

MATERIAL SUPLEMENTAR

Composição química e atividade antileishmania de *Tocoyena hispidula*

Elcilene A. de Sousa^a, Amauri Porto A. Rosa^a, Rodolfo Ritchelle L. dos Santos^b, Ingredy L. dos Santos^b, Valéria C. de Sousa^b, Fernando Aécio de A. Carvalho^b, Gerardo M. Vieira Júnior^a e Mariana H. Chaves^{a,*}

^aDepartamento de Química, Universidade Federal do Piauí, 64049-550 Teresina – PI, Brasil

^bDepartamento de Bioquímica e Farmacologia, Universidade Federal do Piauí, 64049-550 Teresina – PI, Brasil

*e-mail: mariana@ufpi.edu.br

DADOS ESPECTROSCÓPICOS DOS COMPOSTOS ISOLADOS

D-(+)-Manitol (1): sólido branco. $[\alpha]_D^{20} +8,7^\circ$ (c 0,001, DMSO). IV ν_{\max} KBr cm^{-1} : 3300-3400 (OH), 2900 (C-H), 1100 e 1050 (C-O). RMN de ^1H [400 MHz, DMSO- d_6 , δ (ppm)]: 3,37 (m, H1/H6) e 3,61 (encoberto, H-1/H-6), 3,44 (m, H-2/H-5), 3,53 (t, $J=7,8$ Hz, H-3/H-4), 4,43 (t, $J=5,5$ Hz, OH-1/OH-6), 4,47 (d, $J=5,5$ Hz, OH-2/OH-5), 4,20 (d, $J=7,0$ Hz, OH-3/OH-4). RMN ^{13}C (100 MHz, DMSO- d_6): 64,0 (C-1/C-6), 69,9 (C-2/C-5) e 71,5 (C-3/C-4) (Figuras 1S-3S).¹

Lupenona (2): sólido amarelo. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 39,8 (C-1), 34,3 (C-2), 218,4 (C-3), 47,5 (C-4), 55,1 (C-5), 19,8 (C-6), 33,8 (C-7), 41,0 (C-8), 49,9 (C-9), 37,1 (C-10), 21,6 (C-11), 25,3 (C-12), 38,3 (C-13), 43,1 (C-14), 27,6 (C-15), 35,7 (C-16), 43,2 (C-17), 48,4 (C-18), 48,1 (C-19), 151,0 (C-20), 29,9 (C-21), 40,1 (C-22), 26,8 (C-23), 21,2 (C-24), 15,9 (C-25), 16,2 (C-26), 14,6 (C-27), 18,2 (C-28), 109,5 (C-29) e 19,5 (C-30) (Figuras 4S-5S).²

Multiflorenol (3): sólido branco. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 36,2 (C-1), 27,8 (C-2), 79,4 (C-3), 38,9 (C-4), 50,2 (C-5), 24,3 (C-6), 117,9 (C-7), 147,6 (C-8), 48,9 (C-9), 35,3 (C-10), 17,2

(C-11), 34,7 (C-12), 37,1 (C-13), 41,7 (C-14), 31,8 (C-15), 36,7 (C-16), 31,1 (C-17), 47,0 (C-18), 36,3 (C-19), 28,4 (C-20), 34,0 (C-21), 37,3 (C-22), 27,8 (C-23), 15,0 (C-24), 13,3 (C-25), 27,2 (C-26), 26,3 (C-27), 31,1 (C-28), 34,3 (C-29) e 33,8 (C-30) (Figuras 6S-9S).³

Lupeol (4): sólido branco. RMN de ¹³C [100 MHz, CDCl₃, δ (ppm)]: 38,8 (C-1), 27,5 (C-2), 79,1 (C-3), 39,0 (C-4), 55,4 (C-5), 18,5 (C-6), 34,4 (C-7), 41,0 (C-8), 50,6 (C-9), 37,3 (C-10), 21,1 (C-11), 25,3 (C-12), 38,2 (C-13), 43,0 (C-14), 27,6 (C-15), 35,7 (C-16), 43,1 (C-17), 48,4 (C-18), 48,1 (C-19), 151,1 (C-20), 29,8 (C-21), 40,1 (C-22), 28,1 (C-23), 15,5 (C-24), 16,3 (C-25), 16,1 (C-26), 14,7 (C-27), 18,1 (C-28), 109,5 (C-29) e 19,4 (C-30) (Figuras 6S-9S/18S-19S).³

Sitosterol (5): sólido branco. RMN de ¹³C [100 MHz, CDCl₃, δ (ppm)]: 37,4 (C-1), 31,8 (C-2), 72,0 (C-3), 42,3 (C-4), 140,9 (C-5), 121,9 (C-6), 32,1 (C-7), 32,1 (C-8), 50,3 (C-9), 36,7 (C-10), 21,2 (C-11), 39,9 (C-12), 42,5 (C-13), 56,9 (C-14), 24,5 (C-15), 28,4 (C-16), 56,2 (C-17), 12,0 (C-18), 19,5 (C-19), 36,3 (C-20), 18,9 (C-21), 34,1 (C-22), 26,2 (C-23), 46,0 (C-24), 29,3 (C-25), 20,0 (C-26), 19,2 (C-27), 23,2 (C-28), 12,1 (C-29) (Figuras 6S-7S/10S-11S).⁴

Estigmasterol (6): sólido branco. RMN de ¹³C [100 MHz, CDCl₃, δ (ppm)]: 37,4 (C-1), 31,8 (C-2), 72,0 (C-3), 42,3 (C-4), 140,9 (C-5), 121,9 (C-6), 32,1 (C-7), 32,0 (C-8), 50,3 (C-9), 36,7 (C-10), 21,2 (C-11), 39,8 (C-12), 42,4 (C-13), 57,0 (C-14), 24,5 (C-15), 29,1 (C-16), 56,1 (C-17), 12,2 (C-18), 19,1 (C-19), 40,6 (C-20), 21,4 (C-21), 138,5 (C-22), 129,4 (C-23), 51,4 (C-24), 32,0 (C-25), 21,4 (C-26), 18,8 (C-27), 25,5 (C-28), 12,4 (C-29) (Figuras 6S-7S/10S-11S).⁴

Taraxerol (7): RMN de ¹³C [100 MHz, CDCl₃, δ (ppm)]: 37,8 (C-1), 27,3 (C-2), 79,2 (C-3), 39,2 (C-4), 55,7 (C-5), 18,9 (C-6), 35,3 (C-7), 38,9 (C-8), 48,9 (C-9), 38,1 (C-10), 17,6 (C-11), 35,3 (C-12), 38,1 (C-13), 158,2 (C-14), 117,0 (C-15), 36,8 (C-16), 38,1 (C-17), 49,4 (C-18), 41,0 (C-19), 28,9 (C-20), 33,8 (C-21), 33,2 (C-22), 28,1 (C-23), 15,6 (C-24), 15,6 (C-25), 30,1 (C-26), 26,0 (C-27), 30,0 (C-28), 33,5 (C-29) e 21,4 (C-30) (Figuras 18S-19S).³

Germanicol (8): RMN de ¹³C [100 MHz, CDCl₃, δ (ppm)]: 37,9 (C-1), 27,4 (C-2), 79,1 (C-3), 39,0 (C-4), 55,6 (C-5), 18,4 (C-6), 34,7 (C-7), 41,0 (C-8), 51,4 (C-9), 37,4 (C-10), 21,2 (C-11), 26,4 (C-12), 39,1 (C-13), 45,5 (C-14), 27,7 (C-15), 37,6 (C-16), 34,5 (C-17), 142,9 (C-18), 129,8 (C-19), 32,5 (C-20), 33,2 (C-21), 37,4 (C-22), 28,2 (C-23), 15,5 (C-24), 16,2 (C-25), 16,8 (C-26), 14,7 (C-27), 25,4 (C-28), 31,5 (C-29) e 29,3 (C-30) (Figuras 18S-19S).³

β-amirina (**9**): RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 38,7 (C-1), 27,3 (C-2), 79,0 (C-3), 38,9 (C-4), 55,3 (C-5), 18,5 (C-6), 32,8 (C-7), 38,9 (C-8), 47,8 (C-9), 37,7 (C-10), 23,7 (C-11), 121,9 (C-12), 145,3 (C-13), 41,9 (C-14), 26,3 (C-15), 27,2 (C-16), 32,6 (C-17), 47,4 (C-18), 47,0 (C-19), 31,2 (C-20), 34,8 (C-21), 37,3 (C-22), 28,5 (C-23), 15,6 (C-24), 15,7 (C-25), 16,9 (C-26), 26,1 (C-27), 28,5 (C-28), 32,9 (C-29) e 23,8 (C-30) (Figuras 18S-19S).³

Ácido acetil oleanólico (**10**): sólido branco. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 38,2 (C-1), 23,5 (C-2), 81,1 (C-3), 37,8 (C-4), 55,4 (C-5), 18,3 (C-6), 32,6 (C-7), 39,4 (C-8), 47,7 (C-9), 37,1 (C-10), 23,5 (C-11), 122,7 (C-12), 143,7 (C-13), 41,7 (C-14), 27,8 (C-15), 23,0 (C-16), 46,7 (C-17), 41,0 (C-18), 46,0 (C-19), 30,8 (C-20), 33,9 (C-21), 32,6 (C-22), 28,2 (C-23), 16,8 (C-24), 15,5 (C-25), 17,3 (C-26), 26,0 (C-27), 184,2 (C-28), 33,2 (C-29), 23,5 (C-30), 171,2 (C-1') e 21,4 (C-2') (Figuras 27S-28S).⁶

E-fitol (**11**): RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 59,6 (C-1), 123,2 (C-2), 140,4 (C-3), 40,0 (C-4), 24,9 (C-5), 36,7 (C-6), 32,8 (C-7), 37,5 (C-8), 24,3 (C-9), 37,4 (C-10), 32,8 (C-11), 37,3 (C-12), 24,6 (C-13), 39,5 (C-14), 28,1 (C-15), 22,9 (C-16), 22,8 (C-17), 19,9 (C-18), 19,9 (C-19) e 16,2 (C-20) (Figuras 18S-19S).⁷

7-cetositosterol (**16**): sólido branco. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 36,5 (C-1), 31,4 (C-2), 70,7 (C-3), 42,0 (C-4), 165,2 (C-5), 126,3 (C-6), 202,4 (C-7), 45,6 (C-8), 50,1 (C-9), 38,4 (C-10), 21,4 (C-11), 38,9 (C-12), 43,3 (C-13), 50,1 (C-14), 26,3 (C-15), 28,7 (C-16), 54,9 (C-17), 12,1 (C-18), 17,5 (C-19), 36,2 (C-20), 19,1 (C-21), 34,1 (C-22), 26,6 (C-23), 46,0 (C-24), 29,3 (C-25), 19,9 (C-26), 19,2 (C-27), 23,2 (C-28), 12,1 (C-29) (Figuras 29S-30S).⁸

7-cetoestigmasterol (**17**): sólido branco. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 36,5 (C-1), 31,4 (C-2), 70,7 (C-3), 42,0 (C-4), 165,2 (C-5), 126,3 (C-6), 202,4 (C-7), 45,6 (C-8), 50,2 (C-9), 38,4 (C-10), 21,4 (C-11), 38,8 (C-12), 43,2 (C-13), 50,2 (C-14), 26,6 (C-15), 29,2 (C-16), 54,9 (C-17), 12,1 (C-18), 17,5 (C-19), 40,4 (C-20), 21,6 (C-21), 138,2 (C-22), 129,7 (C-23), 51,4 (C-24), 32,0 (C-25), 21,2 (C-26), 19,2 (C-27), 25,5 (C-28), 12,4 (C-29) (Figuras 29S-30S).⁸

Lapachol (**18**): sólido laranja. RMN de ^{13}C [100 MHz, CDCl_3 , δ (ppm)]: 184,7 (C-1), 152,8 (C-2), 123,6 (C-3), 181,8 (C-4), 133,0 (C-4a), 126,2 (C-5), 135,0 (C-6), 133,0 (C-7), 126,9 (C-8), 129,6 (C-8a), 22,8 (C-1'), 119,8 (C-2'), 134,0 (C-3'), 18,0 (C-4') e 25,9 (C-5') (Figuras 31S-32S).⁹

Morindolídeo (**20**): Óleo amarelo. RMN de ^{13}C [150 MHz, CDCl_3 , δ (ppm)]: 173,3 (C-1), 67,8 (C-3), 29,3 (C-4), 34,8 (C-5), 38,9 (C-6), 129,3 (C-7), 140,0 (C-8), 50,6 (C-9), 60,7 (C-10) (Figuras 37S-40S).¹⁰

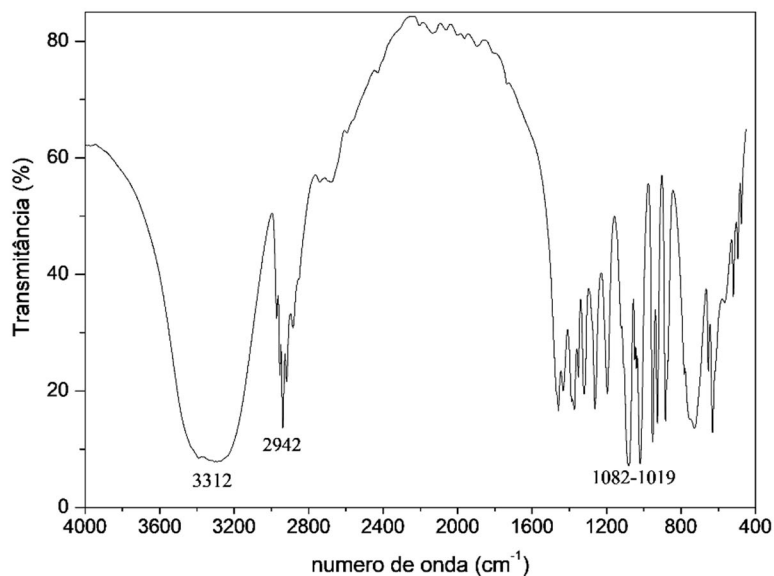


Figura 1S. Espectro no IV (KBr) de **1**

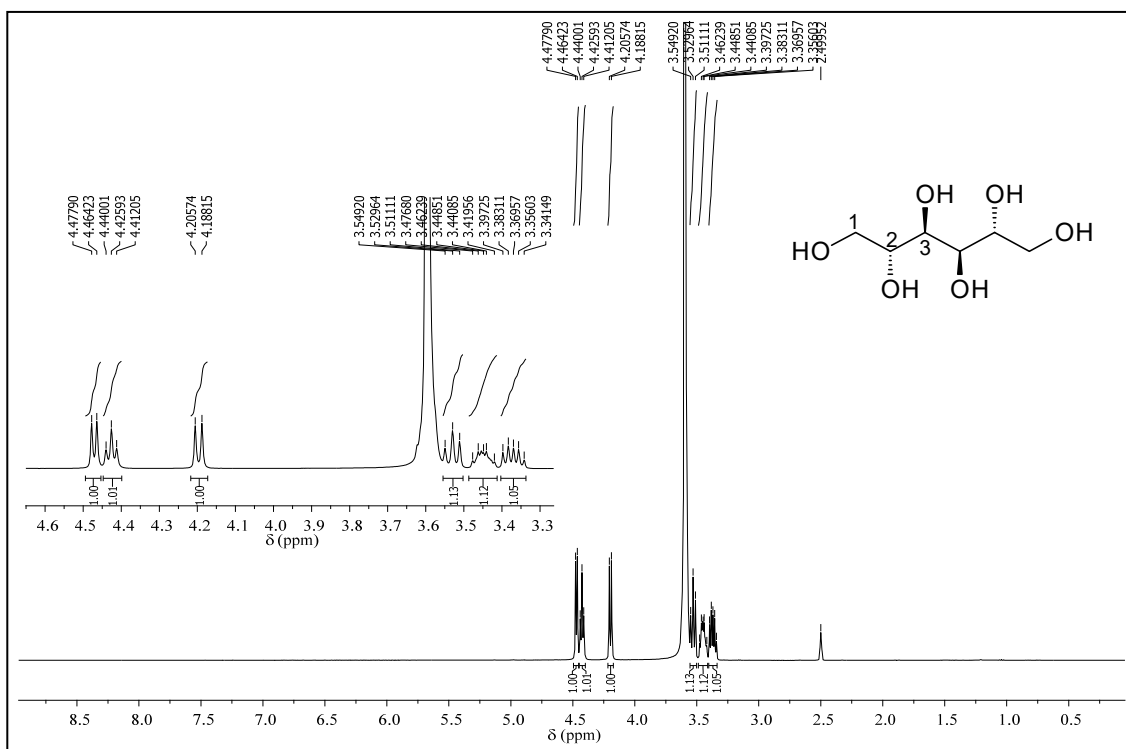


Figura 2S. Espectro de RMN de ^1H de **1** ($\text{DMSO}-d_6$, 400 MHz)

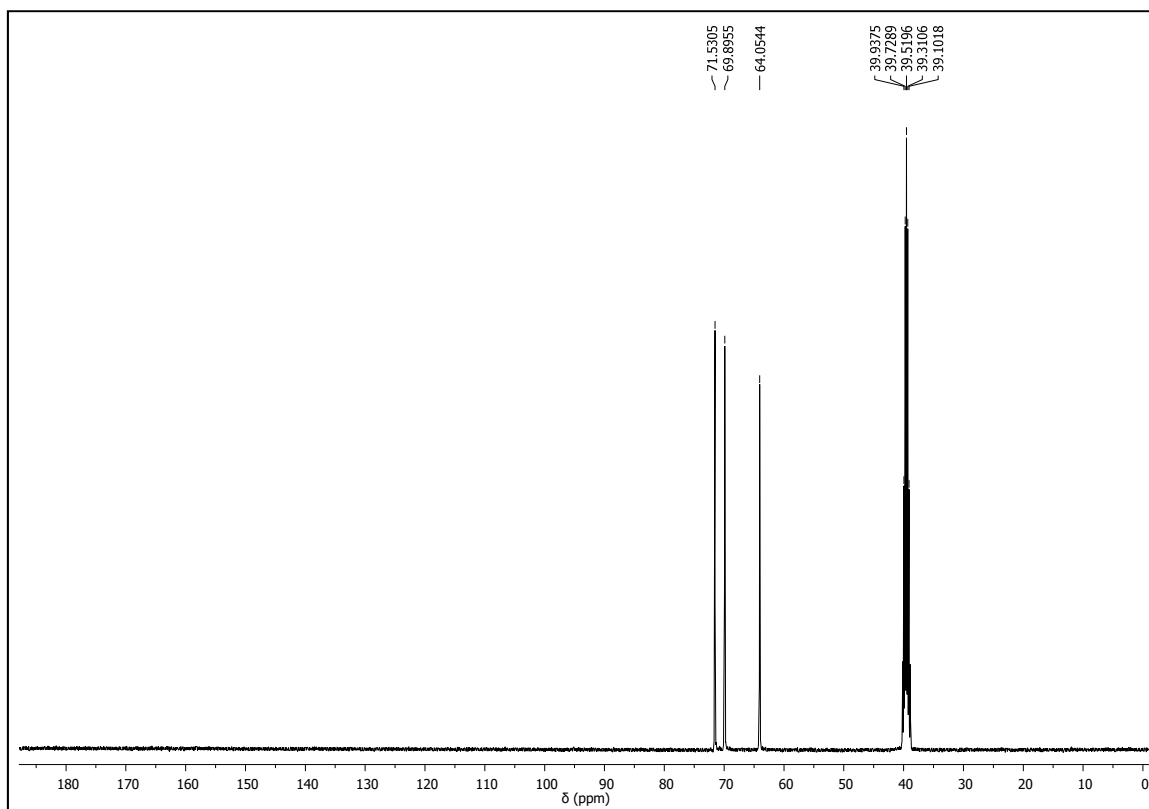


Figura 3S. Espectro de RMN de ^{13}C de **1** (DMSO-d_6 , 100 MHz)

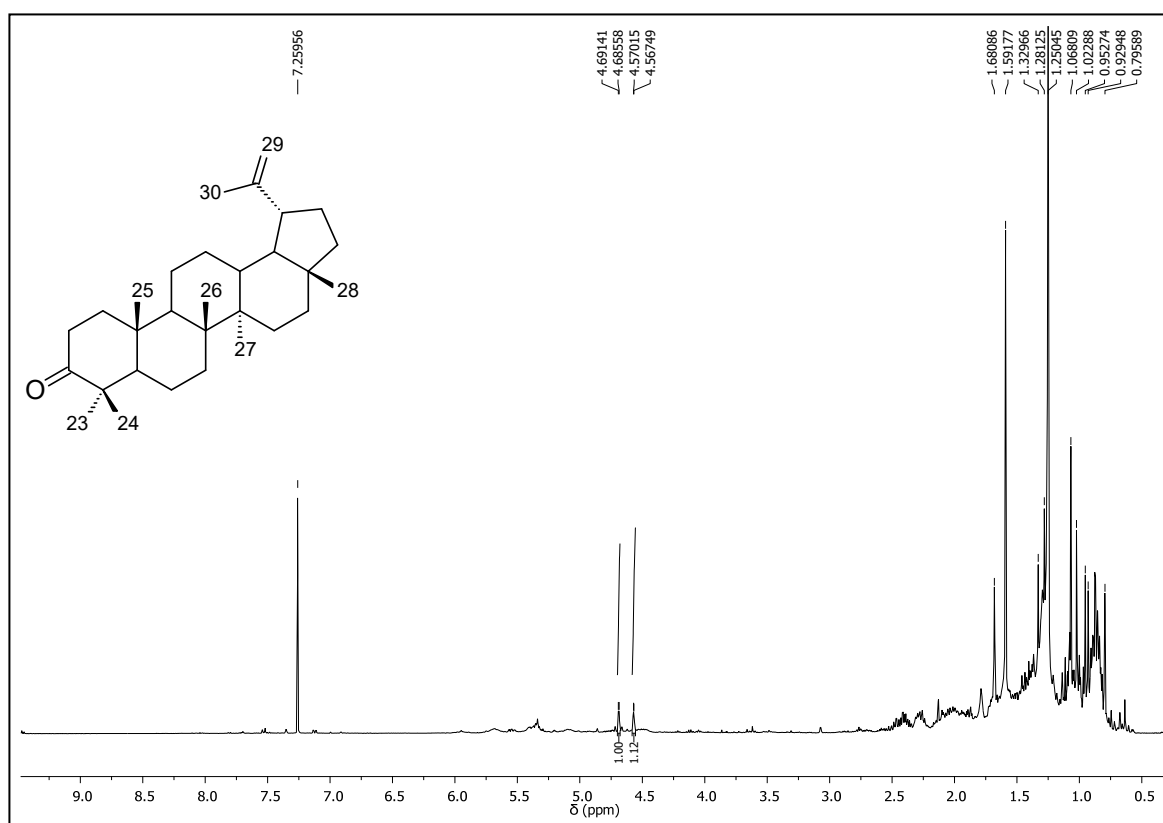


Figura 4S. Espectro de RMN de ^1H de **2** (CDCl_3 , 400 MHz)

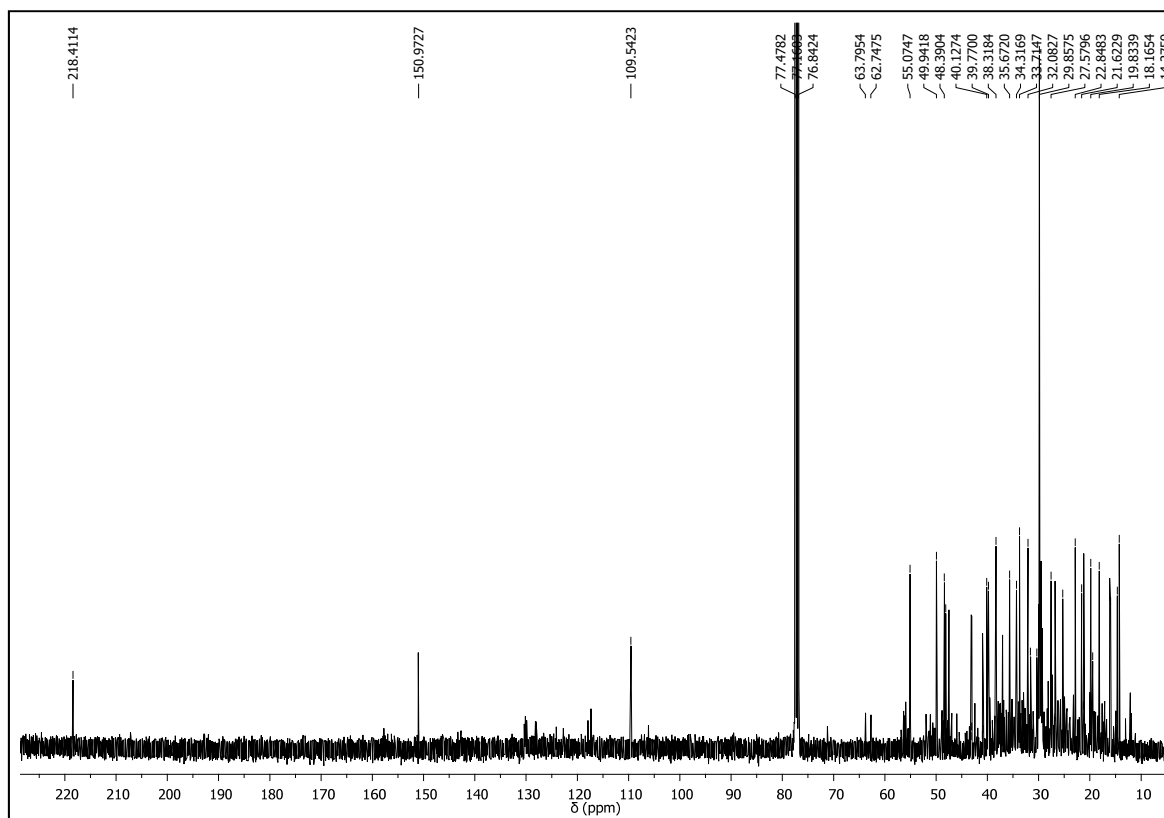


Figura 5S. Espectro de RMN de ^{13}C de **2** (CDCl_3 , 100 MHz)

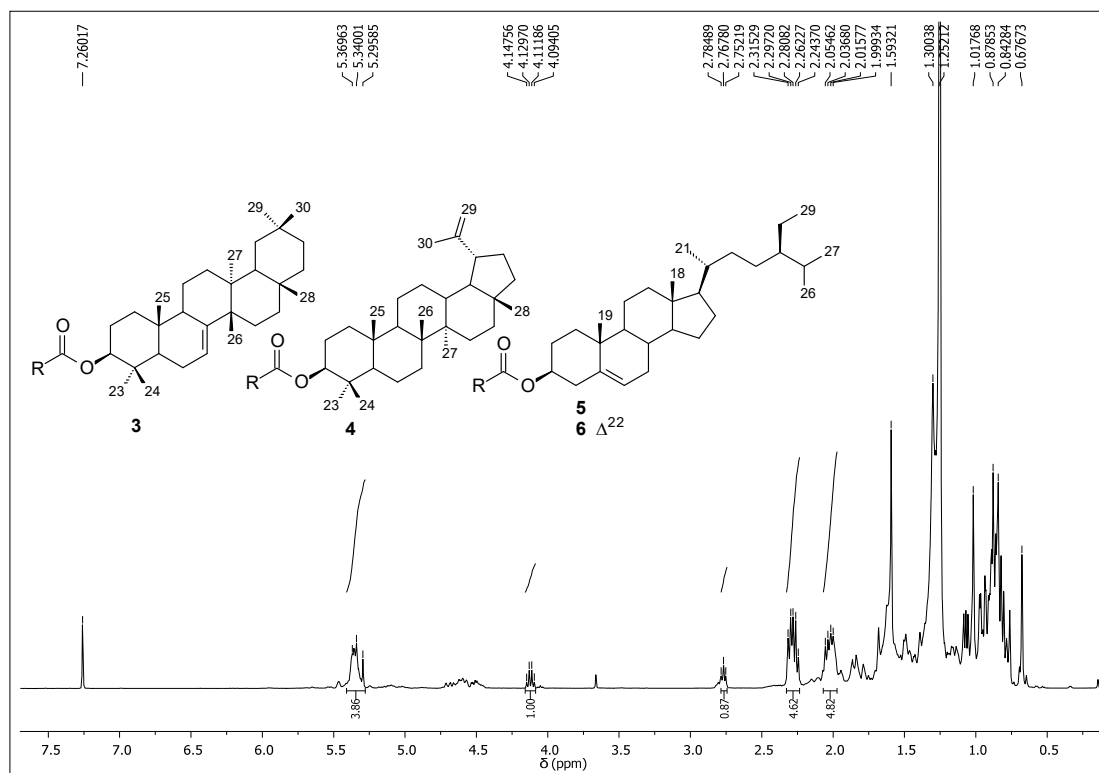


Figura 6S. Espectro de RMN de ^1H de M1 (triterpenos e esteroides esterificados com ácidos graxos; **3a-3e**, **4a-4e**, **5a-5e** e **6a-6e**) (CDCl_3 , 400 MHz)

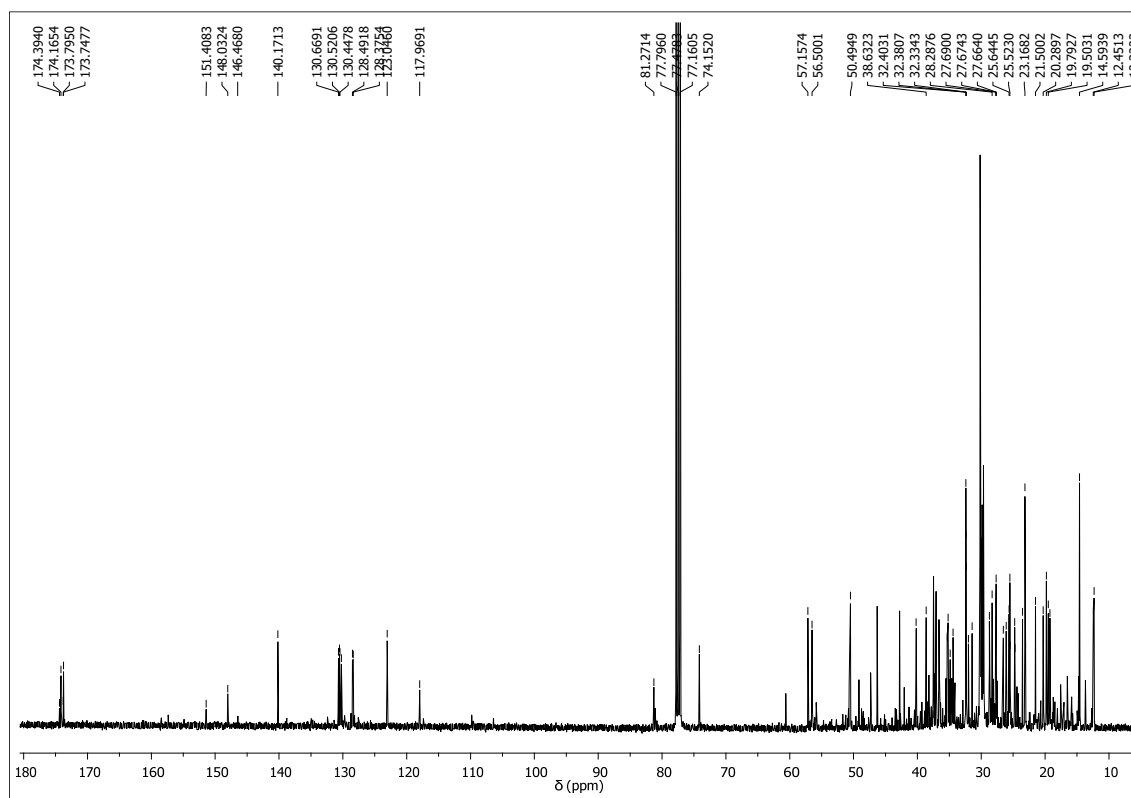


Figura 7S. Espectro de RMN de ^{13}C de MI (triterpenos e esteroides esterificados com ácidos graxos; 3a-3e, 4a-4e, 5a-5e e 6a-6e) (CDCl_3 , 100 MHz)

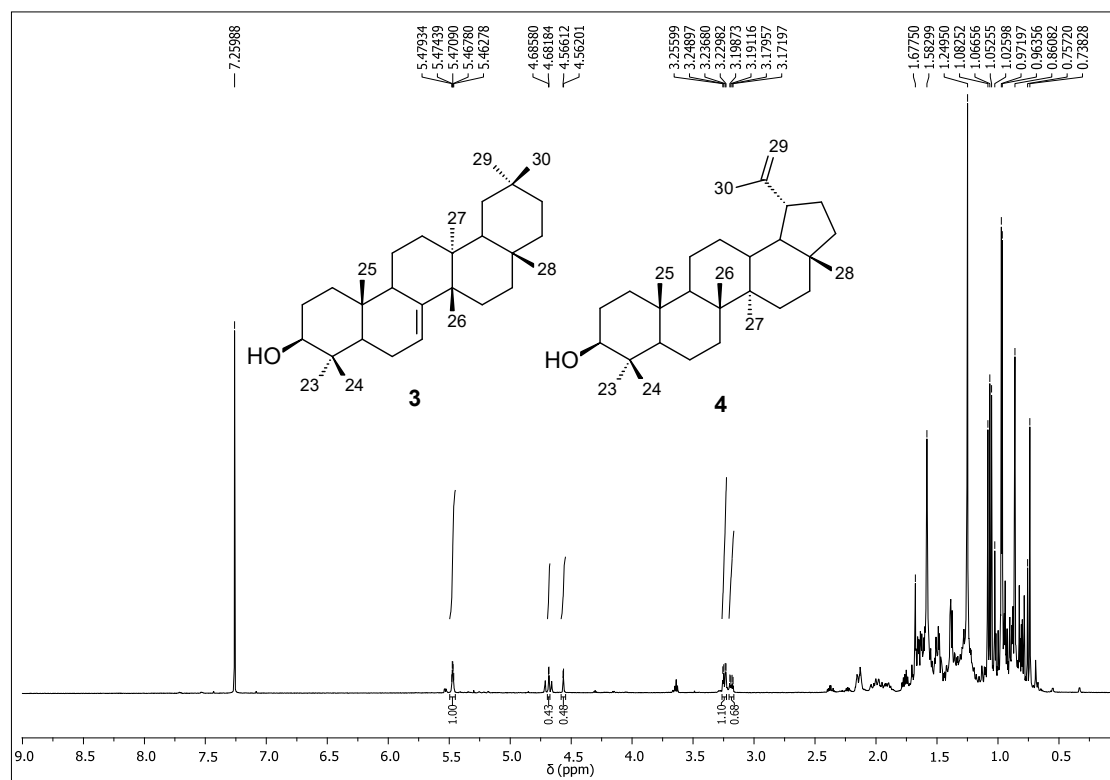


Figura 8S. Espectro de RMN de ^1H de 3+4 (CDCl_3 , 600 MHz)

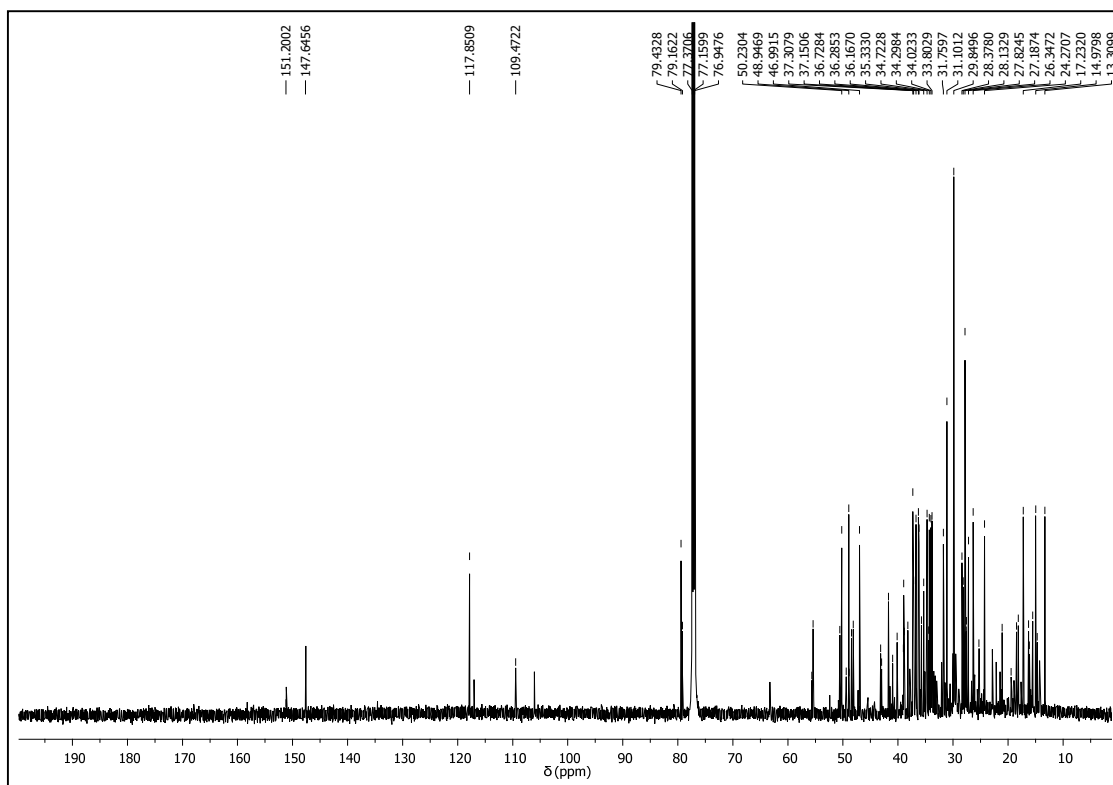


Figura 9S. Espectro de RMN de ^{13}C de 3+4 (CDCl_3 , 150 MHz)

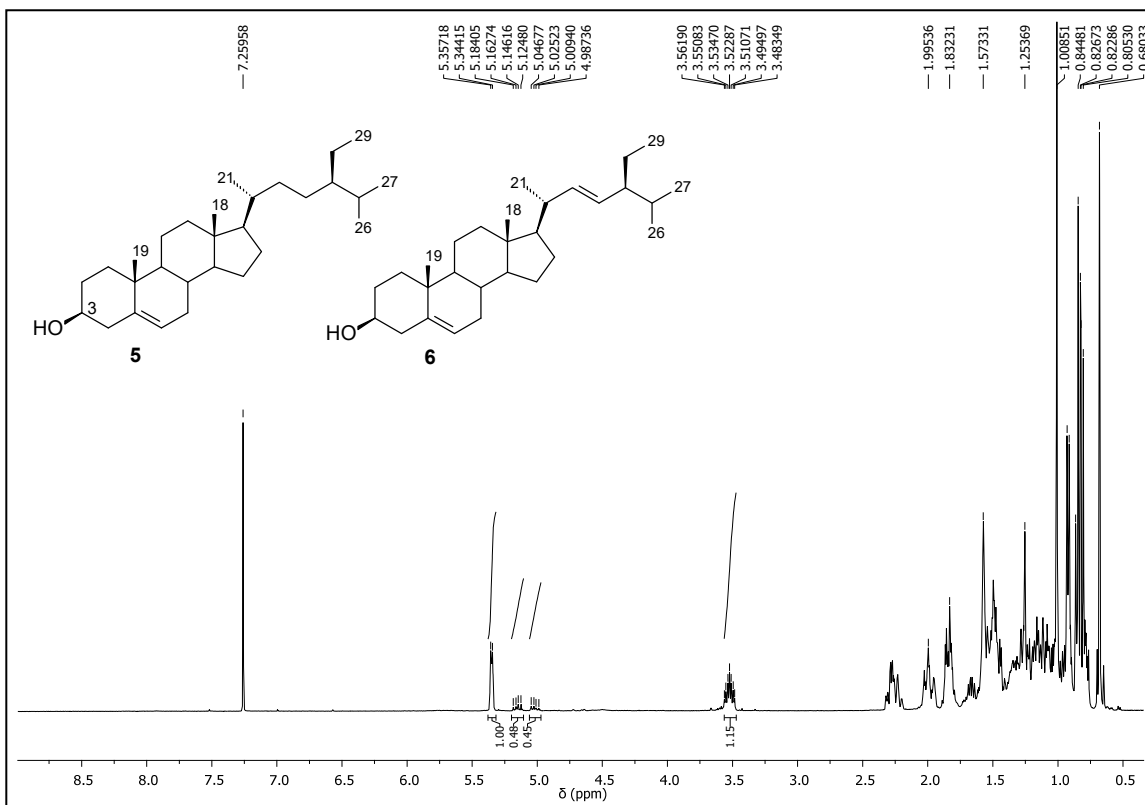


Figura 10S. Espectro de RMN de ^1H de 5+6 (CDCl_3 , 400 MHz)

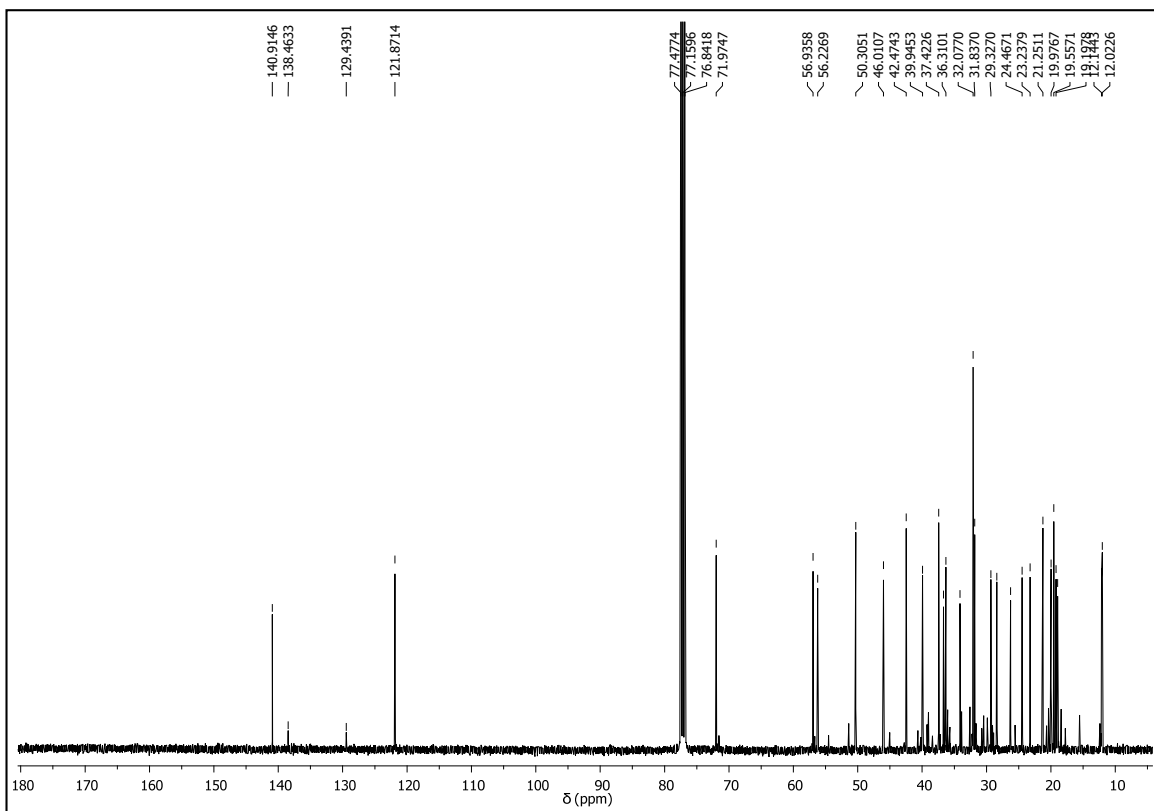


Figura 11S. Espectro de RMN de ^{13}C de 5+6 (CDCl_3 , 100 MHz)

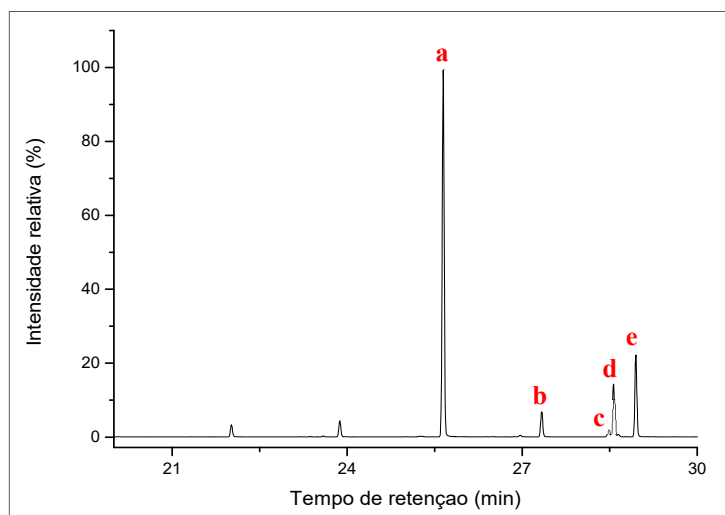


Figura 12S. Cromatograma de íons monitorados (MIC) dos ésteres metílicos de ácidos graxos (a-e)

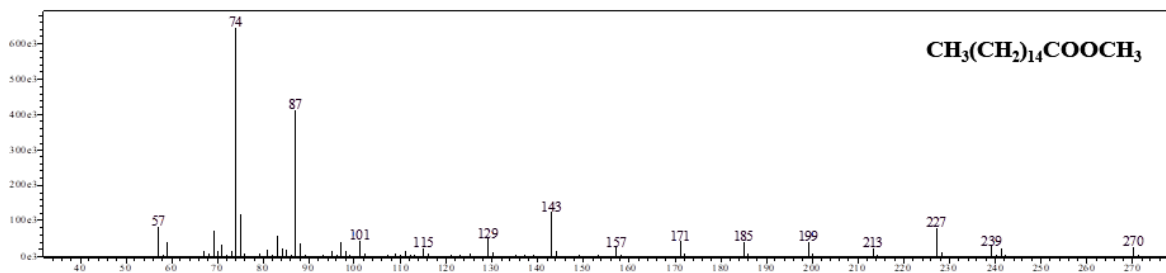


Figura 13S. Espectro de massas do palmitato de metila (a)

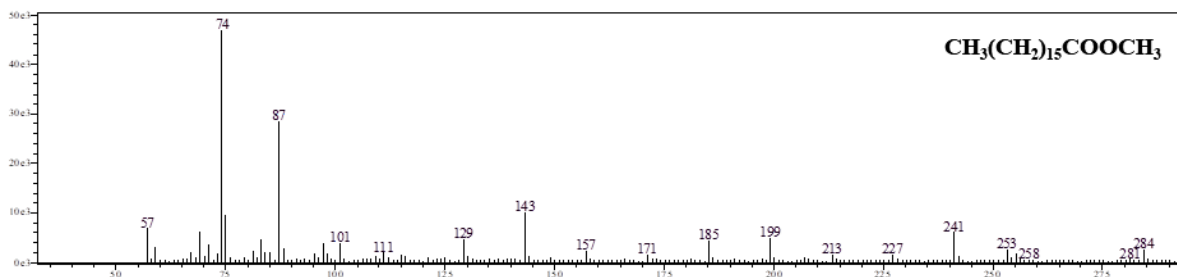


Figura 14S. Espectro de massas do margarato de metila (b)

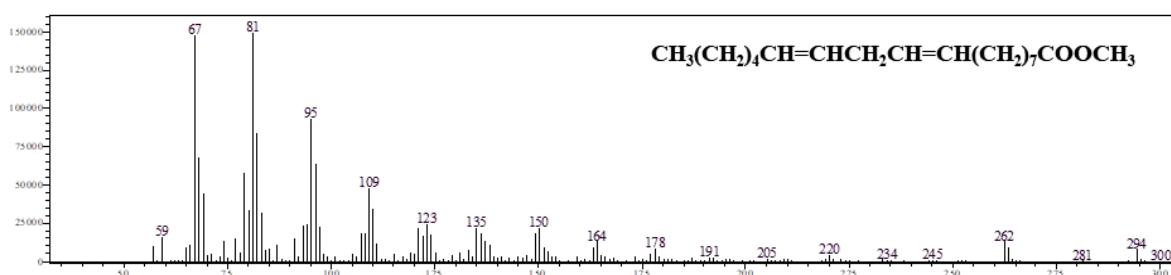


Figura 15S. Espectro de massas do linoleato de metila (c)

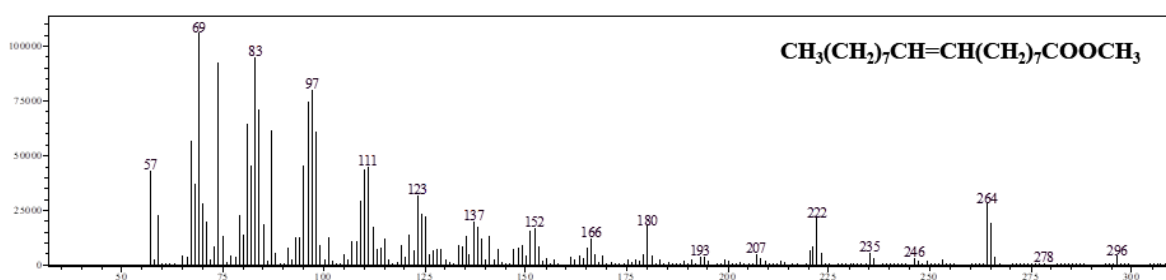


Figura 16S. Espectro de massas do oleato de metila (d)

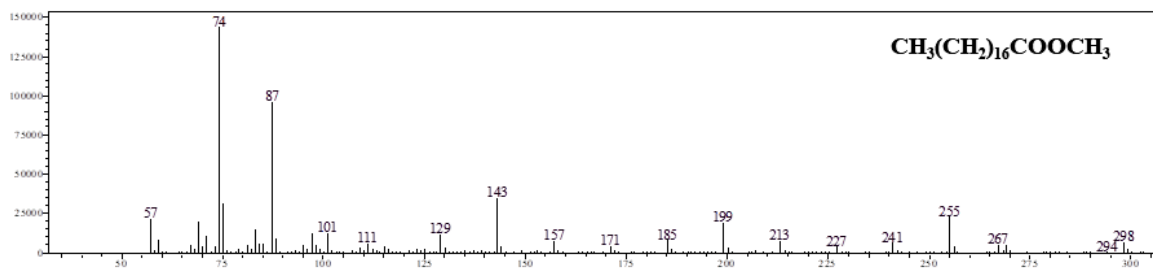


Figura 17S. Espectro de massas do estearato de metila (e)

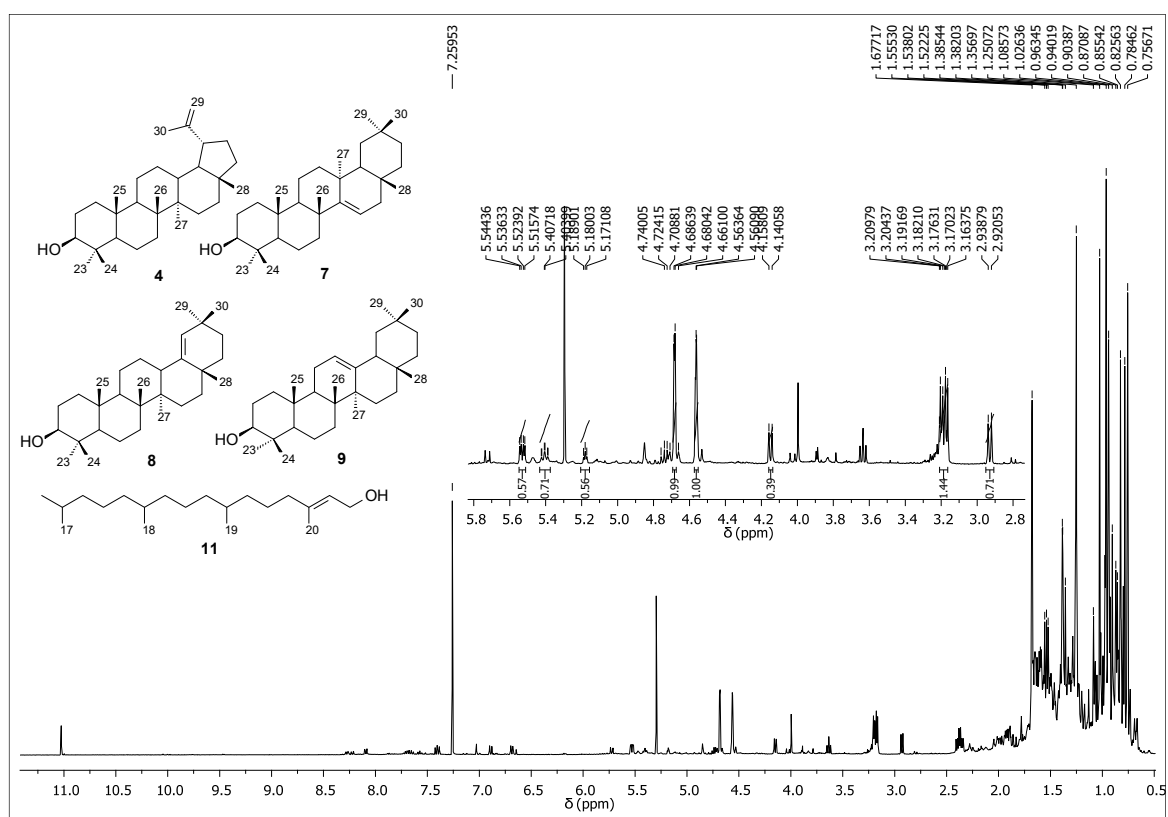


Figura 18S. Espectro de RMN de ¹H de M2 (4+7+8+9+11) (CDCl₃, 400 MHz)

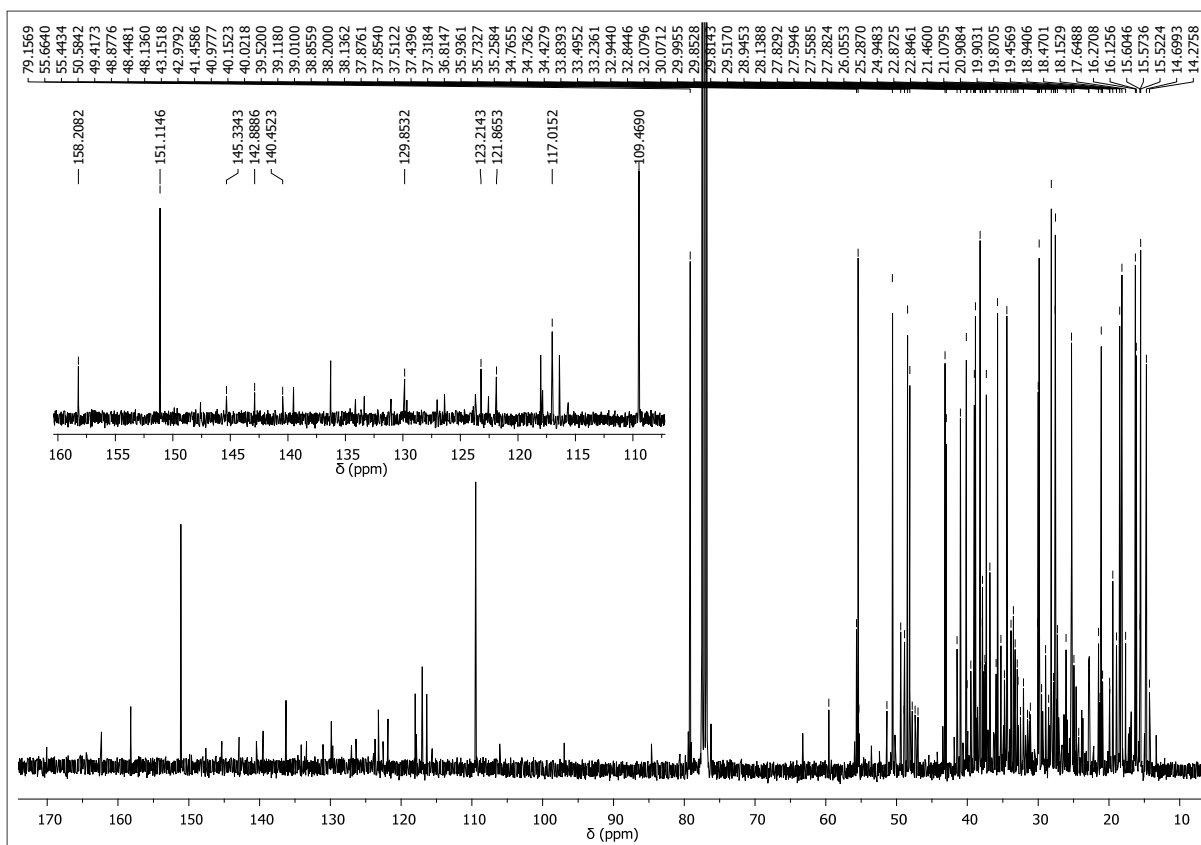


Figura 19S. Espectro de RMN de ^{13}C de M2 (4+8+9+10+11) (CDCl_3 , 100 MHz)

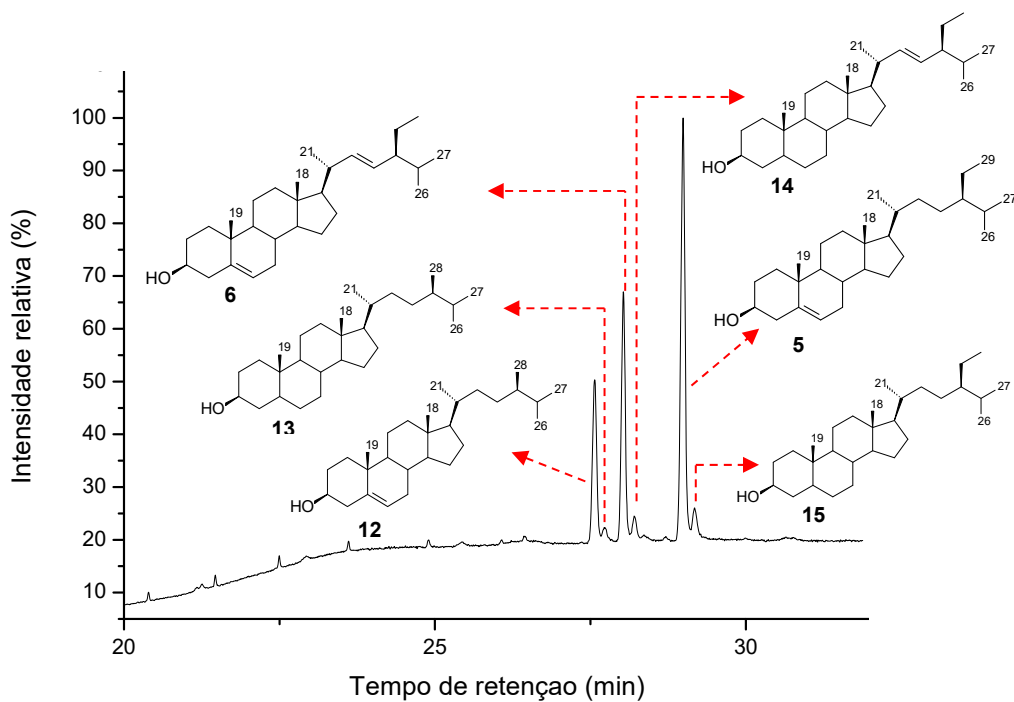


Figura 20S. Cromatograma de íons totais de M3 (5+6+12+13+14+15)

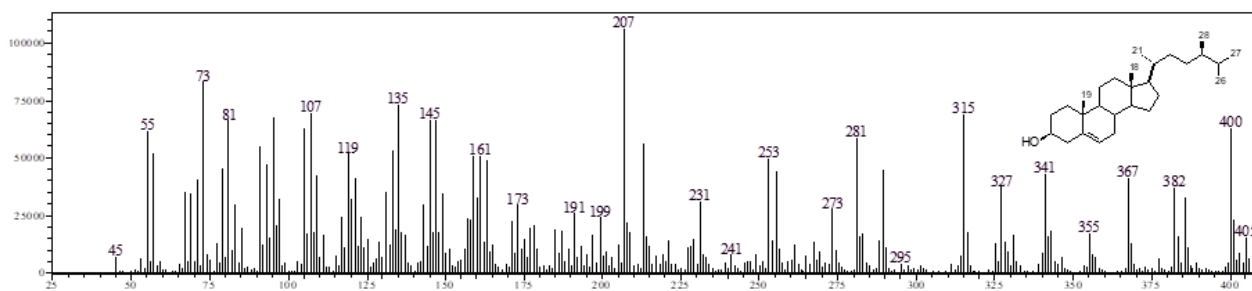


Figura 21S. Espectro de massas do campesterol (12) - $M^+ \bullet 400$

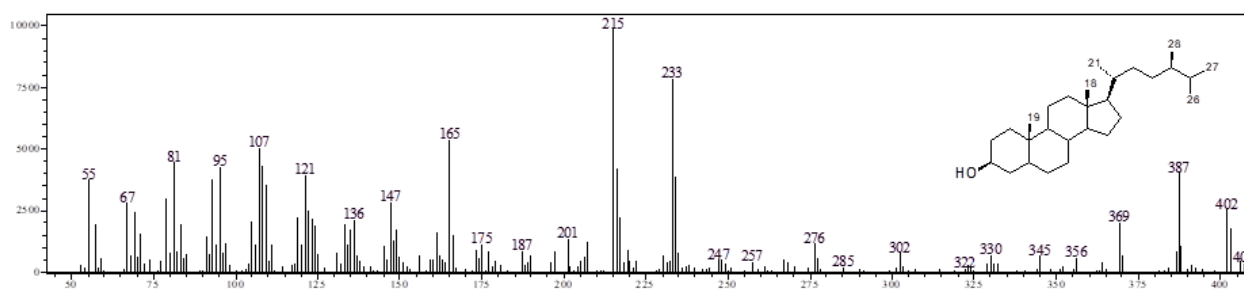


Figura 22S. Espectro de massas do campestanol (13) - $M^+ \bullet 402$

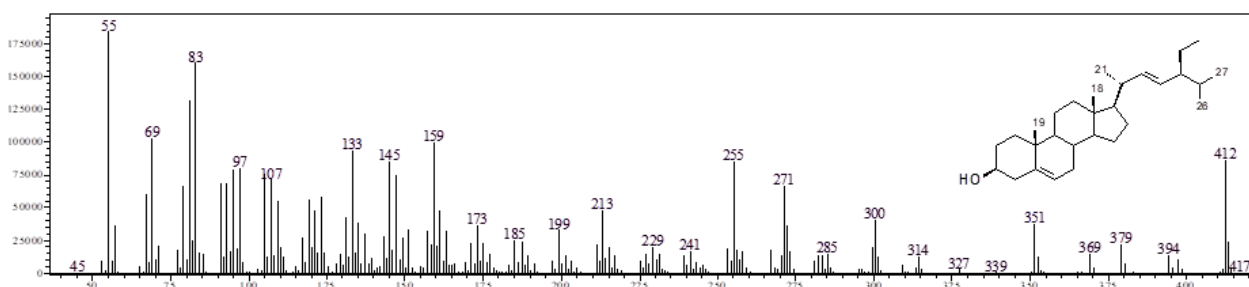


Figura 23S. Espectro de massas do stigmasterol (6) - $M^+ \bullet 412$

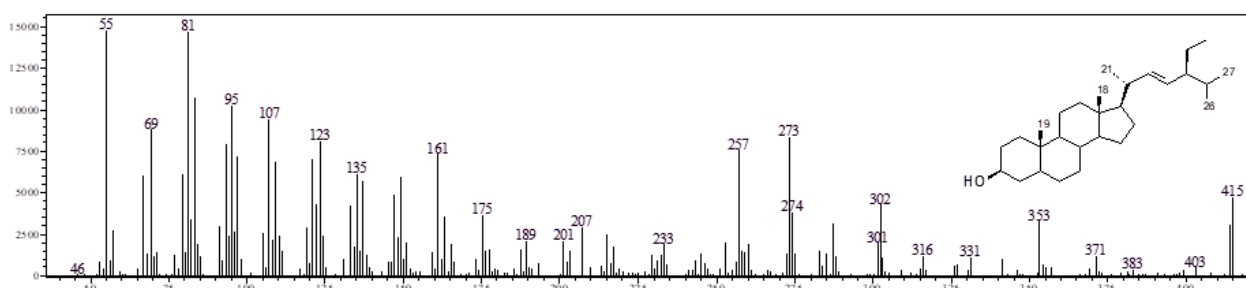


Figura 24S. Espectro de massas do Δ^{22} -stigmastenol (14) - $M^+ \bullet 414$

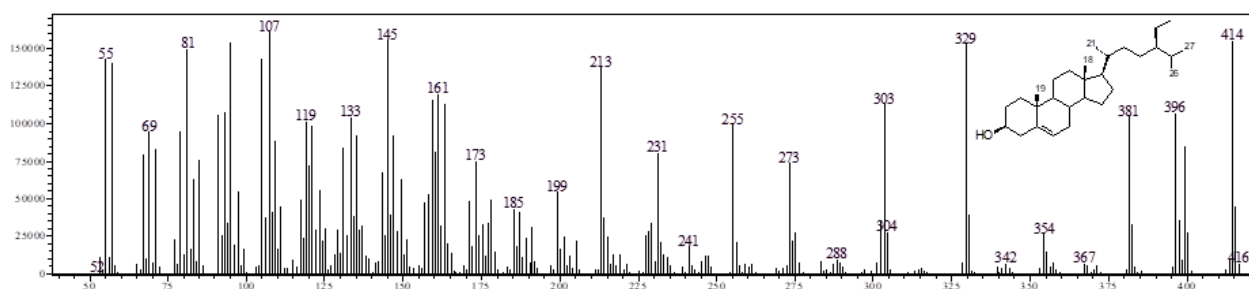


Figura 25S. Espectro de massas do sitosterol (5) - $M^+ \bullet 414$

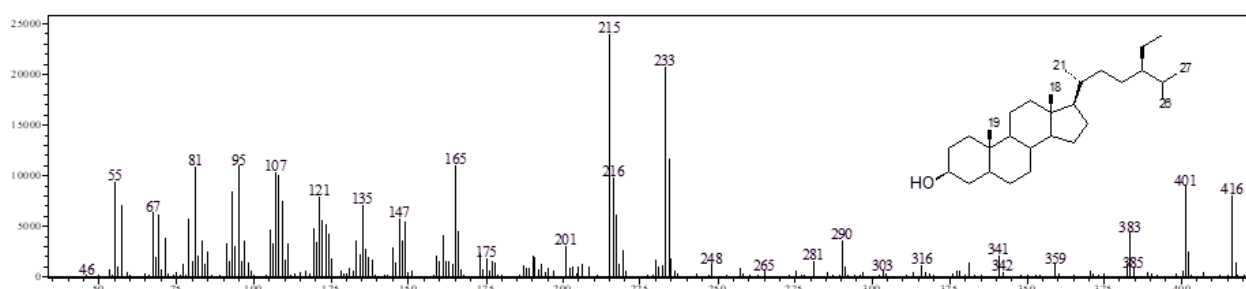


Figura 26S. Espectro de massas do sitostanol (15) - $M^+ \bullet 416$

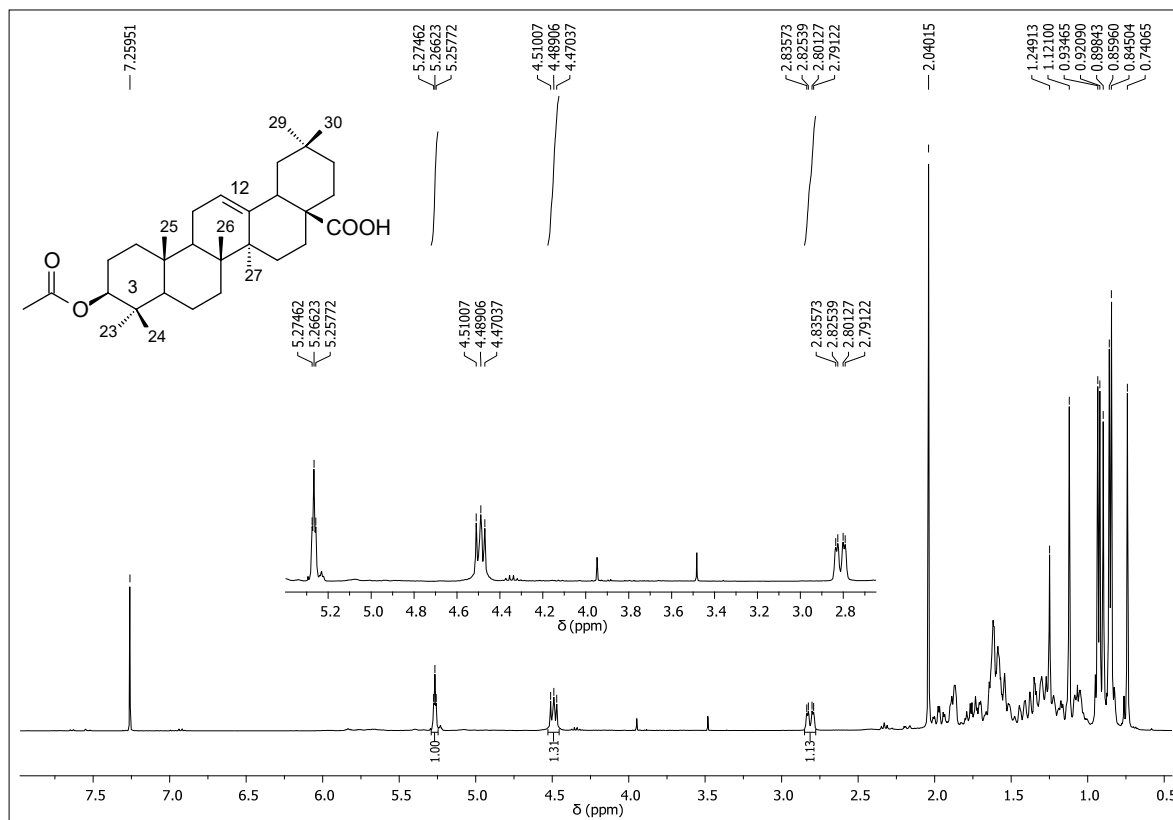


Figura 27S. Espectro de RMN de 1H de 10 ($CDCl_3$, 400 MHz)

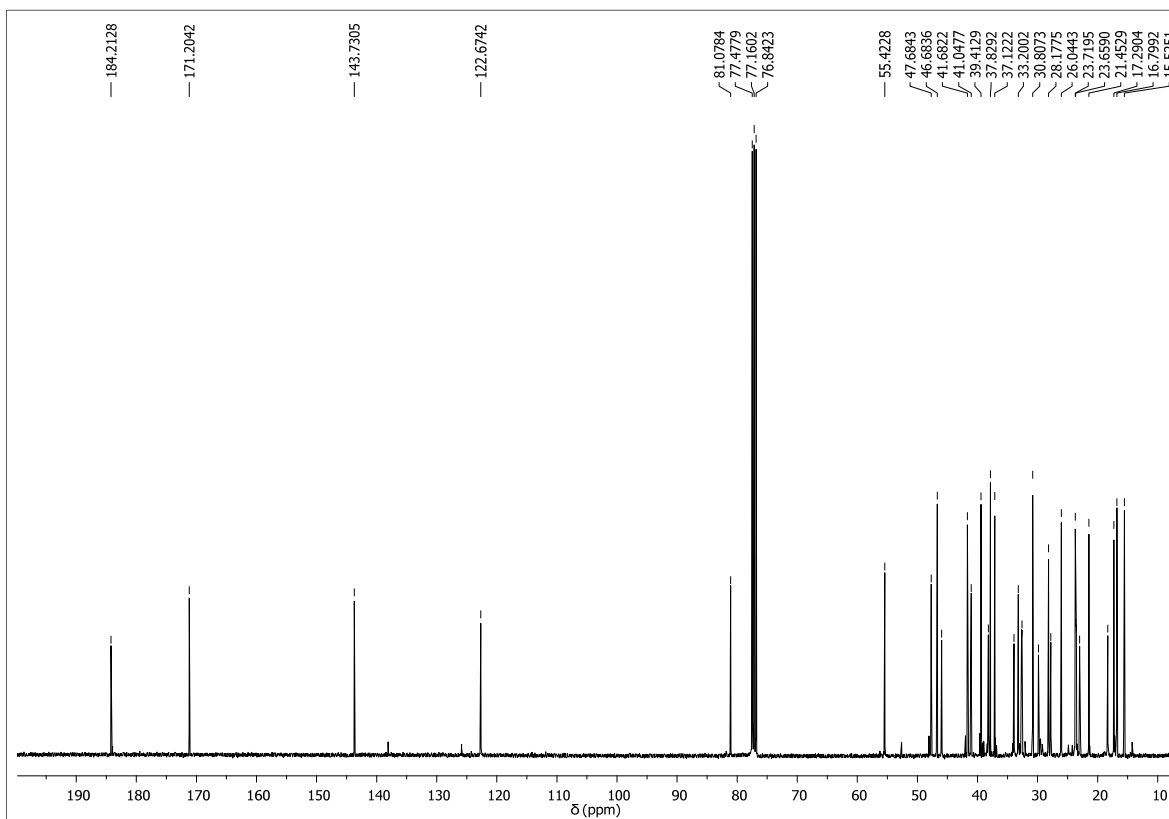


Figura 28S. Espectro de RMN de ^{13}C de 10 (CDCl_3 , 100 MHz)

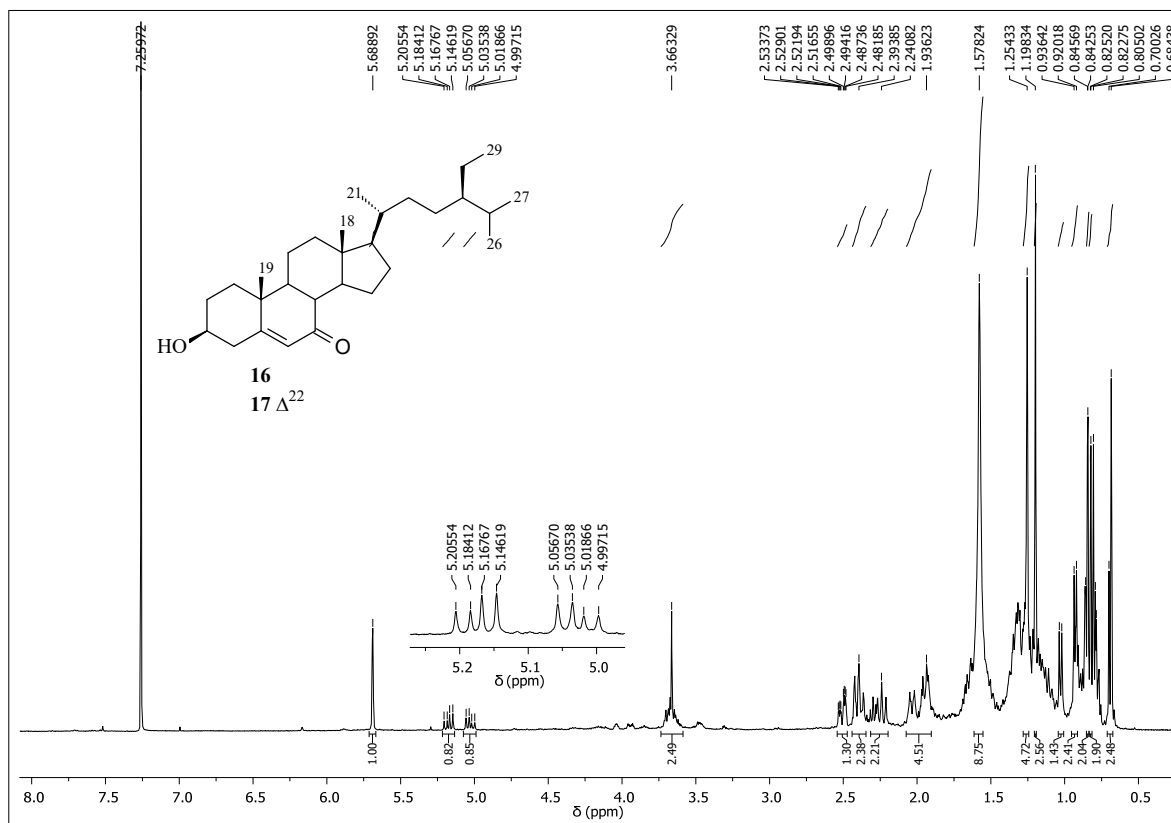


Figura 29S. Espectro de RMN de ^1H de M4 (16+17) (CDCl_3 , 400 MHz)

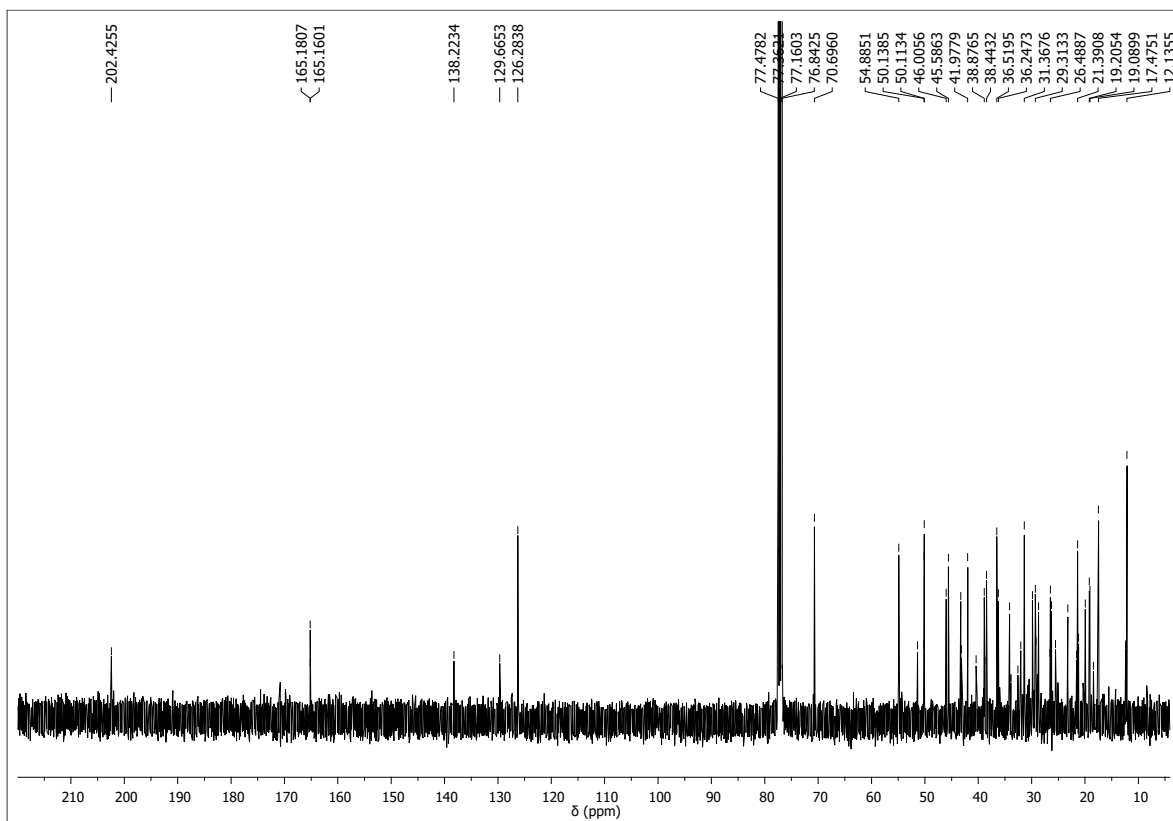


Figura 30S. Espectro de RMN de ^{13}C de M4 (16+17) (CDCl_3 , 100 MHz)

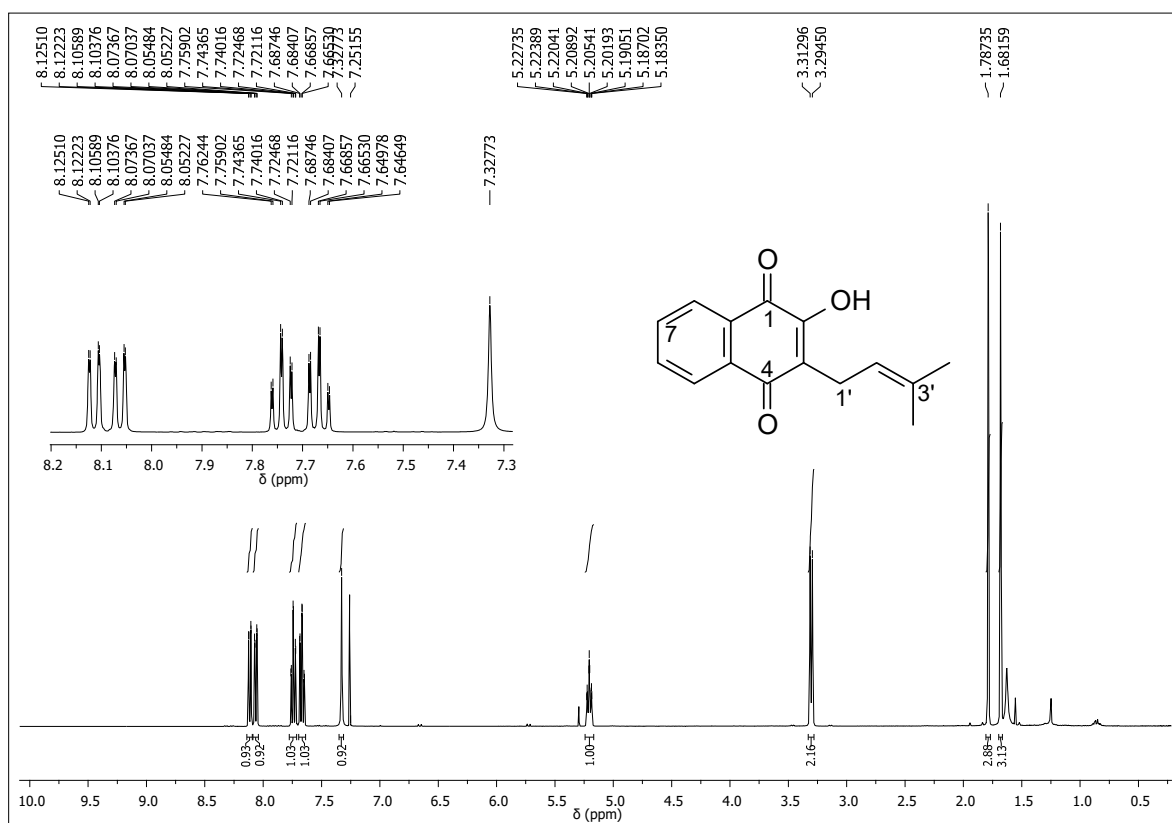


Figura 31S. Espectro de RMN de ^1H de 18 (CDCl_3 , 400 MHz)

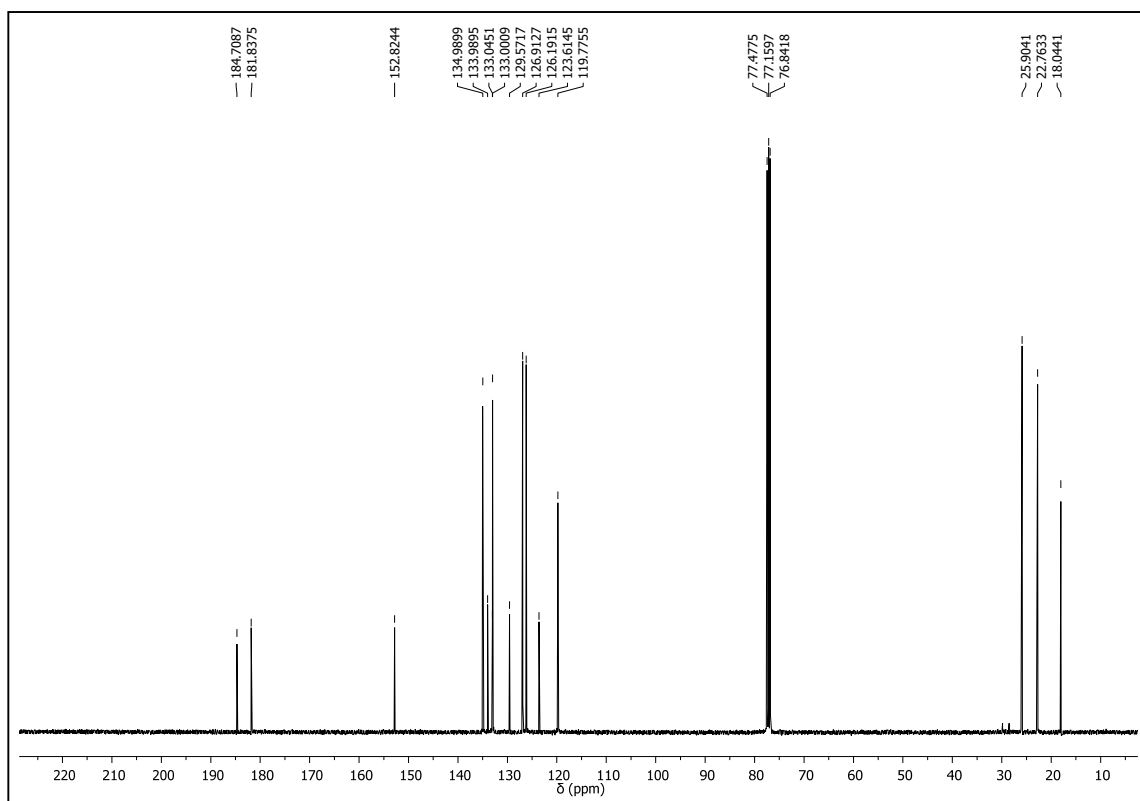


Figura 32S. Espectro de RMN de ^{13}C de **18** (CDCl_3 , 100 MHz)

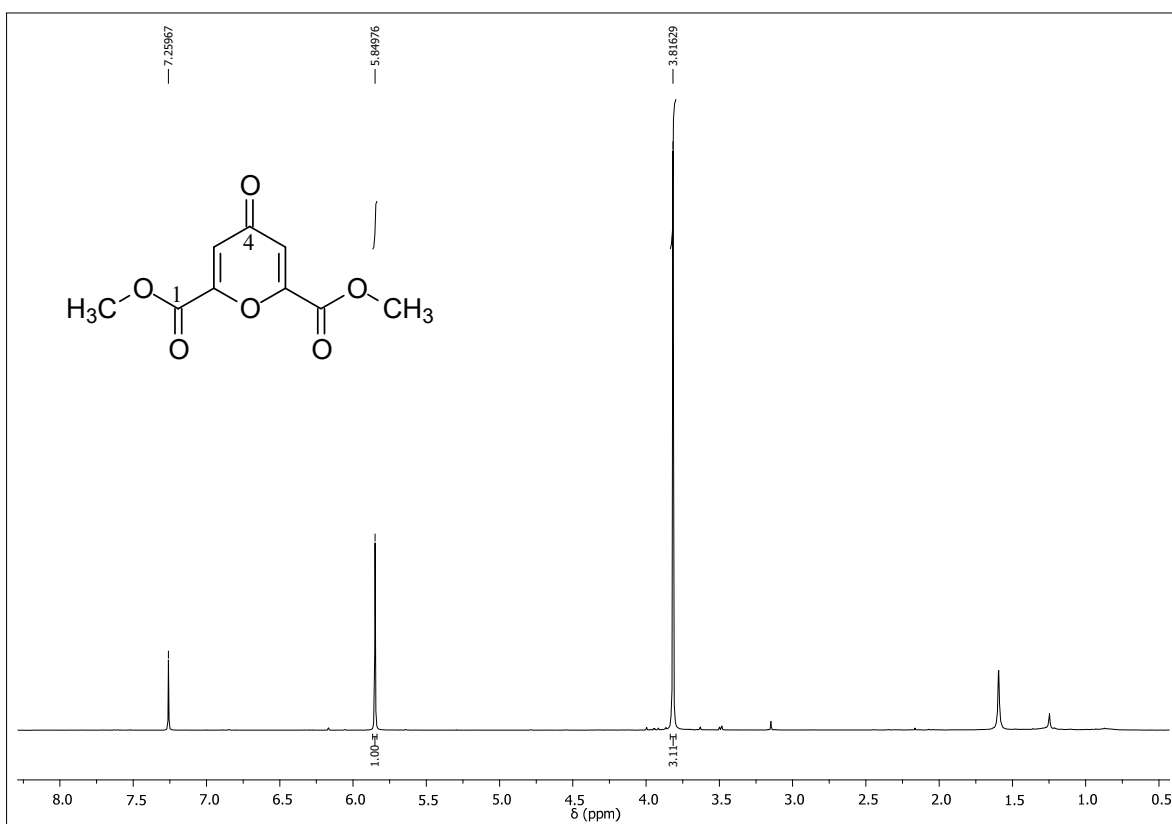


Figura 33S. Espectro de RMN de ^1H de **19** (CDCl_3 , 400 MHz)

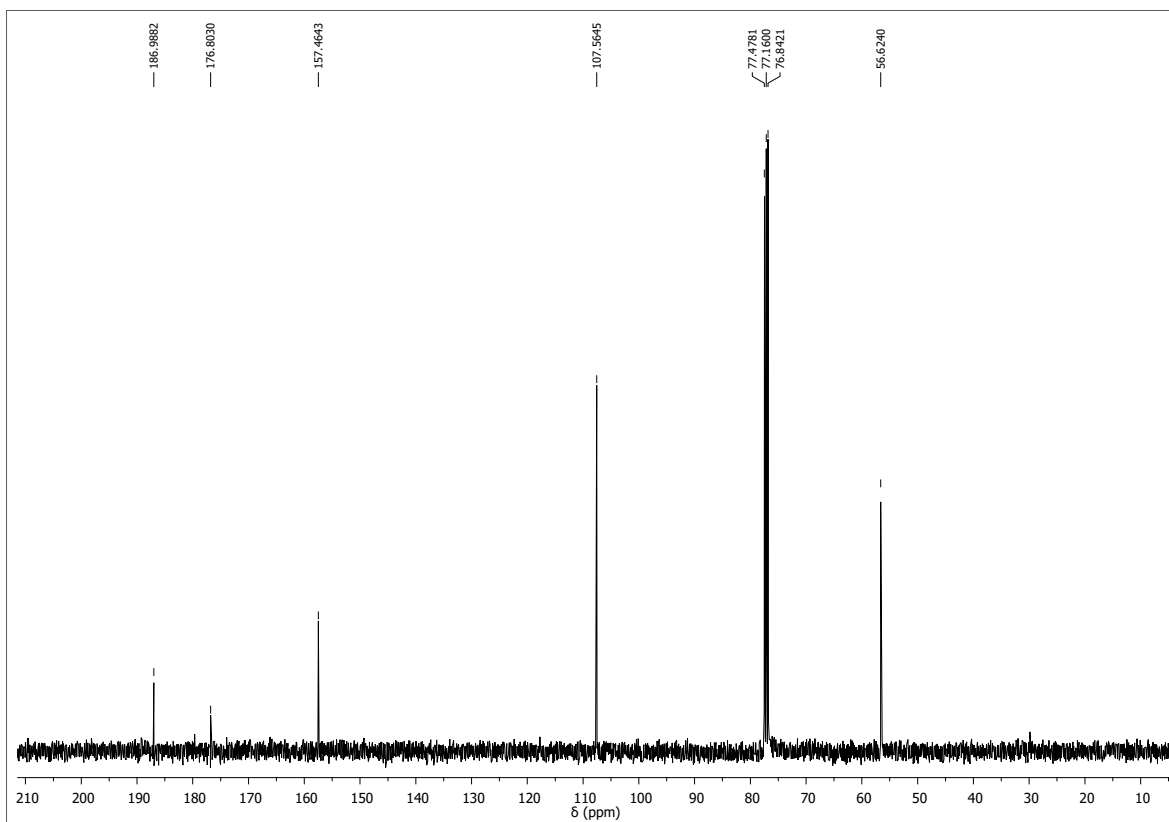


Figura 34S. Espectro de RMN de ^{13}C de **19** (CDCl_3 , 100 MHz)

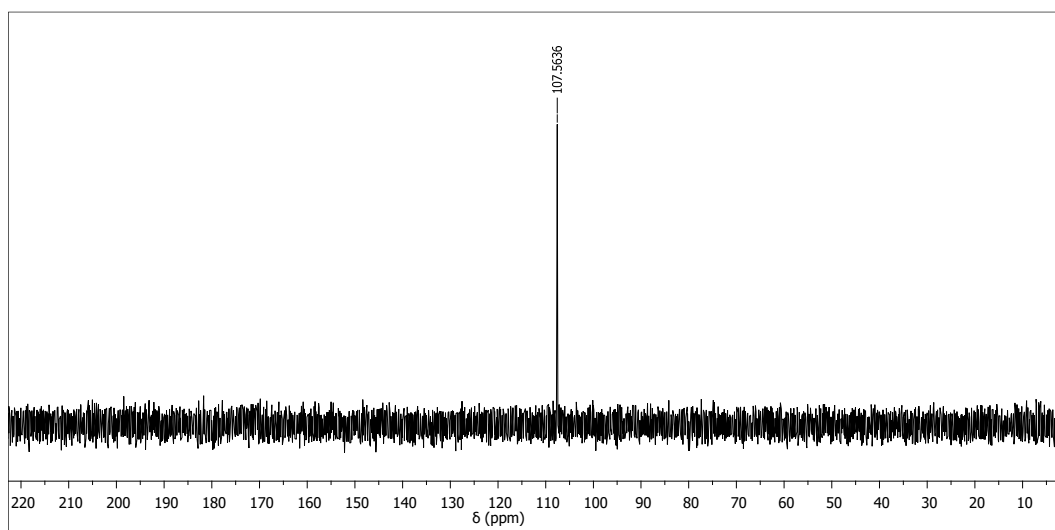


Figura 35S. Espectro de RMN de ^{13}C – DEPT 90 de **19** (CDCl_3 , 100 MHz)

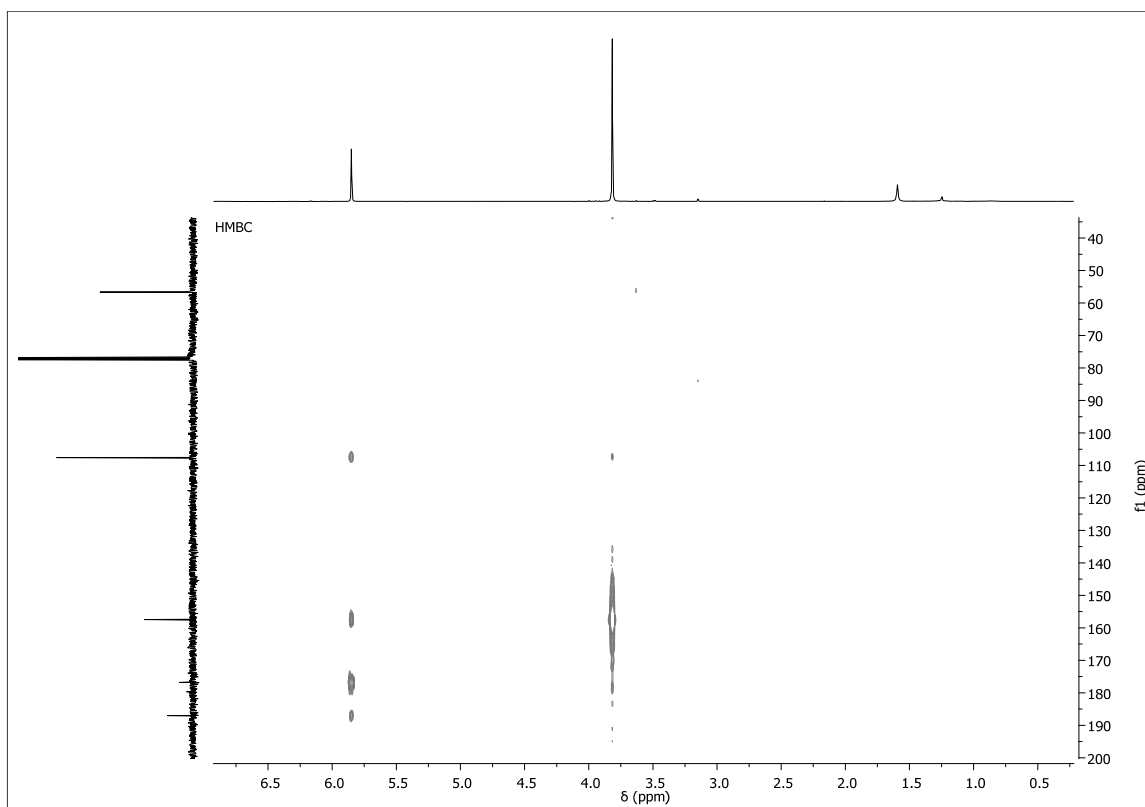


Figura 36S. Mapa de contornos gHMBC de 19 (CDCl_3 , 400 e 100 MHz)

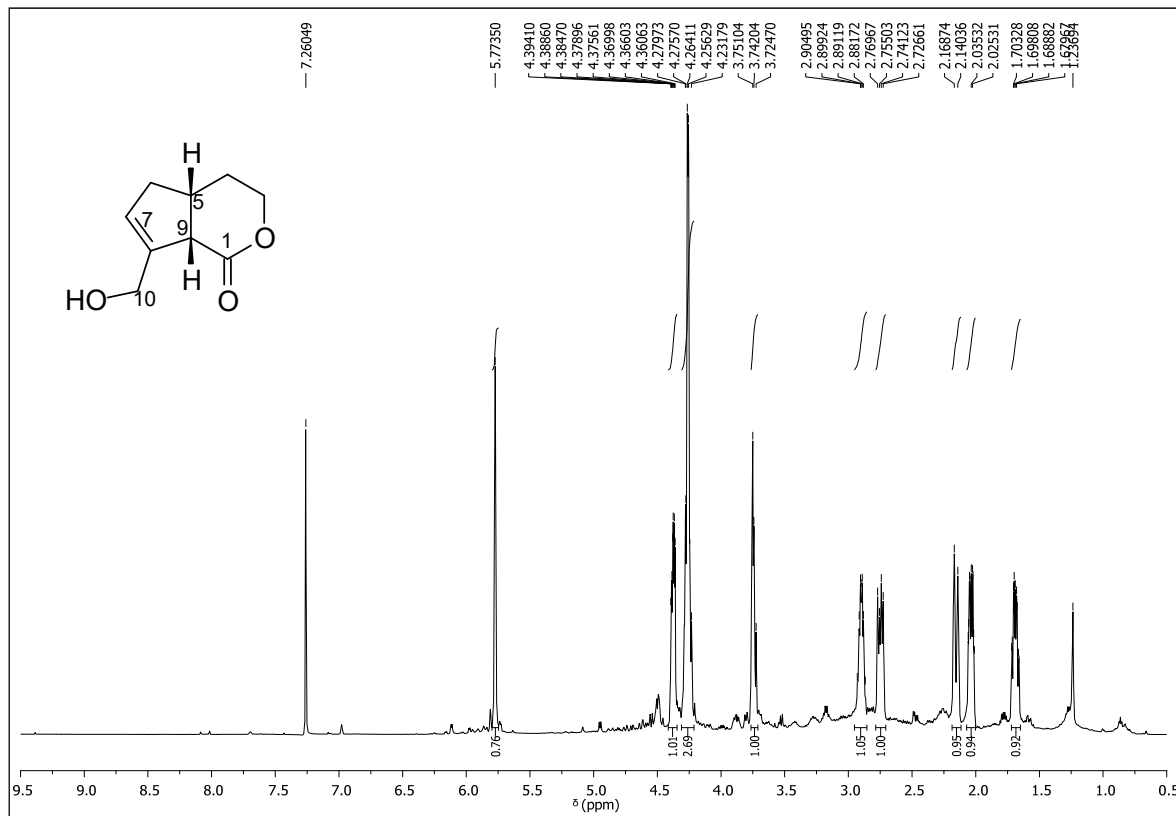


Figura 37S. Espectro de RMN de ^1H de 20 (CDCl_3 , 600 MHz)

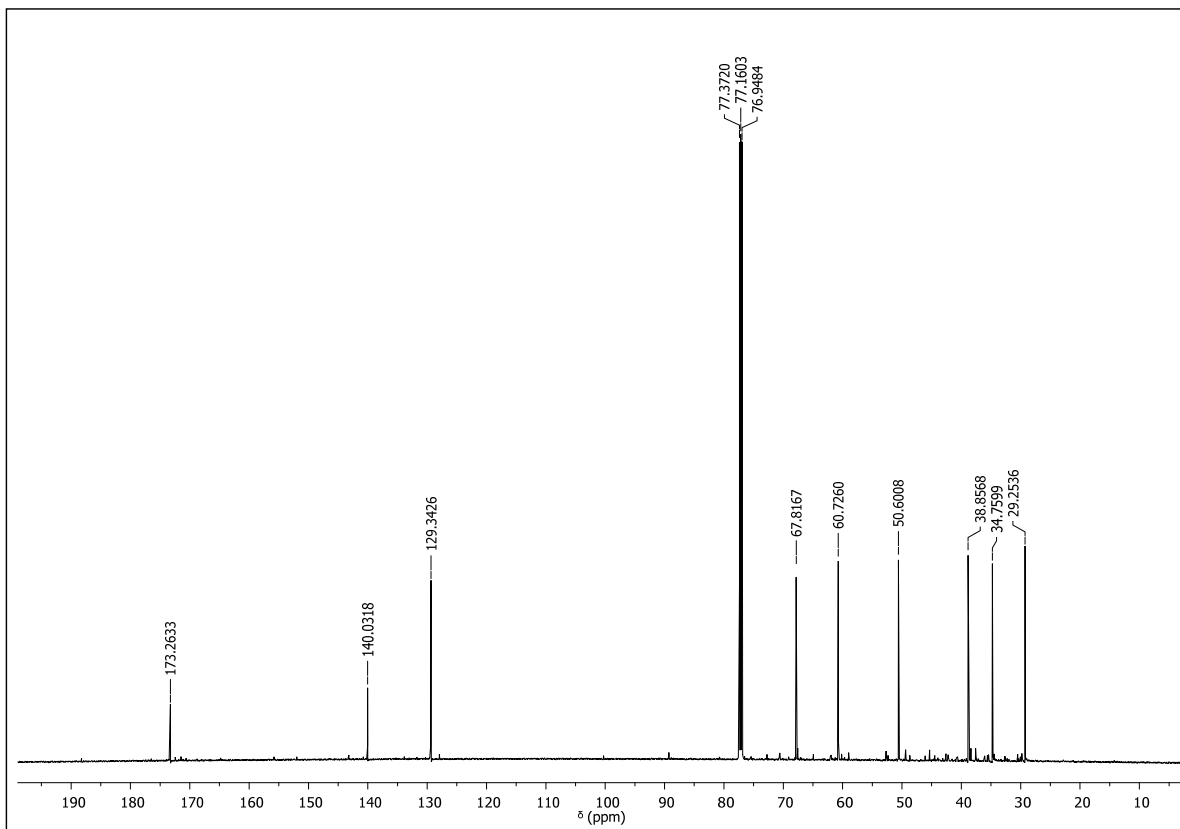


Figura 38S. Espectro de RMN de ^{13}C de **20** (CDCl_3 , 150 MHz)

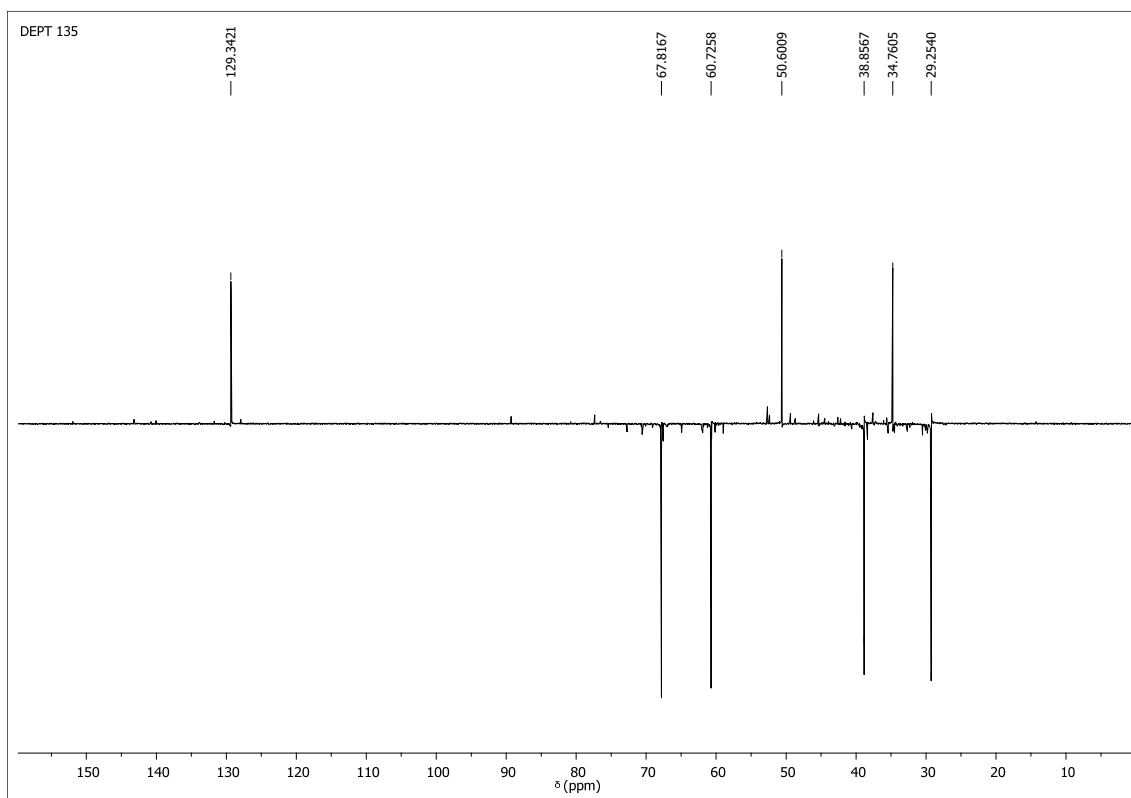


Figura 39S. Espectro de RMN de ^{13}C -DEPT 135° de **20** (CDCl_3 , 150 MHz)

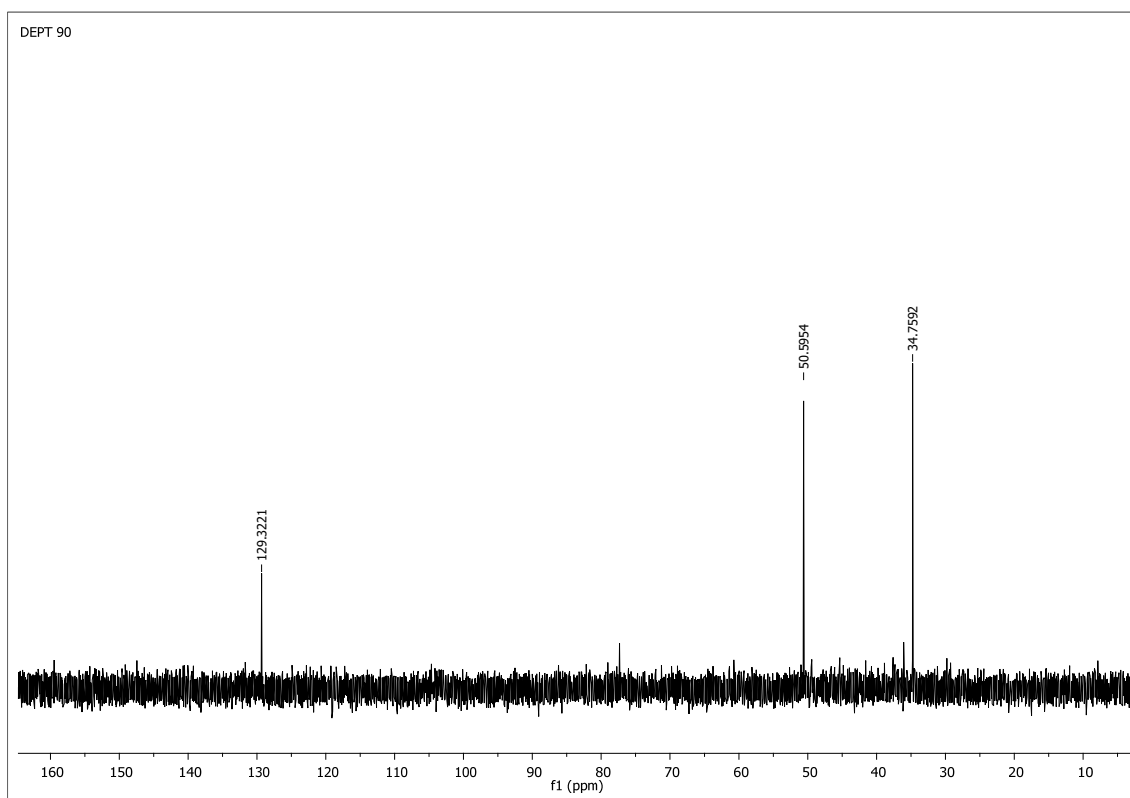


Figura 40S. Espectro de RMN de ^{13}C -DEPT 90° de **20** (CDCl_3 , 150 MHz)

REFERÊNCIAS

1. Paula, V. F.; Barbosa, L. C. A.; Piló-Veloso, D.; Demuner, A. J.; Howarth, O.; *Ecletica Quim.* **1998**, *23*, 45
2. Olea, R. S. G.; Roque, N. F.; *Quim. Nova* **1990**, *13*, 278.
3. Mahato, S. B.; Kundu, A. P.; *Phytochemistry* **1994**, *37*, 1517.
4. De-Eknamkul, W.; Potduang, B.; *Phytochemistry* **2003**, *62*, 389.
5. Jo, Y.; Suh, J.; Shin, M. H.; Jung, J. H.; Im, K. S.; *Arch. Pharm. Res.* **2005**, *28*, 885.
6. Rahman, A.; Ahmad, V. U.; *¹³C-NMR of Natural Products: Diterpenes*. Plenum Press: New York, 1992.
7. Wang, Q.-Y.; Cui, G.-X.; Wu, J.-C.; Chen, Y.-G.; *Chem. Nat. Compd.* **2015**, *51*, 1196.
8. Li, R.-J.; Guo, D.-X.; Lou, H.-X.; *Chin. J. Nat. Med.* **2013**, *11*, 74.
9. Moreira, R. Y. O.; Arruda, M. S. P.; Arruda, A. C.; Santos, L. S.; Müller, A. H.; Guilhon, G. M. S. P.; Santos, A. S.; Terezo, E.; *Rev. Bras. Farmacogn.* **2006**, *16*, 392.
10. Yoshikawa, M.; Yamaguchi, S.; Nishisaka, H.; Yamahara, J.; Murakami, N.; *Chem. Pharm. Bull.* **1995**, *43*, 1462.

