REFERENCES

1. สถาบันมะเร็งแห่งชาติ, สถาบัน. ข้อมูลสถิติอุบัติการโรคมะเร็งในประเทศไทย พ.ศ.2536(ประมาณการ). กรุงเทพมหานคร : หน่วยงานสถิติ ฝ่ายแผนงานและสถิติสถาบันมะเร็งแห่งชาติ, 2536. (เอกสารไม่ตีพิมพ์)
2. จิตตินัดด์ หะวานนท์. การบำบัดผู้ป่วยโรคมะเร็งเต้านม. วารสารวิจัยวิทยาศาสตร์การแพทย์ 6 (มกราคม 2535) : 40-45.
3. สุภาภรณ์ พงศกร, อโนชา อุทัยพัฒน์, ปราโมทย์ ธีรพงษ์, นงลักษณ์ สุขวาณิชย์ศิลป์, สมใจ นครชัย. การใช้ยาในโรคติดเชื้อไวรัส และโรคมะเร็ง. กรุงเทพมหานคร: โรงพิมพ์อักษรบัณฑิต, 2531, 320-370.
4. ไพรัช เทพมงคล. โรคมะเร็งสำหรับแพทย์เวชปฏิบัติทั่วไป และนักศึกษาแพทย์. กรุงเทพมหานคร : โรงพิมพ์อักษรเจริญทัศน์, 2524, 230-270.
5. Kubo, I.; Ochi, M.; Vieira, P.C.; Komatsu, S. Antitumor Agent from the Cashe (*Anacardium occidentale*) Apple Juice. J.Ame. chem. soc. 41(6) (1993) : 1012 - 1015.
6. Cover, M.C.; Hsieh, S.J.; Tran, H.S.; Gunnell, H.; Gloria, S.K.; Firestone, L.G.; Bjeldanes, F.L. Indole-3-carbinol Inhibits the Expression of Cyclin-dependent Kinase-6 and Induces a G1 Cell Cycle Arrest of Human Breast Cancer Cells Independent of Estrogen Receptor Signaling. J.of Bio. Chem. 273(7) (1997) : 3838 - 3847.
7. Davis, G.D., Recent Advances in the Chemistry of Taxol. J.of Nat. Prod. 63(5) (2000) : 726 - 734.
8. Murakami, A.; Kondo, A.; Nakamura, Y.; Ohigashi, H.; Koshimizu, K. Possible Anti-tumor Promoting Properties of Edible Plants from Thailand, and Identification of an Active Constituent, Cardamonin, of *Boesenbergia pandurata*. J.Biosci. Biotech. Biochem. 57 (11) (1993) : 1971 - 1973.
9. Tian-Shung, W.; Hsien-Ju, T.; Mou-Yung, Y.; Kuo-Hsiung, L. Isolation and cytotoxicity of Rhinacanthin-A and -B,Two Naphthoquinones, From *Rhinacanthus nasutus*. J.of Biochem. 27(12) (1988) : 3787 - 3788.
10. Winston J.C. Health-promoting properties of common herbs. J.Clin. Nut. 70(suppl) (1999) : 491S - 499S.
11. นันทวัน บุณยะประภัสสร. ก้าวไปกับสมุนไพรเล่ม 1. กรุงเทพมหานคร : สำนักพิมพ์ธรรกมลการพิมพ์, 2536, 67 - 77.
12. วุฒิ วุฒิธรรมเวช, สารานุกรมสมุนไพรรวมหลักเภสัชกรรมไทย. กรุงเทพมหานคร : สำนักพิมพ์โอ.เอส.พริ้นติ้ง เฮ้าส์, 2540, 73.
13. ฌาตยา ธนะศิริวัฒนา. องค์ประกอบทางเคมี และ ฤทธิ์ต้านจุลชีพของน้ำมันหอมระเหยจากเปราะหอม, กระชายดำ และ เฒ่าหนังแห้ง. ปริญญานิพนธ์คณะเภสัชศาสตร์, จุฬาลงกรณ์มหาวิทยาลัย, 2540.

14. Tuntiwachwuttikul, P.; Jaipetch, T.; Reutrakul, V. and Santisuk, T. Flavonoids in the black rhizomes of *Boesenbergia pandurata*. Phytochem. 22 (1983) : 625 - 626.

15. Tuntiwachwuttikul, P.; Herunsalee, A. and Pancharoen, O. Further studies of flavonoids of the black rhizomes *Boesenbergia pandurata* (black rhizome). J.Sci.Soc.Thailand. 13 (1987) : 119 - 122.

16. ลัดดาวัลย์ บุญรัตนกรกิจ. เคมีอนุกรมวิธานของพืชที่มีฟลาโวนอยด์. กรุงเทพมหานคร: คณะเภสัชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, 2537, 83 - 167.

17. สุรัตนา อำนวยผล. สารฟลาโวนอยด์จากพืช. กรุงเทพมหานคร: คณะเภสัชศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, 2531, 1- 6.

18. Beutler, J.A.; Hamel, E.; Vlietinck, A.J.; Haemers, A.; Rajan, P.; Roitman, J.N.; Cardellina, J.H. and Boyd, M.R. Structure-Activity Requirements for Flavone cytotoxicity and binding to Tubulin. J. Med.Chem. 41 (1997) : 2333 - 2338.

19. Cos, P.; Ying, L.; Calomme, M.; Cimanga, K.; Poel, B.V.; Pieters, L.; Vlietinck, A.J.and Berghe, D.V. Structure - Activity Relationship and Classification of Flavonoids as Inhibitors of Xanthine Oxidase and Superoxide Scavengers. J. Nat. Prod. 61 (1998) : 71- 76.

20. Cook, N.C. and Samman, S. Flavonoids - Chemistry, mtabolism, cardioprotective effects, and dietary sources. Nut. Biochem. 7 (1996) : 66 - 76.

21. Alley, M.C.; Scudiero D.A.; Monks, A.; Hursey, M.L.; Czerwinski, M.J.; Fine, D.L.; Abott, B.J.; Mayo, J.G.; Shoemaker, R.H. and Boyd, M.R. Feasibility of Drug Screening with Panels of Human Tumor Cell Lines Using a Microculture Tetrazonium Assay. Cancer Res. 48 (1998) : 589.

22. Pancharoen, O.; Reutrakul, J. Chemical constituents of *Boesengia pandurata* (black rhizome). Master's Thesis, Department of Library Science, Mahidol University, 1982.

23. Harborne, J.B.; Mabry, T.J.; The flavonoids advances in research. New York : Charles Scribner's Sons, 1982. 1-200.

24. Matthes, H. W. D.; Luu, B. and Ourisson G. Cytotoxic Components of *Zingiber Zerumbet* and *Curcuma zedoaria*. Phytochemistry. 19 (1980) : 2643 - 2650.

25. Bruch, M.D., NMR spectroscopy Techniques (Practical spectroscopy series Volume 21). New York: Marcel Dekker, 1971. 70 - 72.

APPENDICES

General characteristic of *Kaempferia parviflora*

Rhizome dark purple, with several succulent roots in a fascicle.

Leaves 1 to several ; blades ovate or elliptic, slightly unequal sided, 7-11 * 4-6 cm, apex acute or mucronate, base subcordate, upper surface glabrous, under surface hairy; leaf-sheaths ca 6 cm long, margin membranous, red-tinted; bladeless sheaths greenish, purple-tinted; ligule broadly triangular, ca 2 mm long, membranous, caducous.

Inflorescence enclosed by the two innermost leaf-sheaths or by the leaf-sheath and the bladeless sheath, usually elongate; peduncle 5-6 cm long.

Flowers few; bracts oblong ca 1.7-2.3*0.6 cm, glabrous, apex rounded.

Calyx 1.8-2.2 cm long, finely hairy, apex bifid.

Corolla-tube 3-3.2 cm long, lobes linear; dorsal lobe ca 1.2*0.25 cm. Apex hooded, aristate; laterallobes slightly smaller, apex rounded.

Staminodes white, oblong, 1-1.3*0.3 cm, apex acute or rounded.

Labellum purple, darker at the middle, obvate, 1.2-1.5 * 0.8-0.9 cm, apex emarginate.

Stamen with very short filament, ca 1 mm long; anther ca 2 mm long, anther-crest suborbicular, entire or emarginate, 1-1.5*2 mm.

Ovary ca 2*1 mm, hairy; stylodes filiform 8-9 mm long.

Thailand -- Northern : Tak ; South-Western : Kanchanaburi

Distribution -- India, Burma (type, Wallich 6587, Bank of the River Attran.)

Ecology -- Scattered in moist soil, shaded bamboo or deciduous forest, 75-500 m alt.

Vernacular -- Krachai dam (กระชายดำ)

Table A1 Crystal data and structure refinement for compound 1.

Empirical formula	$C_{18}H_{16}O_5$	
Formula weight	312.31	
Temperature	293 (2) K	
Wavelenght	0.71073 A	
Crystal system, space group	Monoclinic, P21/n	
Unit cell dimensions	A = 7.53630 (10) A	alpha = 90 deg.
	B = 18.66430 (10) A	beta = 108.8880 (10) deg.
	C = 11.50920 (10) A	gamma = 90 deg.
Volume	1531.71 (3) A^3	
Z, Calculated density	4, 1.354 Mg / m^3	
Absorption coefficient	0.099 mm^{-1}	
F (000)	656	
Theta range for data collection	2.17 to 30.44 deg.	
Index ranges	-10<=h<=10, -22<=k<=25, -8<=1<=16	
Reflections collected / unique	11160 / 4340 [R (int) = 0.0200]	
Completeness to 2 theta = 30.44	93.30%	
Refinement method	Full – matrix least - squares on F^2	
Data / restraints / parameters	4340 / 0 / 272	
Goodness - of - fit on F^2	1.019	
Final R indices [I > 2sigma (I)]	R1 = 0.0444, wR2 = 0.1149	
R indices (all data)	R1 = 0.0608, wR2 = 0.1267	
Largest diff. peak and hole	0.178 and -0.285 $e.A^3$	

Table A2 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($A^2 * 10^3$) for compound 1.

	X	*Y*	*Z*	*U*(eq)*
C (1)	3601 (3)	-1871 (1)	8632 (2)	72 (1)
C (2)	-276 (3)	1168 (1)	5626 (2)	62 (1)
C (3)	5503 (3)	-62 (1)	13527 (1)	59 (1)

C (4)	-2126 (2)	3379 (1)	8804 (1)	52 (1)
C (5)	-3145 (2)	2892 (1)	7939 (1)	53 (1)
C (6)	-2438 (2)	2213 (1)	7866 (1)	46 (1)
C (7)	-676 (2)	2012 (1)	8659 (1)	36 (1)
C (8)	82 (2)	1284 (1)	8626 (1)	35 (1)
C (9)	-172 (2)	852 (1)	7638 (1)	39 (1)
C (10)	558 (2)	115 (1)	7750 (1)	39 (1)
C (11)	1776 (2)	-81 (1)	8987 (1)	35 (1)
C (12)	2780 (2)	-744 (1)	9303 (1)	40 (1)
C (13)	3895 (2)	-880 (1)	10489 (1)	42 (1)
C (14)	4066 (2)	-371 (1)	11423 (1)	39 (1)
C (15)	3105 (2)	275 (1)	11169 (1)	37 (1)
C (16)	2006 (1)	403 (1)	9955 (1)	34 (1)
C (18)	345 (2)	2508 (1)	9531 (1)	48 (1)
C (19)	-378 (2)	3188 (1)	9594 (1)	58 (1)
O (1)	2590 (1)	-1208 (1)	8355 (1)	55 (1)
O (2)	-1272 (1)	1083 (1)	6496 (1)	52 (1)
O (3)	123 (2)	-286 (1)	6849 (1)	56 (1)
O (4)	5233 (1)	-568 (1)	12551 (1)	52 (1)
O (5)	1142 (1)	1061 (1)	9780 (1)	37 (1)

U(eq)* is defined as one third of the trace of the orthogonalized *U*ij tensor.

Table A3 Bond distances (A) for compound 1.

Bond Distances	(A)	Bond Distances	(A)
C (1) - O (1)	1.4058 (13)	C (10) - O (3)	1.2345 (14)
C (2) - O (2)	1.4410 (19)	C (10) - C (11)	1.4685 (17)
C (3) - O (4)	1.4306 (19)	C (11) - C (16)	1.4002 (5)
C (4) - C (5)	1.383 (2)	C (11) - C (12)	1.4353 (16)
C (4) - C (19)	1.383 (2)	C (12) - O (1)	1.3644 (14)
C (5) - C (6)	1.3882 (18)	C (12) - C (13)	1.3751 (18)
C (6) - C (7)	1.3971 (16)	C (13) - C (14)	1.4077 (18)

C (7) - C (18)	1.3979 (17)	C (14) - O (4)	1.3614 (15)
C (7) - C (8)	1.4792 (15)	C (14) - C (15)	1.3880 (15)
C (8) - C (9)	1.3565 (16)	C (15) - C (16)	1.3953 (16)
C (8) - O (5)	1.3749 (13)	C (16) - O (5)	1.3743 (12)
C (9) - O (2)	1.3771 (14)	C (18) - C (19)	1.3928 (18)
C (9) - C (10)	1.4700 (16)		

Table A4 Bond angles (deg.) for compound 1.

Angles	(deg.)	Angles	(deg.)
C (5) - C (4) - C (19)	119.53 (12)	O (1) - C (12) - C (13)	123.27 (11)
C (4) - C (5) - C (6)	120.60 (12)	O (1) - C (12) - C (11)	115.79 (11)
C (5) - C (6) - C (7)	120.50 (12)	C (13) - C (12) - C (11)	120.92 (10)
C (6) - C (7) - C (18)	118.52 (11)	C (12) - C (13) - C (14)	120.56 (11)
C (6) - C (7) - C (8)	121.49 (10)	O (4) - C (14) - C (15)	124.47 (11)
C (18) - C (7) - C (8)	119.94 (10)	O (4) - C (14) - C (13)	114.69 (10)
C (9) - C (8) - O (5)	120.64 (10)	C (15) - C (14) - C (13)	120.84 (11)
C (9) - C (8) - C (7)	128.17 (10)	C (14) - C (15) - C (16)	117.39 (11)
O (5) - C (8) - C (7)	111.19 (9)	O (5) - C (16) - C (15)	113.58 (9)
C (8) - C (9) - O (2)	119.40 (11)	O (5) - C (16) - C (11)	121.90 (10)
C (8) - C (9) - C (10)	122.39 (10)	C (15) - C (16) - C (11)	124.52 (10)
O (2) - C (9) - C (10)	118.02 (10)	C (19) - C (18) - C (7)	120.47 (12)
O (3) - C (10) - C (11)	125.22 (11)	C (4) - C (19) - C (18)	120.38 (13)
O (3) - C (10) - C (9)	120.17 (11)	C (12) - O (1) - C (1)	117.40 (13)
C (11) - C (10) - C (9)	114.61 (10)	C (9) - O (2) - C (2)	114.20 (11)
C (16) - C (11) - C (12)	115.76 (10)	C (14) - O (4) - C (3)	117.11 (10)
C (16) - C (11) - C (10)	119.26 (10)	C (16) - O (5) - C (8)	120.80 (9)
C (12) - C (11) - C (10)	124.99 (10)		

Symmetry transformations used to generate equivalent atoms:

Table A5 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2\ pi^2\ [\ h^2\ a^{*2}\ U11 + ...+ 2hka^*b^*U12\ ]$.

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
C (1)	79 (1)	46 (1)	89 (1)	-16 (1)	25 (1)	16 (1)
C (2)	79 (1)	64 (1)	42 (1)	4 (1)	20 (1)	5 (1)
C (3)	68 (1)	63 (1)	42 (1)	9 (1)	14 (1)	14 (1)

C (4)	62 (1)	38 (1)	54 (1)	6 (1)	16 (1)	14 (1)
C (5)	45 (1)	50 (1)	56 (1)	9 (1)	7 (1)	12 (1)
C (6)	41 (1)	44 (1)	47 (1)	-1 (1)	4 (1)	2 (1)
C (7)	38 (1)	35 (1)	34 (1)	3 (1)	12 (1)	2 (1)
C (8)	33 (1)	35 (1)	35 (1)	1(1)	10 (1)	-1 (1)
C (9)	35 (1)	43 (1)	37 (1)	-3 (1)	10 (1)	-1 (1)
C (10)	38 (1)	39 (1)	43 (1)	-8 (1)	16 (1)	-8 (1)
C (11)	33 (1)	32 (1)	44 (1)	-3 (1)	17 (1)	-5 (1)
C (12)	39 (1)	33 (1)	53 (1)	-5 (1)	22 (1)	-4 (1)
C (13)	42 (1)	33 (1)	57 (1)	5 (1)	23 (1)	4 (1)
C (14)	39 (1)	39 (1)	45 (1)	8 (1)	19 (1)	2 (1)
C (15)	40 (1)	35 (1)	39 (1)	2 (1)	17 (1)	1 (1)
C (16)	33 (1)	29 (1)	42 (1)	2 (1)	16 (1)	-1 (1)
C (18)	48 (1)	40 (1)	47 (1)	-3 (1)	1 (1)	6 (1)
C (19)	67 (1)	39 (1)	55 (1)	-7 (1)	2(1)	8 (1)
O (1)	62 (1)	38 (1)	64 (1)	-13 (1)	20 (1)	5 (1)
O (2)	50 (1)	66 (1)	35 (1)	-3 (1)	5 (1)	11 (1)
O (3)	70 (1)	46 (1)	48 (1)	-16 (1)	14 (1)	-8 (1)
O (4)	59 (1)	48 (1)	47 (1)	11(1)	16 (1)	14 (1)
O (5)	44 (1)	33 (1)	35 (1)	1(1)	10 (1)	5 (1)

Table A6 Crystal data and structure refinement for compound 2.

Empirical formula	$C_{17}H_{14}O_4$	
Formula weight	282	
Temperature	293 (2) K	
Wavelenght	0.71073 A	
Crystal system, space group	Monoclinic, P21/n	
Unit cell dimensions	A = 7.53630 (10) A	alpha = 90 deg.
	B = 18.66430 (10) A	beta = 108.8880 (10) deg.
	C = 11.50920 (10) A	gamma = 90 deg.
Volume	1531.71 (3) A^3	
Z, Calculated density	4, 1.354 Mg / m^3	
Absorption coefficient	0.099 mm^{-1}	
F (000)	656	
Theta range for data collection	2.17 to 30.44 deg.	
Index ranges	.-10<=h<=10, -22<=k<=25, -8<=1<=16	
Reflections collected / unique	11160 / 4340 [R (int) = 0.0200]	

Completeness to 2 theta = 30.44	93.30%
Refinement method	Full - matrix least - squares on F^2
Data / restraints / parameters	4340 / 0 / 272
Goodness - of - fit on F^2	1.019
Final R indices [I > 2sigma (I)]	R1 = 0.0444, wR2 = 0.1149
R indices (all data)	R1 = 0.0608, wR2 = 0.1267
Largest diff. peak and hole	0.178 and -0.285 $e.A^3$

Table A7 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($A^2 * 10^3$) for compound 2.

	X	*Y*	*Z*	*U*(eq)*
C (1)	3601 (3)	-1871 (1)	8632 (2)	72 (1)
C (2)	-276 (3)	1168 (1)	5626 (2)	62 (1)
C (3)	5503 (3)	-62 (1)	13527 (1)	59 (1)
C (4)	-2126 (2)	3379 (1)	8804 (1)	52 (1)
C (5)	-3145 (2)	2892 (1)	7939 (1)	53 (1)
C (6)	-2438 (2)	2213 (1)	7866 (1)	46 (1)
C (7)	-676 (2)	2012 (1)	8659 (1)	36 (1)
C (8)	82 (2)	1284 (1)	8626 (1)	35 (1)
C (9)	-172 (2)	852 (1)	7638 (1)	39 (1)
C (10)	558 (2)	115 (1)	7750 (1)	39 (1)
C (11)	1776 (2)	-81 (1)	8987 (1)	35 (1)
C (12)	2780 (2)	-744 (1)	9303 (1)	40 (1)
C (13)	3895 (2)	-880 (1)	10489 (1)	42 (1)
C (14)	4066 (2)	-371 (1)	11423 (1)	39 (1)
C (15)	3105 (2)	275 (1)	11169 (1)	37 (1)
C (16)	2006 (1)	403 (1)	9955 (1)	34 (1)
C (19)	-378 (2)	3188 (1)	9594 (1)	58 (1)
O (1)	2590 (1)	-1208 (1)	8355 (1)	55 (1)
O (2)	-1272 (1)	1083 (1)	6496 (1)	52 (1)
O (3)	123 (2)	-286 (1)	6849 (1)	56 (1)
O (4)	5233 (1)	-568 (1)	12551 (1)	52 (1)
O (5)	1142 (1)	1061 (1)	9780 (1)	37 (1)

Table A8 Bond distances (A) for compound 2.

Bond Distances	(A)	Bond Distances	(A)
C (1) - C (6)	1.367 (4)	C (10) - C (11)	1.375 (3)
C (1) - C (2)	1.383 (4)	C (11) - O (3)	1.359 (2)
C (2) - C (3)	1.384 (3)	C (11) - C (12)	1.398 (3)
C (3) - C (4)	1.377 (3)	C (12) - C (13)	1.376 (3)
C (4) - C (5)	1.392 (3)	C (13) - O (2)	1.357 (2)
C (4) - C (7)	1.511 (3)	C (13) - C (14)	1.427 (3)
C (5) - C (6)	1.390 (3)	C (14) - C (15)	1.475 (2)
C (7) - O (4)	1.446 (2)	C (15) - O (1)	1.214 (2)
C (7) - C (16)	1.517 (3)	C (15) - C (16)	1.511 (3)
C (9) - O (4)	1.36 (2)	C (17) - O (3)	1.439 (3)
C (9) - C (10)	1.387 (3)	C (18) - O (2)	1.434 (3)
C (9) - C (14)	1.406 (3)		

Table A9 Bond angles (deg.) for compound 2.

Angles	(deg.)	Angles	(deg.)
C (6) - C (1) - C (2)	119.5 (2)	O (3) - C (11) - C (12)	115.26 (17)
C (1) - C (2) - C (3)	120.3 (3)	C (10) - C (11) - C (12)	121.13 (17)
C (4) - C (3) - C (2)	120.5 (2)	C (13) - C (12) - C (11)	119.98 (17)
C (3) - C (4) - C (5)	119.2 (2)	O (2) - C (13) - C (12)	122.81 (17)
C (3) - C (4) - C (7)	121.81 (18)	O (2) - C (13) - C (14)	116.27 (16)
C (5) - C (4) - C (7)	119.0 (2)	C (12) - C (13) - C (14)	120.91 (16)
C (6) - C (5) - C (4)	119.8 (2)	C (9) - C (14) - C (13)	116.56 (16)
C (1) - C (6) - C (5)	120.7 (2)	C (9) - C (14) - C (15)	118.95 (17)
O (4) - C (7) - C (4)	107.48 (15)	C (13) - C (14) - C (15)	124.44 (16)
O (4) - C (7) - C (16)	108.39 (15)	O (1) - C (15) - C (14)	124.72 (19)
C (4) - C (7) - C (16)	115.55 (16)	O (1) - C (15) - C (16)	120.08 (18)
O (4) - C (9) - C (10)	114.65 (16)	C (14) - C (15) - C (16)	115.20 (16)
O (4) - C (9) - C (14)	122.64 (16)	C (15) - C (16) - C (7)	110.71 (16)
C (10) - C (9) - C (14)	122.70 (17)	C (13) - O (2) - C (18)	117.90 (16)
C (11) - C (10) - C (9)	118.70 (17)	C (11) - O (3) - C (17)	117.58 (17)
O (3) - C (11) - C (10)	123.60 (17)	C (9) - O (4) - C (7)	114.71 (14)

Table A10 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2 pi^2 [h^2 a^{*2} U11 + ...+ 2hka^*b^*U12]$.

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
C (1)	79 (1)	46 (1)	89 (1)	-16 (1)	25 (1)	16 (1)
C (2)	79 (1)	64 (1)	42 (1)	4 (1)	20 (1)	5 (1)
C (3)	68 (1)	63 (1)	42 (1)	9 (1)	14 (1)	14 (1)
C (4)	62 (1)	38 (1)	54 (1)	6 (1)	16 (1)	14 (1)
C (5)	45 (1)	50 (1)	56 (1)	9 (1)	7 (1)	12 (1)
C (6)	41 (1)	44 (1)	47 (1)	-1 (1)	4 (1)	2 (1)
C (7)	38 (1)	35 (1)	34 (1)	3 (1)	12 (1)	2 (1)
C (8)	33 (1)	35 (1)	35 (1)	1(1)	10 (1)	-1 (1)
C (9)	35 (1)	43 (1)	37 (1)	-3 (1)	10 (1)	-1 (1)
C (10)	38 (1)	39 (1)	43 (1)	-8 (1)	16 (1)	-8 (1)
C (11)	33 (1)	32 (1)	44 (1)	-3 (1)	17 (1)	-5 (1)
C (12)	39 (1)	33 (1)	53 (1)	-5 (1)	22 (1)	-4 (1)
C (13)	42 (1)	33 (1)	57 (1)	5 (1)	23 (1)	4 (1)
C (14)	39 (1)	39 (1)	45 (1)	8 (1)	19 (1)	2 (1)
C (15)	40 (1)	35 (1)	39 (1)	2 (1)	17 (1)	1 (1)
C (16)	33 (1)	29 (1)	42 (1)	2 (1)	16 (1)	-1 (1)
C (18)	48 (1)	40 (1)	47 (1)	-3 (1)	1 (1)	6 (1)
C (19)	67 (1)	39 (1)	55 (1)	-7 (1)	2(1)	8 (1)
O (1)	62 (1)	38 (1)	64 (1)	-13 (1)	20 (1)	5 (1)
O (2)	50 (1)	66 (1)	35 (1)	-3 (1)	5 (1)	11 (1)
O (3)	70 (1)	46 (1)	48 (1)	-16 (1)	14 (1)	-8 (1)
O (4)	59 (1)	48 (1)	47 (1)	11(1)	16 (1)	14 (1)

Table A11 Crystal data and structure refinement for compound 6.

Empirical formula	$C_{19}H_{16}O_5$	
Formula weight	340.89	
Temperature	293 (2) K	
Wavelenght	0.71073 A	
Crystal system, space group	Monoclinic, P21/c	
Unit cell dimensions	A = 20.2460 (11) A	alpha = 90 deg.
	b = 7.2651 (4) A	beta = 114.5490 (10) deg.
	C = 20.8990 (12) A	gamma = 90 deg
Volume	2796.1 (3) A^3	

Z, Calculated density	7, 1.417 Mg/m^3
Absorption coefficient	0.105 mm^{-1}
F (000)	1248
Theta range for data collection	1.96 to 30.55 deg.
Index ranges	.-27<=h<=26, -10<=k<=9, -29<=1<=29
Reflections collected / unique	19549 / 8003 [R (int) = 0.0534]
Completeness to 2 theta = 30.44	93.30%
Refinement method	Full - matrix least - squares on F^2
Data / restraints / parameters	8003 / 0 /493
Goodness - of - fit on F^2	1.033
Final R indices [I > 2sigma (I)]	R1 = 0.0729, wR2 = 0.1241
R indices (all data)	R1 = 0.1760, wR2 = 0.1625
Largest diff. peak and hole	0.205 and -0.219 $e.A^{-3}$

Table 12 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (A^2 * 10^3) for compound 6.

	X	Y	Z	*U* (eq)*
O (10)	1420 (1)	6740 (2)	4656 (1)	48 (1)
O (4)	3192 (1)	6381 (3)	4632 (1)	58 (1)
C (15)	2005 (1)	6069 (4)	3672 (1)	46 (1)
C (14)	1235 (1)	6032 (3)	3475 (1)	43 (1)
O (3)	969 (1)	5284 (3)	2279 (1)	64 (1)
O (2)	-959 (1)	5834 (3)	3024 (1)	61 (1)
C (10)	232 (1)	6301 (4)	3822 (1)	47 (1)
O (1)	2270 (1)	5759 (3)	3236 (1)	60 (1)
C (6)	2524 (1)	7183 (3)	5630 (1)	43 (1)
C (12)	.-5 (2)	5558 (4)	2613 (1)	52 (1)
C (16)	2454 (1)	6488 (4)	4403 (1)	45 (1)
C (7)	2158 (1)	6805 (3)	4869 (1)	42 (1)
C (9)	957 (1)	6350 (3)	3975 (1)	42 (1)
C (11)	.-250 (1)	5897 (4)	3134 (1)	47 (1)
C (13)	728 (1)	5625 (4)	2785 (1)	47 (1)
C (5)	2127 (2)	7050 (4)	6036 (2)	55 (1)
C (18)	.-1503 (2)	5744 (7)	2316 (2)	69 (1)
C (3)	3172 (2)	7875 (4)	7074 (2)	63 (1)
C (1)	3250 (2)	7678 (4)	5967 (2)	55 (1)
C (2)	3570 (2)	8024 (4)	6683 (2)	62 (1)

C (17)	3515 (2)	7744 (5)	4348 (2)	77 (1)
C (4)	2453 (2)	7395 (5)	6755 (2)	67 (1)

U(eq)* is defined as one third of the trace of the orthogonalized *U*ij tensor.

Table A13 Bond distances (A) for compound 6.

Bond Distances	(A)	Bond Distances	(A)
O (10) - C (9)	1.370 (3)	C (10) - C (9)	1.368 (3)
O (10) - C (7)	1.371 (3)	C (10) - C (11)	1.393 (3)
O (4) - C (16)	1.369 (3)	C (6) - C (1)	1.387 (4)
O (4) - C (17)	1.442 (3)	C (6) - C (5)	1.394 (4)
C (15) - O (1)	1.255 (3)	C (6) - C (7)	1.476 (3)
C (15) - C (14)	1.438 (3)	C (12) - C (13)	1.376 (4)
C (15) - C (16)	1.448 (3)	C (12) - C (11)	1.393 (3)
C (14) - C (9)	1.395 (3)	C (16) - C (7)	1.358 (3)
C (14) - C (13)	1.412 (3)	C (5) - C (4)	1.390 (4)
O (3) - C (13)	1.357 (3)	C (3) - C (2)	1.369 (4)
O (2) - C (11)	1.357 (3)	C (3) - C (4)	1.372 (4)
O (2) - C (18)	1.433 (4)	C (1) - C (2)	1.385 (4)

Table A14 Bond angles (deg.) for compound 6.

Angles	(deg.)	Angles	(deg.)
C (9) - O (10) - C (7)	121.79 (18)	C (16) - C (7) - O (10)	120.5 (2)
C (16) - O (4) - C (17)	115.6 (2)	C (16) - C (7) - C (6)	129.1 (2)
O (1) -C (15) - C (14)	121.9 (2)	O (10) -C (7) - C (6)	110.3 (2)
O (1) -C (15) - C (16)	122.2 (2)	C (10) - C (9) - O (10)	116.9 (2)
C (14) - C (15) - C (16)	115.9 (2)	C (10) - C (9) - O (14)	123.3 (2)
C (9) - C (14) - C (13)	116.9 (2)	O (10) -C (9) - C (14)	119.8 (2)
C (9) - C (14) - C (15)	120.6 (2)	O (2) -C (11) - C (10)	114.8 (2)
C (13) - C (14) - C (15)	122.5 (2)	O (2) -C (11) - C (12)	123.8 (2)
C (11) - O (2) - C (18)	118.8 (2)	C (10) - C (11) - C (12)	121.4 (2)
C (9) - C (10) - C (11)	117.9 (2)	O (3) -C (13) - C (12)	119.2 (2)
C (1) - C (6) - C (5)	117.9 (3)	O (3) -C (13) - C (14)	119.4 (2)
C (1) - C (6) - C (7)	123.1 (2)	C (12) - C (13) - C (14)	121.4 (2)
C (5) - C (6) - C (7)	119.0 (2)	C (4) - C (5) - C (6)	120.6 (3)
C (13) - C (12) - C (11)	119.0 (3)	C (2) - C (3) - C (4)	119.9 (3)
C (7) - C (16) - O (4)	120.2 (2)	C (2) - C (1) - C (6)	121.1 (3)
C (7) - C (16) - C (15)	121.4 (2)	C (3) - C (2) - C (1)	120.2 (3)
O (4) -C (16) - C (15)	118.2 (2)	C (3) - C (4) - C (5)	120.2 (3)

Symmetry transformations used to generate equivalent atoms:

Table A15 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2 pi^2 [h^2 a^{*2} U11 + ...+ 2hka^*b^*U12]$.

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
O (10)	42 (1)	61 (1)	39 (1)	-6 (1)	16 (1)	1 (1)
O (4)	43 (1)	71 (1)	60 (1)	-1 (1)	22 (1)	5 (1)
C (15)	52 (2)	44 (2)	47 (2)	6 (1)	26 (1)	10 (1)
C (14)	47 (2)	39 (1)	39 (1)	4 (1)	20 (1)	7 (1)
O (3)	65 (1)	91 (2)	39 (1)	-5 (1)	24 (1)	11 (1)
O (2)	42 (1)	86 (2)	49 (1)	-5 (1)	14 (1)	-1 (1)
C (10)	46 (2)	56 (2)	41 (2)	-3 (1)	20 (1)	2 (1)
O (1)	55 (1)	82 (2)	51 (1)	0 (1)	29 (1)	12 (1)
C (6)	49 (2)	36 (1)	43 (2)	0 (1)	18 (1)	6 (1)
C (12)	56 (2)	56 (2)	38 (2)	1 (1)	14 (1)	5 (1)
C (16)	43 (2)	46 (2)	47 (2)	3 (1)	19 (1)	5 (1)
C (7)	39 (1)	40 (2)	45 (2)	3 (1)	16 (1)	3 (1)
C (9)	43 (2)	44 (2)	38 (1)	0 (1)	14 (1)	2 (1)
C (11)	42 (2)	48 (2)	48 (2)	2 (1)	17 (1)	2 (1)
C (13)	54 (2)	49 (2)	40 (2)	2 (1)	22 (1)	10 (1)
C (5)	50 (2)	69 (2)	47 (2)	-8 (1)	20 (1)	0 (2)
C (18)	51 (2)	85 (3)	58 (2)	-16 (2)	10 (2)	-1 (2)
C (3)	69 (2)	62 (2)	44 (2)	-8 (1)	9 (2)	8 (2)
C (1)	52 (2)	58 (2)	50 (2)	0 (1)	17 (2)	-2 (1)
C (2)	58 (2)	63 (2)	54 (2)	-3 (2)	12 (2)	-2 (2)
C (17)	63 (2)	88 (3)	96 (3)	-9 (2)	49 (2)	-17 (2)
C (4)	73 (2)	81 (2)	49 (2)	-8 (2)	28 (2)	3 (2)

Table A16 Hydrogen bonds for compound 6 [A and deg.].

D-H....A	d (D-H)	d (H....A)	d (D.....A)	< (DHA)
O (3) - H (31).....O (1)	1.05 (4)	1.61 (4)	2.584 (3)	154 (3)
O (3A) - H (32).....O (1A)	0.92 (4)	1.75 (4)	2.606 (3)	155 (3)

Symmetry transformations used to generate equivalent atoms:

Table A17 Crystal data and structure refinement for compound 7.

Empirical formula	$C_{16}H_{12}O_4$
Formula weight	268
Temperature	293 (2) K

Wavelenght	0.71073 A	
Crystal system, space group	Monoclinic, P21/c	
Unit cell dimensions	A = 20.2460 (11) A	alpha = 90 deg.
	B = 7.2651 (4) A	beta = 114.5490 (10) deg.
	C = 20.8990 (12) A	gamma = 90 deg
Volume	2796.1 (3) A^3	
Z, Calculated density	7, 1.417 Mg/m^3	
Absorption coefficient	0.105 mm^{-1}	
F (000)	1248	
Theta range for data collection	1.96 to 30.55 deg.	
Index ranges	.-27<=h<=26, -10<=k<=9, -29<=1<=29	
Reflections collected / unique	19549 / 8003 [R (int) = 0.0534]	
Completeness to 2 theta = 30.44	93.30%	
Refinement method	Full - matrix least - squares on F^2	
Data / restraints / parameters	8003 / 0 /493	
Goodness - of - fit on F^2	1.033	
Final R indices [I > 2sigma (I)]	R1 = 0.0729, wR2 = 0.1241	
R indices (all data)	R1 = 0.1760, wR2 = 0.1625	
Largest diff. Peak and hole	0.205 and -0.219 $e.A^{-3}$	

Table A18 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($A^2 * 10^3$) for compound 7.

	X	Y	Z	*U*(eq)*
C (1)	3195 (4)	7054 (2)	2176 (2)	39 (1)
C (2)	948 (4)	7421 (2)	1513 (2)	39 (1)
C (3)	768 (4)	8675 (2)	1592 (2)	38 (1)
C (4)	-1360 (4)	9165 (2)	1025 (2)	41 (1)
C (5)	-1513 (5)	10370 (2)	1130 (2)	45 (1)
C (6)	469 (4)	11105 (2)	1801 (2)	44 (1)
C (7)	2586 (4)	10660 (2)	2382 (2)	44 (1)
C (8)	2656 (4)	9456 (2)	2270 (2)	38 (1)
C (10)	4933 (4)	7855 (2)	2841 (2)	37 (1)
C (11)	7149 (4)	7642 (2)	3645 (2)	36 (1)
C (12)	7967 (5)	8465 (2)	4554 (2)	45 (1)
C (13)	10009 (5)	8306 (2)	5321 (2)	48 (1)

C (14)	11333 (4)	7314 (2)	5216 (2)	40 (1)
C (15)	10573 (4)	6493 (2)	4320 (2)	40 (1)
C (16)	8503 (4)	6662 (2)	3550 (2)	39 (1)
O (1)	528 (4)	12305 (2)	1957 (2)	60 (1)
O (2)	13328 (3)	7241 (2)	6029 (1)	53 (1)
O (3)	-3279 (3)	8441 (2)	374 (1)	59 (1)
O (4)	-750 (3)	6686 (2)	933 (1)	54 (1)

Table A19 Bond distances (A) for compound 7.

Bond Distances	(A)	Bond Distances	(A)
O (10) - C (9)	1.370 (3)	C (10) - C (9)	1.368 (3)
O (10) - C (7)	1.371 (3)	C (10) - C (11)	1.393 (3)
O (4) - C (16)	1.369 (3)	C (6) - C (1)	1.387 (4)
O (4) - C (17)	1.442 (3)	C (6) - C (5)	1.394 (4)
C (15) - O (1)	1.255 (3)	C (6) - C (7)	1.476 (3)
C (15) - C (14)	1.438 (3)	C (12) - C (13)	1.376 (4)
C (15) - C (16)	1.448 (3)	C (12) - C (11)	1.393 (3)
C (14) - C (9)	1.395 (3)	C (16) - C (7)	1.358 (3)
C (14) - C (13)	1.412 (3)	C (5) - C (4)	1.390 (4)
O (3) - C (13)	1.357 (3)	C (3) - C (2)	1.369 (4)
O (2) - C (11)	1.357 (3)	C (3) - C (4)	1.372 (4)
O (2) - C (17)	1.433 (4)	C (1) - C (2)	1.385 (4)

Table A20 Bond angles (deg.) for compound 7.

Angles	(deg.)	Angles	(deg.)
C (10) - C (1) - O (5)	119.83 (19)	C (7) - C (8) - C (3)	123.21 (19)
C (10) - C (1) - O (2)	121.08 (19)	C (1) - C (10) - O (6)	121.42 (19)
O (5) - C (1) - C (2)	118.37 (18)	C (1) - C (10) - C (11)	128.62 (19)
O (4) - C (2) - C (3)	122.4 (2)	O (6) - C (10) - C (11)	109.88 (17)
O (4) - C (2) - C (1)	121.9 (2)	C (16) - C (11) - C (12)	117.52 (19)
C (3) - C (2) - C (1)	115.65 (19)	C (16) - C (11) - C (10)	123.26 (18)
C (8) - C (3) - C (4)	117.2 (2)	C (12) - C (11) - C (10)	119.21 (19)
C (8) - C (3) - C (2)	120.52 (19)	C (13) - C (12) - C (11)	121.4 (2)
C (4) - C (3) - C (2)	122.25 (19)	C (12) - C (13) - C (14)	120.3 (2)
O (3) - C (4) - C (5)	119.3 (2)	O (2) - C (14) - C (13)	115.40 (19)
O (3) - C (4) - C (3)	119.5 (2)	O (2) - C (14) - C (15)	125.2 (2)
C (5) - C (4) - C (3)	121.1 (2)	C (13) - C (14) - C (15)	119.4 (2)
C (4) - C (5) - C (6)	118.8 (2)	C (16) - C (15) - C (14)	119.8 (2)
O (1) - C (6) - C (5)	123.8 (2)	C (15) - C (16) - C (11)	121.6 (2)

O (1) - C (6) - C (7)	114.3 (2)	C (6) - O (1) - C (19)	118.6 (2)
C (5) - C (6) - C (7)	121.9 (2)	C (14) - O (2) - C (16)	118.34 (18)
C (8) - C (7) - C (6)	117.7 (2)	C (1) - O (5) - C (17)	114.61 (19)
O (6) - C (8) - C (7)	116.18 (19)	C (8) - O (6) - C (10)	120.64 (17)
O (6) - C (8) - C (3)	120.60 (19)		

Table A21 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2 pi^2 [h^2 a^{*2} U11 + ...+ 2hka^*b^*U12]$.

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
O (10)	42 (1)	61 (1)	39 (1)	-6 (1)	16 (1)	1 (1)
O (4)	43 (1)	71 (1)	60 (1)	-1 (1)	22 (1)	5 (1)
C (15)	52 (2)	44 (2)	47 (2)	6 (1)	26 (1)	10 (1)
C (14)	47 (2)	39 (1)	39 (1)	4 (1)	20 (1)	7 (1)
O (3)	65 (1)	91 (2)	39 (1)	-5 (1)	24 (1)	11 (1)
O (2)	42 (1)	86 (2)	49 (1)	-5 (1)	14 (1)	-1 (1)
C (10)	46 (2)	56 (2)	41 (2)	-3 (1)	20 (1)	2 (1)
O (1)	55 (1)	82 (2)	51 (1)	0 (1)	29 (1)	12 (1)
C (6)	49 (2)	36 (1)	43 (2)	0 (1)	18 (1)	6 (1)
C (12)	56 (2)	56 (2)	38 (2)	1 (1)	14 (1)	5 (1)
C (16)	43 (2)	46 (2)	47 (2)	3 (1)	19 (1)	5 (1)
C (7)	39 (1)	40 (2)	45 (2)	3 (1)	16 (1)	3 (1)
C (9)	43 (2)	44 (2)	38 (1)	0 (1)	14 (1)	2 (1)
C (11)	42 (2)	48 (2)	48 (2)	2 (1)	17 (1)	2 (1)
C (13)	54 (2)	49 (2)	40 (2)	2 (1)	22 (1)	10 (1)
C (5)	50 (2)	69 (2)	47 (2)	-8 (1)	20 (1)	0 (2)
C (18)	51 (2)	85 (3)	58 (2)	-16 (2)	10 (2)	-1 (2)
C (3)	69 (2)	62 (2)	44 (2)	-8 (1)	9 (2)	8 (2)
C (1)	52 (2)	58 (2)	50 (2)	0 (1)	17 (2)	-2 (1)
C (2)	58 (2)	63 (2)	54 (2)	-3 (2)	12 (2)	-2 (2)
C (17)	63 (2)	88 (3)	96 (3)	-9 (2)	49 (2)	-17 (2)
C (4)	73 (2)	81 (2)	49 (2)	-8 (2)	28 (2)	3 (2)

Table A22 Hydrogen bonds for compound 7 [A and deg.].

D-H....A	d (D-H)	d (H....A)	d (D.....A)	< (DHA)
O (3) - H (31).....O (1)	1.05 (4)	1.61 (4)	2.584 (3)	154 (3)
O (3A) - H (32).....O (1A)	0.92 (4)	1.75 (4)	2.606 (3)	155 (3)

Table A23 Crystal data and structure refinement for compound 8.

Empirical formula	$C_{18}H_{17}O_6$	
Formula weight	329.32	
Temperature	293 (2) K	
Wavelenght	0.71073 A	
Crystal system, space group	Triclinic, P(-1)	
Unit cell dimensions	a = 5.3069 (5) A	alpha = 95.845 (2) deg.
	b = 11.4472 (10) A	beta = 100.490 (2) deg.
	c = 20.9516 (11) A	gamma = 94.957 (2) deg
Volume	765.18 (12) A^3	
Z, Calculated density	2, 1.429 Mg / m^3	
Absorption coefficient	0.108 mm^{-1}	
F (000)	346	
Theta range for data collection	1.80 to 30.43 deg	
Index ranges	.-7<=h<=7, -14<=k<=15, -18<=1<=14	
Reflections collected / unique	5645 / 4124 [R (int) = 0.0205]	
Completeness to 2 theta = 30.44	88.70%	
Refinement method	Full - matrix least - squares on F^2	
Data / restraints / parameters	4124 / 0 / 285	
Goodness - of - fit on F^2	1.014	
Final R indices [I > 2sigma (I)]	R1 = 0.0644, wR2 = 0.1509	
R indices (all data)	R1 = 0.1128, wR2 = 0.1853	
Largest diff. peak and hole	0.202 and -0.262 $e.A^{-3}$	

Table A24 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (A^2 * 10^3) for compound 8.

	X	Y	Z	*U*(eq)*
C (1)	3195 (4)	7054 (2)	2176 (2)	39 (1)
C (2)	948 (4)	7421 (2)	1513 (2)	39 (1)
C (3)	768 (4)	8675 (2)	1592 (2)	38 (1)
C (4)	-1360 (4)	9165 (2)	1025 (2)	41 (1)
C (5)	-1513 (5)	10370 (2)	1130 (2)	45 (1)

C (6)	469 (4)	11105 (2)	1801 (2)	44 (1)
C (7)	2586 (4)	10660 (2)	2382 (2)	44 (1)
C (8)	2656 (4)	9456 (2)	2270 (2)	38 (1)
C (10)	4933 (4)	7855 (2)	2841 (2)	37 (1)
C (11)	7149 (4)	7642 (2)	3645 (2)	36 (1)
C (12)	7967 (5)	8465 (2)	4554 (2)	45 (1)
C (13)	10009 (5)	8306 (2)	5321 (2)	48 (1)
C (14)	11333 (4)	7314 (2)	5216 (2)	40 (1)
C (15)	10573 (4)	6493 (2)	4320 (2)	40 (1)
C (16)	8503 (4)	6662 (2)	3550 (2)	39 (1)
C (17)	3683 (6)	5197 (3)	1271 (2)	56 (1)
C (18)	14842 (6)	6271 (2)	5950 (2)	55 (1)
C (19)	-1668 (6)	12838 (3)	1480 (3)	61 (1)
O (1)	528 (4)	12305 (2)	1957 (2)	60 (1)
O (2)	13328 (3)	7241 (2)	6029 (1)	53 (1)
O (3)	-3279 (3)	8441 (2)	374 (1)	59 (1)
O (4)	-750 (3)	6686 (2)	933 (1)	54 (1)
O (5)	3320 (3)	5864 (1)	2234 (1)	47 (1)
O (6)	4722 (3)	9045 (1)	2876 (1)	42 (1)

U(eq)* is defined as one third of the trace of the orthogonalized *U*ij tensor.

Table A25 Bond distances (A) for compound 8.

Bond Distances	(A)	Bond Distances	(A)
C (1) - C (10)	1.356 (3)	C (8) - O (6)	1.375 (2)
C (1) - O (5)	1.379 (3)	C (10) - O (6)	1.373 (3)
C (1) - C (2)	1.457 (3)	C (10) - C (11)	1.476 (3)
C (2) - O (4)	1.256 (3)	C (11) - C (16)	1.391 (3)
C (2) - C (3)	1.441 (3)	C (11) - C (12)	1.407 (3)
C (3) - C (8)	1.393 (3)	C (12) - C (13)	1.369 (3)
C (3) - C (4)	1.422 (3)	C (13) - C (14)	1.394 (3)
C (4) - O (3)	1.355 (3)	C (14) - O (2)	1.366 (3)
C (4) - C (5)	1.383 (3)	C (14) - C (15)	1.391 (3)
C (5) - C (6)	1.391 (3)	C (15) - C (16)	1.385 (3)
C (6) - O (1)	1.365 (3)	C (17) - O (5)	1.447 (3)
C (6) - C (7)	1.399 (3)	C (18) - O (2)	1.432 (3)
C (7) - C (8)	1.375 (3)	C (19) - O (1)	1.431 (3)

Table 26 Bond angles (deg.) for compound 8.

Angles	(deg.)	Angles	(deg.)
C (10) - C (1) - O (5)	119.83 (19)	C (7) - C (8) - C (3)	123.21 (19)
C (10) - C (1) - O (2)	121.08 (19)	C (1) - C (10) - O (6)	121.42 (19)
O (5) - C (1) - C (2)	118.37 (18)	C (1) - C (10) - C (11)	128.62 (19)
O (4) - C (2) - C (3)	122.4 (2)	O (6) - C (10) - C (11)	109.88 (17)
O (4) - C (2) - C (1)	121.9 (2)	C (16) - C (11) - C (12)	117.52 (19)
C (3) - C (2) - C (1)	115.65 (19)	C (16) - C (11) - C (10)	123.26 (18)
C (8) - C (3) - C (4)	117.2 (2)	C (12) - C (11) - C (10)	119.21 (19)
C (8) - C (3) - C (2)	120.52 (19)	C (13) - C (12) - C (11)	121.4 (2)
C (4) - C (3) - C (2)	122.25 (19)	C (12) - C (13) - C (14)	120.3 (2)
O (3) - C (4) - C (5)	119.3 (2)	O (2) - C (14) - C (13)	115.40 (19)
O (3) - C (4) - C (3)	119.5 (2)	O (2) - C (14) - C (15)	125.2 (2)
C (5) - C (4) - C (3)	121.1 (2)	C (13) - C (14) - C (15)	119.4 (2)
C (4) - C (5) - C (6)	118.8 (2)	C (16) - C (15) - C (14)	119.8 (2)
O (1) - C (6) - C (5)	123.8 (2)	C (15) - C (16) - C (11)	121.6 (2)
O (1) - C (6) - C (7)	114.3 (2)	C (6) - O (1) - C (19)	118.6 (2)
C (5) - C (6) - C (7)	121.9 (2)	C (14) - O (2) - C (18)	118.34 (18)
C (8) - C (7) - C (6)	117.7 (2)	C (1) - O (5) - C (17)	114.61 (19)
O (6) - C (8) - C (7)	116.18 (19)	C (8) - O (6) - C (10)	120.64 (17)
O (6) - C (8) - C (3)	120.60 (19)		

Symmetry transformations used to generate equivalent atoms:

Table A27 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2 pi^2 [h^2 a^{*2} U11 + ...+ 2hka^*b^*U12]$.

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
C (1)	41 (1)	36 (1)	38 (1)	4 (1)	6 (1)	3 (1)
C (2)	39 (1)	43 (1)	33 (1)	2 (1)	4 (1)	.-1 (1)
C (3)	37 (1)	41 (1)	35 (1)	5 (1)	4 (1)	2 (1)
C (4)	35 (1)	50 (1)	37 (1)	9 (1)	0 (1)	2 (1)
C (5)	37 (1)	53 (1)	44 (1)	10 (1)	0 (1)	10 (1)
C (6)	43 (1)	42 (1)	45 (1)	7 (1)	4 (1)	9 (1)
C (7)	40 (1)	43 (1)	44 (1)	3 (1)	.-3 (1)	4(1)
C (8)	34 (1)	40 (1)	37 (1)	6 (1)	2 (1)	4(1)
C (10)	39 (1)	34 (1)	37 (1)	4 (1)	6 (1)	4(1)
C (11)	36 (1)	36 (1)	36 (1)	7 (1)	5 (1)	2 (1)
C (12)	50 (1)	36 (1)	48 (1)	0 (1)	2 (1)	12 (1)
C (13)	53 (1)	42 (1)	42 (1)	.-4 (1)	.-2 (1)	8 (1)
C (14)	40 (1)	40 (1)	38 (1)	8 (1)	3 (1)	3 (1)
C (15)	42 (1)	38 (1)	39 (1)	3 (1)	5 (1)	7 (1)

C (16)	41 (1)	38 (1)	36 (1)	.-1 (1)	4 (1)	5 (1)
C (17)	60 (2)	47 (2)	58 (2)	.-9 (1)	8 (1)	6 (1)
C (18)	53 (2)	45 (1)	61 (2)	8 (1)	.-7 (1)	10 (1)
C (19)	56 (2)	55 (2)	71 (2)	15 (2)	3 (2)	20 (1)
O (1)	59 (1)	42 (1)	73 (1)	5 (1)	.-11 (1)	15 (1)
O (2)	52 (1)	54 (1)	47 (1)	.-2 (1)	.-10 (1)	14 (1)
O (3)	47 (1)	57 (1)	61 (1)	5 (1)	.-15 (1)	0 (1)
O (4)	48 (1)	47 (1)	56 (1)	.-2 (1)	.-7 (1)	.-5 (1)
O (5)	56 (1)	35 (1)	47 (1)	3 (1)	4 (1)	2 (1)
O (6)	40 (1)	35 (1)	46 (1)	5 (1)	.-5 (1)	4 (1)

Table A28 Hydrogen bonds for compound 8 [A and deg.].

D-H....A	d (D-H)	d (H....A)	d (D.....A)	< (DHA)
O (3) - H (30).....O (4)	0.95 (4)	1.71 (4)	2.601 (2)	155 (4)

Symmetry transformations used to generate equivalent atoms:

Table A29 Crystal data and structure refinement for compound 10.

Empirical formula	$C_{22}H_{21}O_5$	
Formula weight	379.06	
Temperature	293 (2) K	
Wavelenght	0.71073 A	
Crystal system, space group	Orthorhombic, P2(1) 2(1) 2(1)	
Unit cell dimensions	a = 5.51390 (10) A	alpha = 90 deg.
	b = 8.9049 (2) A	beta = 90 deg.
	c = 28.9882 (2) A	gamma = 90 deg.
Volume	1423.34 (4) A^3	
Z, Calculated density	3, 1.327 Mg / m^3	
Absorption coefficient	0.094 mm^{-1}	
F (000)	600	
Theta range for data collection	2.39 to 30.46 deg	
Index ranges	.-7<=h<=7, -12<=k<=10, -35<=1<=40	
Reflections collected / unique	10566 / 4030 [R (int) = 0.0278]	

Completeness to 2 theta = 30.44	96.50%
Refinement method	Full - matrix least - squares on F^2
Data / restraints / parameters	4030 / 0 / 218
Goodness - of - fit on F^2	1.058
Final R indices [I > 2sigma (I)]	R1 = 0.0526, wR2 = 0.1110
R indices (all data)	R1 = 0.0795, wR2 = 0.1250
Absolute structure parameter	0.2 (12)
Largest diff. peak and hole	0.136 and -0.171 $e.A^{-3}$

Table A30 Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters ($A^2 * 10^3$) for compound 10.

	X	Y	Z	*U* (eq)*
C (1)	1017 (5)	7851 (3)	7077 (1)	71 (1)
C (2)	483 (5)	7345 (3)	7516 (1)	68 (1)
C (3)	1959 (4)	7728 (3)	7884 (1)	56 (1)
C (4)	3969 (4)	8620 (2)	7818 (1)	44 (1)
C (5)	4509 (5)	9124 (3)	7375 (1)	57 (1)
C (6)	3021 (5)	8726 (3)	7008 (1)	71 (1)
C (7)	5626 (4)	9049 (2)	8212 (1)	44 (1)
C (9)	7673 (3)	7894 (2)	8836 (1)	42 (1)
C (10)	8941 (4)	6615 (2)	8964 (1)	47 (1)
C (11)	10628 (4)	6722 (2)	9312 (1)	45 (1)
C (12)	11034 (4)	8080 (2)	9541 (1)	47 (1)
C (13)	9748 (4)	9342 (2)	9417 (1)	43 (1)
C (14)	7988 (4)	9287 (2)	9056 (1)	40 (1)
C (15)	6448 (4)	10563 (2)	8917 (1)	47 (1)
C (16)	4637 (4)	10226 (2)	8540 (1)	50 (1)
C (17)	11901 (5)	4182 (2)	9193 (1)	72 (1)
C (18)	11914 (5)	10811 (3)	9971 (1)	59 (1)
O (1)	6545 (4)	11810 (2)	9085 (1)	73 (1)
O (2)	10098 (3)	10700 (1)	9618 (1)	54 (1)
O (3)	12037 (3)	5556 (2)	9452 (1)	63 (1)
O (4)	6130 (3)	7700 (1)	8472 (1)	51 (1)

U(eq)* is defined as one third of the trace of the orthogonalized *U*ij tensor.

Table A31 Bond distances (A) for compound 10.

Bond Distances	(A)	Bond Distances	(A)
C (1) - C (6)	1.367 (4)	C (10) - C (11)	1.375 (3)
C (1) - C (2)	1.383 (4)	C (11) - O (3)	1.359 (2)
C (2) - C (3)	1.384 (3)	C (11) - C (12)	1.398 (3)
C (3) - C (4)	1.377 (3)	C (12) - C (13)	1.376 (3)
C (4) - C (5)	1.392 (3)	C (13) - O (2)	1.357 (2)
C (4) - C (7)	1.511 (3)	C (13) - C (14)	1.427 (3)
C (5) - C (6)	1.390 (3)	C (14) - C (15)	1.475 (2)
C (7) - O (4)	1.446 (2)	C (15) - O (1)	1.214 (2)
C (7) - C (16)	1.517 (3)	C (15) - C (16)	1.511 (3)
C (9) - O (4)	1.36 (2)	C (17) - O (3)	1.439 (3)
C (9) - C (10)	1.387 (3)	C (18) - O (2)	1.434 (3)
C (9) - C (14)	1.406 (3)		

Table A32 Bond angles (deg.) for compound 10.

Angles	(deg.)	Angles	(deg.)
C (6) - C (1) - C (2)	119.5 (2)	O (3) - C (11) - C (12)	115.26 (17)
C (1) - C (2) - C (3)	120.3 (3)	C (10) - C (11) - C (12)	121.13 (17)
C (4) - C (3) - C (2)	120.5 (2)	C (13) - C (12) - C (11)	119.98 (17)
C (3) - C (4) - C (5)	119.2 (2)	O (2) - C (13) - C (12)	122.81 (17)
C (3) - C (4) - C (7)	121.81 (18)	O (2) - C (13) - C (14)	116.27 (16)
C (5) - C (4) - C (7)	119.0 (2)	C (12) - C (13) - C (14)	120.91 (16)
C (6) - C (5) - C (4)	119.8 (2)	C (9) - C (14) - C (13)	116.56 (16)
C (1) - C (6) - C (5)	120.7 (2)	C (9) - C (14) - C (15)	118.95 (17)
O (4) - C (7) - C (4)	107.48 (15)	C (13) - C (14) - C (15)	124.44 (16)
O (4) - C (7) - C (16)	108.39 (15)	O (1) - C (15) - C (14)	124.72 (19)
C (4) - C (7) - C (16)	115.55 (16)	O (1) - C (15) - C (16)	120.08 (18)
O (4) - C (9) - C (10)	114.65 (16)	C (14) - C (15) - C (16)	115.20 (16)
O (4) - C (9) - C (14)	122.64 (16)	C (15) - C (16) - C (7)	110.71 (16)
C (10) - C (9) - C (14)	122.70 (17)	C (13) - O (2) - C (18)	117.90 (16)
C (11) - C (10) - C (9)	118.70 (17)	C (11) - O (3) - C (17)	117.58 (17)
O (3) - C (11) - C (10)	123.60 (17)	C (9) - O (4) - C (7)	114.71 (14)

Symmetry transformations used to generate equivalent atoms:

Table A33 Anisotropic displacement parameters ($A^2 * 10^3$). The anisotropic displacement factor exponent takes the form: $-2 pi^2 [h^2 a^{*2} U11 + ...+ 2hka^*b^*U12]$

	U11	*U22*	*U33*	*U23*	*U13*	*U12*
C (1)	63 (2)	81 (2)	68 (2)	-10 (1)	-20 (1)	12 (1)
C (2)	45 (1)	67 (2)	92 (2)	-6 (1)	-7 (1)	-3 (1)
C (3)	44 (1)	64 (1)	60 (1)	5 (1)	4 (1)	1 (1)
C (4)	43 (1)	42 (1)	46 (1)	1 (1)	-1 (1)	11 (1)
C (5)	58 (1)	59 (1)	55 (1)	12 (1)	-5 (1)	2 (1)
C (6)	80 (2)	82 (2)	50 (1)	10 (1)	-11 (1)	11 (2)
C (7)	43 (1)	44 (1)	43 (1)	4 (1)	-1 (1)	7 (1)
C (9)	47 (1)	40 (1)	39 (1)	1 (1)	0 (1)	6 (1)
C (10)	59 (1)	34 (1)	48 (1)	-1 (1)	-2 (1)	6 (1)
C (11)	51 (1)	40 (1)	45 (1)	6 (1)	-1 (1)	10 (1)
C (12)	52 (1)	47 (1)	42 (1)	3 (1)	-7 (1)	3 (1)
C (13)	50 (1)	40 (1)	39 (1)	1 (1)	2 (1)	3 (1)
C (14)	46 (1)	36 (1)	39 (1)	1 (1)	3 (1)	7 (1)
C (15)	54 (1)	42 (1)	44 (1)	-3 (1)	3 (1)	13 (1)
C (16)	47 (1)	49 (1)	53 (1)	-3 (1)	-2 (1)	14 (1)
C (17)	83 (2)	47 (1)	88 (2)	-2 (1)	-15 (1)	26 (1)
C (18)	71 (1)	56 (1)	50 (1)	-6 (1)	-10 (1)	-6 (1)
O (1)	96 (1)	49 (1)	75 (1)	-19 (1)	-20 (1)	32 (1)
O (2)	71 (1)	41 (1)	51 (1)	-5 (1)	-11 (1)	3 (1)
O (3)	74 (1)	44 (1)	70 (1)	2 (1)	-19 (1)	19 (1)
O (4)	63 (1)	39 (1)	50 (1)	-1 (1)	-14 (1)	8 (1)

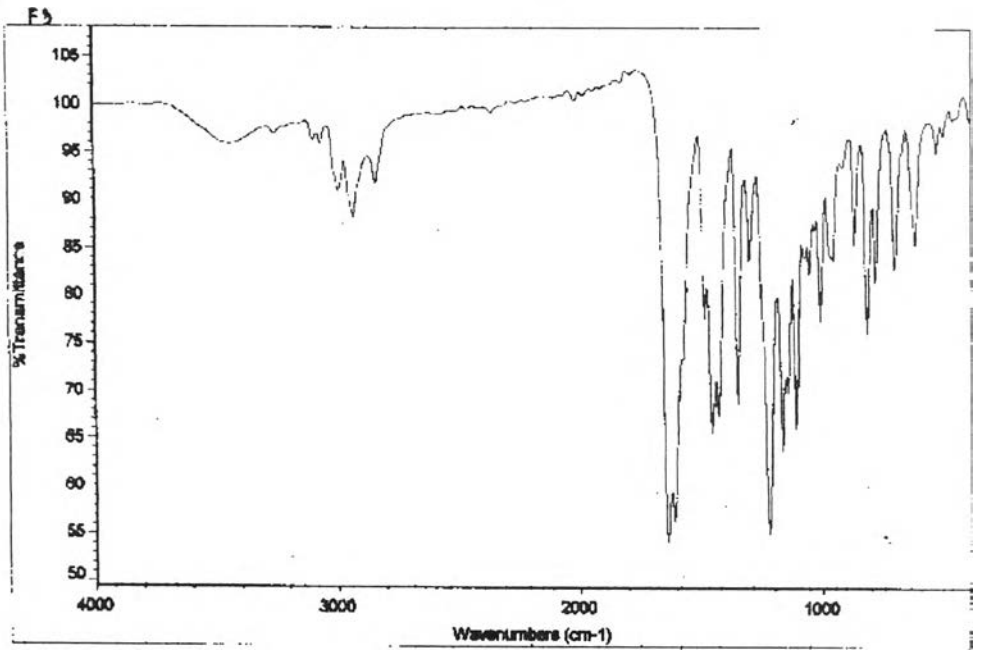


Figure A1 The IR spectrum of Compound 1.(3,5,7-trimethoxyflavone)

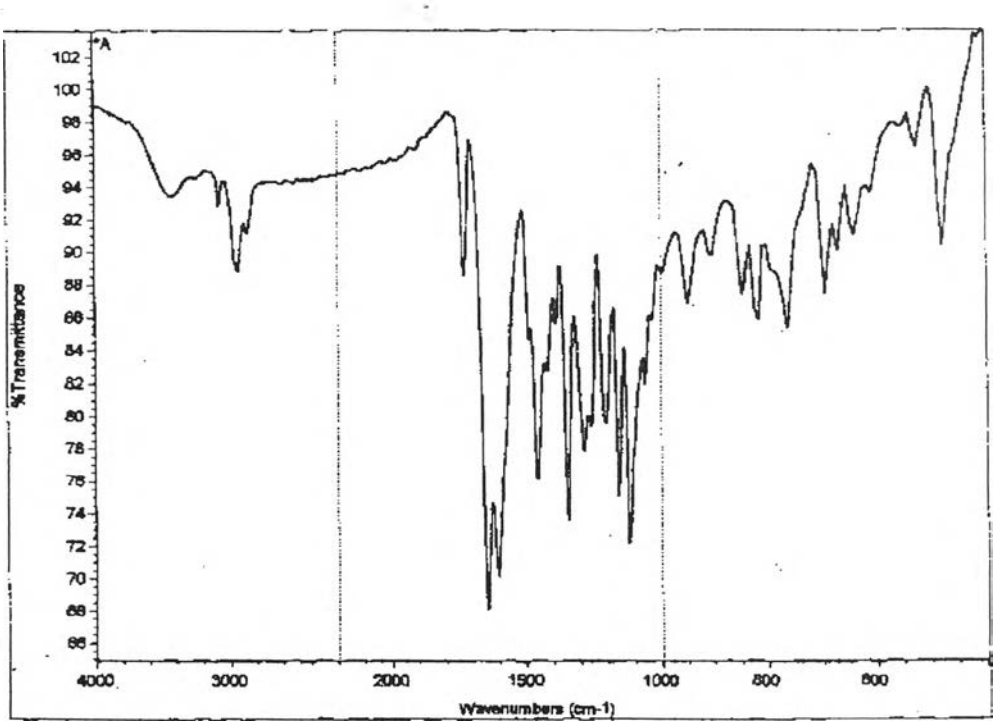


Figure A2 The IR spectrum of Compound 2.(5,7-dimethoxyflavone)

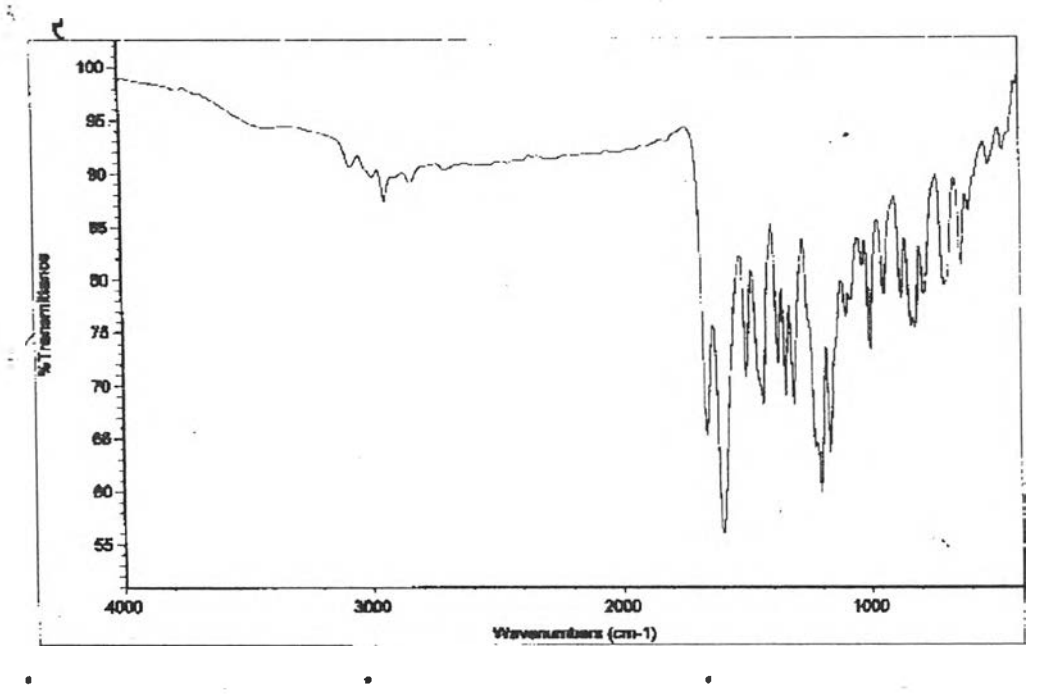


Figure A3 The IR spectrum of Compound 3.(5,7,4'-trimethoxyflavone)

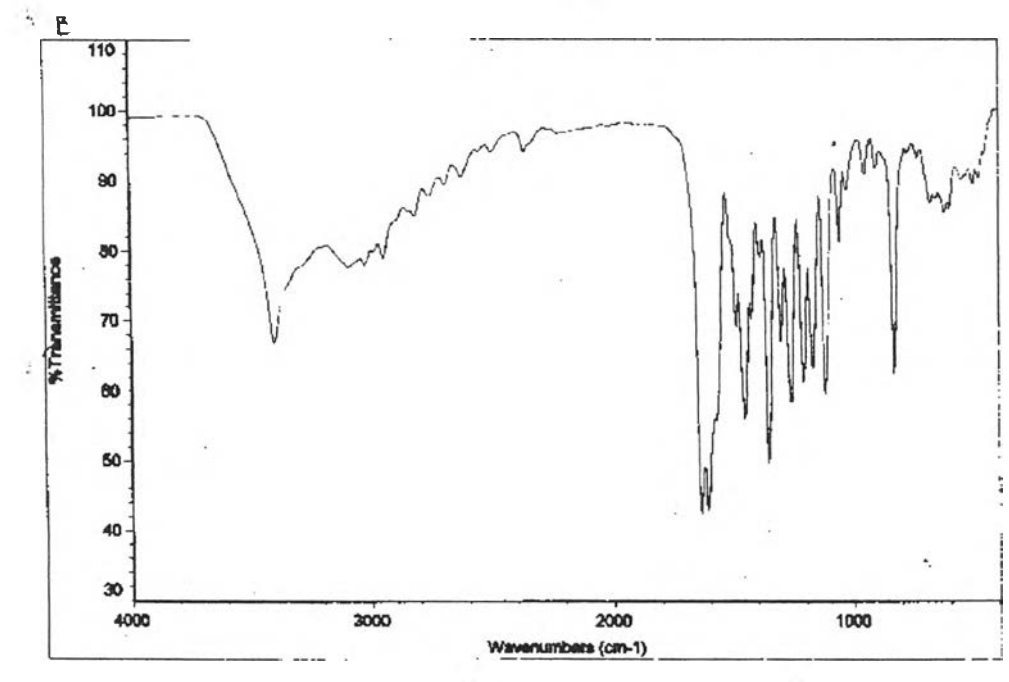


Figure A4 The IR spectrum of Compound 4.(4'-hydroxy-5,7-dimethoxyflavone)

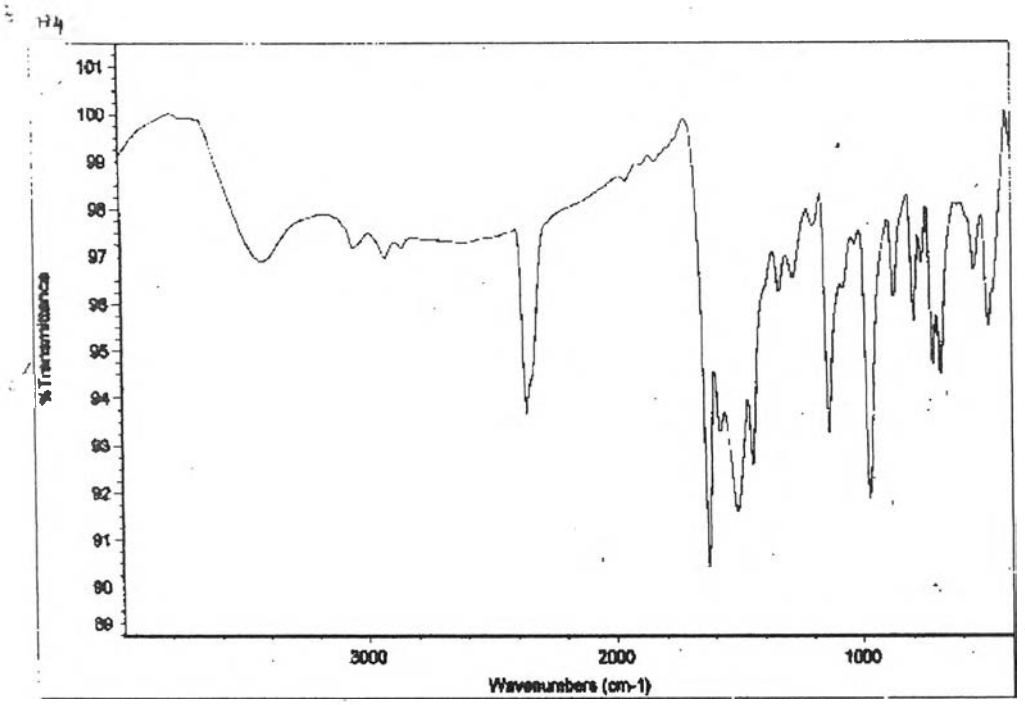


Figure A5 The IR spectrum of Compound 5.(dicinnamoylmethane)

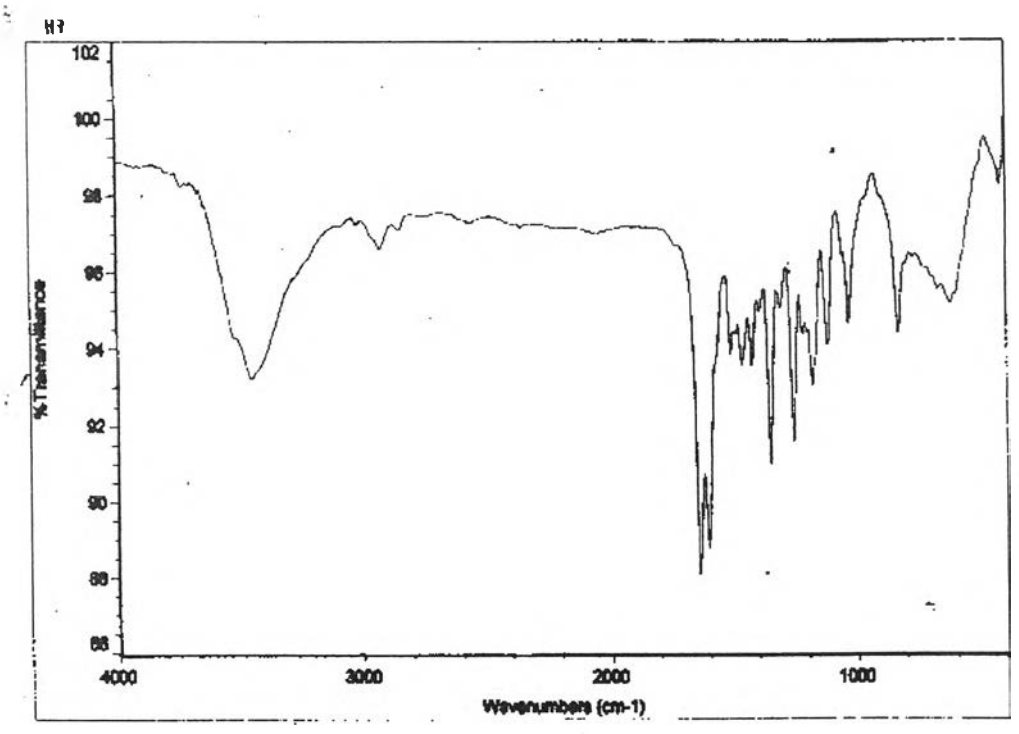


Figure A6 The IR spectrum of Compound 6.(5-hydroxy-3,7-dimethoxyflavone)

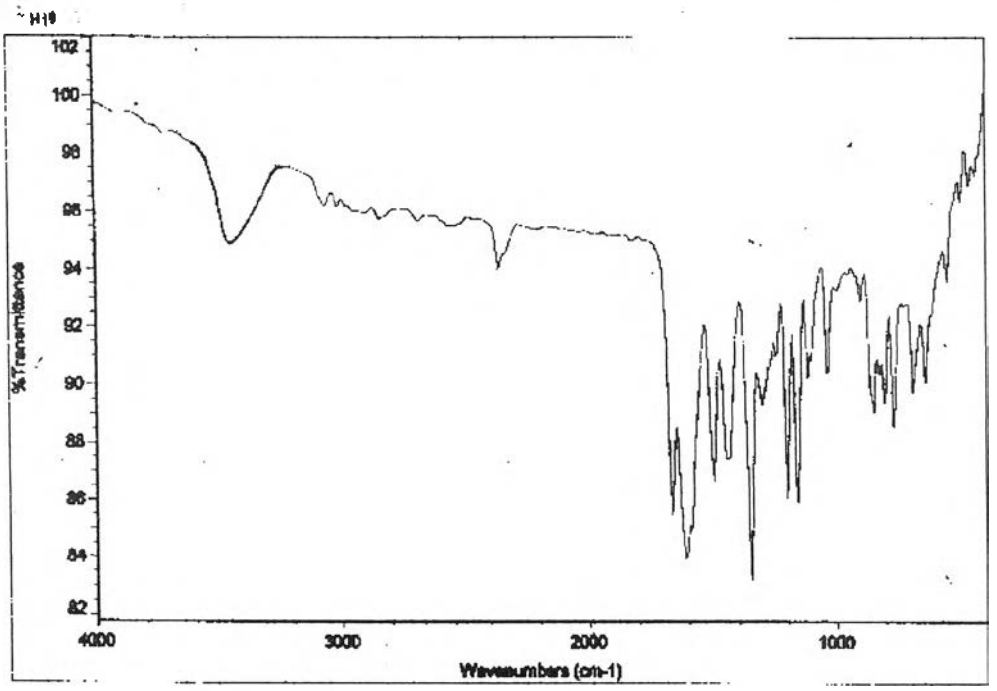


Figure A7 The IR spectrum of Compound 7.(5-hydroxy-7-methoxyflavone)

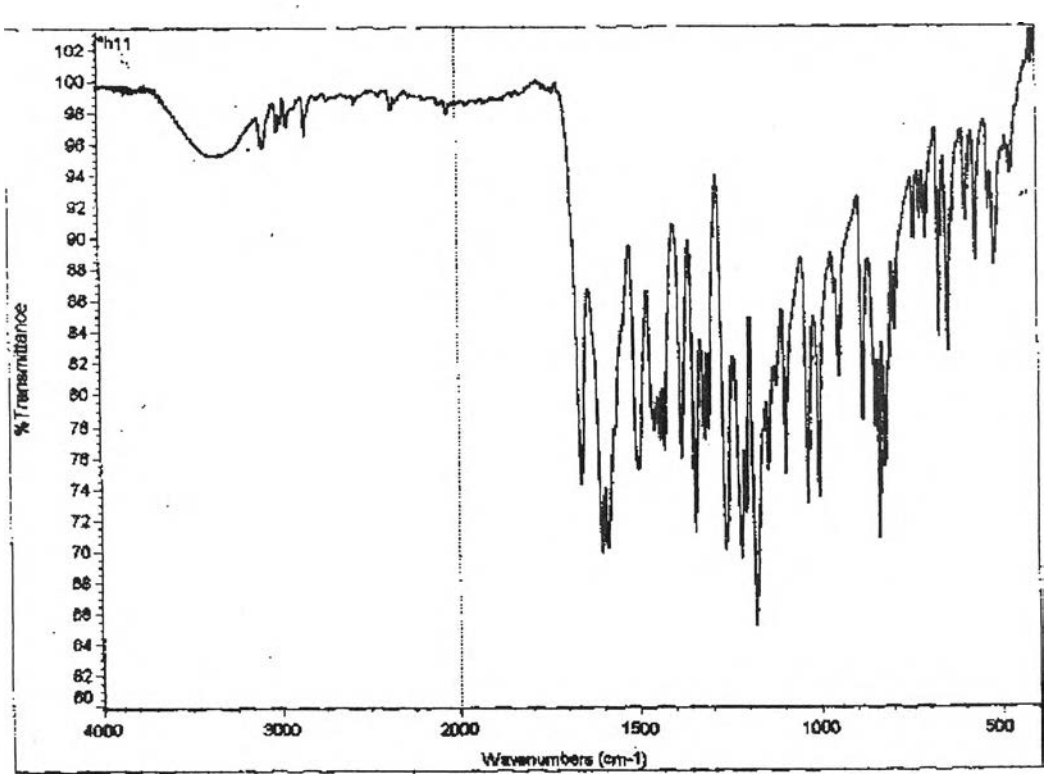


Figure A8 The IR spectrum of Compound 8.(5-hydroxy-3,7,4'-trimethoxyflavone)

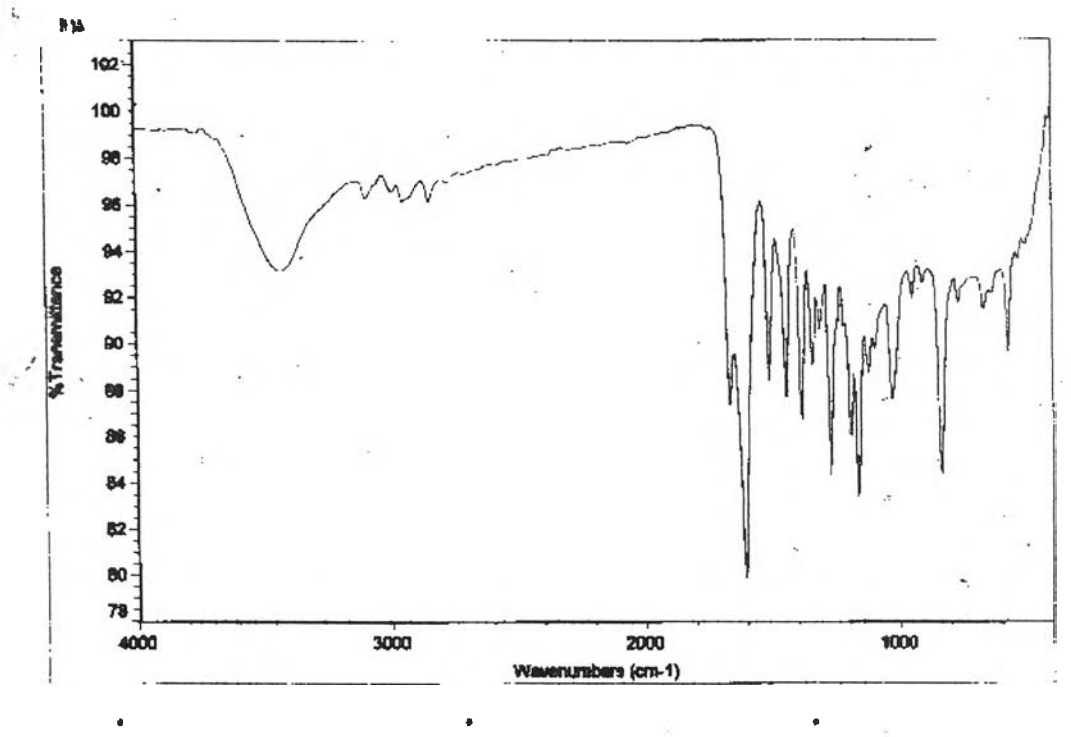


Figure A9 The IR spectrum of Compound 9.(5-hydroxy-7,4'-dimethoxyflavone)

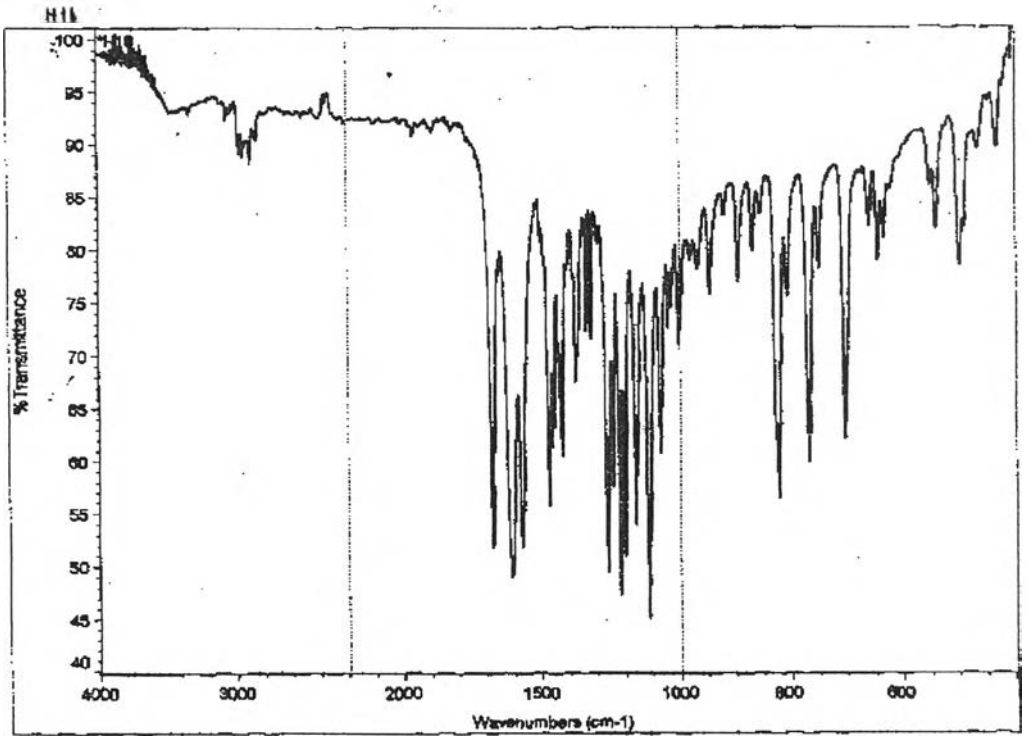


Figure A10 The IR spectrum of Compound 10.(5,7-dimethoxyflavanone)

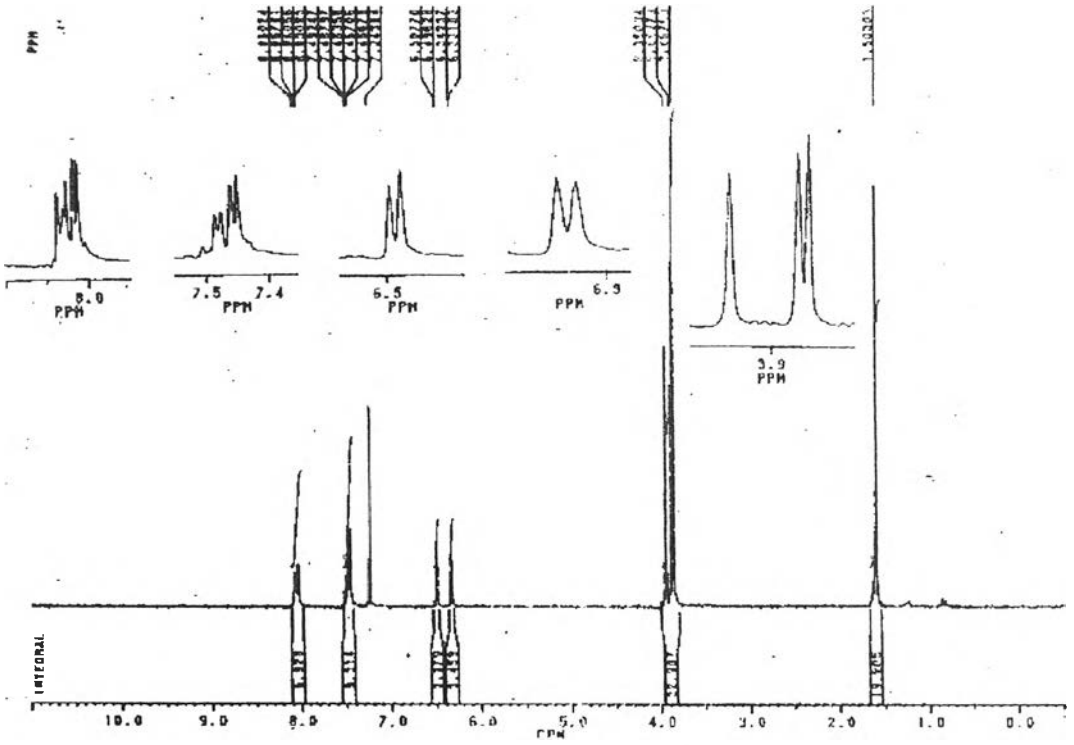


Figure A11 The ^{1}H-NMR spectrum of Compound 1.(3,5,7-trimethoxyflavone)

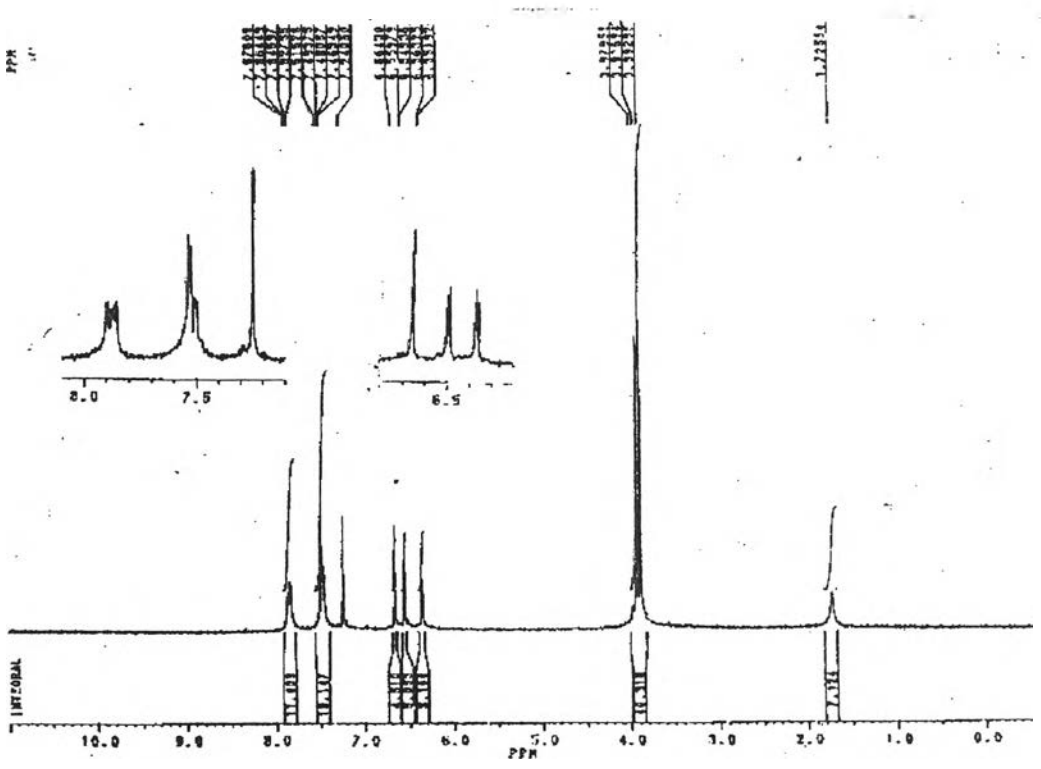


Figure A12 The ^{1}H-NMR spectrum of Compound 2.(5,7-dimethoxyflavone)

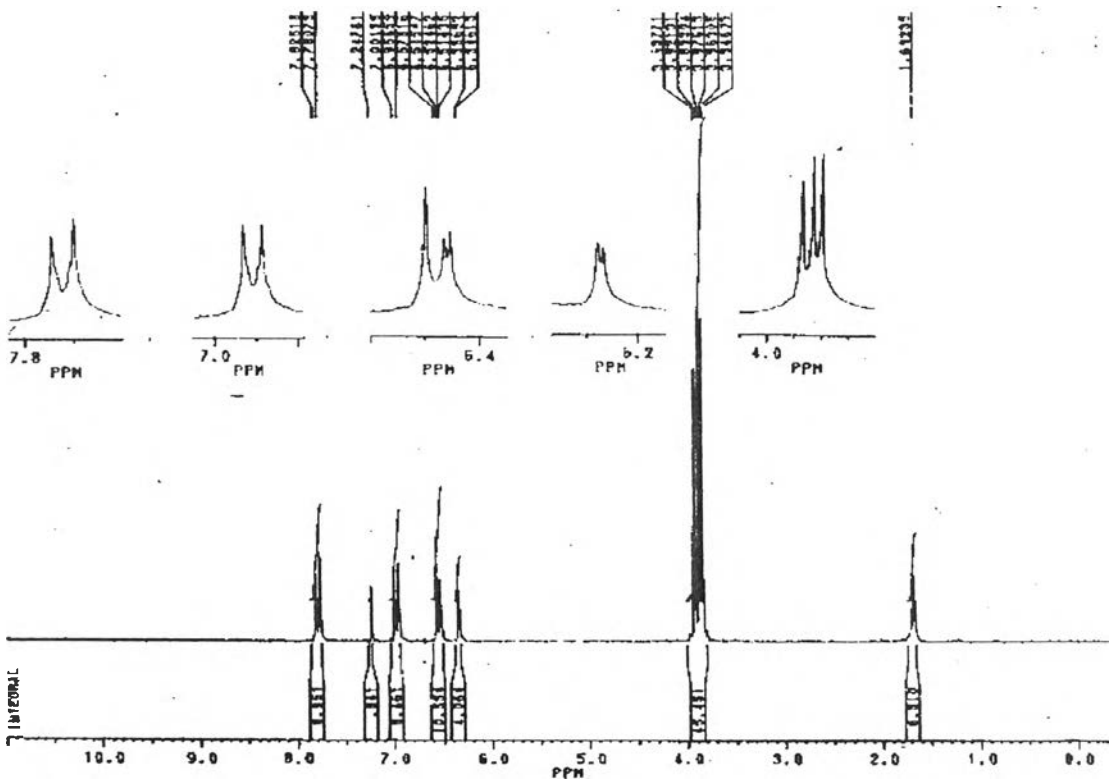


Figure A13 The ^{1}H-NMR spectrum of Compound 3.(5,7,4'-trimethoxyflavone)

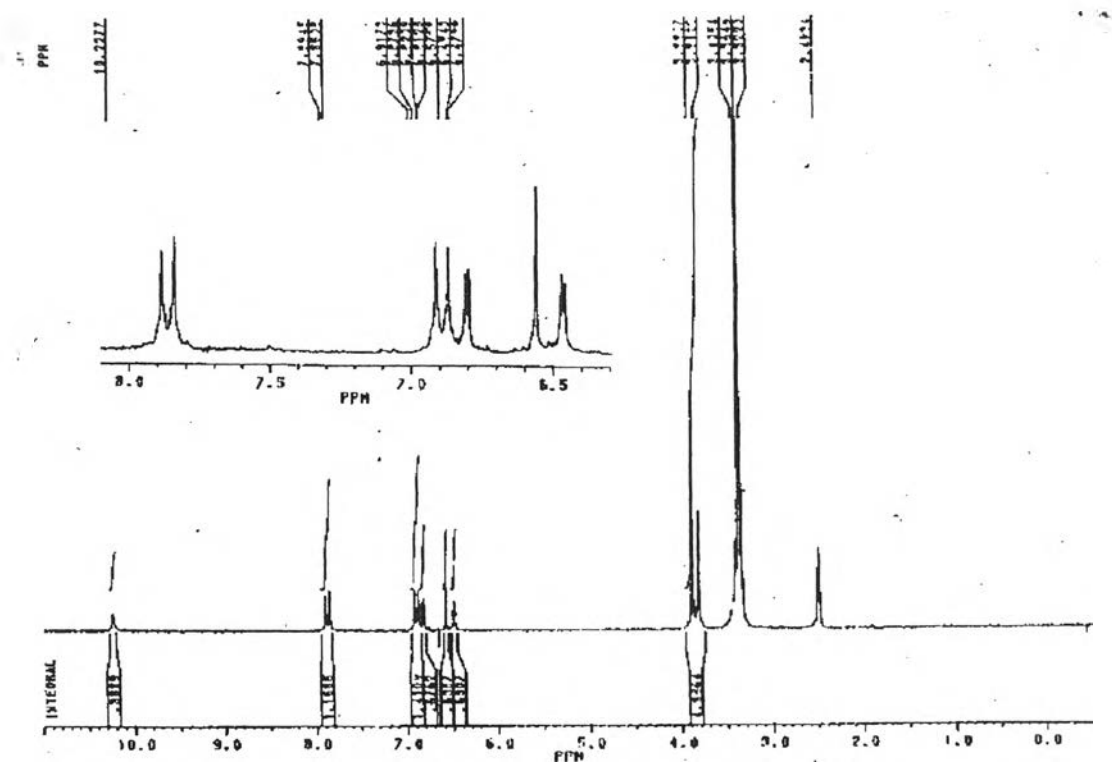


Figure A14 The ^{1}H-NMR spectrum of Compound 4.(4'-hydroxy-5,7-dimethoxyflavone)

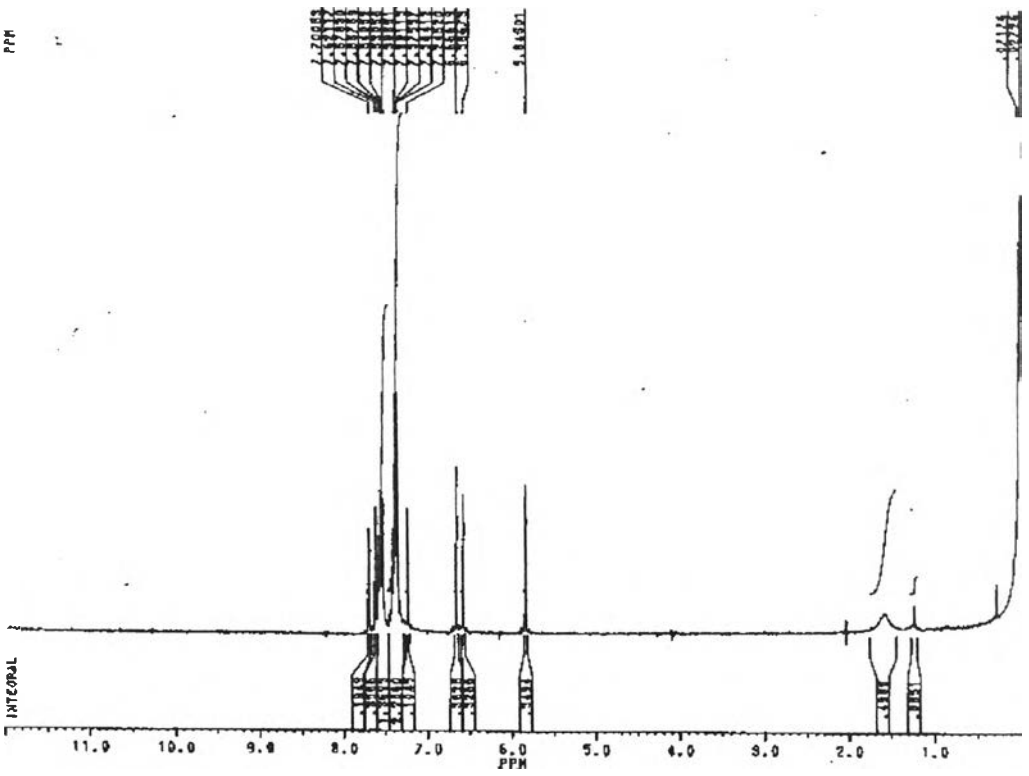


Figure A15 The ^{1}H-NMR spectrum of Compound 5.(dicinnamoylmethane)

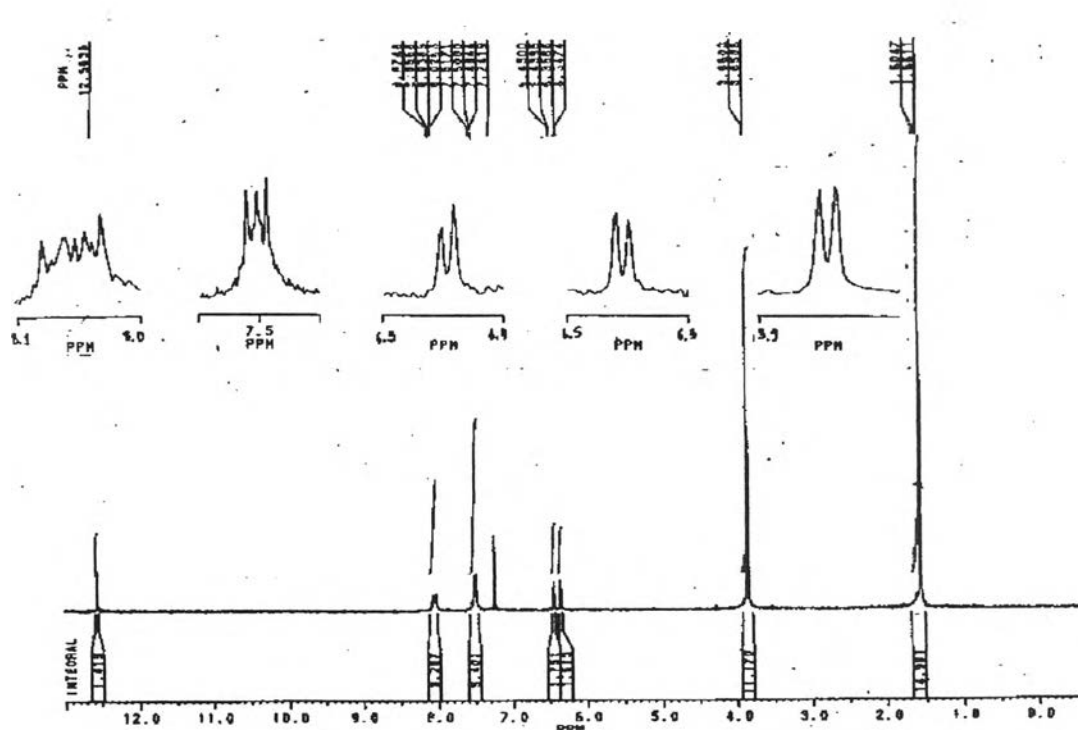


Figure A16 The ^{1}H-NMR spectrum of Compound 6.(5-hydroxy-3,7-dimethoxyflavone)

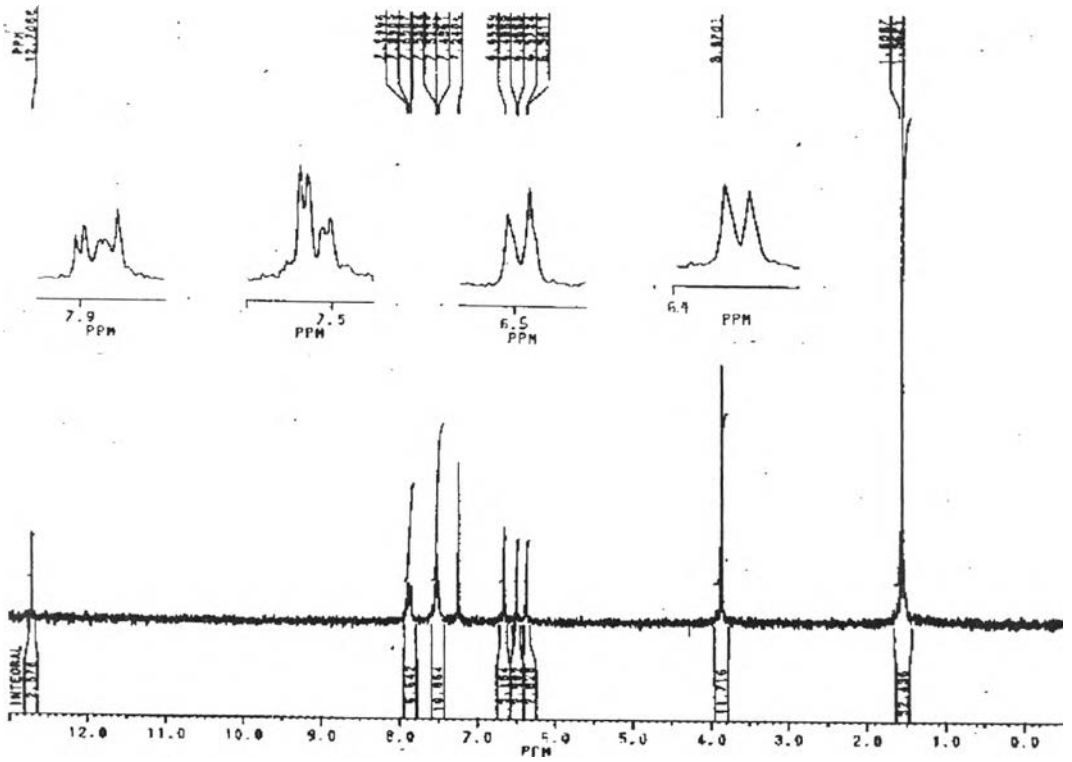


Figure A17 The ^{1}H-NMR spectrum of Compound 7.(5-hydroxy-7-methoxyflavone)

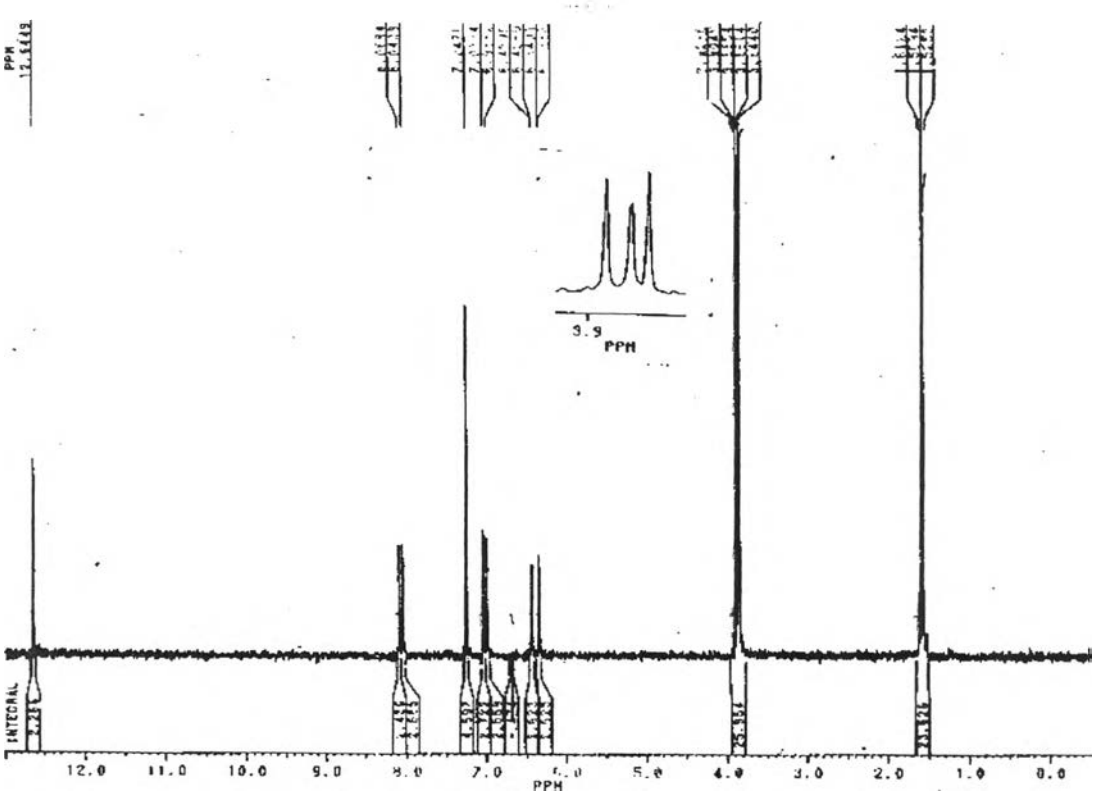


Figure A18 The ^{1}H-NMR spectrum of Compound 8.(5-hydroxy-3,7,4'-trimethoxyflavone)

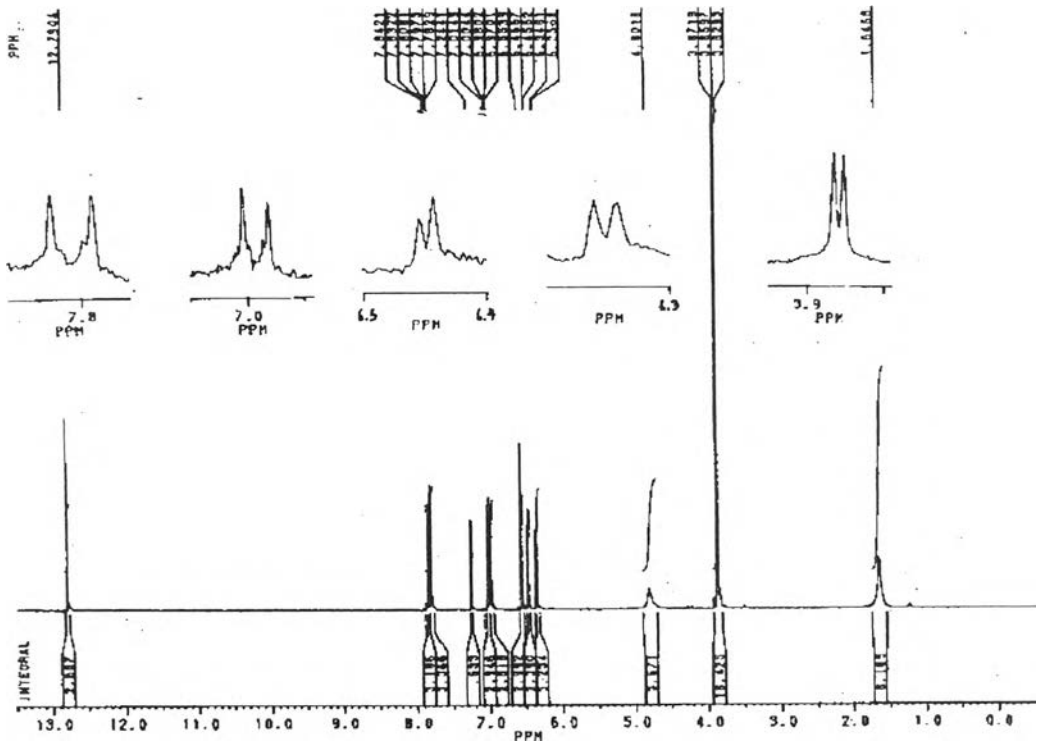


Figure A19 The ^{1}H-NMR spectrum of Compound 9.(5-hydroxy-7,4'-dimethoxyflavone)

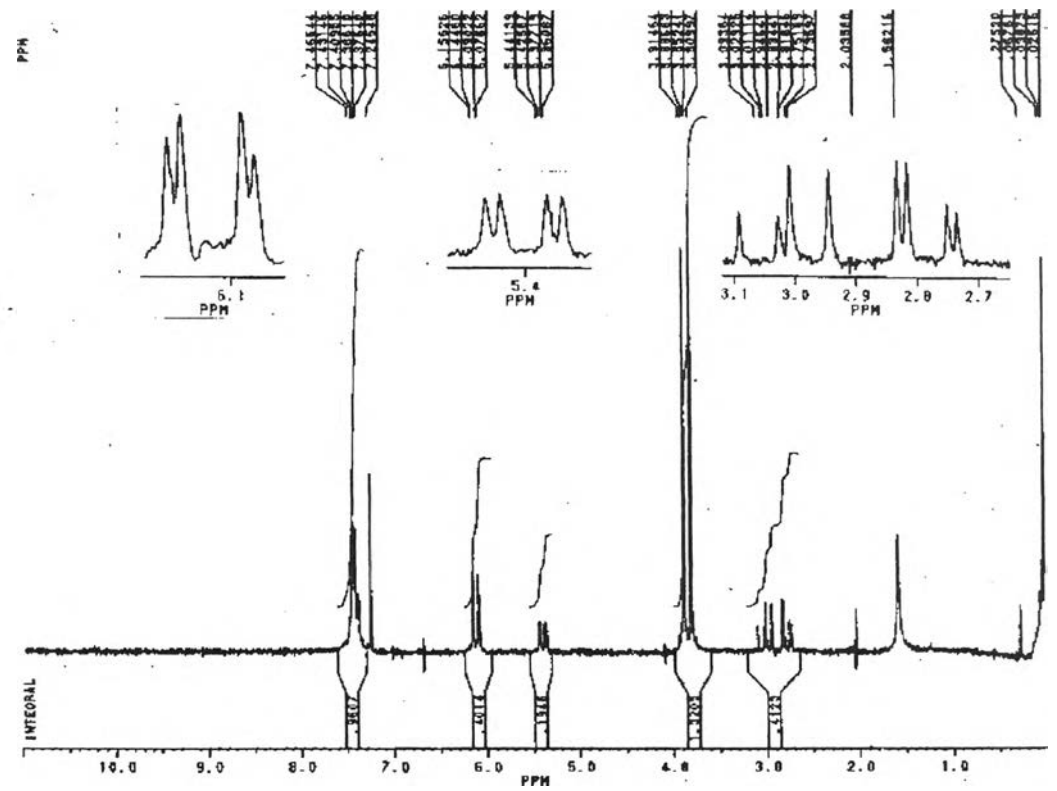


Figure A20 The ^{1}H-NMR spectrum of Compound 10.(5,7-dimethoxyflavanone)

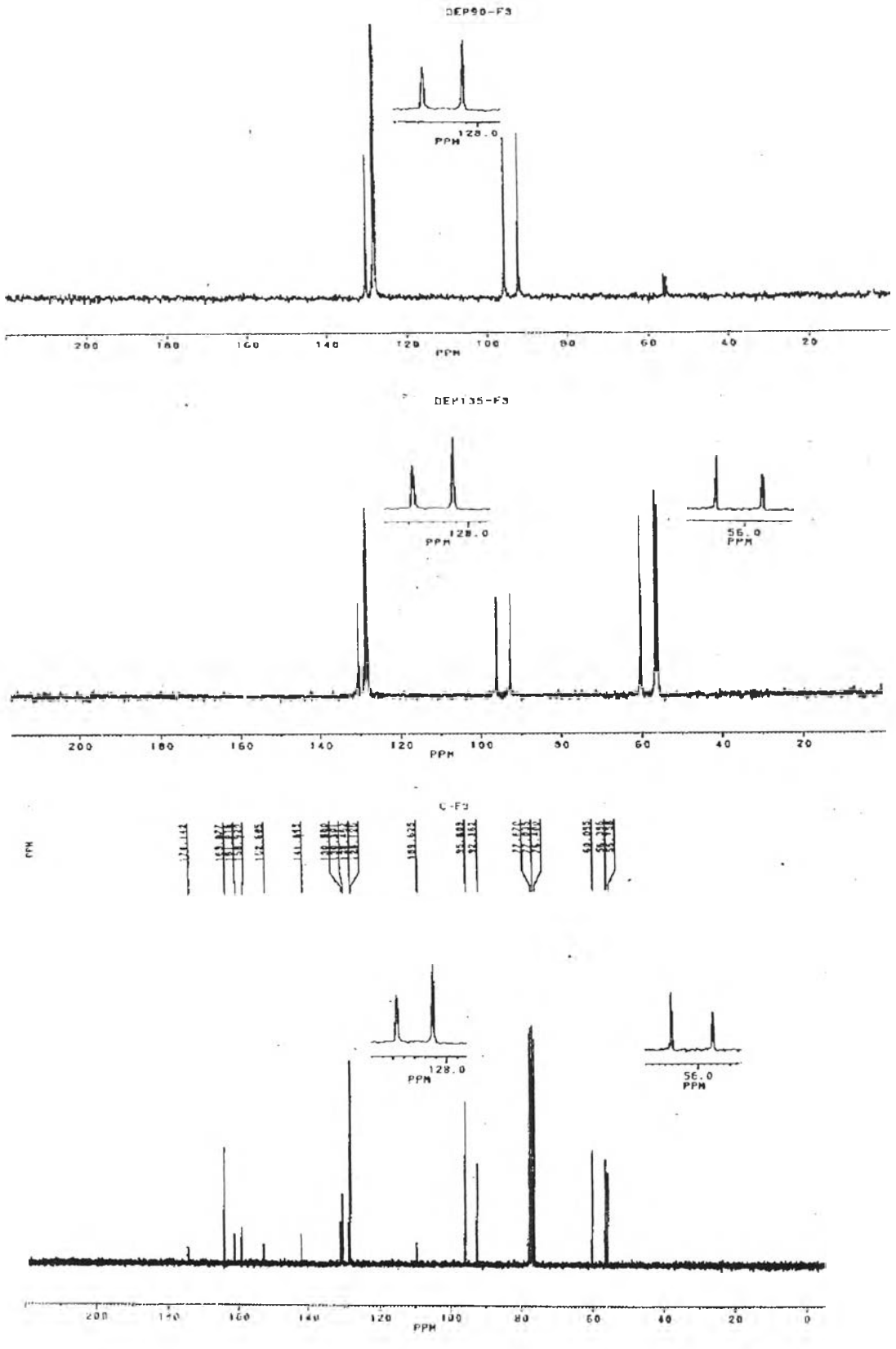


Figure A21 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 1.(3,5,7-trimethoxyflavone)

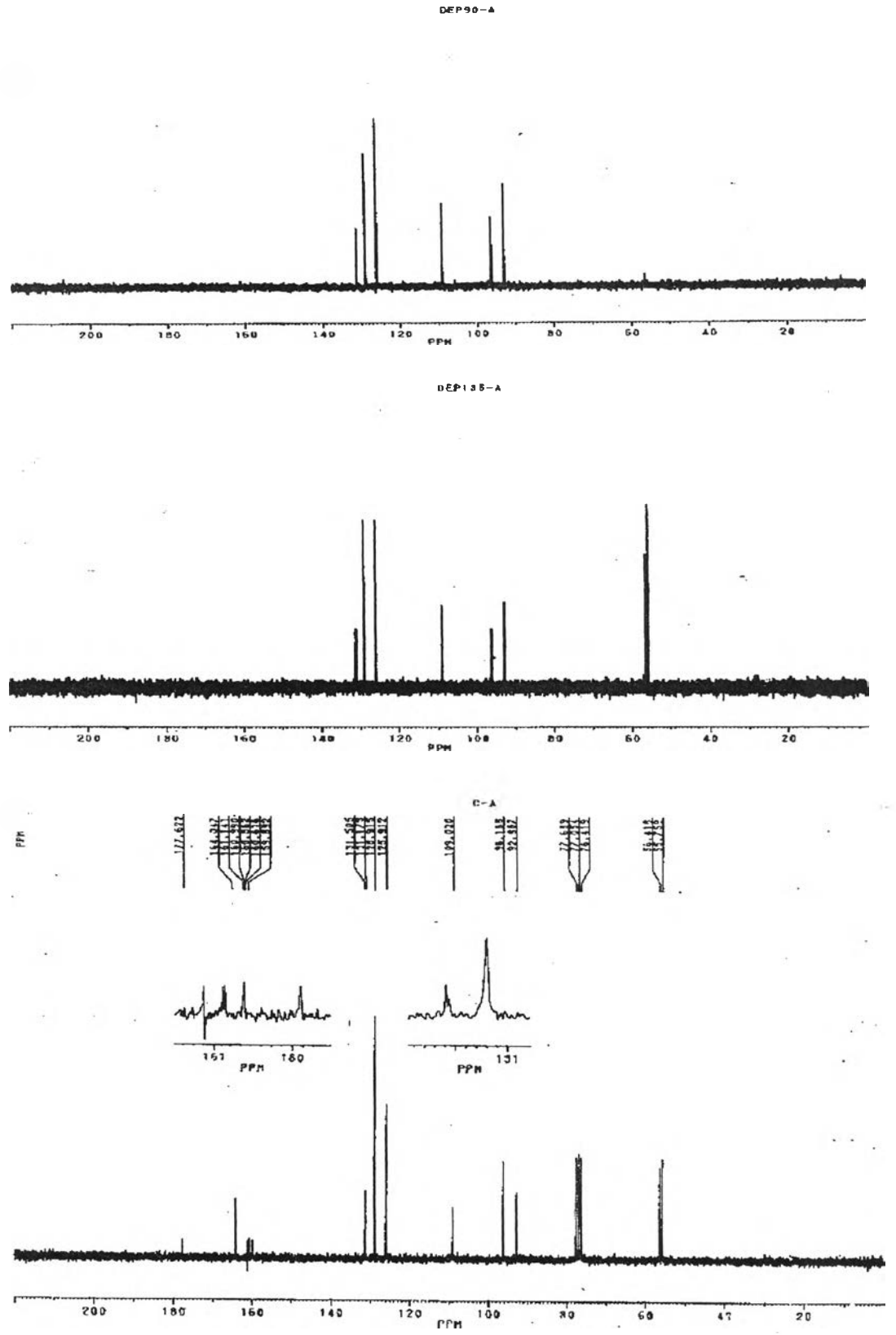


Figure A22 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 2.(5,7-dimethoxyflavone)

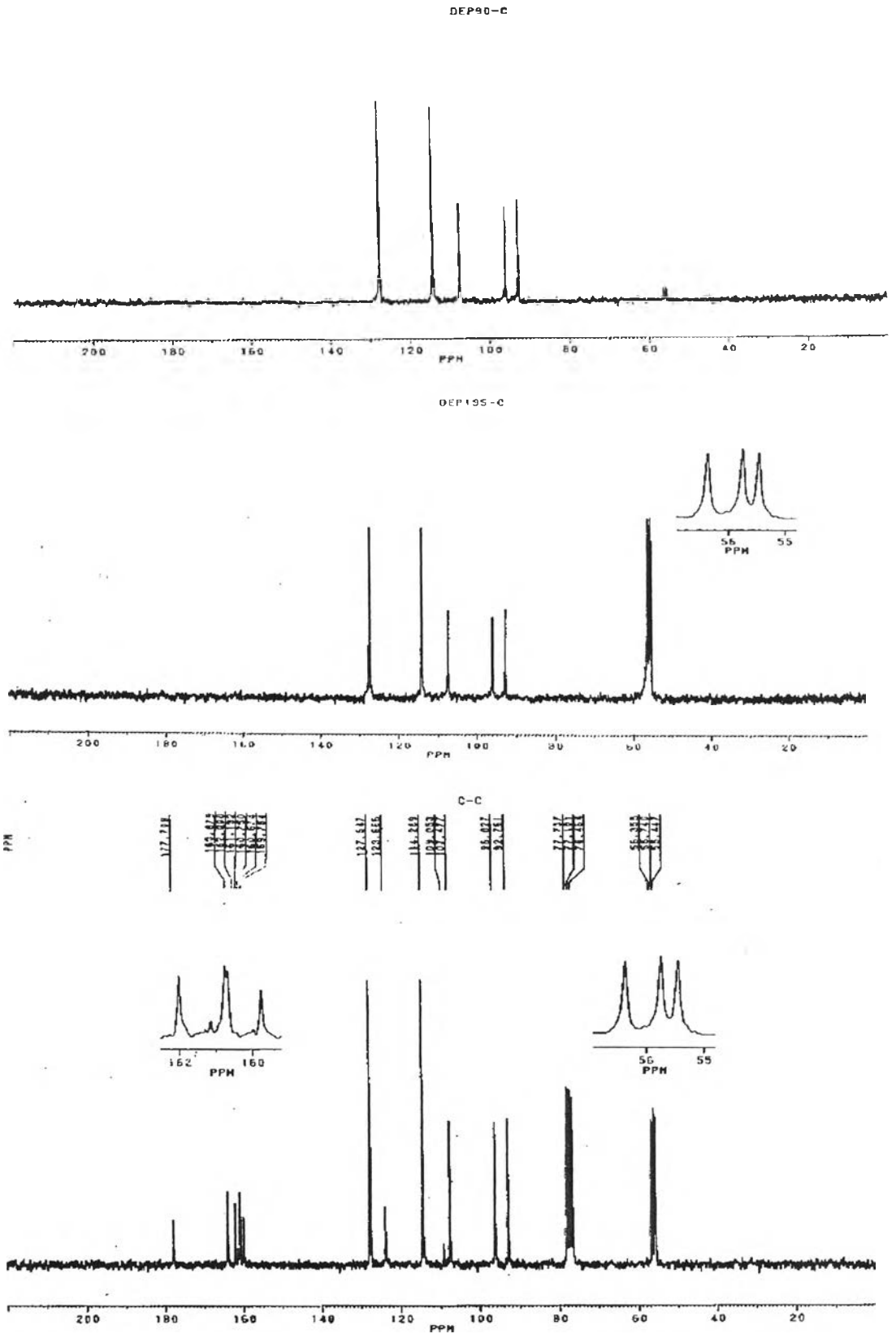


Figure A23 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 3.(5,7,4'-trimethoxyflavone)

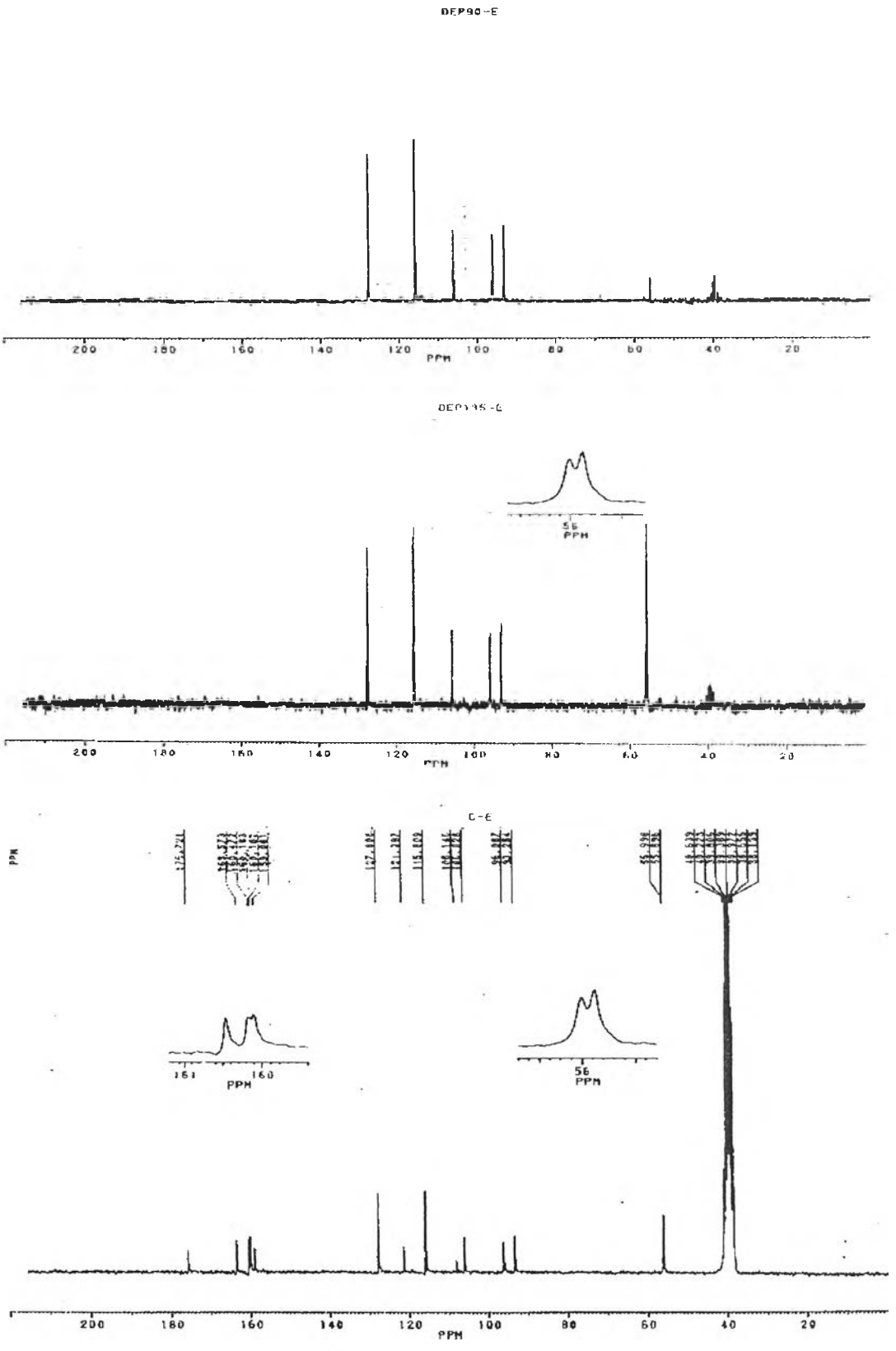


Figure A24 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 4. (4'-hydroxy-5,7-dimethoxyflavone)

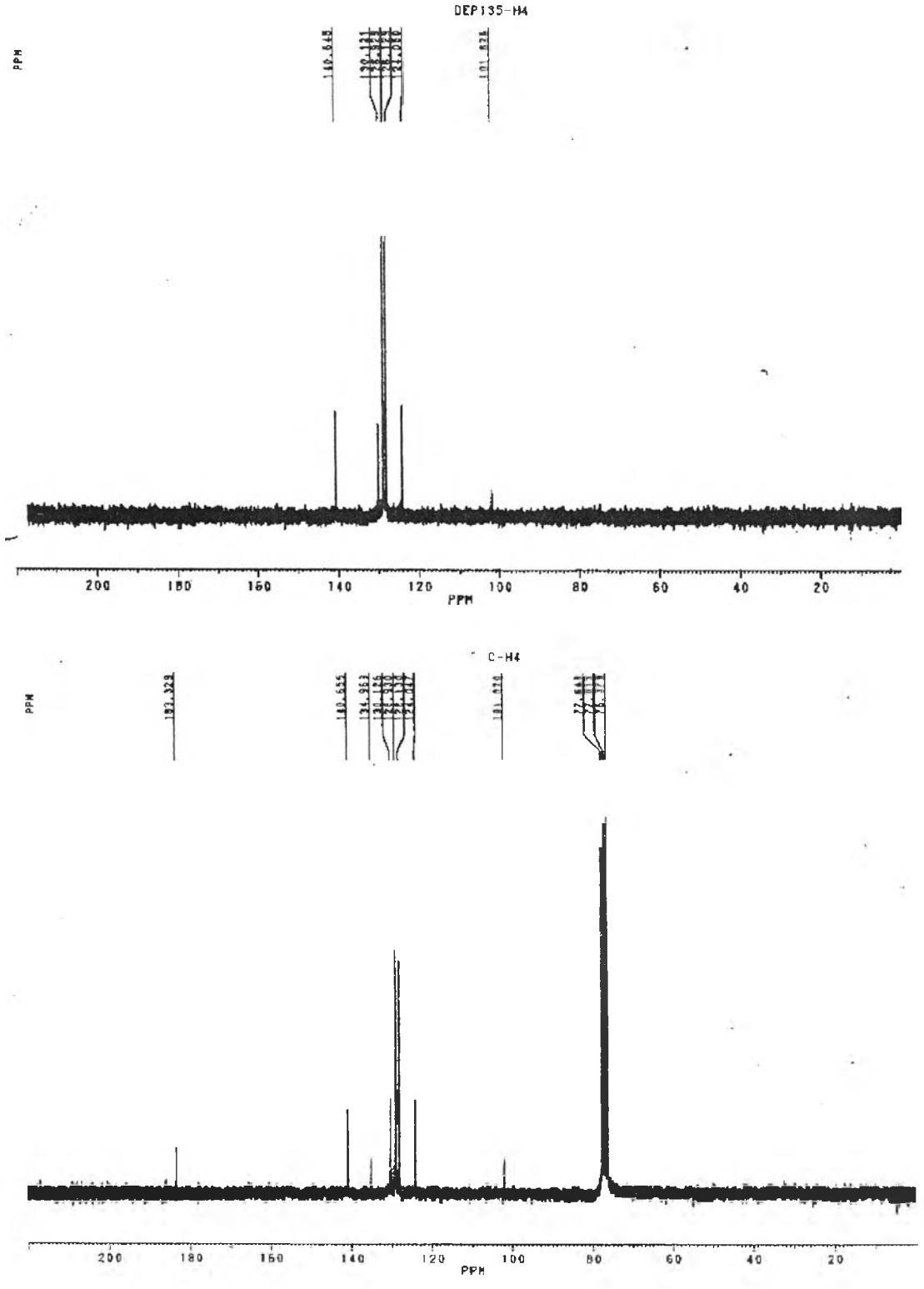


Figure A25 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 5.(dicinnamoylmethane)

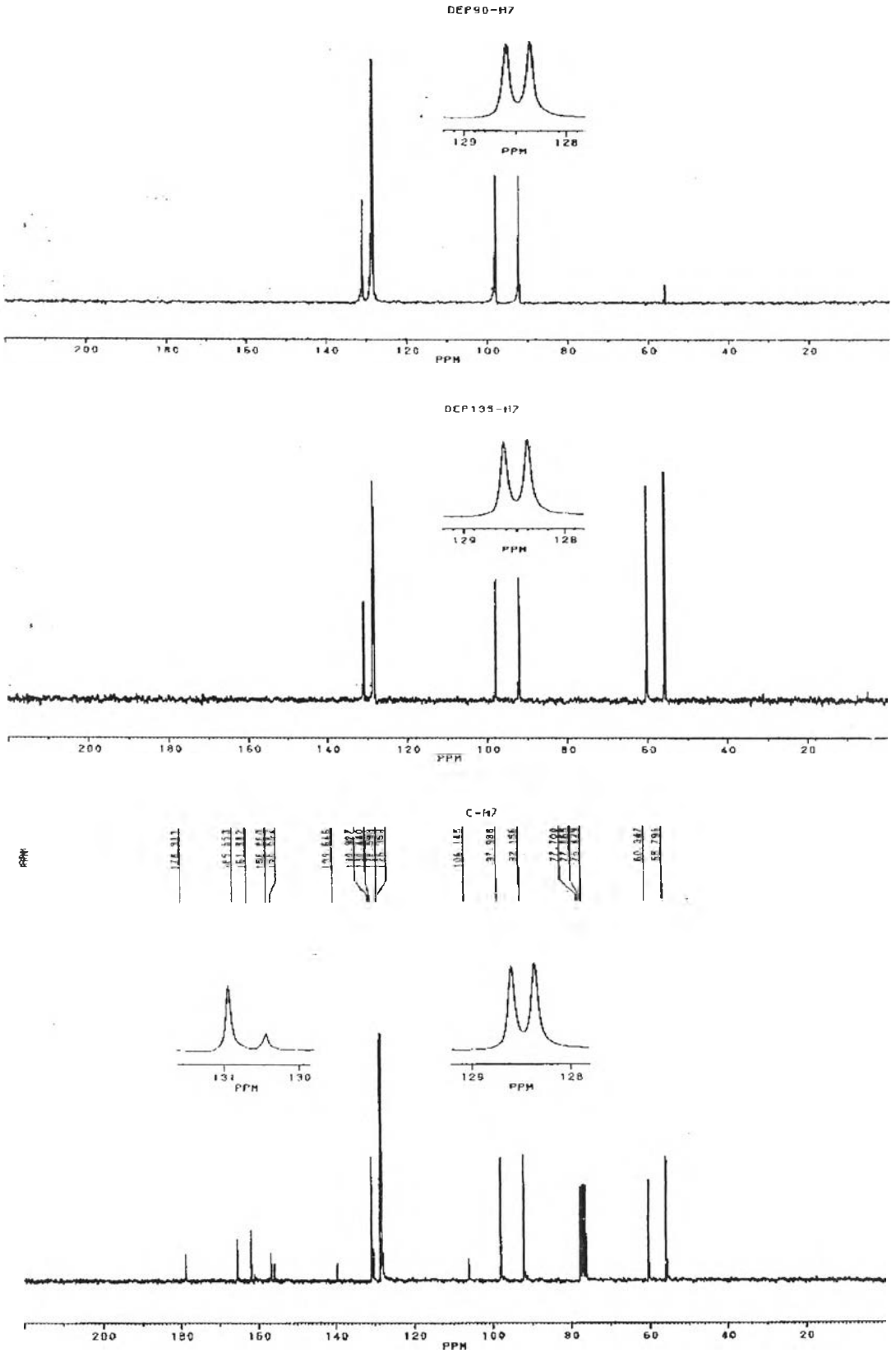


Figure A26 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 6. (5-hydroxy-3,7-dimethoxyflavone)

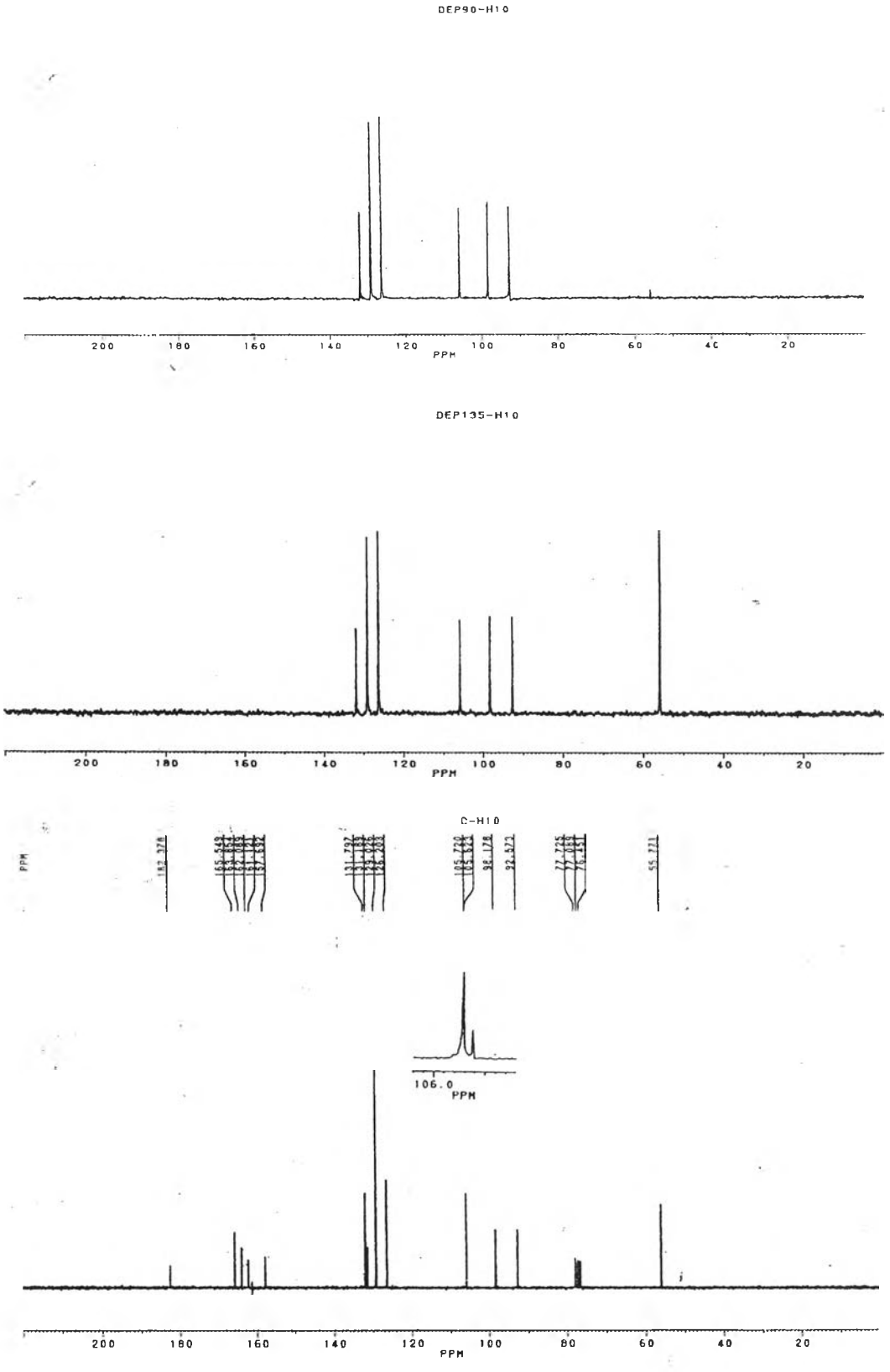


Figure A27 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 7. (5-hydroxy-7- methoxyflavone)

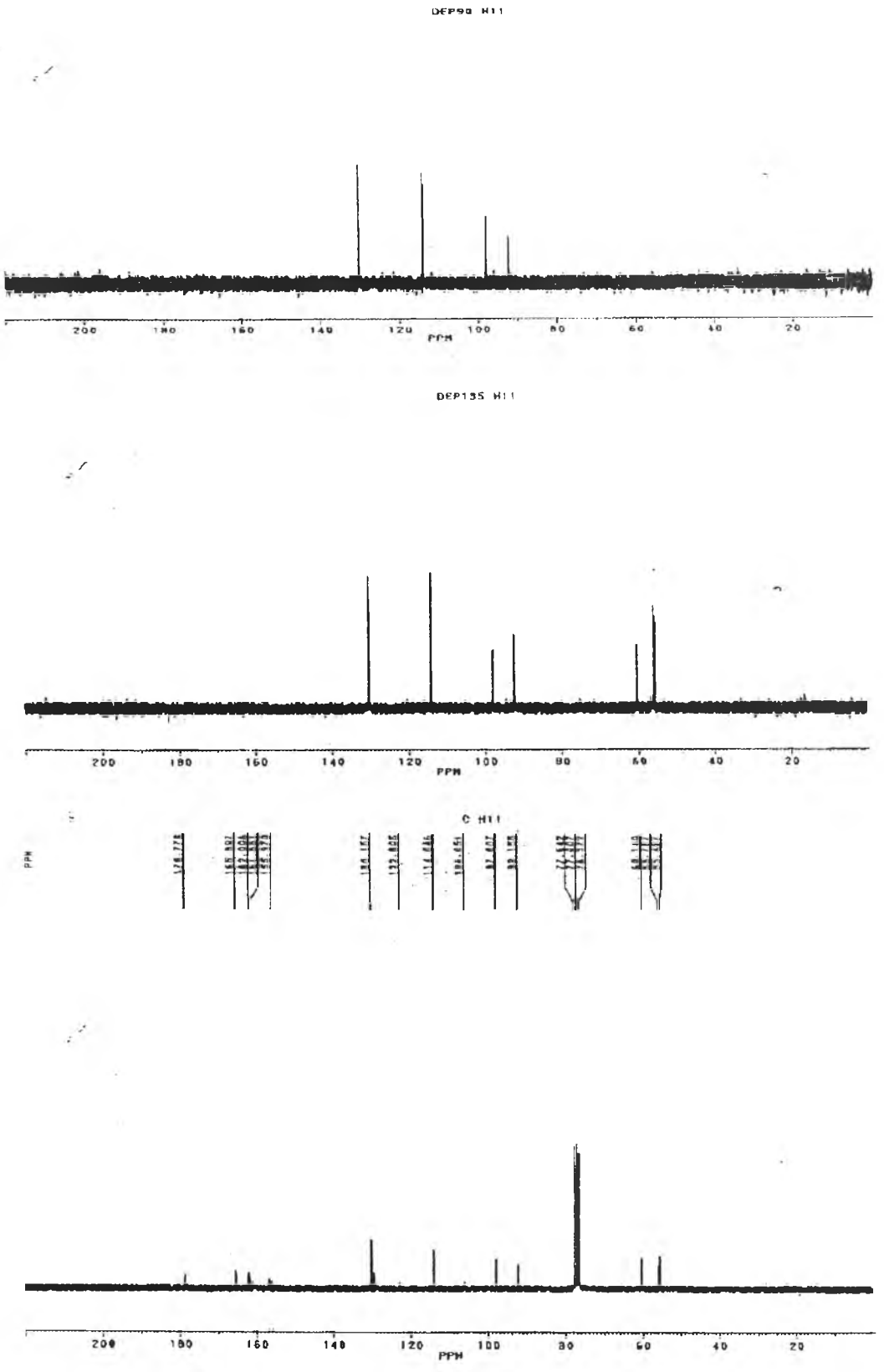


Figure A28 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound 8.
(5-hydroxy -3,7,4'-trimethoxyflavone)

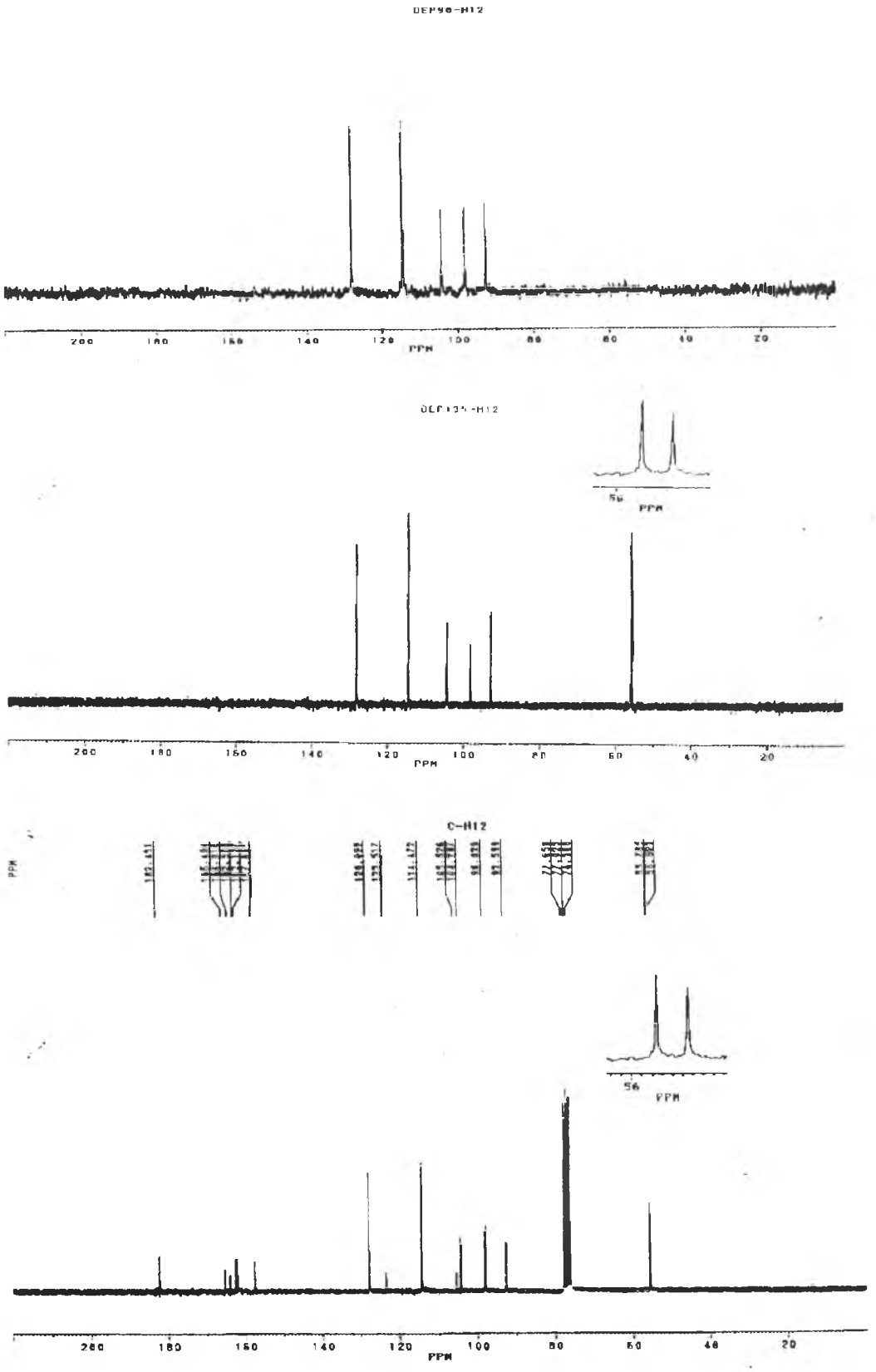


Figure A29 DEPT 90, DEPT 135 and ^{13}C-NMR spectra of Compound 9. (5 - hydroxy -7, 4' -dimethoxyflavone)

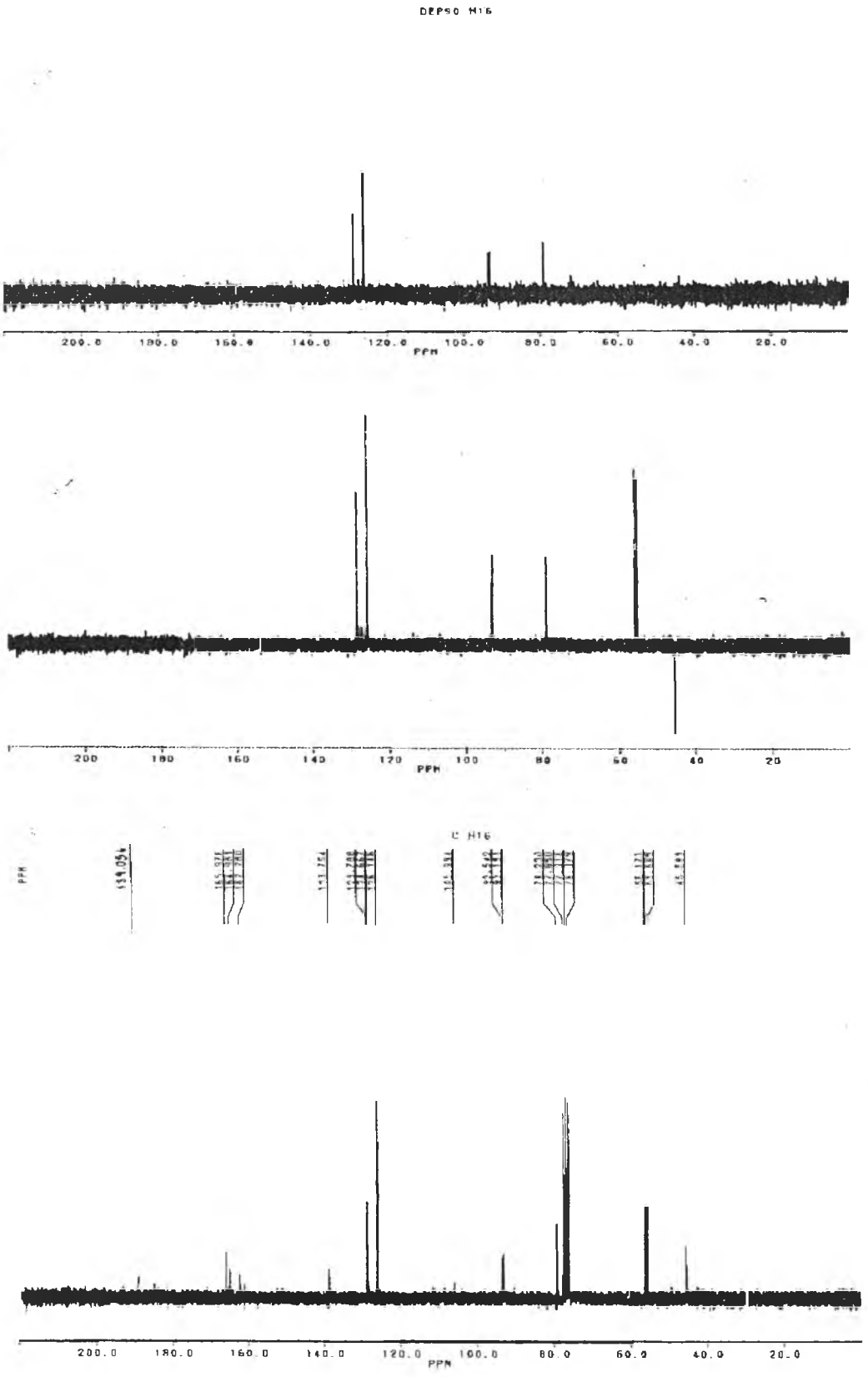


Figure A30 DEPT 90, DEPT 135 and ^{13}C-NMR spectra of Compound 10. (5,7-dimethoxyflavanone)

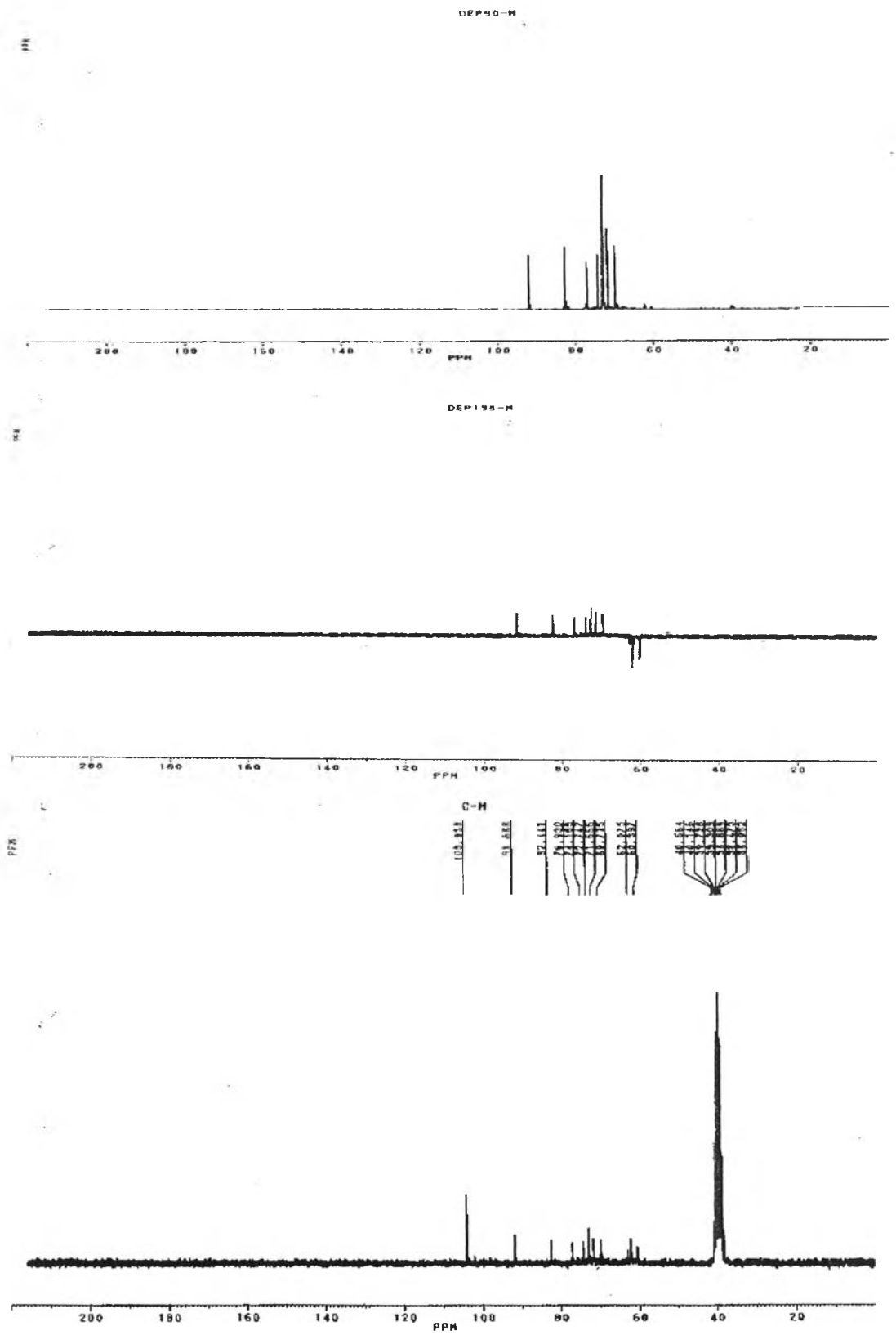


Figure A31 DEPT90, DEPT135 and ^{13}C-NMR spectra of Compound11. (Sucrose)

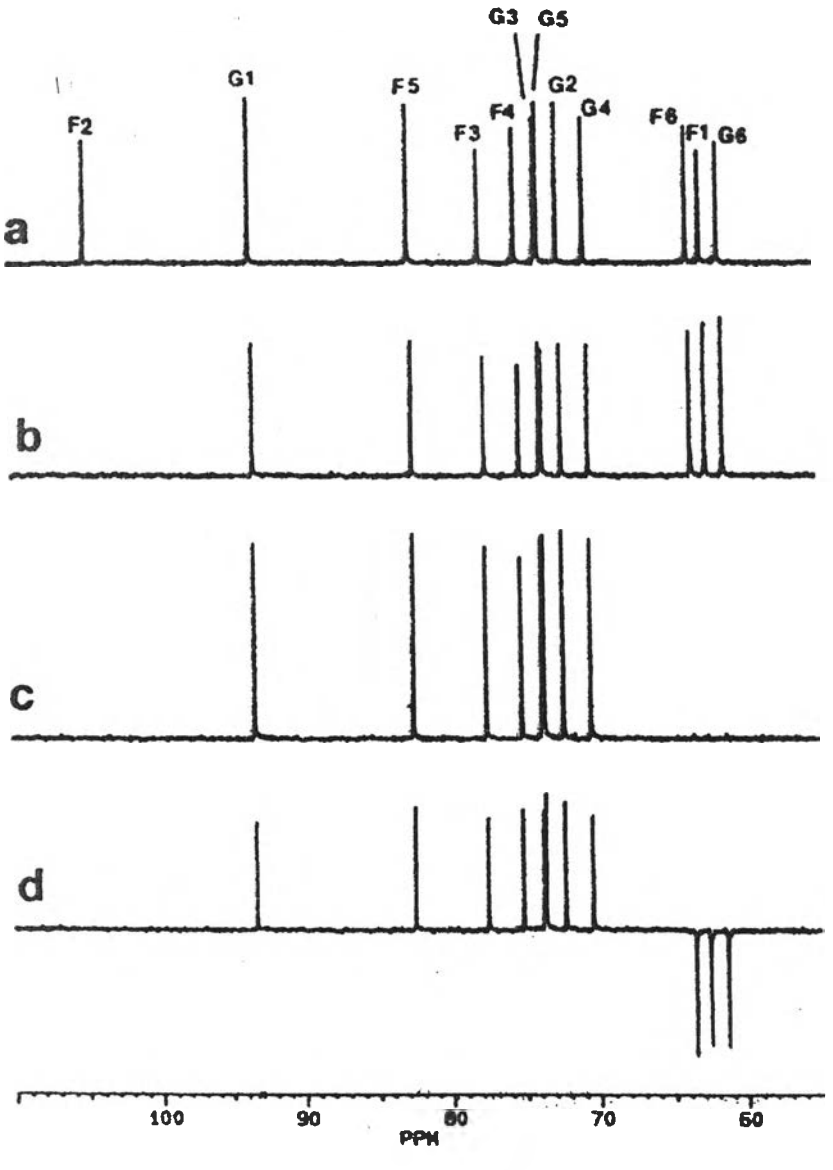


Figure A31a DEPT 90, DEPT 135 AND ^{13}C-NMR spectra. of sucrose (in D_2O) [25]

(a) Broadband proton-decoupled ^{13}C-NMR spectra of a sucrose solution in D_2O.

(b) DEPT spectra of the same sucrose solution θ 45 .

(c) DEPT spectra of the same sucrose solution θ 90.

(d) DEPT spectra of the same sucrose solution θ 135.

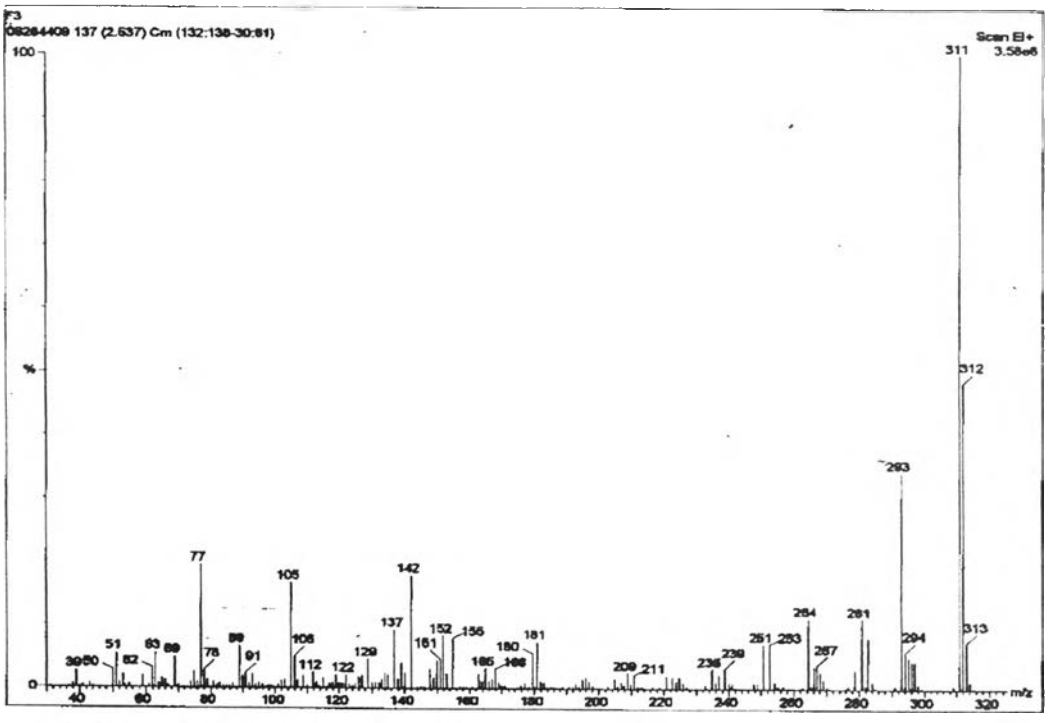


Figure A32 The EI mass spectrum of Compound 1.(3,5,7-trimethoxyflavone)

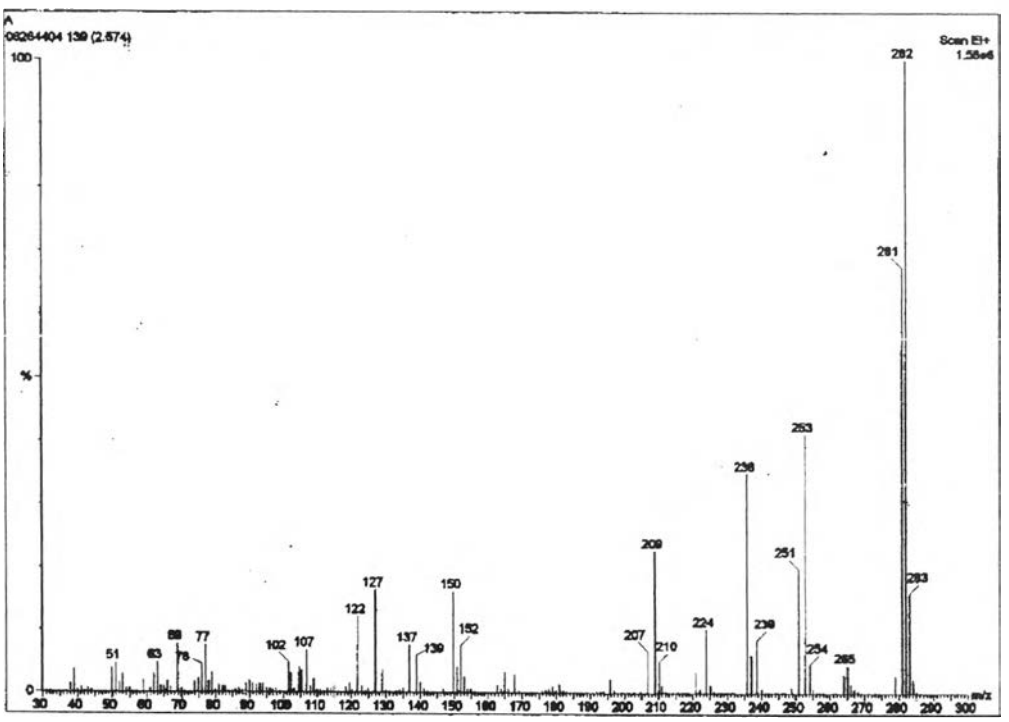


Figure A33 The EI mass spectrum of Compound 2.(5,7-dimethoxyflavone)

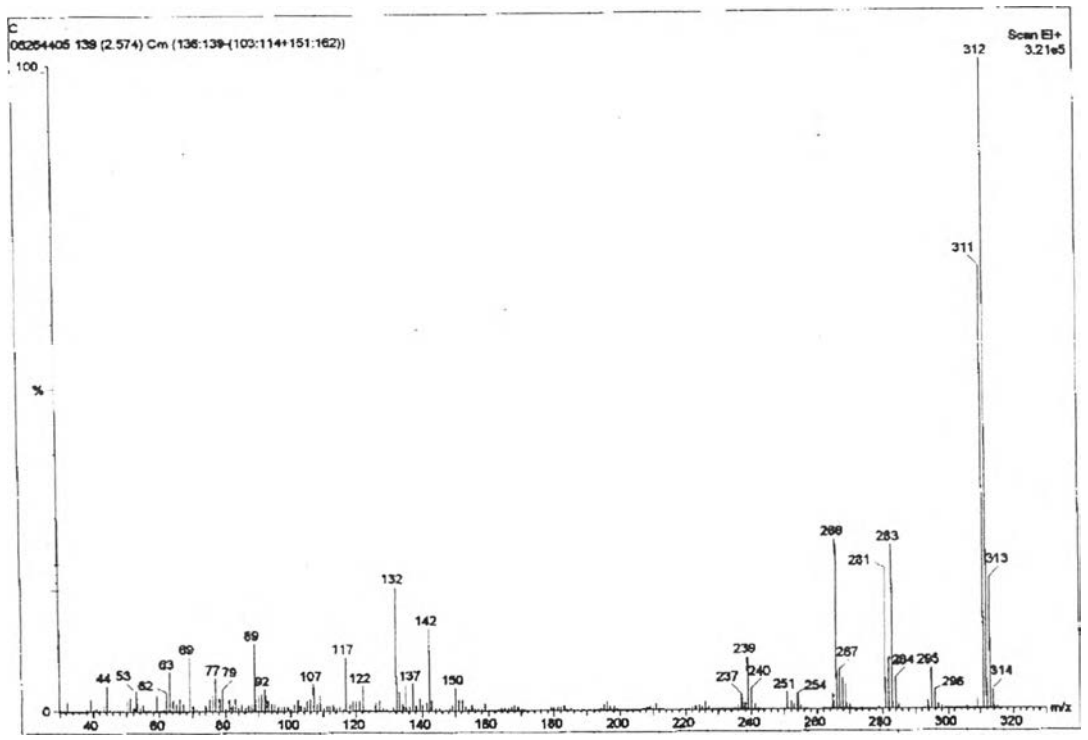


Figure A34 The EI mass spectrum of Compound 3.(5,7,4'-trimethoxyflavone)

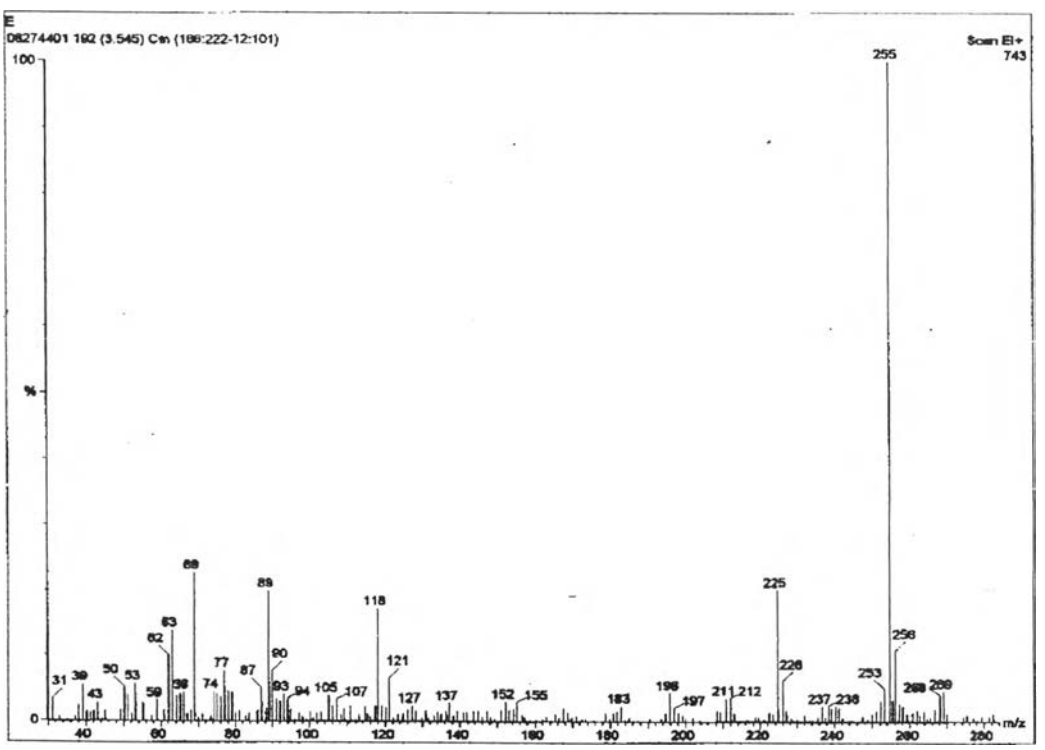


Figure A35 The EI mass spectrum of Compound 4.(4'-hydroxy -5,7-dimethoxyflavone)

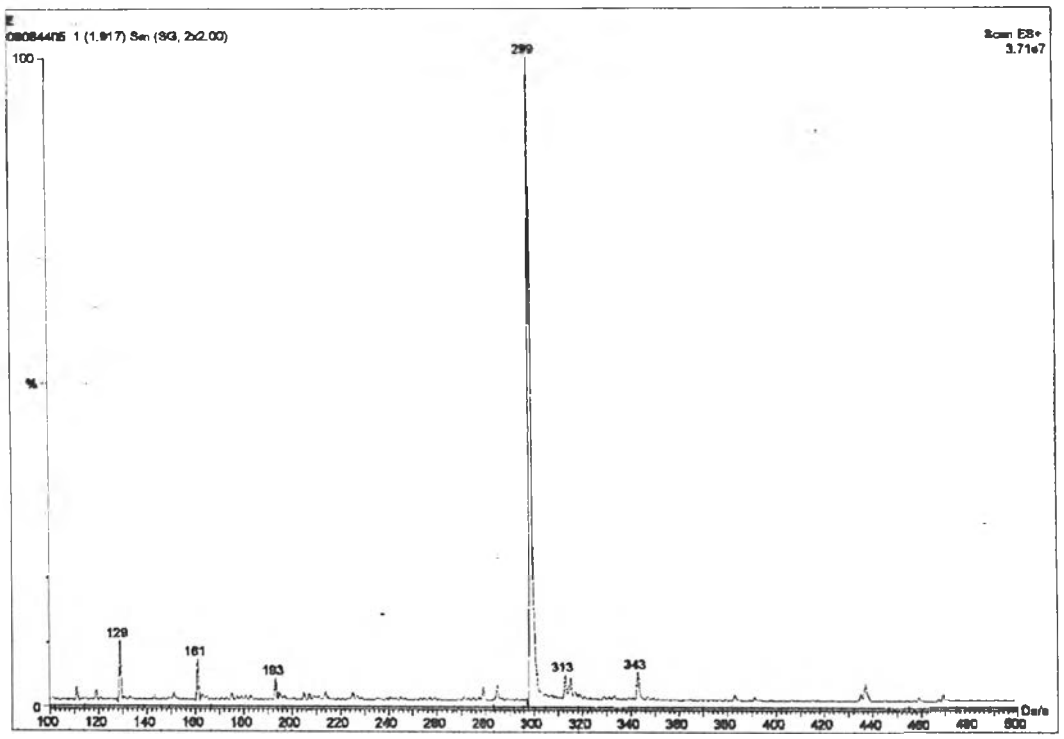


Figure A36 The LC mass spectrum of Compound 4.(4'-hydroxy -5,7-dimethoxyflavone)

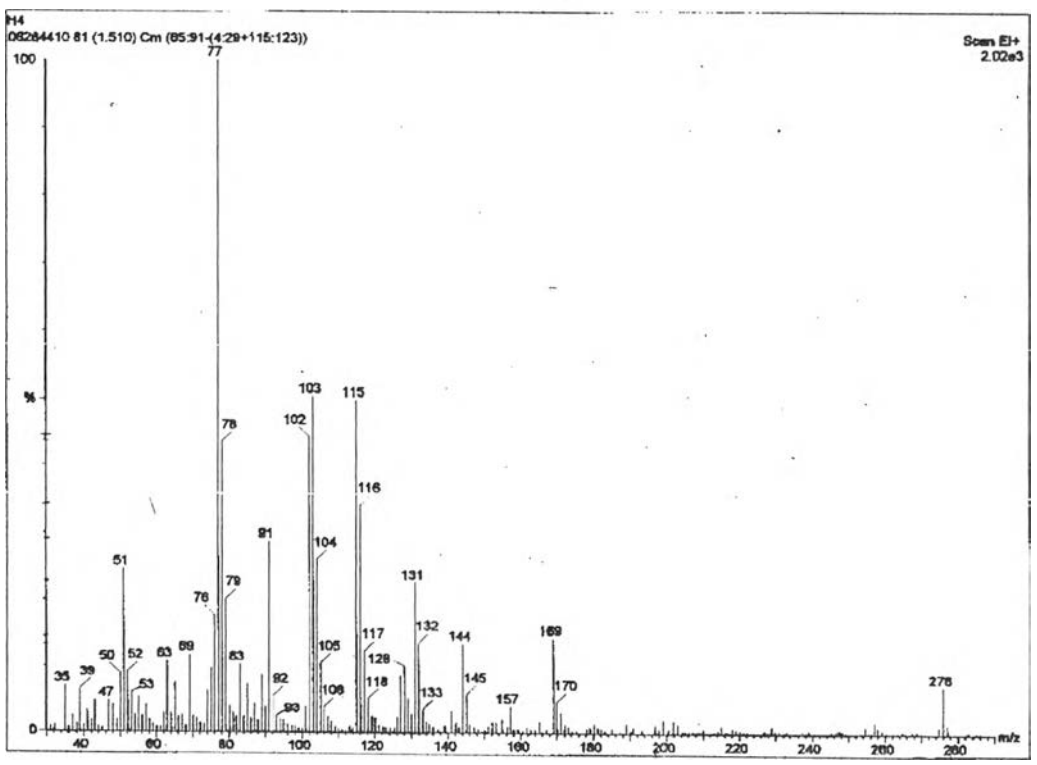


Figure A37 The EI mass spectrum of Compound 5.(dicinnamoylmethane)

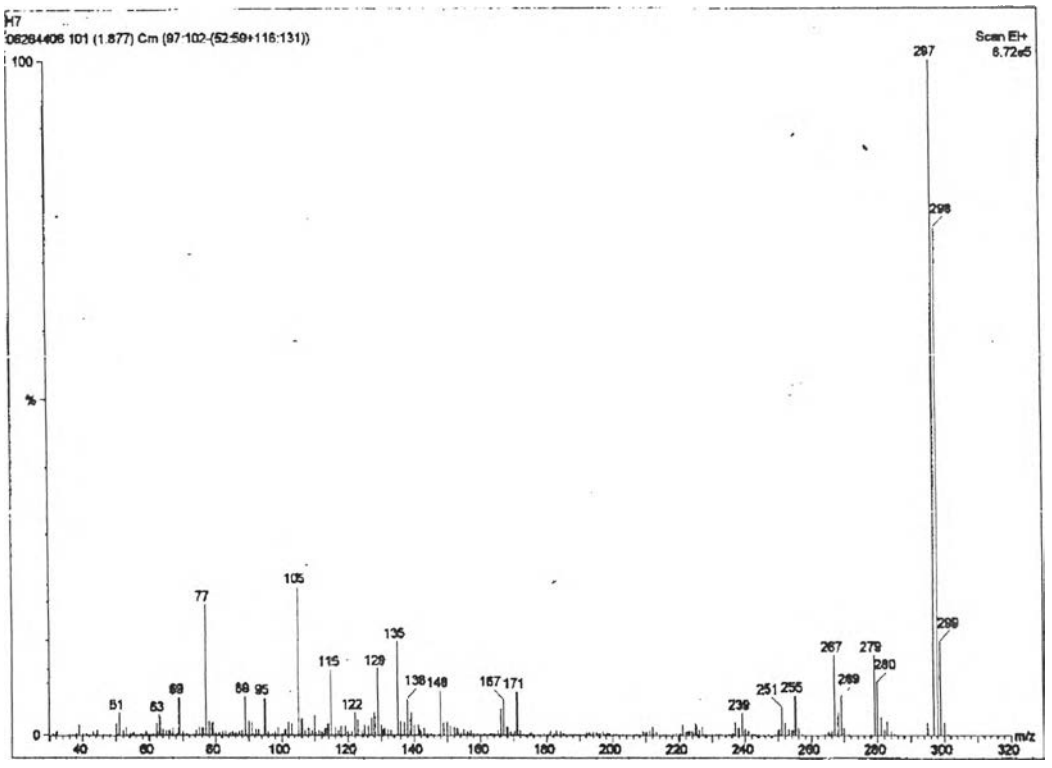


Figure A38 The EI mass spectrum of Compound 6.(5-hydroxy -3,7-dimethoxyflavone)

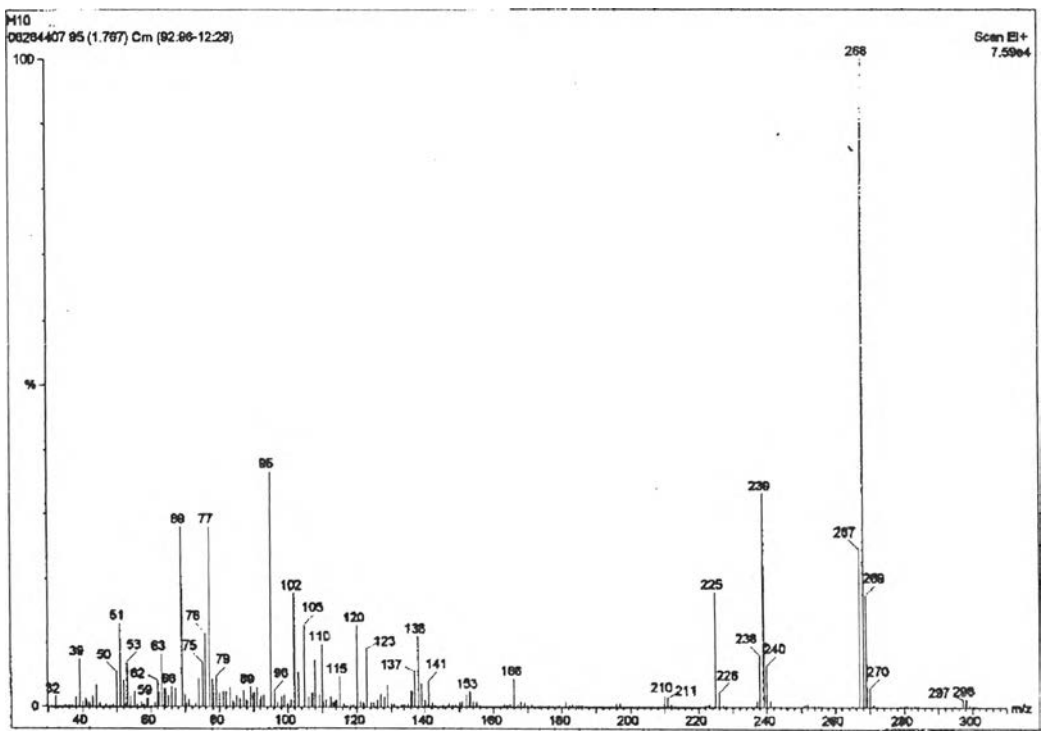


Figure A39 The EI mass spectrum of Compound 7.(5-hydroxy-7-methoxyflavone)

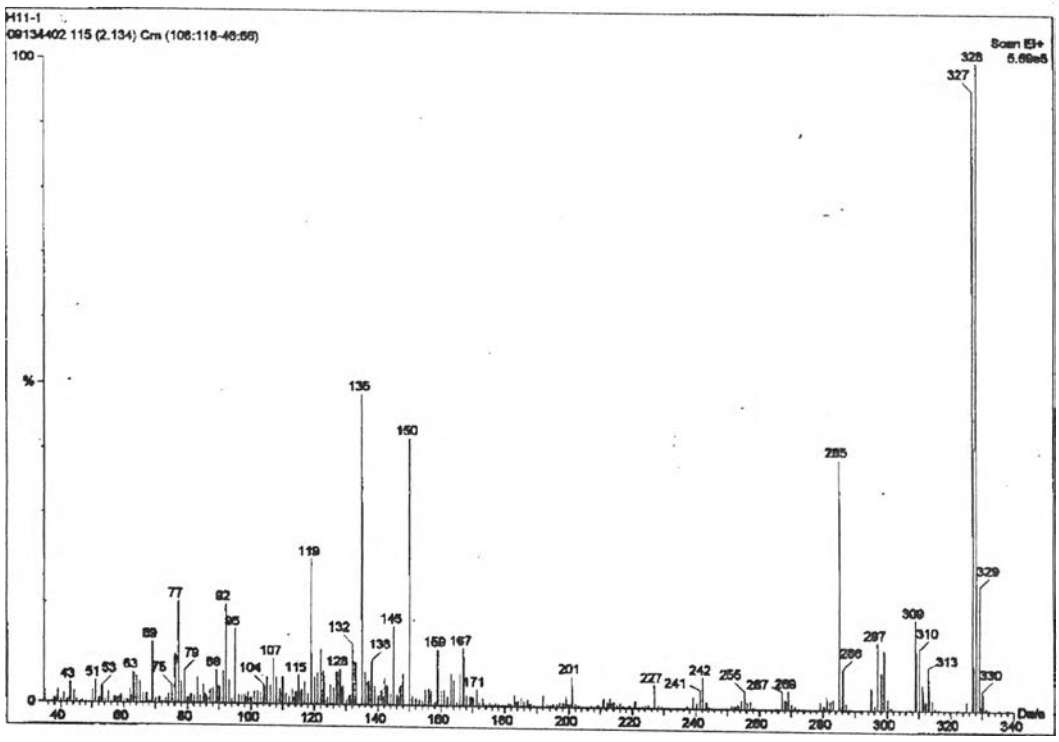


Figure A40 The EI mass spectrum of Compound 8. (5-hydroxy-3,7,4'-trimethoxyflavone)

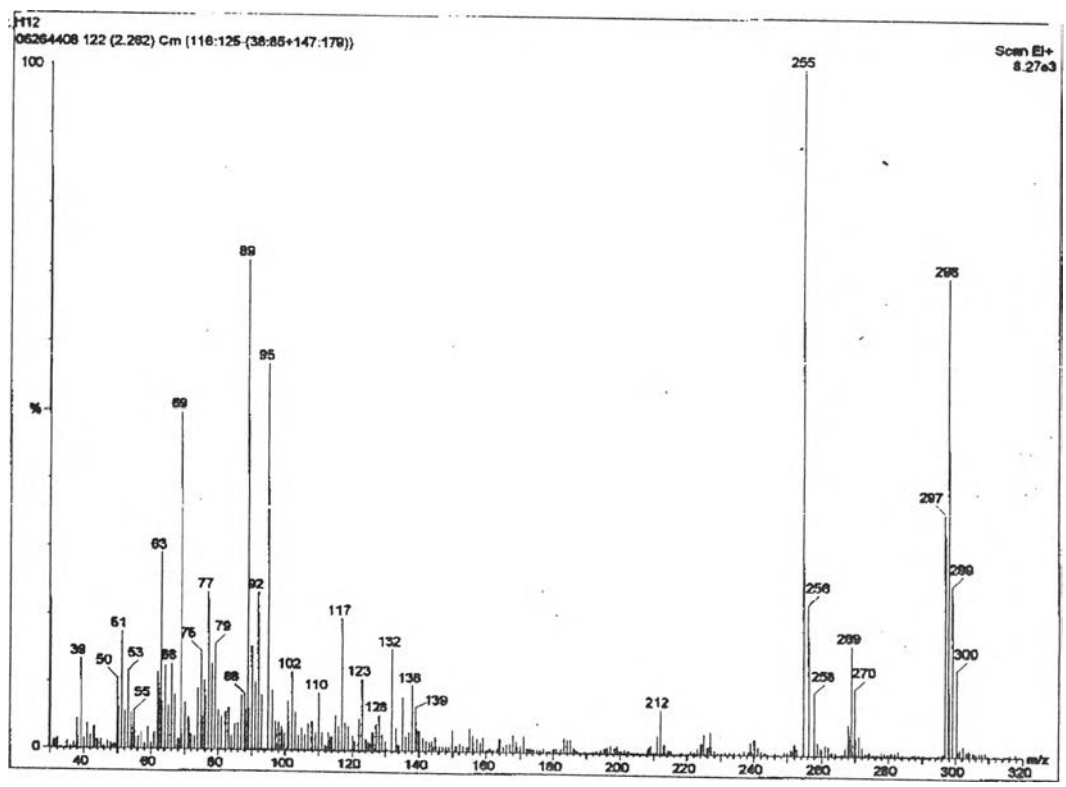
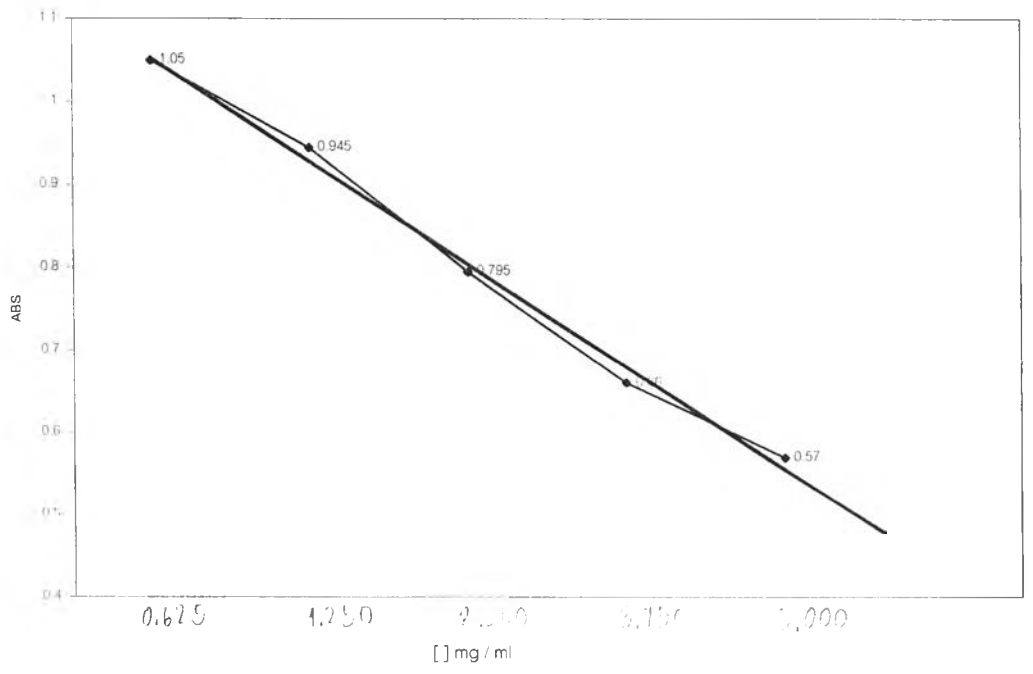
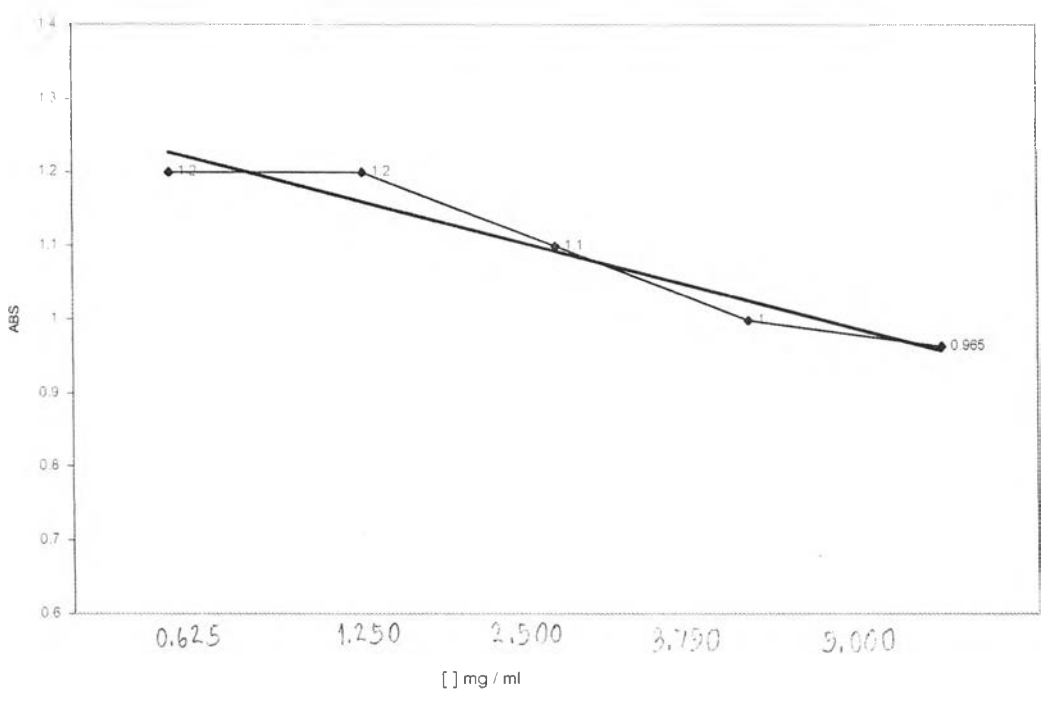


Figure A41 The EI mass spectrum of Compound 9.(5-hydroxy -7,4'-dimethoxyflavone)



IC_{50} = 16 mM

Figure A44 IC_{50} values of dicinnamoylmethane by DPPH method.



IC_{50} >14 mM

Figure A45 IC_{50} values of sucrose by DPPH method.

VITA

Miss Supana Deachodomphan was born on Febuary 16, 1974 in Bangkok, Thailand. She graduated primary school at Assumption Convent and high school at Mahaphurtaram. She graduated with a Bachelor Degree of Science, Faculty Agro-industry field of study Biotechnology from Kasetsart University in March 1996. In 1999, she was admitted into a Master Degree program in Biotechnology at Chulalongkorn University.