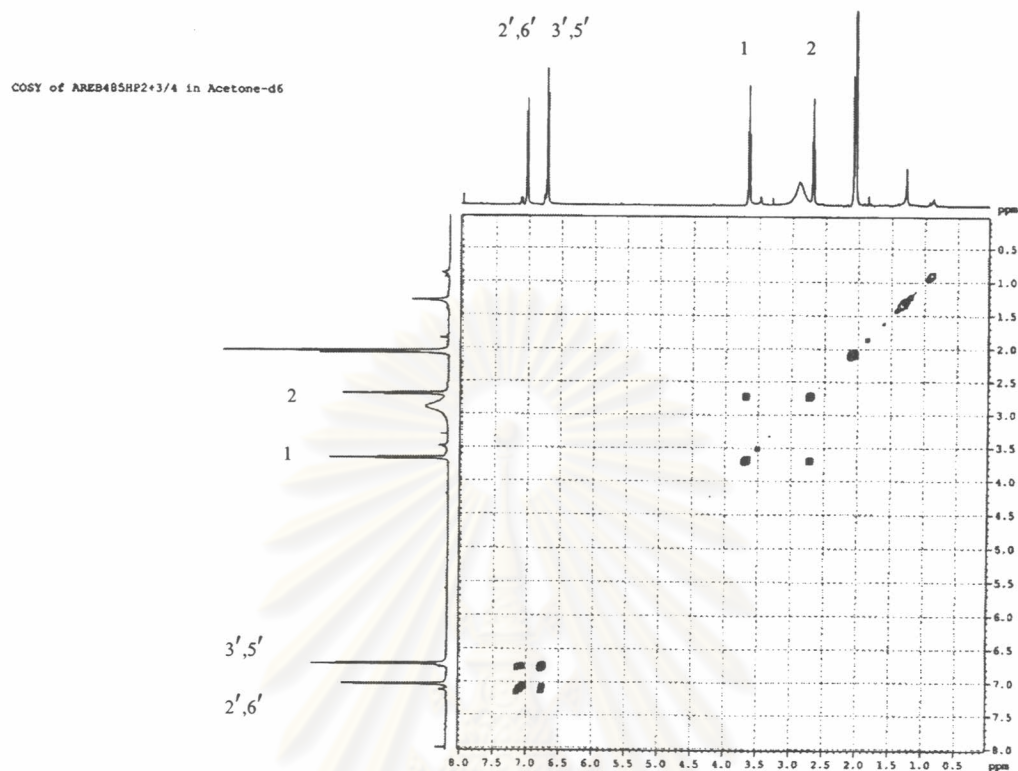
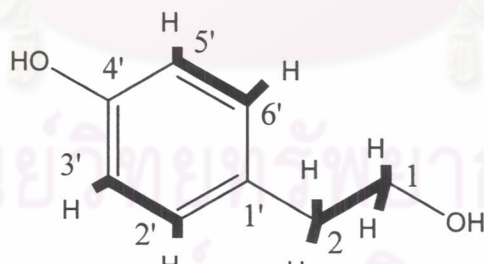


Figure 52  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of compound AREB 485 HP2+3/4



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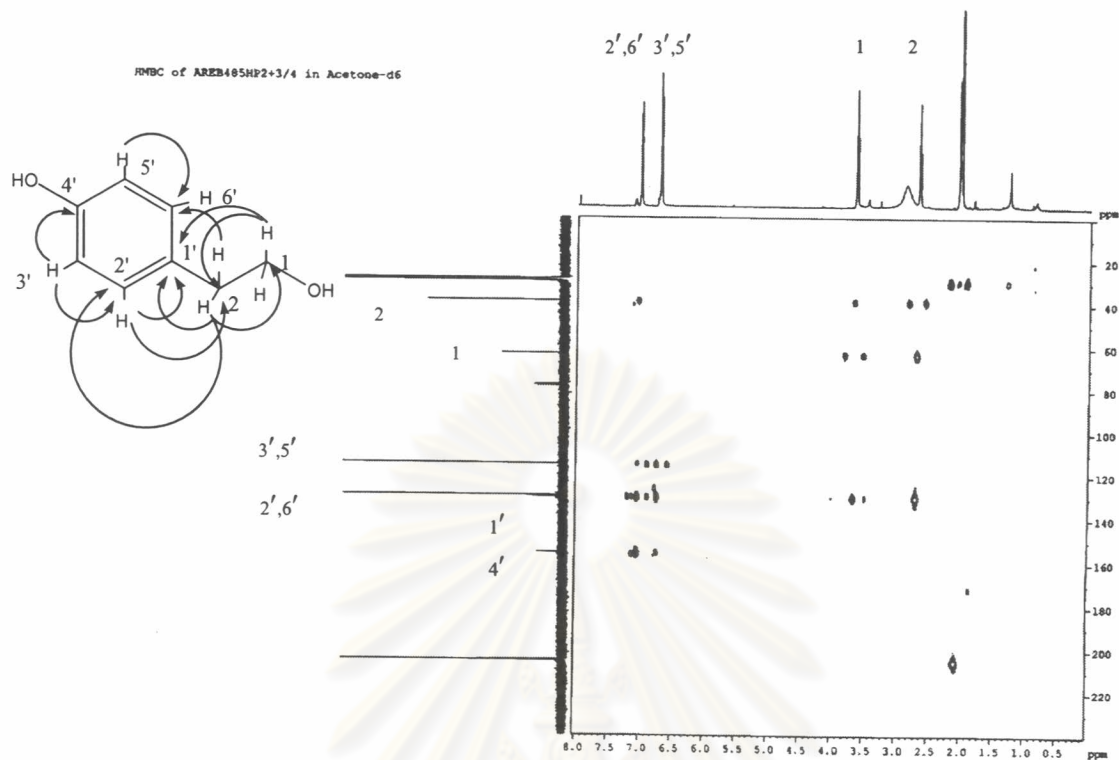


Figure 54 HMBC spectrum of compound AREB 485 HP2+3/4

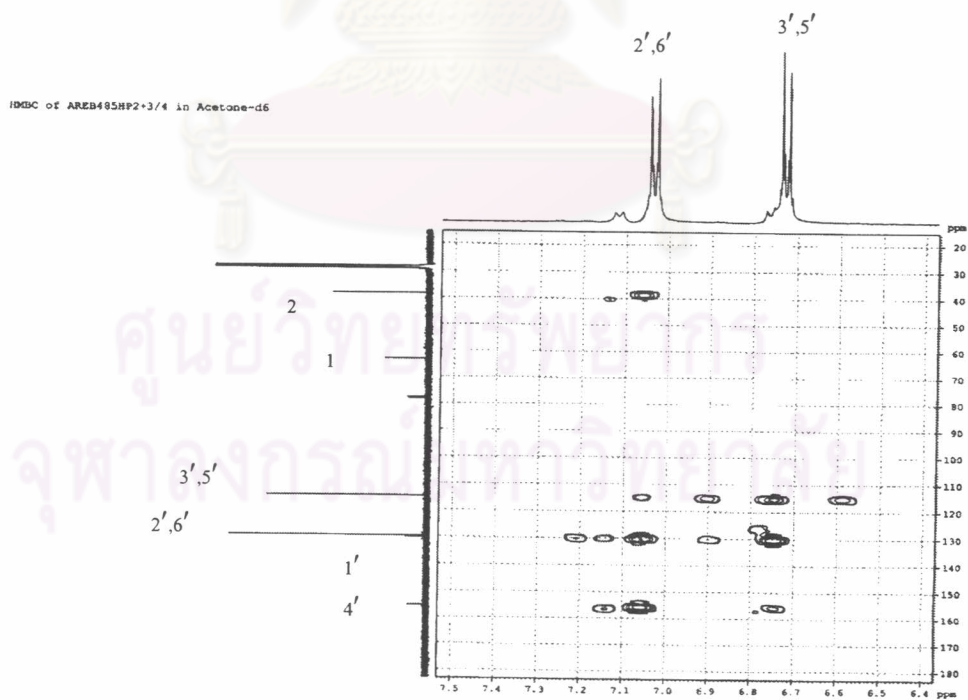


Figure 55 HMBC spectrum (partial expanded:  $\delta$ H 6.4-7.5 ppm,  $\delta$ C 20-180 ppm) of compound AREB 485 HP2+3/4

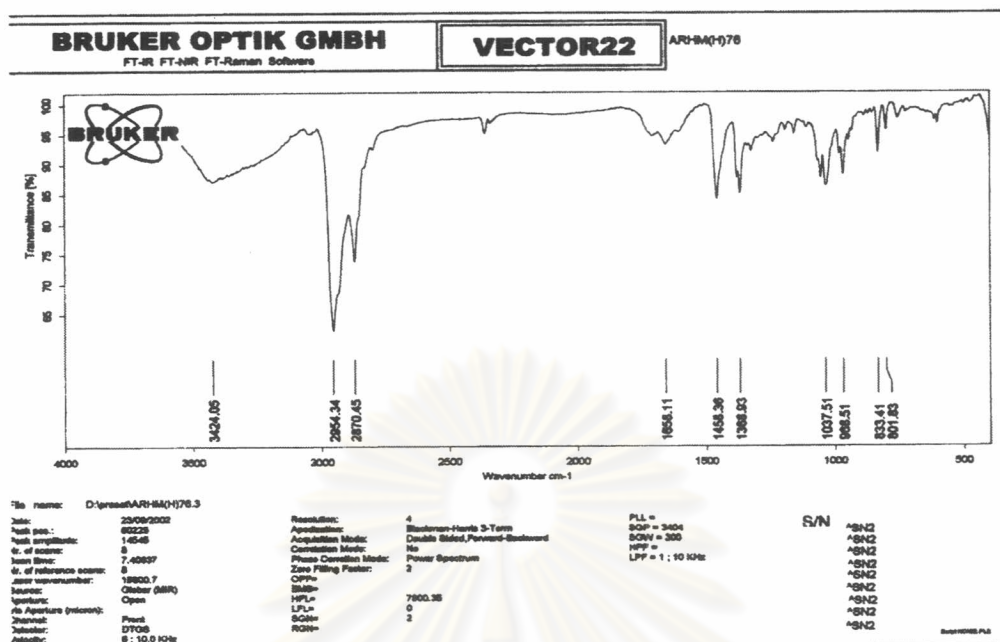


Figure 57 IR spectrum of compound ARHM(H)76

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12/9/02 15:22:27 Page 1 of 1

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Instrument Serial Number EL96833097

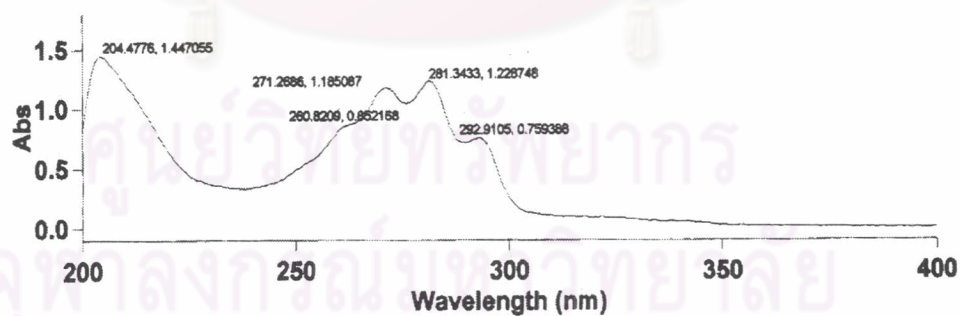
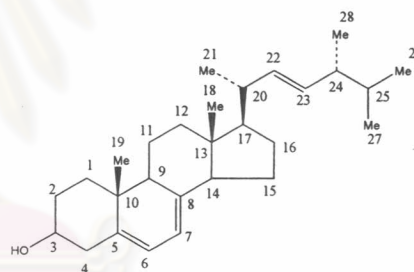
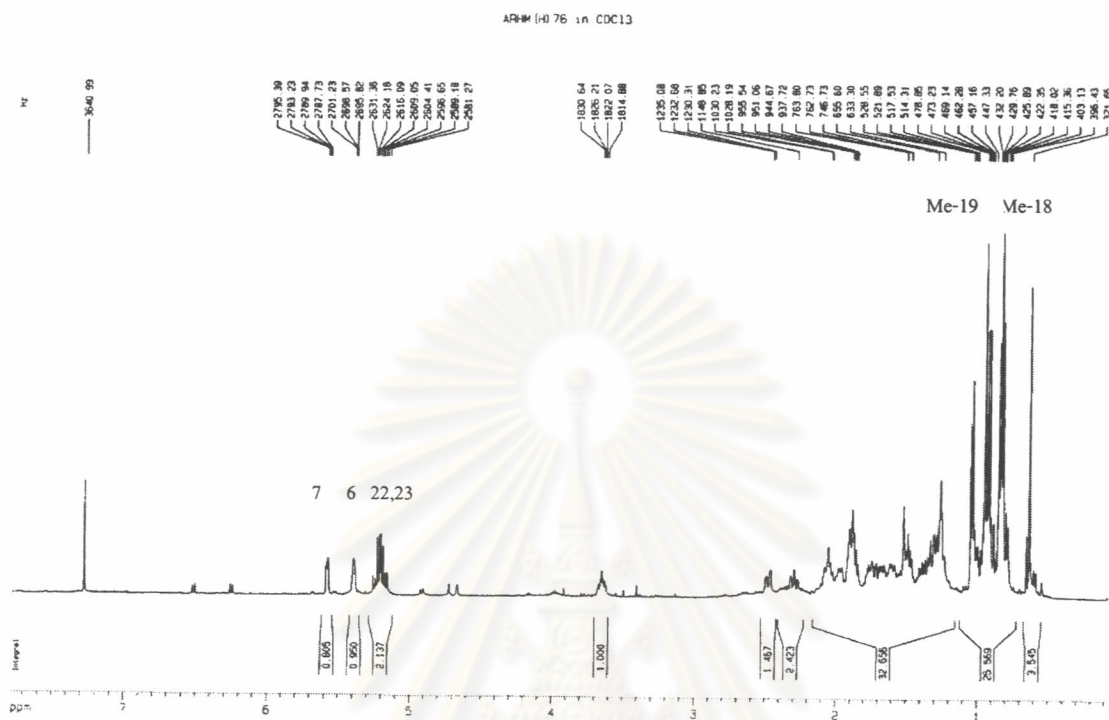
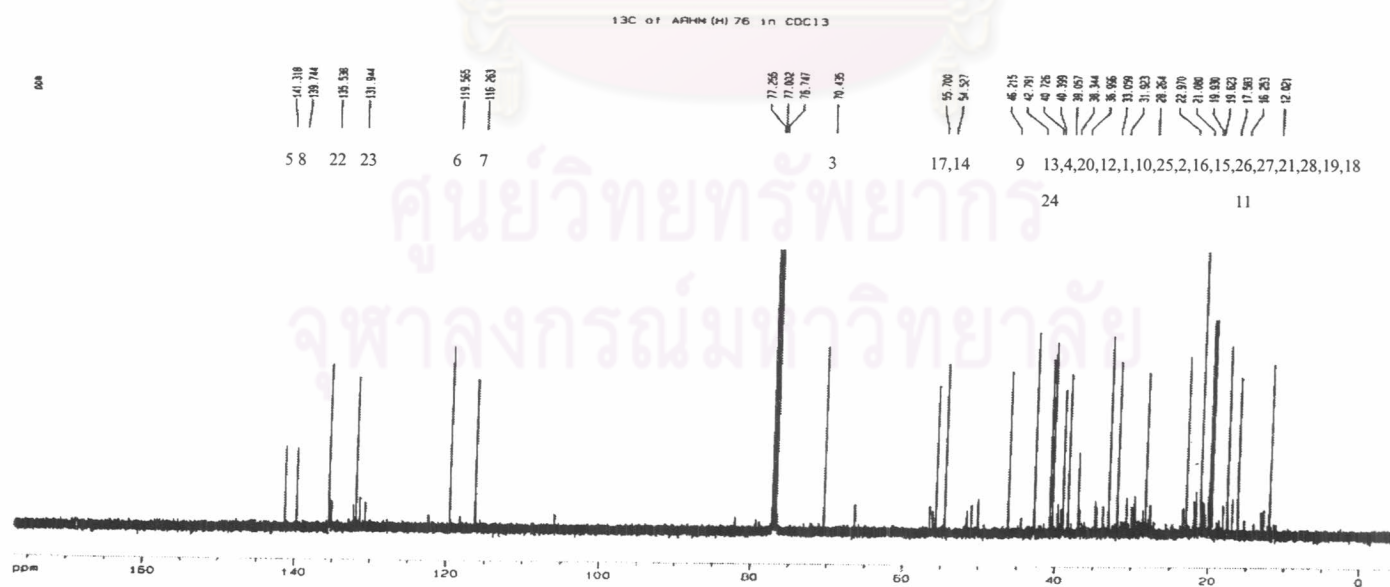


Figure 58 UV spectrum of compound ARHM(H)76 in methanol

Figure 59 500 MHz <sup>1</sup>H-NMR spectrum of compound ARHM(H)76Figure 60 125 MHz <sup>13</sup>C-NMR spectrum of compound ARHM(H)76

## APPENDIX C

### 1. MYCOLOGICAL MEDIA

#### **Czapek Yeast Autolysate Agar**

Czapek solution agar	49.0 g
Yeast extract	4.9 g
Agar	15.0 g
Distilled water	1000.0 ml

#### **Malt Czapek Agar**

Czapek solution agar	49.0 g
Malt agar	40.0 g
Agar	15.0 g
Distilled water	1000.0 ml

#### **Malt Extract Agar**

Malt extract	20.0 g
Peptone	1.0 g
Glucose	20.0 g
Agar	15.0 g
Distilled water	1000.0 ml

#### **Sabouraud 4 % Dextrose Agar**

Peptone	10.0 g
Glucose	40.0 g
Agar	15.0 g
Distilled water	1000.0 ml



**Yeast Extract Sucrose Agar**

Yeast extract	20.0 g
Sucrose	150.0 g
Agar	15.0 g
Distilled water	1000.0 ml

**Yeast Extract Sucrose**

Yeast extract	20.0 g
Sucrose	150.0 g
Distilled water	1000.0 ml

**2. Solution used in DNA isolation**

Lysis buffer : 50 mM Tris-HCl (pH 7.2)  
 50 mM EDTA  
 3% SDS  
 1% 2-mercaptoethanol

Chloroform : TE-saturated phenol (1:1, V:V)

[TE : 10 mM Tris-HCl (pH 8.0), 1 mM EDTA]

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## VITA

Flt. Lt. Sutheera Watcharadit was born on 1<sup>st</sup> July, 1972 in Bangkok, Thailand. She received her bachelor's degree of Pharmaceutical Sciences in 1996 from the Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand.

At present, she is a pharmacist at Bhumipol Adulayadej Hospital, Bangkok, Thailand.



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