Supporting Information
for

A practical way to synthesize chiral fluoro-containing polyhydro-2*H*-chromenes from monoterpenoids

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Detailed experimental procedures, compound characterization data, and copies of NMR spectra

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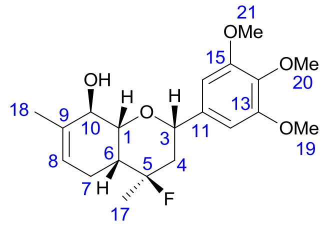
Experimental part

General methods: All the chemicals were of commercial reagent grade. CH_2Cl_2 was passed through calcined Al_2O_3. (1*R*,2*R*,6*S*)-3-Methyl-6-(prop-1-en-2-yl)cyclohex-3-ene-1,2-diol 1 ($[\alpha]_D^{31}$= −49.1 (*c* = 2.6, $CHCl_3$)) was synthesized according to [1] from (−)-verbenone (*Aldrich*), the content of the main substance was not less than 98.0%. Column chromatography (CC): silica gel (SiO_2; 60–200 μ; Macherey-Nagel). GC/MS (purity control and products analysis): Agilent 7890A with a quadrupole mass spectrometer Agilent 5975C as a detector, HP-5MS quartz column, 30000x0.25 mm, He (1 atm) as carrier gas. Optical rotation: *polAAr 3005* spectrometer, $CHCl_3$ soln. HR-MS: DFS-Thermo-Scientific spectrometer in a full scan mode (15–500 *m/z*, 70 eV electron-impact ionization, direct sample introduction). ^1H and ^{13}C NMR: Bruker DRX-500 apparatus at 500.13 MHz (^1H) and 125.76 MHz (^{13}C) in $CDCl_3$ or $CDCl_3/CD_3OD$ (10:1 v/v); chemical shifts δ in ppm rel. to residual $CHCl_3$ (δ(H) 7.24, δ(C) 76.90 ppm), *J* in Hz; structure determinations by analyzing the ^1H NMR spectra, including ^1H–^1H double resonance spectra and ^1H–^1H 2D homonuclear correlation, J-modulated ^{13}C NMR spectra (JMOD), and ^{13}C–^1H 2D heteronuclear correlation with one-bond and long-range spin–spin coupling constants (C–H COSY, $^1J(C,H)$ = 160 Hz, COLOC, $^{2,3}J(C,H)$ = 10 Hz).

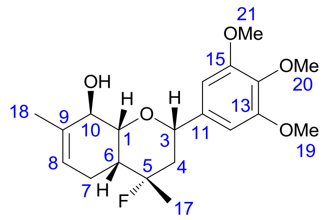
General procedure: Monoterpenoid (2.4 mmol) and aldehyde (2.9 mmol) were dissolved in CH_2Cl_2 (5 ml) and cooled to 2 °C. Then water (17.8 mmol) was added to the $BF_3{\cdot}Et_2O$ (3.6 mmol) solution in CH_2Cl_2 (5 ml) under vigorous stirring. Resulting cloudy solution of $BF_3{\cdot}Et_2O$ was added dropwise to the mixture of aldehyde and monoterpenoid, and then the reaction mixture was stirred for 8 or 72 hours at 2 °C. Then 10 % $NaHCO_3$ solution was added, the layers were separated and the aqueous phase was extracted with CH_2Cl_2 (2 x 15 ml). The combined organic layers were dried over Na_2SO_4, filtered and concentrated. Reaction mixture was separated on a SiO_2 column (hexane/EtOAc 100:0–0:100 as eluent).

Reaction of 1 with 3,4,5-trimethoxybenzaldehyde (6a): The reaction of diol **1** and aldehyde **6a** for 8 hours at 2 °C gave products **2a** (*R*:*S* = 2:3, 7%), **8a** (*R*:*S* = 4:1, 69%). Spectral characteristics of compounds **2a** have coincided with those described in the work [2].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(3,4,5-trimethoxyphenyl) -3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8a): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.36 (d, ^3J(17, F) = 22.4 Hz, 3 H, 17-H); 1.78 (ddd, ^3J(4a,F) = 39.4 Hz, *J*(4a,4e) = 14.7 Hz, *J*(4a,3a) = 11.7 Hz, 1H, 4-H_a); 1.81 (m, all *J* ≤ 2.5 Hz, 3H, 18-H); 1.90 (dddd, *J*(4e,4a) = 14.7 Hz, ^3J(4e,F) = 11.3 Hz, *J*(4e, 3a) = 3.0 Hz, *J*(4e,6a) = 1.1 Hz, 1H, 4-H_e); 1.93-2.03 (m, H_a-C(6), 2 H, 7-H); 3.78 (s, 3 H, 20-MeO); 3.82 (s, 6 H, 19-MeO, 21-MeO); 3.94 (br.s, 1 H, 10-H_e); 4.14 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 4.67 (dd, *J*(3a,4a) = 11.7 Hz, *J*(3a,4e) = 3.0 Hz, 1 H, 3-H_a); 5.55-5.59 (m, 1 H, 8-H); 6.51 (s, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.75 (C-18); 24.04 (d, ^3J(C-F) = 9.7 Hz, C-7); 24.77 (d, ^2J(C-F) = 24.3 Hz, C-17); 36.08 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.13 (d, ^2J(C-F) = 21.7 Hz, C-4); 56.04 (C-19, C-21); 60.61 (C-20); 70.08 (C-10); 75.51 (C-1); 75.96 (C-3); 95.15 (d, ^1J(C-F) = 168.5 Hz, C-5); 103.09 (C-12, C-16); 123.12 (C-8); 132.16 (C-9); 137.41, 137.46 (C-11, C-14); 153.17 (C-13, C-15). HR-MS: 366.1833 (M^+ $(C_{20}H_{27}O_5F)^+$; calc. 366.1837).

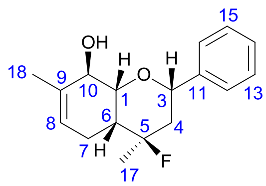


(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(3,4,5-trimethoxyphenyl) -3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8a): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.61 (d, ^3J(17, F) = 23.5 Hz, 3 H, 17-H); 1.78 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.79-1.83 (m, 1 H, 4-H_e); 2.04 (br.dd, *J*(6a,7a) = 10.7 Hz, *J*(6a,7e) = 6.6 Hz, 1 H, 6-H_a); 2.07-2.21 (m, 3 H, H_a-4, 7-2H); 3.68 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 3.75 (s, 3 H, 20-MeO); 3.80 (s, 6 H, 19-MeO, 21-MeO); 3.87 (br.s, 1 H, 10-H_e); 4.27 (dd, *J*(3a,4a) = 12.1 Hz, *J*(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 5.59-5.63 (m, 1H, 8-H); 6.49 (s, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.53 (C-18); 22.39 (d, ^3J(C-F) = 6.2 Hz, C-7); 24.68 (d, ^2J(C-F) = 24.8 Hz, C-17); 37.65 (d, ^2J(C-F) = 18.7 Hz, C-6); 40.41 (d, ^2J(C-F) = 20.6 Hz, C-4); 55.97 (C-19, C-21); 60.55 (C-20); 69.74 (C-10); 77.73 (d, ^3J(C-F) = 11.5 Hz, C-3); 78.05 (d, ^3J(C-F) = 7.5 Hz, C-1); 95.09 (d, ^1J(C-F) = 176.1 Hz, C-5); 103.24 (C-12, C-16); 123.97 (C-8); 131.24 (C-9); 137.34, 137.56 (C-11, C-14); 153.06 (C-13, C-15).

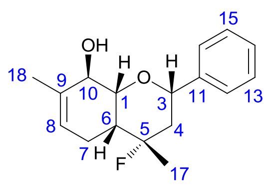


Reaction of 1 with benzaldehyde (6b): The reaction of diol **1** and aldehyde **6b** for 8 hours at 2 °C gave products **2b** (*R*:*S* = 1:3, 24%), **8b** (individual *R*-isomer, 10%) and **8b** (*R*:*S* = 5.5:1, 45%). Spectral characteristics of compounds **2b** have coincided with those described in the work [2].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-phenyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8b): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.36 (d, ^3J(17, F) = 22.3 Hz, 3 H, 17-H); 1.80 (ddd, ^3J(4a, F) = 40.1 Hz, *J*(4a,4e) = 14.7 Hz, *J*(4a, 3a) = 11.6 Hz, 1 H, 4-H$_a$); 1.84 (m, all *J* ≤ 3.0 Hz, 3 H, H-18); 1.92 (dddd, *J*(4e, 4a) = 14.7 Hz, ^3J(4e, F) = 10.6 Hz, *J*(4e,3a) = 3.0 Hz, *J*(4e,6a) = 1.2 Hz, 1 H, 4-H$_e$); 1.94-2.07 (m, 3 H, 6-H$_a$, 7-2H); 3.95 (br.s, 1 H, 10-H$_e$); 4.16 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H$_e$); 4.76 (dd, *J*(3a,4a) = 11.6 Hz, *J*(3a,4e) = 3.0 Hz, 1 H, 3-H$_a$); 5.57-5.61 (m, 1 H, 8-H); 7.22-7.33 (m, 5 H, Ph-H). ^{13}C NMR ($CDCl_3$) δ = 20.79 (C-18); 24.06 (d, ^3J(C-F) = 9.3 Hz, C-7); 24.76 (d, ^2J(C-F) = 24.3 Hz, C-17); 36.05 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.38 (d, ^2J(C-F) = 21.7 Hz, C-4); 70.08 (C(10)); 75.27 (d, ^3J(C-F) = 1.3 Hz, C-1); 75.66 (C-3); 95.09 (d, ^1J(C-F)=169.0 Hz, C-5); 123.14 (C-8); 125.67 (C-12, C-16); 127.43 (C-14); 128.27 (C-13, C-15); 132.19 (C-9); 141.95 (C-11). HR-MS: 276.1523 (M^+ $(C_{17}H_{21}O_2F)^+$; calc. 276.1520).

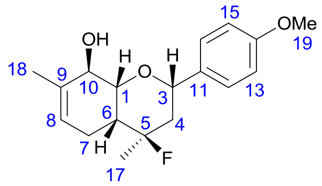


(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-phenyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8b): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.65 (dd, ^3J(17, F) = 23.5 Hz, *J*(17, 4a) = 0.8 Hz, 3 H, 17-H); 1.82 (m, all *J* ≤ 2.5 Hz, 3H,18-H); 1.86 (br.dd, *J*(4e,4a) = 13.3 Hz, *J*(4e,3a) = 2.7 Hz, 1 H, 4-H$_e$); 2.07 (br.dd, *J*(6a,7a) = 10.7 Hz, *J*(6a,7e) = 6.5 Hz, 1 H, 6-H$_a$); 2.15 (dddq, ^3J(4a, F) = 14.1 Hz, *J*(4a,4e) = 13.3 Hz, *J*(4a,3a) = 12.1 Hz, *J*(4a, 17) = 0.8 Hz, 1 H, 4-H$_a$); 2.16-2.29 (m, 2 H, 7-H); 3.73 (ddd, *J*(1e,10e) = 2.3 Hz, *J*(1e,6a) = ^4J(1e,F) = 2.1 Hz, 1 H, 1-H$_e$); 3.93 (m, *all J* ≤ 3.0 Hz, 1 H, 10-H$_e$); 4.38 (dd, *J*(3a,4a) = 12.1 Hz, *J*(3a,4e) = 2.7 Hz, 1 H, 3-H$_a$); 5.64-5.67 (m, 1 H, 8-H); 7.24-7.34 (m, 5 H, Ph-H). ^{13}C NMR ($CDCl_3$) δ = 20.68 (C-18); 22.54 (d, ^3J(C-F) = 6.3 Hz, C-7); 24.80 (d, ^2J(C-F) = 26.0 Hz, C-17); 37.74 (d, ^2J(C-F) = 18.6 Hz, C-6); 40.90 (d, ^2J(C-F) = 20.8 Hz, C-4); 70.20 (d, ^4J(C-F) = 2.3 Hz, C-10); 77.6 (d, ^3J(C-F) = 11.6 Hz, C-3); 77.8 (d, ^3J(C-F) = 7.6 Hz, C-1); 95.14 (d, ^1J(C-F)=176.6 Hz, C-5); 124.41 (C-8); 125.79 (C-12, C-16); 127.73 (C-14); 128.36 (C-13, C-15); 131.29 (C-9); 141.26 (C-11).



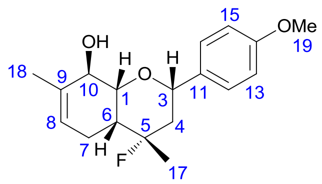
Reaction of 1 with 4-methoxybenzaldehyde (6c): The reaction of diol **1** and aldehyde **6c** for 8 hours at 2 °C gave products **2c** (*R*:*S* = 1:4, 24%), **8c** (*R*:*S* = 4:1, 34%). Spectral characteristics of compounds **2c** have coincided with those described in the work [3].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-2-(4-methoxyphenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8c): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^3J(17, F) = 22.4 Hz, 3 H, 17-H); 1.80 (ddd, ^3J(4a, F) = 39.4 Hz, *J*(4a,4e) = 14.7 Hz, *J*(4a, 3a) = 11.5 Hz, 1 H, 4-H$_a$); 1.82 (m,



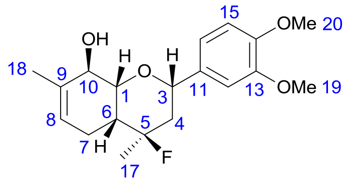
all $J \leq 3.0$ Hz, 3 H, 18-H); 1.84-1.91 (m, 1H, 4-H_e); 1.91-2.06 (m, 3H, 6-H_a, 7-2H); 3.76 (s, 3 H, 19-MeO); 3.93 (br.s, 1H, 10-H_e); 4.14 (m, all $J \leq$ 3.0 Hz, 1 H, 1-H_e); 4.70 (dd, *J*(3a,4a) = 11.5 Hz, *J*(3a,4e) = 3.2 Hz, 1 H, 3-H_a); 5.55-5.59 (m, 1 H, 8-H); 6.84 (d, *J*(13,12) = *J*(15,16) = 8.8 Hz, 2 H, 13-H, 15-H); 7.23 (d, J(12,13) = J(16,15) = 8.8 Hz, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.79 (C-18); 24.09 (d, ^{3}J(C-F) = 9.3 Hz, C-7); 24.79 (d, ^{2}J(C-F) = 24.8 Hz, C-17); 36.08 (d, ^{2}J(C-F) = 20.8 Hz, C-6); 40.23 (d, ^{2}J(C-F) = 21.2 Hz, C-4); 55.17 (C-19); 70.16 (C-10); 75.34 (d, ^{3}J(C-F) = 1.3 Hz, C-1); 75.36 (C-3); 95.15 (d, ^{1}J(C-F)=168.5 Hz, C-5); 113.74 (C-13, C-15); 123.20 (C-8); 127.08 (C-12, C-16); 132.21 (C-9); 134.10 (C-11); 159.01 (C-14). HR-MS: 306.1623 (M^+ $(C_{17}H_{23}O_3F)^+$; calc. 306.1626).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4-fluoro-2-(4-methoxyphenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8c): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.63 (dd, ^{3}J(17, F) = 23.5 Hz, *J*(17,4a) = 0.7 Hz, 3 H, 17-H); 1.80 (m, all $J \leq 2.5$ Hz, 3H, 18-H); 1.82 (br.dd, *J*(4e,4a) = 13.3 Hz, *J*(4e, 3a) = 2.7 Hz, 1 H, 4-H_e); 2.05 (br.dd, *J*(6a,7a) = 10.8 Hz, *J*(6a,7e) = 6.5 Hz, 1 H, 6-H_a); 2.16 (ddd, ^{3}J(4a, F) = 14.1 Hz, *J*(4a,4e) = 13.3 Hz, *J*(4a, 3a) = 12.0 Hz, 1 H, 4-H_a); 2.17-2.27 (m, 2 H, 7-H); 3.71 (*J*(1e,10e) = 2.4 Hz, *J*(1e,6a) = ^{4}J(1e,F) = 2.1 Hz, 1 H, 1-H_e); 3.76 (s, 3 H, 19-MeO); 3.90 (m, all $J \leq 3.0$ Hz, 1 H, 10-H_e); 4.32 (dd, *J*(3a,4a) = 12.0 Hz, *J*(3a,4e) = 2.7 Hz, 1 H, 3-H_a); 5.62-5.66 (m, 1 H, 8-H); 6.84 (d, *J*(13,12) = *J*(15,16) = 8.8 Hz, 2 H, 13-H, 15-H); 7.23 (d, J(12,13) = J(16,15) = 8.8 Hz, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.65 (C-18); 22.50 (d, ^{3}J(C-F) = 6.2 Hz, C-7); 24.77 (d, ^{2}J(C-F) = 25.7 Hz, C-17); 37.71 (d, ^{2}J(C-F) = 19.0 Hz, C-6); 40.70 (d, ^{2}J(C-F) = 20.4 Hz, C-4); 55.15 (C-19); 70.12 (d, ^{4}J(C-F) = 2.2 Hz, C-10); 77.26 (d, ^{3}J(C-F) = 11.5 Hz, C-3); 77.83 (d, ^{3}J(C-F) = 7.5 Hz, C-1); 95.18 (d, ^{1}J(C-F)=176.0 Hz, C-5); 113.74 (C-13, C-15); 124.35 (C-8); 127.16 (C-12, C-16); 131.25 (C-9); 133.41 (C-11); 159.15 (C-14).



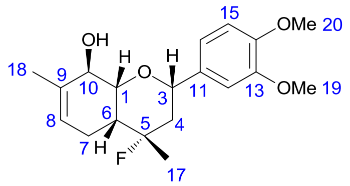
Reaction of 1 with 3,4-dimethoxybenzaldehyde (6d): The reaction of diol **1** and aldehyde **6d** for 8 hours at 2 °C gave products **2d** (*R*:*S* = 1:5, 20%), **8d** (*R*:*S* = 3:1, 35%). Spectral characteristics of compounds **2d** have coincided with those described in the work [3].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(3,4-dimethoxyphenyl)-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8d): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^{3}J(17, F) = 22.4 Hz, 3 H, 17-H); 1.81 (ddd, ^{3}J(4a, F) = 39.2 Hz, *J*(4a,4e) = 14.6 Hz, *J*(4a, 3a) = 11.3 Hz, 1 H, 4-H_a); 1.81 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.89 (dddd, *J*(4e, 4a) = 14.6 Hz, ^{3}J(4e, F) = 11.2 Hz, *J*(4e,3a) = 3.2 Hz,



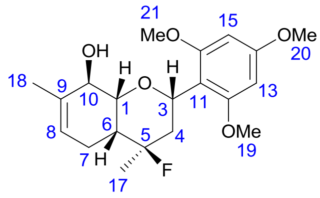
J(4e,6a) = 1.0 Hz, 1 H, 4-H_e); 1.91-2.06 (m, 3 H, 6-H_a, 7-2H); 3.82 (s, 3 H, 20-MeO); 3.85 (s, 3 H, 19-MeO); 3.93 (br.s, 1 H, 10-H_e); 4.14 (m, all J < 3.0 Hz, 1 H, 1-H_e); 4.68 (dd, J(3a,4a) = 11.3 Hz, J(3a,4e) = 3.2 Hz, 1 H, 3-H_a); 5.55-5.60 (m, 1 H, 8-H); 6.80 (d, J(15,16) = 8.2 Hz, 1 H, 15-H); 6.82 (d, J(12,16) = 2.0 Hz, 1 H, 12-H); 6.85 (dd, J(16,15) = 8.2 Hz, J(16,12) = 2.0 Hz, 1 H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.76 (C-18); 24.07 (d, ^3J(C-F) = 9.7 Hz, C-7); 24.79 (d, ^2J(C-F) = 24.8 Hz, C-17); 36.10 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.11 (d, ^2J(C-F) = 21.2 Hz, C-4); 55.78 (C-19); 55.83 (C-20); 70.12 (C-10); 75.44 (d, ^3J(C-F) = 1.2 Hz, C-1); 75.58 (C-3); 95.18 (d, ^1J(C-F)=169.0 Hz, C-5); 109.54 (C-12); 111.13 (C-15); 118.06 (C-16); 123.13 (C-8); 132.20 (C-9); 134.47 (C-11); 148.48 (C-14); 148.85 (C-13). HR-MS: 336.1728 (M^+ $(C_{19}H_{25}O_4F)^+$; calc. 336.1731).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-(3,4-dimethoxyphenyl)-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8d): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.63 (dd, ^3J(17, F) = 23.5 Hz, J(17, 4a) = 0.7 Hz, 3 H, 17-H); 1.79 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.83 (br.dd, J(4e, 4a) = 13.3 Hz, J(4e,3a) = 2.6 Hz, 1 H, 4-H_e); 2.04 (br.dd, J(6a, 7a) = 10.6 Hz, J(6a,7e) = 6.5, 1 H, 6-H_a); 2.17 (ddd, ^3J(4a, F) = 14.0 Hz, J(4a,4e) = 13.3 Hz, J(4a,3a) = 12.1 Hz, 1 H, 4-H_a); 2.16-2.26 (m, 2 H, 7-H); 3.70 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 3.82 (s, 3 H, 20-MeO); 3.85 (s, 3 H, 19-MeO); 3.89 (br.s, 1 H, 10-H_e); 4.31 (dd, J(3a,4a) = 12.1 Hz, J(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 5.60-5.65 (m, 1 H, 8-H); 6.80 (d, J(15,16) = 8.2 Hz, 1 H, 15-H); 6.81 (d, J(12,16) = 2.0 Hz, 1 H, 12-H); 6.85 (dd, J(16,15) = 8.2 Hz, J(16,12) = 2.0 Hz, 1 H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.60 (C-18); 22.46 (d, ^3J(C-F) = 6.2 Hz, C-7); 24.76 (d, ^2J(C-F) = 26.0 Hz, C-17); 37.71 (d, ^2J(C-F) = 19.0 Hz, C-6); 40.47 (d, ^2J(C-F) = 20.3 Hz, C-4); 55.76, 55.79 (C-19, C-20); 70.05 (d, ^4J(C-F) = 1.8 Hz, C-10); 77.43 (d, ^3J(C-F) = 11.5 Hz, C-3); 77.91 (d, ^3J(C-F) = 7.5 Hz, C-1); 95.13 (d, ^1J(C-F)=176.0 Hz, C-5); 109.57 (C-12); 111.06 (C-15); 118.25 (C-16); 124.26 (C-8); 131.22 (C-9); 133.71 (C-11); 148.65 (C-14); 148.84 (C-13).



Reaction of 1 with 2,4,6-trimethoxybenzaldehyde (6e): The reaction of diol **1** and aldehyde **6e** for 8 hours at 2 °C gave products **2e** (*R*:*S* = 1:1, 35%), **8e** (*R*:*S* = 10:1, 42%). Spectral characteristics of compounds **2e** have coincided with those described in the work [4].

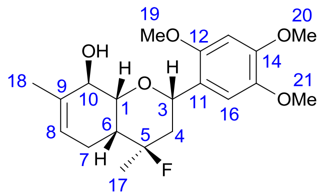
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(2,4,6-trimethoxyphenyl) -3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8e): Brown viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.34 (d, ^3J(17, F) = 22.2 Hz, 3 H, 17-H); 1.54 (dddd, J(4e,4a) = 14.6 Hz, ^3J(4e,F) = 11.5 Hz, J(4e, 3a) = 3.2 Hz, J(4e,6a) = 1.3 Hz, 1 H, 4-H_e); 1.77 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.87-2.00 (m, 2 H, 6-H_a, 7-H_e); 2.14-2.23



(m, 1 H, 7-H_a); 2.60 (ddd, ^3J(4a,F) = 42.0 Hz, J(4a,4e) = 14.6 Hz, J(4a,3a) = 12.1 Hz, 1 H, 4-H_a); 3.73 (s, 6 H, 19-MeO, 21-MeO); 3.75 (s, 3H, 20-MeO); 3.90 (br.s, 1 H, 10-H_e); 4.09 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 5.31 (dd, J(3a,4a) = 12.1 Hz, J(3a,4e) = 3.2 Hz, 1H, 3-H_a); 5.56-5.60 (m, 1 H, 8-H); 6.09 (s, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.71 (C-18); 24.00 (d, ^3J(C-F) = 9.3 Hz, C-7); 25.06 (d, ^2J(C-F) = 24.8 Hz, C-17); 35.52 (d, ^2J(C-F) = 20.8 Hz, C-4); 36.62 (d, ^2J(C-F) = 20.8 Hz, C-6); 55.16 (C-20); 56.10 (C-19, C-21); 67.65 (C-3); 70.34 (C-10); 75.20 (d, ^3J(C-F) = 1.8 Hz, C-1); 91.97 (C-13, C-15); 95.84 (d, ^1J(C-F)=167.6 Hz, C-5); 110.45 (C-11); 123.66 (C-8); 132.02 (C-9); 159.74 (C-14); 160.78 (C-12, C-16). HR-MS: 366.1836 (M^+ $(C_{20}H_{27}O_5F)^+$; calc. 366.1837).

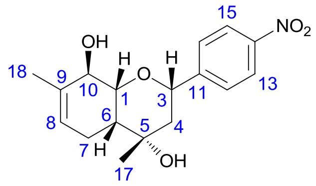
Reaction of 1 with 2,4,5-trimethoxybenzaldehyde (6f): The reaction of diol **1** and aldehyde **6f** for 8 hours at 2 °C gave products **2f** (*R*:*S* = 1:3, 8%), **8f** (*R*:*S* = 7:1, 20%) and **9f** (14%). Spectral characteristics of compounds **2f** and **9f** have coincided with those described in the work [4].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(2,4,5-trimethoxyphenyl) -3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8f): Brown viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.34 (d, ^3J(17, F) = 22.3 Hz, 3 H, 17-H); 1.72 (ddd, J(4a,F) = 40.7 Hz, J(4a,4e) = 14.7 Hz, J(4a,3a) = 11.6 Hz, 1 H, 4-H_a); 1.83 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.92 (ddd, J(4e,4a) = 14.7 Hz, J(4e,F) = 10.8 Hz, J(4e,3a) = 2.8 Hz, 1 H, 4-H_e); 1.93-2.05 (m, 3 H, 6-H, 7-2H); 3.78 (s, 3 H, 19-MeO); 3.80 (s, 3 H, 21-MeO); 3.84 (s, 3 H, 20-MeO); 3.93 (br.s, 1 H, 10-H_e); 4.16 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 5.05 (dd, J(3a,4a) = 11.6 Hz, J(3a,4e) = 2.8 Hz, 1 H, 3-H_a); 5.57-5.61 (m, 1 H, 8-H); 6.48 (s, 1 H, 13-H); 6.88 (s, 1 H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.81 (C-18); 24.13 (d, ^3J(C-F) = 9.3 Hz, C-7); 24.81 (d, ^2J(C-F) = 24.3 Hz, C-17); 36.25 (d, ^2J(C-F) = 20.8 Hz, C-6); 38.89 (d, ^2J(C-F) = 21.7 Hz, C-4); 56.09, 56.49, 56.88 (C-19, C-20, C-21); 70.24 (C-10); 70.27 (C-3); 75.35 (d, ^3J(C-F) = 1.3 Hz, C-1); 95.28 (d, ^1J(C-F) = 168.5 Hz, C-5); 97.83 (C-13); 111.33 (C-16); 122.23 (C-11); 123.23 (C-8); 132.23 (C-9); 143.30 (C-15); 149.08 (C-14); 150.50 (C-12). HR-MS: 366.1842 (M^+ $(C_{20}H_{27}O_5F)^+$; calc. 366.1837).



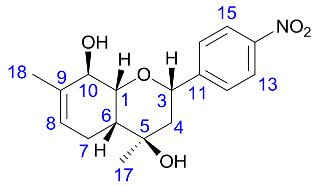
Reaction of 1 with 4-nitrobenzaldehyde (6g): The reaction of diol **1** and aldehyde **6g** for 72 hours at 2 °C gave products **2g** (*R*:*S* = 1:1, 17%), **8g** (*R*:*S* = 12:1, 53%).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4,7-dimethyl-2-(4-nitrophenyl)-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*S*)-2g): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.53 (s, 3 H, 17-H); 1.70 (ddd, J(4e,4a) = 13.3

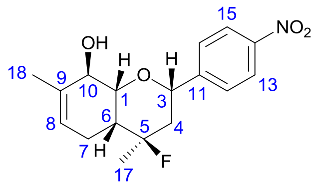


Hz, *J*(4e,3a) = 3.0 Hz, *J*(4e,6a) = 1.1 Hz, 1 H, 4-H_e); 1.75-1.81 (1H, m, 4-H_a); 1.81 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.86 (br.dd, *J*(6a,7a) = 10.7 Hz, *J*(6a,7e) = 6.7 Hz, 1 H, 6-H_a); 2.05-2.22 (m, 2 H, 7-H); 3.82 (br.dd, both *J*~ 2.2 Hz, 1 H, 1-H_e); 3.90 (br.s, 1 H, 10-H_e); 4.51 (dd, *J*(3a,4a) = 11.8 Hz, *J*(3a,4e) = 3.0 Hz, 1 H, 3-H_a); 5.62-5.65 (m, 1 H, 8-H); 7.43 (br.d, *J* = 8.9 Hz, 2 H, 12-H, 16-H); 8.13 (br.d, *J* = 8.9 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.65 (C-18); 22.58 (C-7); 26.93 (C-17); 38.13 (C-6); 42.96 (C-4); 70.35 (C-10); 70.83 (C-5); 76.34 (C-3); 77.64 (C-1); 123.47 (C-13, C-15); 124.43 (C-8); 126.29 (C-12, C-16); 131.34 (C-9); 147.12 (C-14); 149.24 (C-11). HR-MS: 319.1421 (M^+ $(C_{17}H_{21}O_5N)^+$; calc. 319.1414).

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4,7-dimethyl-2-(4-nitrophenyl)-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*R*)-2g): ^{1}H NMR ($CDCl_3$): δ = 1.22 (s, 3 H, 17-H); 1.61 (dd, *J*(4a,4e) = 14.0 Hz, *J*(4a,3a) = 11.3 Hz, 1 H, 4-H_a); 1.67 (ddd, *J*(4e,4a) = 14.0 Hz, *J*(4e,3a) = 3.2 Hz, *J*(4e,6a) = 1.2 Hz, 1 H, 4-H_e); 1.73 (br.dd, *J*(6a,7a) = 10.8 Hz, *J*(6a,7e) = 6.7 Hz, 1 H, 6-H_a); 1.81 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.88-2.04 (m, 2 H, 7-H); 3.92 (br.s, 1 H, 10-H_e); 4.26 (br.dd, both *J*~ 2.2 Hz, 1 H, 1-H_e); 4.88 (dd, *J*(3a,4a) = 11.3 Hz, *J*(3a,4e) = 3.2 Hz, 1 H, 3-H_a); 5.56-5.59 (m, 1 H, 8-H); 7.43 (br.d, *J* = 8.9 Hz, 2 H, 12-H, 16-H); 8.10 (br.d, *J* = 8.9 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.74 (C-18); 24.43 (C-7); 28.16 (C-17); 37.84 (C-6); 41.93 (C-4); 70.36 (C-10); 70.60 (C-5); 74.73 (C-3); 75.10 (C-1); 123.39 (C-13, C-15); 123.81 (C-8); 126.24 (C-12, C-16); 131.81 (C-9); 146.95 (C-14); 150.13 (C-11).



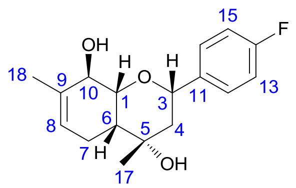
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(4-nitrophenyl)-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8g): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^3J(17, F) = 22.4 Hz, 3 H, 17-H); 1.69 (ddd, ^3J(4a,F) = 39.5 Hz, *J*(4a,4e) = 14.5 Hz, *J*(4a,3a) = 11.8 Hz, 1 H, 4-H_a); 1.83 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.84-1.92 (m, 1 H, 7-H_a); 1.95 (dddd, *J*(4e,4a) = 14.5 Hz, ^3J(4e,F) = 10.0 Hz, *J*(4e,3a) = 2.9 Hz, *J*(4e,6a) = 1.2 Hz, 1 H, 4-H_e); 1.99-2.07 (m, 2 H, 6-H_a, 7-H_e); 3.93 (br.s, 1 H, 10-H_e); 4.16 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 4.84 (dd, *J*(3a,4a) = 11.8 Hz, *J*(3a,4e) = 2.9 Hz, 1 H, 3-H_a); 5.56-5.60 (m, 1 H, 8-H); 7.45 (dd, *J*(12,13) = *J*(16,15) = 8.8 Hz, *J*(12,3a) = *J*(16,3a) = 0.6 Hz, 2 H, 12-H, 16-H); 8.14 (d, *J*(13,12) = *J*(15,16) = 8.8 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.76 (C-18); 23.94 (d, ^3J(C-F) = 9.3 Hz, C-7); 24.65 (d, ^2J(C-F) = 24.3 Hz, C-17); 35.84 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.17 (d, ^2J(C-F) = 21.7 Hz, C-4); 69.91 (C-10); 74.60 (C-3); 75.27 (d, ^3J(C-F) = 1.3 Hz, C-1); 94.81 (d, ^1J(C-F) = 169.8 Hz, C-5); 123.0 (C-8); 123.48 (C-13, C-15);



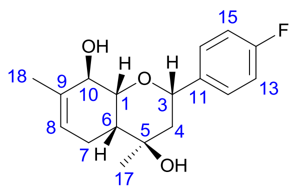
126.23 (C-12, C-16); 132.17 (C-9); 147.11 (C-14); 149.31 (C-11). HR-MS: 321.1369 (M^+ $(C_{17}H_{20}O_4NF)^+$; calc. 321.1371).

Reaction of 1 with 4-fluorobenzaldehyde (6h): The reaction of diol **1** and aldehyde **6h** for 72 hours at 2 °C gave products **2h** (*R*:*S* = 1:2, 17%), **8h** (*R*:*S* = 6:1, 47%).

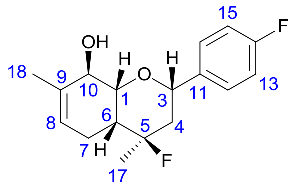
(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-(4-fluorophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*S*)-2h): Yellow oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 1.41 (s, 3 H, 17-H); 1.54 (br. dd, *J*(4e,4a) = 13.3 Hz, *J*(4e,3a) = 2.5 Hz, 1 H, 4-H_e); 1.71 (br.s, 3 H, 18-H); 1.74 (br.t, *J*(6a,7) = 8.7 Hz, 1 H, 6-H_a); 1.78 (dd, *J*(4a,4e) = 13.3 Hz, *J*(4a,3a) = 12.1 Hz, 1 H, 4-H_a); 2.03-2.11 (m, 2 H, 7-H); 3.70 (dd, *J*(1e,6a) ≈ *J*(1e,10e) ≈ 2.2 Hz, 1 H, 1-H_e); 3.76 (br.s, 1 H, 10-H_e); 4.32 (dd, *J*(3a,4a) = 12.1 Hz, *J*(3a,4e) = 2.5 Hz, 1 H, 3-H_a); 5.53-5.57 (m, 1 H, 8-H); 6.89 (dd, *J*(13,12) = ^3J(13,F) = *J*(15,16) = ^3J(15,F) = 8.8 Hz, 2 H, 13-H, 15-H); 7.18 (dd, *J*(12,13) = *J*(16,15) = 8.8 Hz, ^4J(12,F) = ^4J(16,F) = 5.5 Hz, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 20.37 (C-18); 22.50 (C-7); 26.39 (C-17); 38.02 (C-6); 42.50 (C-4); 69.90 (C-10); 70.38 (C-5); 76.76 (C-3); 77.79 (C-1); 114.84 (d, ^2J(C-F) = 21.6 Hz, C-13, C-15); 124.13 (C-8); 127.38 (d, ^3J(C-F) = 8.3 Hz, C-12, C-16); 131.07 (C-9); 137.67 (d, ^4J(C-F) = 3.3 Hz, C-11); 161.94 (d, ^1J(C-F) =245.1 Hz, C-14); HR-MS: 275.1440 ($[M\text{-}OH]^+$ $(C_{17}H_{20}O_2F)^+$; calc. 275.1442).



(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(4-fluorophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*R*)-2h): Yellow oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 1.12 (s, 3 H, 17-H); 1.51 (ddd, *J*(4e,4a) = 14.1 Hz, *J*(4e,3a) = 3.0 Hz, *J*(4e,6a) = 1.3 Hz, 1 H, 4-H_e); 1.60 (dd, *J*(4a,4e) = 14.1 Hz, *J*(4a,3a) = 11.5 Hz, 1 H, 4-H_a); 1.58-1.63 (m, 1 H, 6-H_a); 1.71 (br.s, 3 H, 18-H); 1.86-1.96 (m, 2 H, 7-H); 3.77 (br.s, 1 H, 10-H_e); 4.12 (dd, *J*(1e,6a) ≈ *J*(1e,10e) ≈ 2.2 Hz, 1 H, 1-H_e); 4.67 (dd, *J*(3a,4a) = 11.5 Hz, *J*(3a,4e) = 3.0 Hz, 1 H, 3-H_a); 5.47-5.51 (m, 1 H, 8-H); 6.88 (dd, *J*(13,12) = ^3J(13,F) = *J*(15,16) = ^3J(15,F) = 8.8 Hz, 2 H, 13-H, 15-H); 7.18 (dd, *J*(12,13) = *J*(16,15) = 8.8 Hz, ^4J(12,F) = ^4J(16,F) = 5.5 Hz, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 20.44 (C-18); 24.32 (C-7); 27.61 (C-17); 37.47 (C-6); 41.75 (C-4); 69.90 (C-10); 70.05 (C-5); 75.12 (C-3); 75.24 (C-1); 114.76 (d, ^2J(C-F) = 21.3 Hz, C-13, C-15); 123.51 (C-8); 127.32 (d, ^3J(C-F) = 8.3 Hz, C-12, C-16); 131.66 (C-9); 138.31 (d, ^4J(C-F) = 3.3 Hz, C-11); 161.82 (d, ^1J(C-F) = 245.0 Hz, C-14).



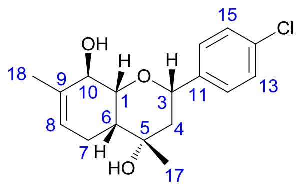
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-2-(4-fluorophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8h): Yellow oil.^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^3J(17, F) = 22.4 Hz, 3 H, 17-H);



1.75 (ddd, ^3J(4a, F) = 39.9 Hz, J(4a,4e) = 14.6 Hz, J(4a, 3a) = 11.7 Hz, 1 H, 4-H_a); 1.82 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.89 (dddd, J(4e,4a) = 14.6 Hz, ^3J(4e,F) = 10.4 Hz, J(4e,3a) = 2.9 Hz, J(4e,6a) = 1.2 Hz, 1 H, 4-H_e); 1.88-1.96 (m, 1 H, 7-H_a); 1.97-2.06 (m, 2 H, 6-H_a, 7-H_e); 3.92 (br.s, 1 H, 10-H_e); 4.14 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 4.73 (dd, J(3a,4a) = 11.7 Hz, J(3a,4e) = 2.9 Hz, 1 H, 3-H_a); 5.56-5.60 (m, 1 H, 8-H); 6.98 (dd, J(13,12) = J(15,16) = 8.8 Hz, ^3J(13,F) = ^3J(15,F) = 8.8 Hz, 2 H, 13-H, 15-H); 7.26 (dd, J(12,13) = J(16,15) = 8.8 Hz, ^4J(12,F) = ^4J(16,F) = 5.4 Hz, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 20.78 (C-18); 24.04 (d, ^3J(C-F) = 9.4 Hz, C-7); 24.73 (d, ^2J(C-F) = 24.4 Hz, C-17); 35.98 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.38 (d, ^2J(C-F) = 21.5 Hz, C-4); 70.05 (C-10); 75.04 (C-3); 75.33 (d, ^3J(C-F) = 1.2 Hz, C-1); 95.05 (d, ^1J(C-F) = 168.8 Hz, C-5); 115.07 (d, ^2J(C-F)=21.3 Hz, C-13, C-15); 123.12 (C-8); 127.37 (d, ^3J(C-F) = 8.1 Hz, C-12, C-16); 132.19 (C-9); 137.73 (d, ^4J(C-F) = 3.1 Hz, C-11); 162.06 (d, ^1J(C-F) = 245.4 Hz, C-14). HR-MS: 294.1424 (M^+ $(C_{17}H_{20}O_2F_2)^+$; calc. 294.1426).

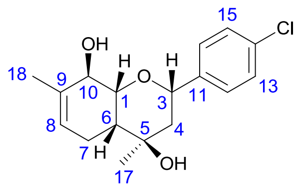
Reaction of 1 with 4-chlorobenzaldehyde (6i): The reaction of diol **1** and aldehyde **6i** for 72 hours at 2 °C gave products **2i** (*R*:*S* = 1:3, 17%), **8i** (*R*:*S* = 6:1, 58%).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-(4-chlorophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*S*)-2i): Transparent viscous oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 1.16 (s, 3 H, 17-H); 1.29



(ddd, J(4e,4a) = 13.4 Hz, J(4e,3a) = 2.7 Hz, J(4e,6a) = 1.1 Hz, 1 H, 4-H_e); 1.45 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.48-1.54 (m, 2 H, 4-H_a, 6-H_a); 1.77-1.89 (m, 2 H, 7-H); 3.45 (dd, J(1e,10e) = 2.4 Hz, J(1e,6a) = 2.2 Hz, 1 H, 1-H_e); 3.48 (br.s, 1 H, 10-H_e); 4.10 (dd, J(3a,4a) = 12.1 Hz, J(3a,4e) = 2.7 Hz, 1 H, 3-H_a); 5.27-5.31 (m, 1 H, 8-H); 6.90-6.94 (m, 4 H, 12-H, 13-H, 15-H, 16-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 19.67 (C-18); 22.09 (C-7); 25.59 (C-17); 37.63 (C-6); 41.90 (C-4); 69.37 (C-10); 69.72 (C-5); 76.27 (C-3); 77.53 (C-1); 123.65 (C-8); 126.66 (C-12, C-16); 127.63 (C-13, C-15); 130.59 (C-9); 132.41 (C-14); 140.27 (C-11). HR-MS: 308.1178 (M^+ $(C_{17}H_{21}O_3Cl)^+$; calc. 308.1174).

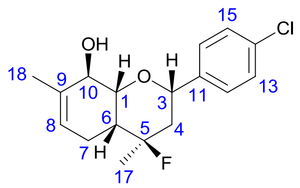
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(4-chlorophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*R*)-2i): Transparent viscous oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 1.05 (s, 3 H, 17-H); 1.46



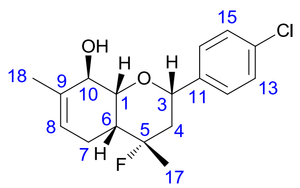
(ddd, J(4e,4a) = 14.1 Hz, J(4e,3a) = 3.2 Hz, J(4e,6a) = 1.1 Hz, 1 H, 4-H_e); 1.51 (dd, J(4a,4e) = 14.1 Hz, J(4a,3a) = 11.4 Hz, 1 H, 4-H_a); 1.53 (dddd, J(6a,7a) = 10.8 Hz, J(6a,7e) = 6.7 Hz, J(6a,1e) = 2.1 Hz, J(6a,4e) = 1.1 Hz, 1 H, 6-H_a); 1.64 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.75-1.91 (m, 2 H, 7-H);

3.69 (br.s, 1 H, 10-H_e); 4.04 (dd, *J*(1e,10e) = 2.3 Hz, *J*(1e,6a) = 2.1 Hz, 1 H, 1-H_e); 4.60 (dd, *J*(3a,4a) = 11.4 Hz, *J*(3a,4e) = 3.2 Hz, 1 H, 3-H_a); 5.45-5.50 (m, 1 H, 8-H); 7.06-7.13 (m, 4 H, 12-H, 13-H, 15-H, 16-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 20.18 (C-18); 24.18 (C-7); 27.34 (C-17); 37.26 (C-6); 41.54 (C-4); 69.83 (C-10); 70.13 (C-5); 75.17 (C-3); 76.64 (C-1); 123.33 (C-8); 126.92 (C-12, C-16); 127.98 (C-13, C-15); 131.54 (C-9); 132.53 (C-14); 141.01 (C-11).

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(4-chlorophenyl)-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8i): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^3J(17, F) = 22.4 Hz, 3 H, 17-H); 1.73 (ddd, ^3J(4a,F) = 39.9 Hz, *J*(4a,4e) = 14.5 Hz, *J*(4a,3a) = 11.7 Hz, 1 H, 4-H_a); 1.83 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.89 (dddd, *J*(4e,4a) = 14.5 Hz, ^3J(4e,F) = 10.2 Hz, *J*(4e,3a) = 2.9 Hz, *J*(4e,6a) = 1.1 Hz, 1 H, 4-H_e); 1.87-1.95 (m, 1 H, 7-H_a); 1.97-2.06 (m, 2 H, 6-H_a, 7-H_e); 3.93 (br.s, 1 H, 10-H_e); 4.14 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 4.72 (dd, *J*(3a,4a) = 11.7 Hz, *J*(3a,4e) = 2.9 Hz, 1 H, 3-H_a); 5.56-5.60 (m, 1 H, 8-H); 7.23 (d, *J*(12,13) = *J*(16,15) = 8.5 Hz, 2 H, 12-H, 16-H); 7.27 (d, *J*(13,12) = *J*(15,16) = 8.5 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.78 (C-18); 24.03 (d, ^3J(C-F) = 9.3 Hz, C-7); 24.74 (d, ^2J(C-F) = 24.3 Hz, C-17); 35.98 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.29 (d, ^2J(C-F) = 21.23 Hz, C-4); 70.07 (C-10); 74.97 (C-3); 75.30 (d, ^3J(C-F) = 1.1 Hz, C-1); 94.94 (d, ^1J(C-F) = 168.5 Hz, C-5); 123.13 (C-8); 127.05 (C-12, C-16); 128.41 (C-13, C-15); 132.19 (C-9); 133.10 (C-14); 140.47 (C-11). HR-MS: 310.1133 (M^+ ($C_{17}H_{20}O_2FCl$)$^+$; calc. 310.1130).

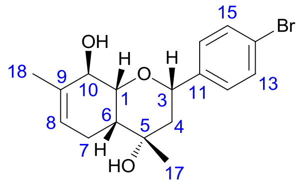


(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-(4-chlorophenyl)-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8i): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.64 (d, ^3J(17, F) = 23.4 Hz, 3 H, 17-H); 1.81 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.82 (br.dd, *J*(4e,4a) = 13.3 Hz, *J*(4e,3a) = 2.6 Hz, 1 H, 4-H_e); 1.98-2.12 (m, 2 H, 4-H_a, 6-H_a); 2.16-2.22 (m, 2 H, 7-H); 3.71 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 3.90 (br.s, 1 H, 10-H_e); 4.35 (dd, *J*(3a,4a) = 12.1 Hz, *J*(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 5.63-5.67 (m, 1 H, 8-H); 7.23 (d, *J*(12,13) = *J*(16,15) = 8.5 Hz, 2 H, 12-H, 16-H); 7.28 (d, *J*(13,12) = *J*(15,16) = 8.5 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.65 (C-18); 22.46 (d, ^3J(C-F) = 6.2 Hz, C-7); 24.73 (d, ^2J(C-F) = 26.1 Hz, C-17); 37.62 (d, ^2J(C-F) = 19.0 Hz, C-6); 40.82 (d, ^2J(C-F) = 20.8 Hz, C-4); 70.07 (d, ^4J(C-F) = 1.8 Hz, C-10); 76.82 (d, ^3J(C-F) = 11.5 Hz, C-3); 77.81 (d, ^3J(C-F) = 7.5 Hz, C-1); 94.88 (d, ^1J(C-F) = 176.9 Hz, C-5); 124.32 (C-8); 127.11 (C-12, C-16); 128.47 (C-13, C-15); 131.23 (C-9); 133.38 (C-14); 139.76 (C-11).

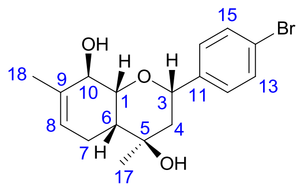


Reaction of 1 with 4-bromobenzaldehyde(6j): The reaction of diol **1** and aldehyde **6j** for 72 hours at 2 °C gave products **2j** (*R*:*S* = 1:2, 13%), **8j** (*R*:*S* = 10:1, 60%).

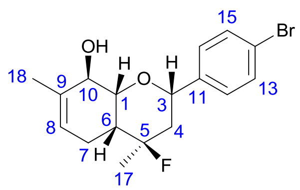
(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-(4-bromophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*S*)-2j): Yellow viscous oil. ^{1}H NMR (CD_3OD): δ = 1.54 (s, 3 H, 17-H); 1.67 (ddd, *J*(4e,4a) = 13.4 Hz, *J*(4e,3a) = 2.8 Hz, *J*(4e,6a) = 1.2 Hz, 1 H, 4-H_e); 1.83 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.85 (dd, *J*(4a,4e) = 13.4 Hz, *J*(4a,3a) = 12.0 Hz, 1 H, 4-H_a); 1.88-1.93 (m, 1 H, 6-H_a); 2.15-2.21 (m, 2 H, 7-H); 3.82-3.85 (m, 2 H, 1-H_e, 10-H_e); 4.51 (dd, *J*(3a,4a) = 12.0 Hz, *J*(3a,4e) = 2.8 Hz, 1 H, 3-H_a); 5.65-5.69 (m, 1 H, 8-H); 7.26 (d, *J*(12,13) = *J*(16,15) = 8.5 Hz, 2 H, 12-H, 16-H); 7.48 (d, *J*(13,12) = *J*(15,16) = 8.5 Hz, 2 H, 13-H, 15-H). ^{13}C NMR (CD_3OD) δ = 21.13 (C-18); 24.02 (C-7); 27.09 (C-17); 39.67 (C-6); 43.97 (C-4); 71.38 (C-10); 71.53 (C-5); 78.12 (C-3); 79.49 (C-1); 122.04 (C-14); 125.40 (C-8); 128.86 (C-12, C-16); 132.37 (C-13, C-15); 132.62 (C-9); 143.25 (C-11). HR-MS: 334.0569 ($[M\text{-}H_2O]^+$ $(C_{17}H_{19}O_2Br)^+$; calc. 334.0563).



(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(4-bromophenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*R*)-2j): Yellow viscous oil. ^{1}H NMR (CD_3OD): δ = 1.24 (s, 3 H, 17-H); 1.63 (ddd, *J*(4e,4a) = 14.1 Hz, *J*(4e,3a) = 3.0 Hz, *J*(4e,6a) = 1.2 Hz, 1 H, 4-H_e); 1.73 (dd, *J*(4a,4e) = 14.1 Hz, *J*(4a,3a) = 11.6 Hz, 1 H, 4-H_a); 1.77-1.82 (m, 1 H, 6-H_a); 1.83 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.96-2.10 (m, 2 H, 7-H); 3.83 (br.s, 1 H, 10-H_e); 4.26 (dd, *J*(1e,10e) = 2.3 Hz, *J*(1e,6a) = 2.1 Hz, 1 H, 1-H_e); 4.77 (dd, *J*(3a,4a) = 11.6 Hz, *J*(3a,4e) = 3.0 Hz, 1 H, 3-H_a); 5.60-5.64 (m, 1 H, 8-H); 7.25 (d, *J*(12,13) = *J*(16,15) = 8.5 Hz, 2 H, 12-H, 16-H); 7.47 (d, *J*(13,12) = *J*(15,16) = 8.5 Hz, 2 H, 13-H, 15-H). ^{13}C NMR (CD_3OD) δ = 22.22 (C-18); 25.64 (C-7); 28.23 (C-17); 38.71 (C-6); 43.15 (C-4); 71.19 (C-5); 71.35 (C-10); 76.61 (C-3); 77.08 (C-1); 121.85 (C-14); 124.83 (C-8); 128.88 (C-12, C-16); 132.33 (C-13, C-15); 133.10 (C-9); 143.70 (C-11).



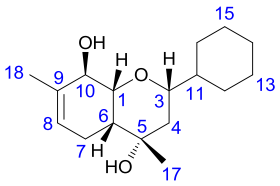
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-(4-bromophenyl)-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8j): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.35 (d, ^3J(17, F) = 22.3 Hz, 3 H, 17-H); 1.72 (ddd, ^3J(4a,F) = 39.8 Hz, *J*(4a,4e) = 14.6 Hz, *J*(4a,3a) = 11.7 Hz, 1 H, 4-H_a); 1.83 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.89 (dddd, *J*(4e,4a) = 14.6 Hz, ^3J(4e,F) = 10.2 Hz, *J*(4e,3a) = 3.0 Hz, *J*(4e,6a) = 1.1 Hz, 1 H, 4-H_e); 1.87-1.95 (m, 1 H, 7-H_a); 1.97-2.07 (m, 2 H, 6-H_a, 7-H_e); 3.93 (br.s, 1 H, 10-H_e); 4.14 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 4.71 (dd, *J*(3a,4a) = 11.7



Hz, J(3a,4e) = 2.9 Hz, 1 H, 3-H_a); 5.56-5.60 (m, 1 H, 8-H); 7.17 (d, J(12,13) = J(16,15) = 8.5 Hz, 2 H, 12-H, 16-H); 7.42 (d, J(13,12) = J(15,16) = 8.5 Hz, 2 H, 13-H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.79 (C-18); 24.04 (d, ^3J(C-F) = 9.3 Hz, C-7); 24.74 (d, ^2J(C-F) = 24.3 Hz, C-17); 35.99 (d, ^2J(C-F) = 20.8 Hz, C-6); 40.26 (d, ^2J(C-F) = 21.2 Hz, C-4); 70.09 (C-10); 75.01 (C-3); 75.30 (d, ^3J(C-F) = 1.3 Hz, C-1); 94.98 (d, ^1J(C-F) = 169.4 Hz, C-5); 121.21 (C-14); 123.15 (C-8); 127.40 (C-12, C-16); 131.38 (C-13, C-15); 132.21 (C-9); 141.00 (C-11). HR-MS: 354.0620 (M^+ $(C_{17}H_{20}O_2FBr)^+$; calc. 354.0625).

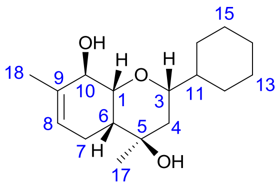
Reaction of 1 with cyclohexanecarbaldehyde (6k): The reaction of diol **1** and aldehyde **6k** for 8 hours at 2 °C gave products **2k** (*R*:*S* = 1:3, 27%), **8k** (*R*:*S* = 3:1, 61%).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-cyclohexyl-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*S*)-2k): Transparent oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 0.74-0.87 (m, 2 H, 12-H_a, 16-H_a); 0.93-1.10



(m, 3 H, 13-H, 14-H, 15-H); 1.15-1.25 (m, 1 H, 11-H); 1.24 (d, J(17,4a) = 0.6 Hz, 3 H, 17-H); 1.29 (ddd, J(4e,4a) = 13.2 Hz, J(4e,3a) = 2.6 Hz, J(4e,6a) = 1.0 Hz, 1 H, 4-H_e); 1.44 (dd, J(4a,4e) = 13.2 Hz, J(4a,3a) = 11.8 Hz, 1 H, 4-H_a); 1.46-1.59 (m, 4 H, 12-H_e or 16-H_e, 13-H', 14-H', 15-H'); 1.58 (br.dd, J(6a,7a) = 10.8 Hz, J(6a,7e) = 6.6 Hz, 1 H, 6-H_a); 1.65 (m, all J ≤ 2.5 Hz, 3 H, 18-H); 1.74-1.81 (m, 1 H, 16-H_e or 12-H_e); 1.86 (dddq, J(7a,7e) = 18.0 Hz, J(7a,6a) = 10.8 Hz, J(7a,8) = 2.5 Hz, J(7a,18) = 2.5 Hz, 1 H, 7-H_a); 1.94 (dddq, J(7e,7a) = 18.0 Hz, J(7e,6a) = 6.6 Hz, J(7e,8) = 5.2 Hz, J(7e,18) = 1.6 Hz, 1 H, 7-H_e); 2.95 (ddd, J(3a,4a) = 11.8 Hz, J(3a,11) = 6.7 Hz, J(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 3.41 (dd, J(1e,10e) = 2.3 Hz, J(1e,6a) = 2.1 Hz, 1 H, 1-H_e); 3.63 (br.s, 1 H, 10-H_e); 5.44-5.47 (m, 1 H, 8-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 20.32 (C-18); 22.36 (C-7); 25.62, 25.77, 26.18 (C-13, C-14, C-15); 26.54 (C-17); 28.06, 28.91 (C-12, C-16); 37.29 (C-4); 38.40 (C-6); 42.27 (C-11); 70.02 (C-10); 70.53 (C-5); 77.32 (C-1); 79.66 (C-3); 124.30 (C-8); 131.02 (C-9). HR-MS: 262.1923 ($[M\text{-}H_2O]^+$ $(C_{17}H_{26}O_2)^+$; calc. 262.1927).

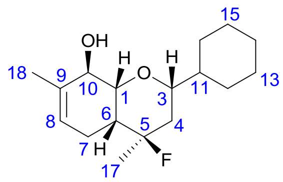
(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-cyclohexyl-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromene-4,8-diol ((*R*)-2k): Transparent oil. ^{1}H NMR ($CDCl_3$+CD_3OD): δ = 0.74-0.87 (m, 2 H, 12-H_a, 16-H_a); 0.94-1.11



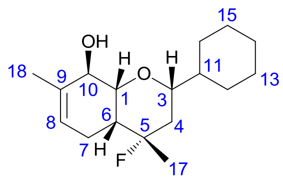
(m, 3 H, 13-H, 14-H, 15-H); 1.04 (s, 3 H, 17-H); 1.15-1.23 (m, 1 H, 11-H); 1.25-1.31 (m, 2 H, 4-H); 1.44-1.59 (m, 5 H, 6-H_a, 12-H_e or 16-H_e, 13-H', 14-H', 15-H'); 1.65 (m, all J ≤ 2.5 Hz, 3 H, 18-H); 1.74-1.79 (m, 2 H, 7-H); 3.25-3.30 (m, 1 H, 3-H_a); 3.65 (br.s, 1 H, 10-H_e); 3.81 (dd, J(1e,10e) = 2.4 Hz, J(1e,6a) = 2.2 Hz, 1 H, 1-H_e); 5.38-5.41 (m, 1 H, 8-H). ^{13}C NMR ($CDCl_3$+CD_3OD) δ = 20.39 (C-18); 24.14 (C-7); 25.65, 25.79, 26.21 (C-13, C-14, C-15); 27.81 (C-17); 27.93, 28.94 (C-12, C-16);

36.36 (C-4); 37.83 (C-6); 42.14 (C-11); 70.02 (C-10); 70.53 (C-5); 74.85 (C-1); 77.87 (C-3); 123.66 (C-8); 131.61 (C-9).

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-2-cyclohexyl-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8k): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 0.85-0.98 (m, 2 H, 12-H_a, 16-H_a); 1.04-1.23 (m, 3 H, 13-H, 14-H, 15-H); 1.29 (d, ^{3}J(17,F) = 22.3 Hz, 3 H, 17-H); 1.24-1.34 (m, 1 H, 11-H); 1.45 (ddd, ^{3}J(4a,F) = 40.7 Hz, *J*(4a,4e) = 14.3 Hz, *J*(4a,3a) = 11.7 Hz, 1 H, 4-H_a); 1.55-1.71 (m, 5 H, 4-H_e, 13-H', 14-H', 15-H', 16-H_e or 12-H_e); 1.78 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 1.72-1.80 (m, 1 H, 7-H); 1.82-1.95 (m, 3 H, 6-H, 7-H', 12-H_e or 16-H_e); 3.36 (ddd, *J*(3a,4a) = 11.7 Hz, *J*(3a,11) = 7.1 Hz, *J*(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 3.80 (br.s, 1 H, 10-H_e); 3.86 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 5.48-5.52 (m, 1 H, 8-H). ^{13}C NMR ($CDCl_3$) δ = 20.80 (C-18); 23.91 (d, ^{3}J(C-F) = 9.6 Hz, C-7); 25.01 (d, ^{2}J(C-F) = 24.5 Hz, C-17); 25.73, 25.92, 26.36 (C-13, C-14, C-15); 28.11, 28.92 (C-12, C-16); 35.33 (d, ^{2}J(C-F) = 21.6 Hz, C-4); 36.40 (d, ^{2}J(C-F) = 21.0 Hz, C-6); 42.19 (C-11); 70.09 (C-10); 74.97 (C-1); 77.85 (C-3); 95.19 (d, ^{1}J(C-F) = 167.8 Hz, C-5); 123.24 (C-8); 132.17 (C-9). HR-MS: 263.2005 ([*M-F*]$^{+}$ ($C_{17}H_{27}O_2$)$^{+}$; calc. 263.2006).

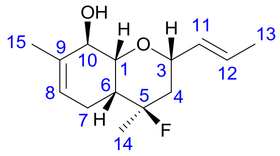


(2*S*,4*S*,4a*R*,8*R*,8a*R*)-2-cyclohexyl-4-fluoro-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8k): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.49 (d, ^{3}J(17, F) = 23.7 Hz, 3 H, 17-H); 1.78 (m, all *J* ≤ 2.5 Hz, 3 H, 18-H); 2.02-2.08 (m, 2 H, 7-H); 3.00 (ddd, *J*(3a,4a) = 12.0 Hz, *J*(3a,11) = 6.7 Hz, *J*(3a,4e) = 2.4 Hz, 1 H, 3-H_a); 3.44 (m, all *J* ≤ 3.0 Hz, 1 H, 1-H_e); 3.78 (m, 1 H, 10-H_e); 5.55-5.59 (m, 1 H, 8-H). The signals of the others protons are overlapped by those of the main isomer (*R*)-7k in the areas 0.86-0.98, 1.05-1.23, 1.28-1.36, 1.56-1.71 and 1.87-1.95 ppm. ^{13}C NMR ($CDCl_3$) δ = 20.67 (C-18); 22.36 (d, ^{3}J(C-F) = 6.2 Hz, C-7); 24.93 (d, ^{2}J(C-F) = 25.9 Hz, C-17); 25.75, 25.91, 26.32 (C-13, C-14, C-15); 28.28, 28.94 (C-12, C-16); 36.01 (d, ^{2}J(C-F) = 20.0 Hz, C-4); 38.01 (d, ^{2}J(C-F) = 18.5 Hz, C-6); 42.35 (C-11); 70.09 (C-10); 77.43 (d, ^{3}J(C-F) = 7.3 Hz, C-1); 79.92 (d, ^{3}J(C-F) = 10.7 Hz, C-3); 95.67 (d, ^{1}J(C-F) = 175.2 Hz, C-5); 124.39 (C-8); 131.22 (C-9).



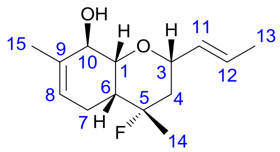
Reaction of 1 with (*E*)-but-2-enal 6l: The reaction of diol **1** and aldehyde **6l** for 8 hours at 2°C gave products **2l** (*R*:*S* = 1:2, 20%), **8l** (*R*:*S* = 3:1, 57%). Spectral characteristics of compounds **2l** have coincided with those described in the work [1].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-((*E*)-prop-1-en-1-yl)-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8l): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.29 (d, ^{3}J(14, F) = 22.3 Hz, 3 H, 14-H);



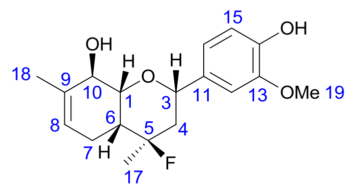
1.58 (ddd, ^{3}J(4a,F) = 39.7 Hz, J(4a,4e) = 14.6 Hz, J(4a,3a) = 11.4 Hz, 1 H, 4-H_a); 1.64 (dd, J(13,12) = 6.5 Hz, J(13,11) = 1.7 Hz, 3 H, 13-H); 1.60-1.70 (m, 1 H, 4-H_e); 1.77 (m, all $J \leq 2.5$ Hz, 3 H, 15-H); 1.76-1.84 (m, 1 H, 7-H_a); 1.86-1.96 (m, 2 H, 6-H_a, 7-H_e); 3.85 (m, 1 H, 10-H_e); 3.96 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 4.12 (ddd, J(3a,4a) = 11.2 Hz, J(3a,11) = 7.0 Hz, J(3a,4e) = 3.1 Hz, 1 H, 3-H_a); 5.42 (ddq, J(11,12) = 15.4 Hz, J(11,3a) = 7.0 Hz, J(11,13) = 1.7 Hz, 1 H, 11-H); 5.48-5.52 (m, 1 H, 8-H); 5.68 (dqd, J(12,11) = 15.4 Hz, J(12,13) = 6.5 Hz, J(12,3a) = 1.0 Hz, 1 H, 12-H). ^{13}C NMR ($CDCl_3$) δ = 17.57 (C-13); 20.75 (C-15); 23.89 (d, ^{3}J(C-F) = 9.6 Hz, C-7); 24.71 (d, ^{2}J(C-F) = 24.5 Hz, C-14); 35.95 (d, ^{2}J(C-F) = 20.9 Hz, C-6); 38.26 (d, ^{2}J(C-F) = 21.8 Hz, C-4); 69.94 (C-10); 74.48 (C-3); 74.79 (C-1); 94.85 (d, ^{1}J(C-F) = 168.1 Hz, C-5); 123.22 (C-8); 127.99 (C-12); 131.08 (C-11); 132.02 (C-9). HR-MS: 240.1524 (M^+ $(C_{14}H_{21}O_2F)^+$; calc. 240.1520).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-((*E*)-prop-1-en-1-yl)-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8l): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 1.53 (dd, ^{3}J(14, F) = 22.3 Hz, J(14, 4a) = 0.8 Hz, 3 H, 14-H); 1.59-1.70 (m, 5 H, 4-2H, 13-3H); 1.77 (m, 3 H, 15-H); 1.93-1.98 (m, 1 H, 6-H_a); 2.05-2.12 (m, 2 H, 7-H); 3.54 (m, all $J \leq 3.0$ Hz, 1 H, 1-H_e); 3.76 (br.ddd, J(3a,4a) = 12.0 Hz, J(3a,11) = 6.7 Hz, J(3a,4e) = 2.5 Hz, 1 H, 3-H_a); 3.83 (m, 1 H, 10-H_e); 5.45 (ddq, J(11,12) = 15.3 Hz, J(11,3a) = 6.7 Hz, J(11,13) = 1.6 Hz, 1 H, 11-H); 5.56-5.60 (m, 1 H, 8-H); 5.64-5.72 (m, 1 H, 12-H). ^{13}C NMR ($CDCl_3$) δ = 17.51 (C-13); 20.62 (C-15); 22.35 (d, ^{3}J(C-F) = 6.2 Hz, C-7); 24.74 (d, ^{2}J(C-F) = 25.9 Hz, C-14); 37.57 (d, ^{2}J(C-F) = 18.7 Hz, C-6); 38.95 (d, ^{2}J(C-F) = 20.1 Hz, C-4); 69.97 (C-10); 76.33 (d, ^{3}J(C-F) = 11.6 Hz, C-3); 77.36 (d, ^{3}J(C-F) = 7.5 Hz, C-1); 94.91 (d, ^{1}J(C-F) = 175.9 Hz, C-5); 124.40 (C-8); 128.22 (C-12); 130.68 (C-11); 131.08 (C-9).



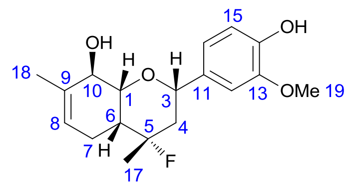
Reaction of 1 with 4-hydroxy-3-methoxybenzaldehyde (6m): The reaction of diol **1** and aldehyde **6m** for 8 hours at 2 °C gave products **2m** (*R*:*S* = 1:3, 35%), **8m** (*R*:*S* = 3:1, 60%). Spectral characteristics of compounds **2m** have coincided with those described in the work [2].

(2*S*,4*R*,4a*R*,8*R*,8a*R*)-4-fluoro-2-(4-hydroxy-3-methoxyphenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*R*)-8m): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.36 (d, ^{3}J(17, F) = 22.4 Hz, 3 H, 17-H); 1.81 (ddd, ^{3}J(4a, F) = 39.2 Hz, J(4a,4e) = 14.6 Hz, J(4a, 3a) = 11.5 Hz, 1 H, 4-H_a); 1.82 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.85-1.92 (m, 1 H, 4-H_e); 1.92-2.06 (m, 3 H, 6-H_a, 7-2H); 3.86 (s, 3 H, 19-MeO); 3.94 (br.s, 1 H, 10-H_e); 4.15 (m, all $J < 3.0$ Hz, 1 H, 1-H_e); 4.67 (dd, J(3a,4a) = 11.5 Hz, J(3a,4e) = 3.3 Hz, 1 H, 3-H_a); 5.56 (br.s, 1 H, 14-HO); 5.56-5.60 (m, 1 H, 8-H); 6.79-6.82



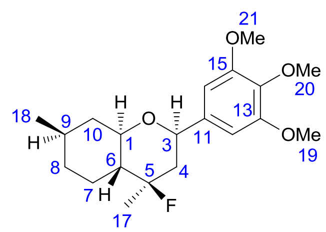
(m, 2 H, 12-H, 16-H); 6.85 (d, *J*(15,16) = 8.5 Hz, 1 H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.77 (C-18); 24.10 (d, ^3J(C-F) = 9.7 Hz, C-7); 24.81 (d, ^2J(C-F) = 24.5 Hz, C-17); 36.14 (d, ^2J(C-F) = 20.9 Hz, C-6); 40.17 (d, ^2J(C-F) = 21.6 Hz, C-4); 55.84 (C-19); 70.20 (C-10); 75.47 (d, ^3J(C-F) = 1.0 Hz, C-1); 75.72 (C-3); 95.21 (d, ^1J(C-F)=168.8 Hz, C-5); 108.82 (C-12); 114.21 (C-15); 118.79 (C-16); 123.22 (C-8); 132.23 (C-9); 133.81 (C-11); 145.10 (C-14); 146.34 (C-13). HR-MS: 322.1573 (M^+ $(C_{18}H_{23}O_4F)^+$; calc. 322.1575).

(2*S*,4*S*,4a*R*,8*R*,8a*R*)-4-fluoro-2-(4-hydroxy-3-methoxyphenyl)-4,7-dimethyl-3,4,4a,5,8,8a-hexahydro-2*H*-chromen-8-ol ((*S*)-8m): Yellow viscous oil. ^{1}H NMR ($CDCl_3$): δ = 1.64 (dd, ^3J(17, F) = 23.5 Hz, *J*(17, 4a) = 0.8 Hz, 3 H, 17-H); 1.81 (m, all $J \leq 2.5$ Hz, 3 H, 18-H); 1.83 (br.dd, *J*(4e, 4a) = 13.3 Hz, *J*(4e,3a) = 2.6 Hz, 1 H, 4-H_e); 2.05 (br.dd, *J*(6a,7a) = 10.6 Hz, *J*(6a,7e) = 6.5, 1 H, 6-H_a); 2.17 (dddq, ^3J(4a, F) ~ 14.0 Hz, *J*(4a,4e) = 13.3 Hz, *J*(4a,3a) = 12.1 Hz, *J*(4a,17) = 0.8 Hz, 1 H, 4-H_a); 2.15-2.28 (m, 2 H, 7-H); 3.72 (m, all $J \leq 2.5$ Hz, 1 H, 1-H_e); 3.87 (s, 3 H, 19-MeO); 3.92 (br.s, 1 H, 10-H_e); 4.30 (dd, *J*(3a,4a) = 12.1 Hz, *J*(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 5.58 (br.s, 1 H, 14-HO); 5.63-5.66 (m, 1 H, 8-H); 6.79-8.82 (m, 2 H, 12-H, 16-H); 6.85 (d, *J*(15,16) = 8.5 Hz, 1 H, 15-H). ^{13}C NMR ($CDCl_3$) δ = 20.64 (C-18); 22.54 (d, ^3J(C-F) = 6.4 Hz, C-7); 24.84 (d, ^2J(C-F) = 25.9 Hz, C-17); 37.80 (d, ^2J(C-F) = 18.9 Hz, C-6); 40.62 (d, ^2J(C-F) = 20.4 Hz, C-4); 55.85 (C-19); 70.23 (d, ^4J(C-F) = 2.1 Hz, C-10); 77.65 (d, ^3J(C-F) = 11.6 Hz, C-3); 77.93 (d, ^3J(C-F) = 7.9 Hz, C-1); 95.18 (d, ^1J(C-F)=176.2 Hz, C-5); 108.77 (C-12); 114.19 (C-15); 119.09 (C-16); 124.46 (C-8); 131.27 (C-9); 133.09 (C-11); 145.35 (C-14); 146.40 (C-13).



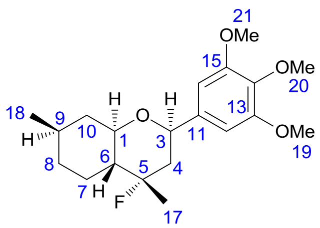
Reaction of isopulegol 4 with 3,4,5-trimethoxybenzaldehyde (6a): The reaction of isopulegol **4** and aldehyde **6a** for 8 hours at 2 °C gave products **11** (*R*:*S* = 7:2, 76%), **12** (*R*:*S* = 1:5, 15%). Spectral characteristics of compound **12** have coincided with those described in the work [5].

(2*R*,4*R*,4a*R*,7*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(3,4,5-trimethoxyphenyl)octahydro-2*H*-chromene ((*R*)-11): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 0.85-1.00 (m, 1 H, 8-H_a); 0.93 (d, *J*(18, 9) = 6.6 Hz, 3 H, 18-H); 1.09 (ddd, *J*(10a,10e) = *J*(10a,9a) = 12.2 Hz, *J*(10a,1a) = 11.2 Hz, 1 H, 10-H_a); 1.18-1.34 (m, 2 H, 6-H_a, 7-H_a); 1.34 (d, ^3J(17,F) = 21.4 Hz, 3 H, 17-H); 1.45-1.54 (m, 1 H, 9-H_a); 1.71 (ddd, ^3J(4a,F) = 39.3 Hz, *J*(4a,4e) = 14.2 Hz, *J*(4a,3a) = 11.7 Hz, 1 H, 4-H_a); 1.70-1.78 (m, 1 H, 8-H_e); 1.89 (dm, *J*(7e,7a) = 13.1 Hz, 1 H, 7-H_e); 1.98-2.04 (m, 2 H, 4-H_e,

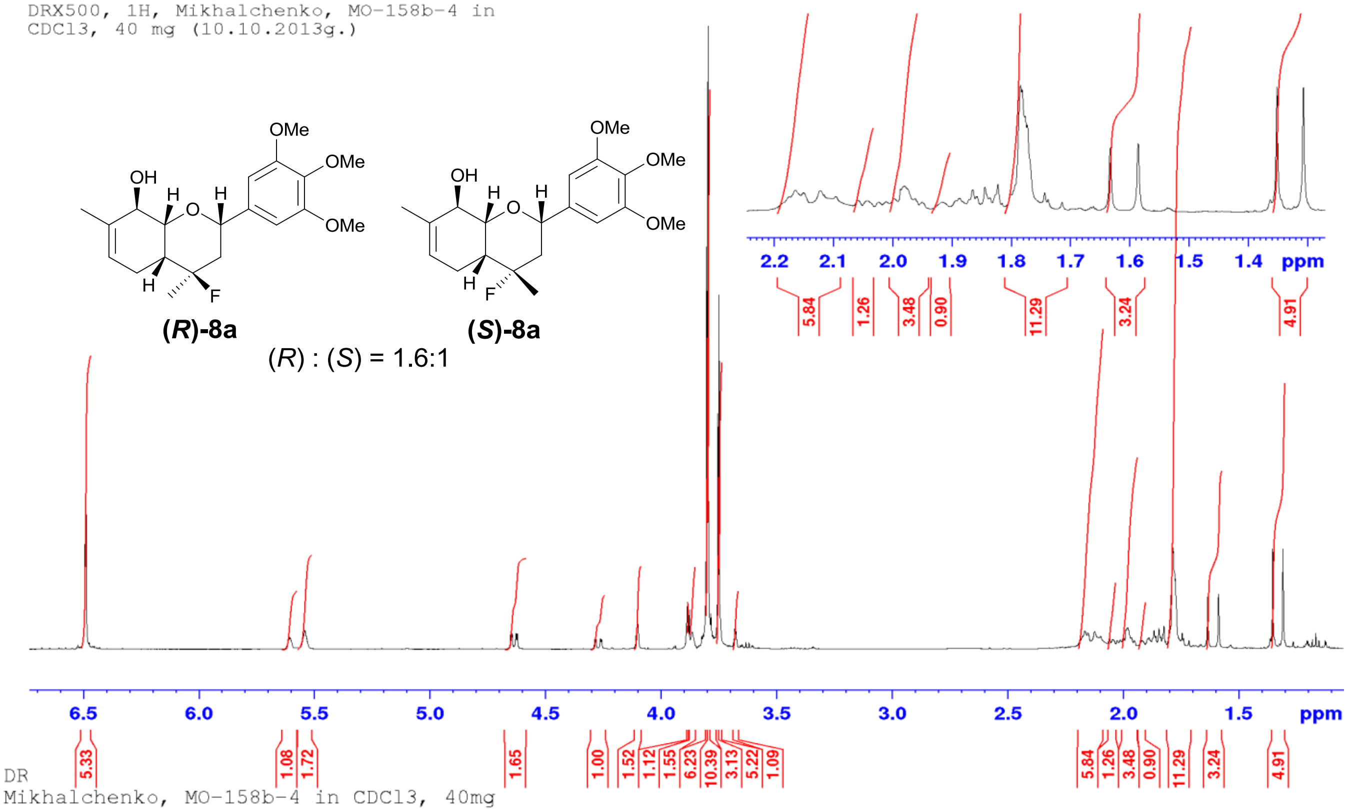


10-H_e); 3.56 (dddd, *J*(1a,10a) = 11.2 Hz, *J*(1a,6a) = 9.8 Hz, *J*(1a,10e) = 4.2 Hz, ^4J(1a,F) = 1.5 Hz, 1 H, 1-H_a); 3.79 (s, 3 H, 20-MeO); 3.84 (s, 6 H, 19-MeO, 21-MeO); 4.68 (dd, *J*(3a,4a) = 11.7 Hz, *J*(3a,4e) = 2.3 Hz, 1 H, 3-H_a); 6.56 (s, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 22.10 (C-18); 23.17 (C-7); 24.18 (d, ^2J(C-F) = 24.8 Hz, C-17); 31.10 (C-9); 34.32 (C-8); 41.11 (C-10); 45.76 (d, ^2J(C-F) = 21.7 Hz, C-4); 48.43 (d, ^2J(C-F) = 20.3 Hz, C-6); 55.99 (C-19, C-21); 60.63 (C-20); 74.87 (C-3); 75.84 (C-1); 93.40 (d, ^1J(C-F) = 171.7 Hz, C-5); 103.01 (C-12, C-16); 137.27 (C-14); 137.92 (C-11); 153.15 (C-13, C-15).

(2*R*,4*S*,4a*R*,7*R*,8a*R*)-4-fluoro-4,7-dimethyl-2-(3,4,5-trimethoxyphenyl)octahydro-2*H*-chromene ((*S*)-11): Yellow oil. ^{1}H NMR ($CDCl_3$): δ = 0.85-1.00 (m, 1 H, 8-H_a); 0.94 (d, *J*(18, 9) = 6.5 Hz, 3 H,



18-H); 1.05-1.13 (m, 1 H, 7-H_a); 1.12-1.21 (m, 1 H, 10-H_a); 1.43 (d, ^3J(17,F) = 23.1 Hz, 3 H, 17-H); 1.41-1.49 (m, 1 H, 9-H_a); 1.59 (dddd, *J*(6a,7a) = *J*(6a,F) = 12.2 Hz, *J*(6a,1a) = 10.2 Hz, *J*(6a,7e) = 3.3 Hz, 1 H, 6-H_a); 1.70-1.78 (m, 1 H, 8-H_e); 1.94 (dm, *J*(7e,7a) = 13.1 Hz, 1 H, 7-H_e); 1.96-2.08 (m, 3 H, 4-2H, 10-H_e); 3.21 (ddd, *J*(1a,10a) = 10.8 Hz, *J*(1a,6a) = 10.2 Hz, *J*(1a,10e) = 4.3 Hz, 1 H, 1-H_a); 3.79 (s, 3 H, 20-MeO); 3.85 (s, 6 H, 19-MeO, 21-MeO); 4.30 (dd, *J*(3a,4a) = 11.4 Hz, *J*(3a,4e) = 2.6 Hz, 1 H, 3-H_a); 6.55 (s, 2 H, 12-H, 16-H). ^{13}C NMR ($CDCl_3$) δ = 19.44 (d, ^2J(C-F) = 26.5 Hz, C-17); 22.04 (C-18); 22.40 (d, ^3J(C-F) = 2.7 Hz, C-7); 31.26 (C-9); 33.92 (C-8); 41.23 (C-10); 47.13 (d, ^2J(C-F) = 19.5 Hz, C-4); 49.88 (d, ^2J(C-F) = 19.5 Hz, C-6); 56.02 (C-19, C-21); 60.63 (C-20); 76.91 (d, ^3J(C-F) = 11.9 Hz, C-3); 77.54 (C-1); 94.88 (d, ^1J(C-F) = 173.3 Hz, C-5); 103.24 (C-12, C-16); 137.12 (C-11); 137.54 (C-14); 153.17 (C-13, C-15). HR-MS: 352.2047 (M^+ $(C_{20}H_{29}O_4F)^+$; calc. 352.2044).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OMe
OMe
OH
H
O
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F
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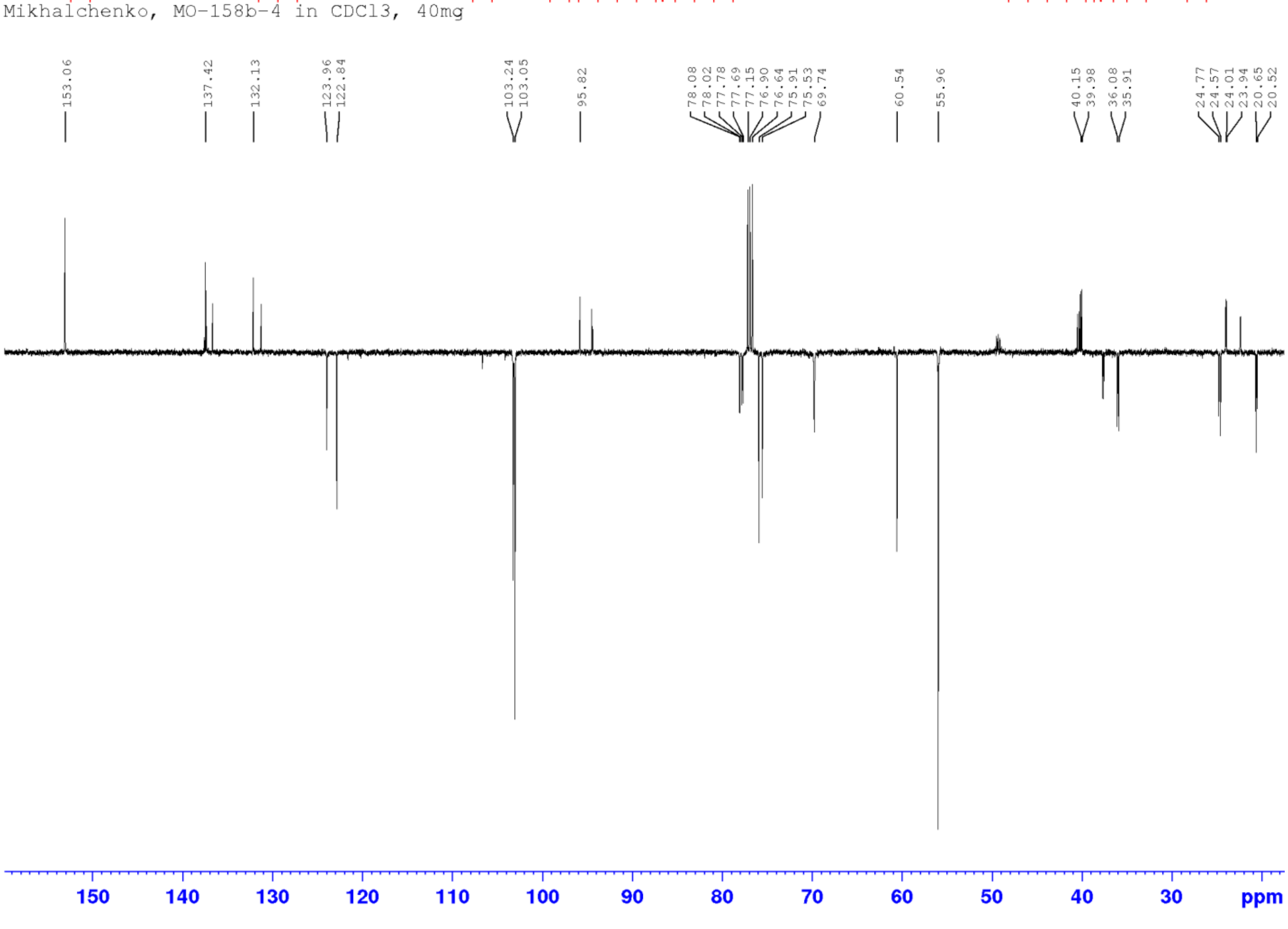
(S)-8a
(R) : (S) = 1.6:1
ppm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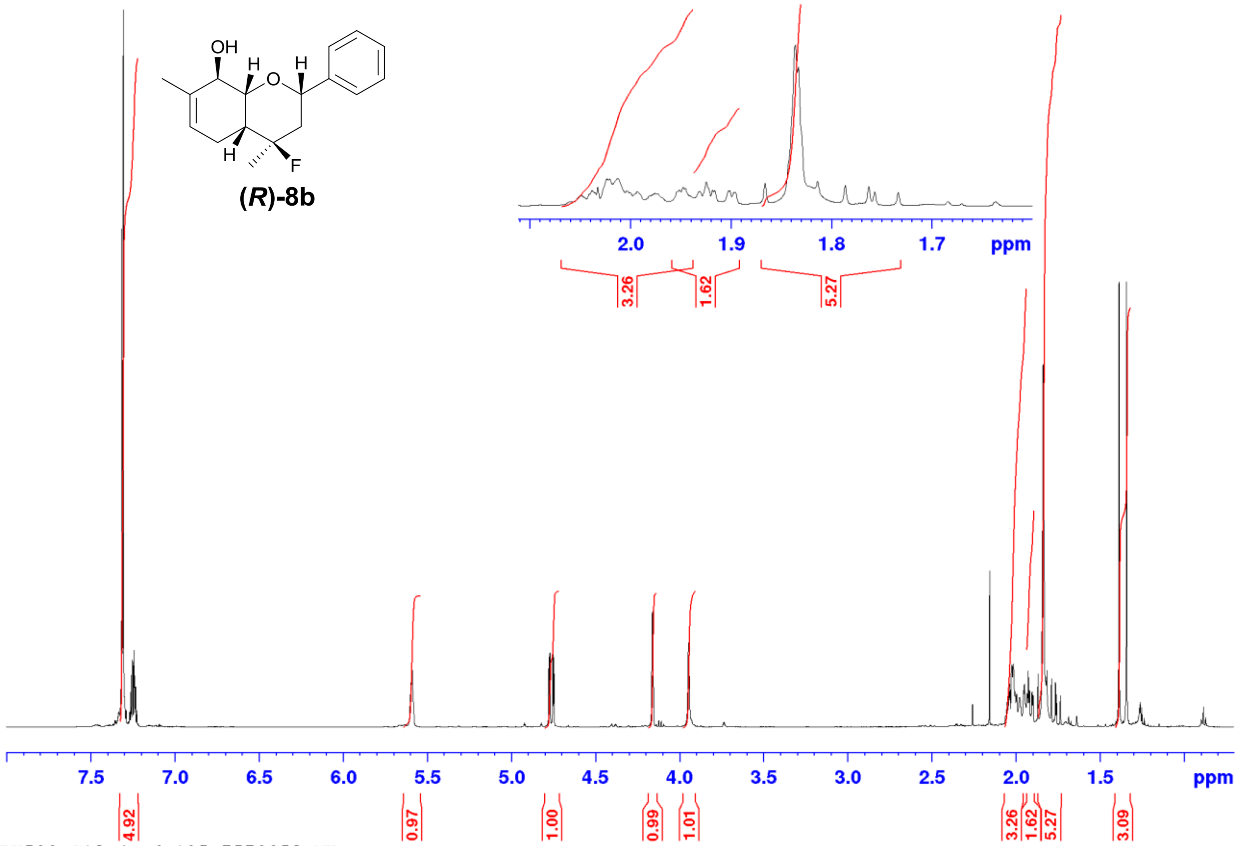
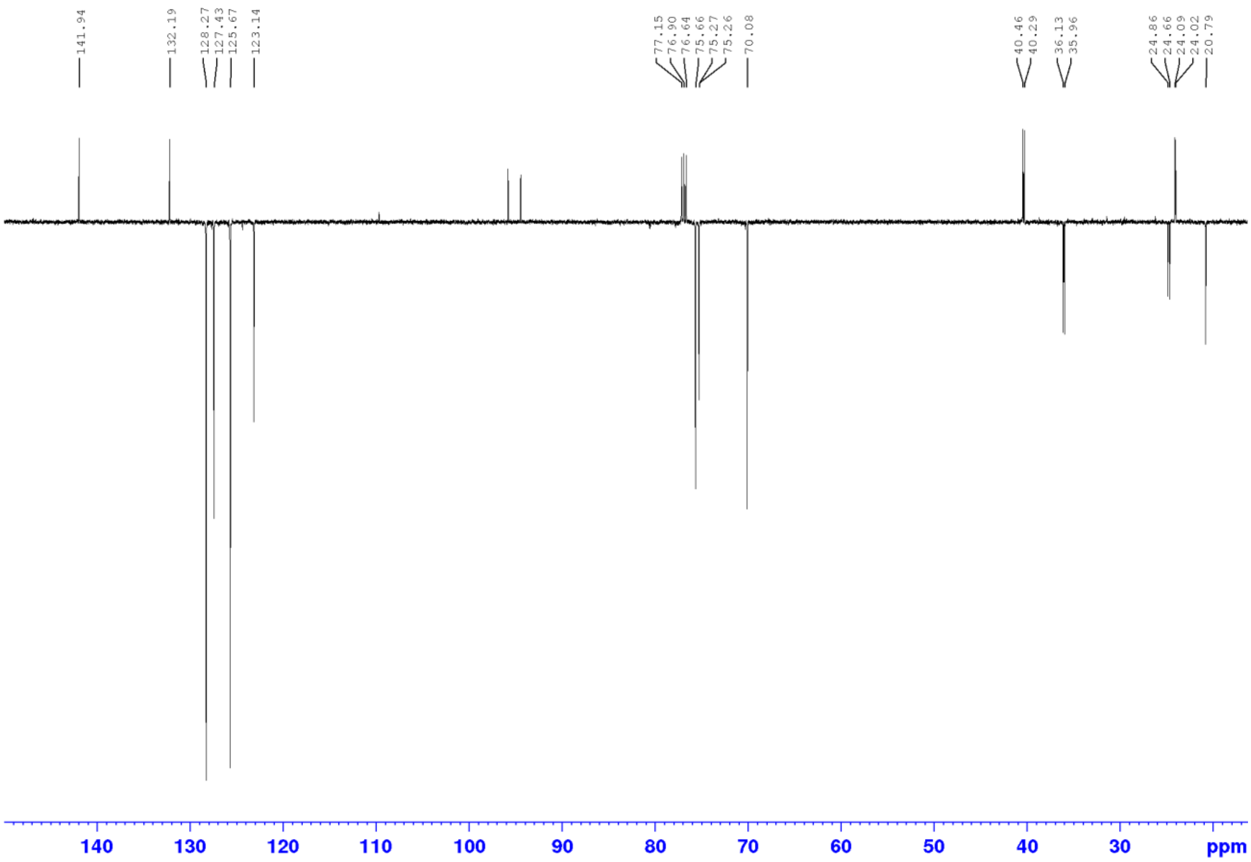
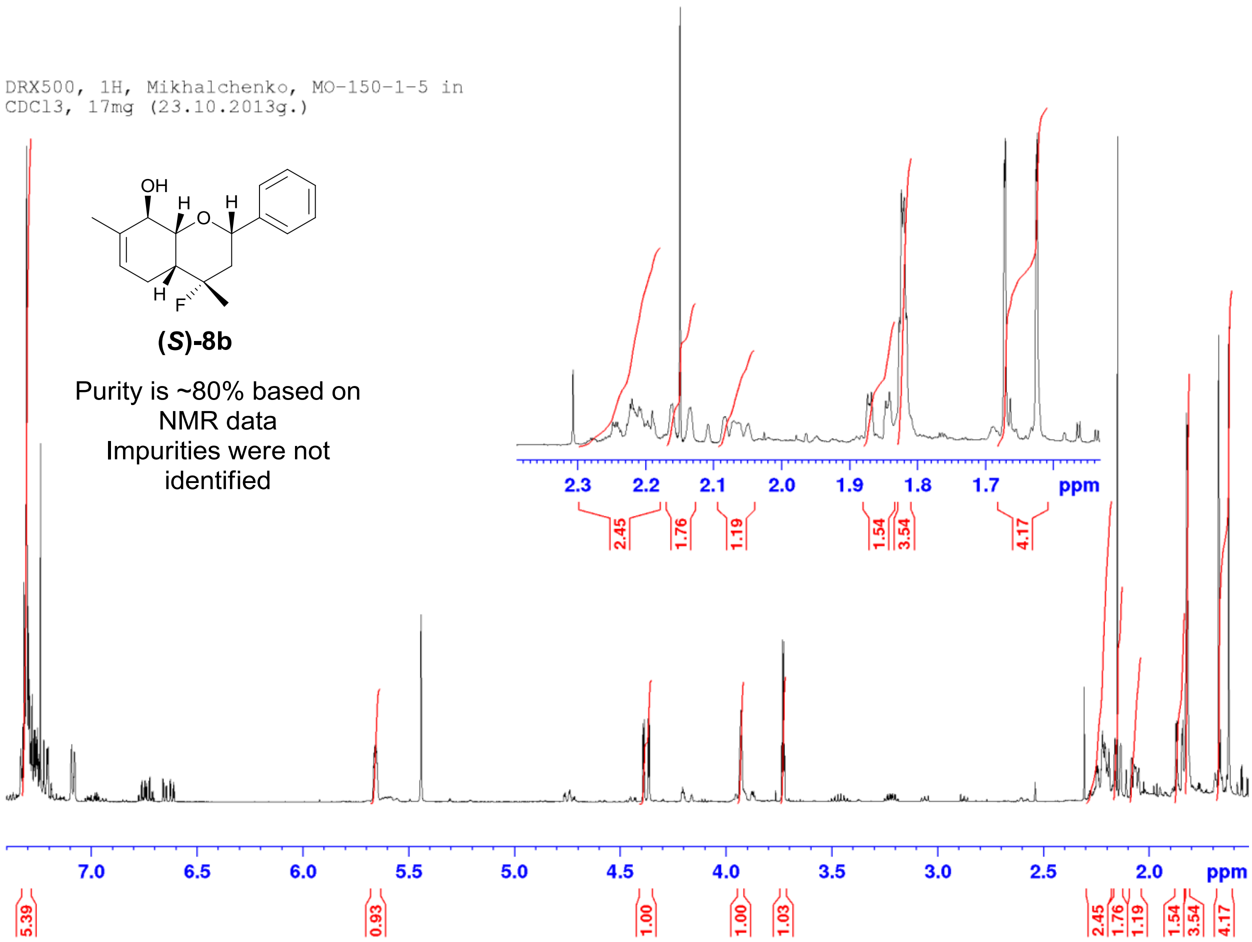
ppm

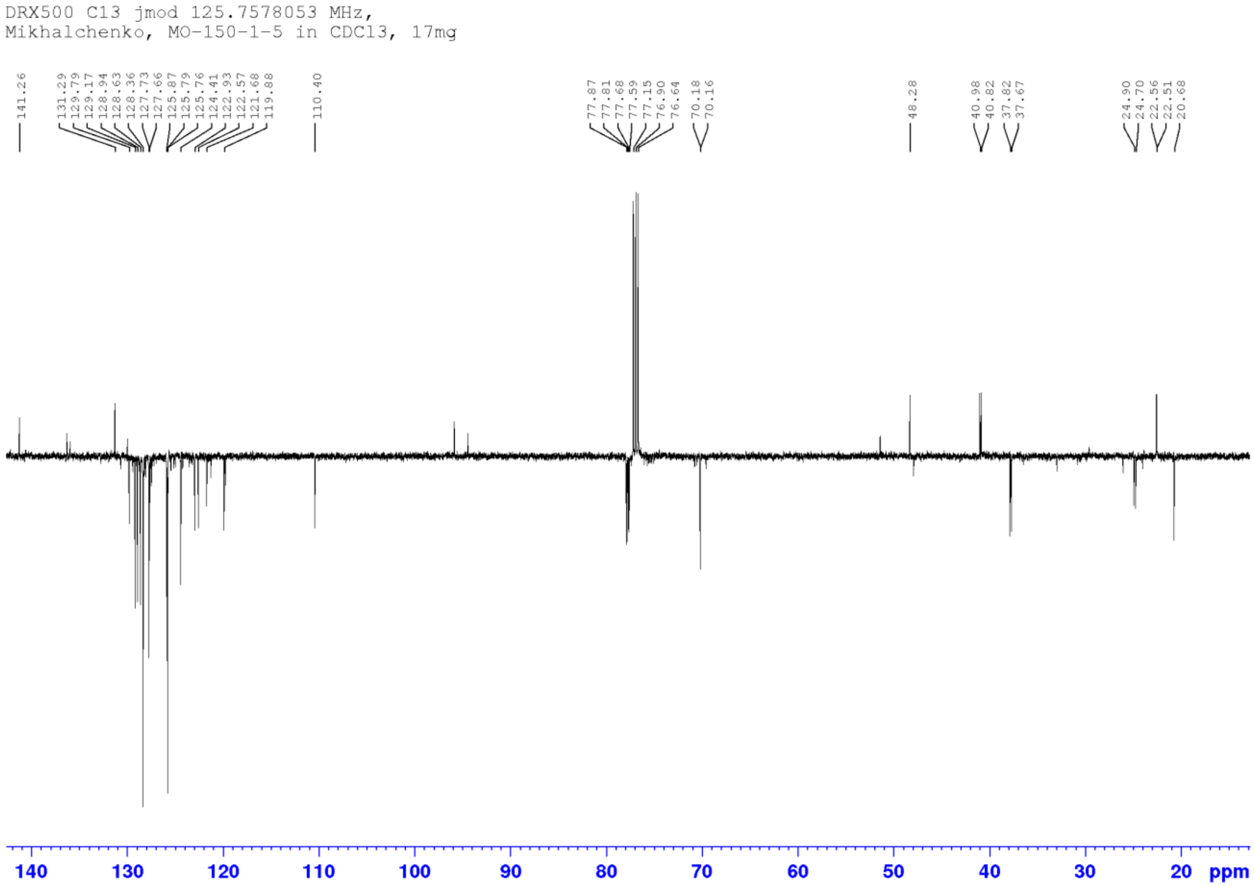
DRX500, 1H, Mikhalchenko, MO-150-1-3 in CDCl3, 60mg (23.10.2013g.)



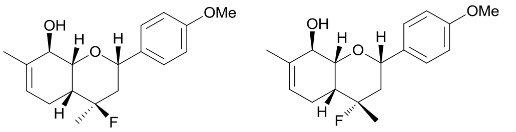
DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-150-1-3 in CDCl3, 60mg




DRX500, 1H, Mikhalchenko, MO-150-1-5 in CDCl3, 17mg (23.10.2013g.)
OH
H
O
H
H
F
(S)-8b
Purity is ~80% based on NMR data
Impurities were not identified
2.3 2.2 2.1 2.0 1.9 1.8 1.7 ppm
2.45 1.76 1.19 1.54 3.54 4.17
7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 ppm
5.39 0.93 1.00 1.00 1.03 2.45 1.76 1.19 1.54 3.54 4.17

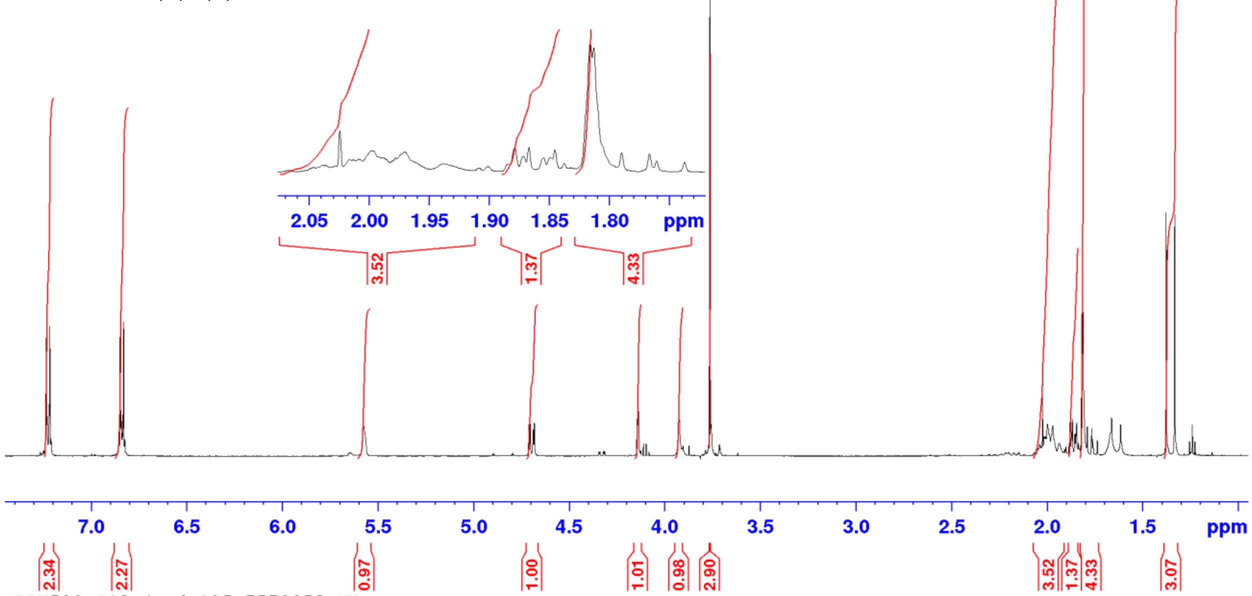

DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-150-1-5 in CDCl3, 17mg
141.26
131.29 129.79 129.17 128.94 128.63 128.36 127.73 127.66 125.87 125.79 125.76 124.41 122.93 122.57 121.68 119.88
110.40
77.87 77.81 77.68 77.59 77.15 76.90 76.64
70.18 70.16
48.28
40.98 40.82 37.82 37.67
24.90 24.70 22.56 22.51 20.68
140 130 120 110 100 90 80 70 60 50 40 30 20 ppm

DRX500, 1H, Mikhalchenko, MO-151-2 in CDCl3,
30mg (09.10.2013g.)

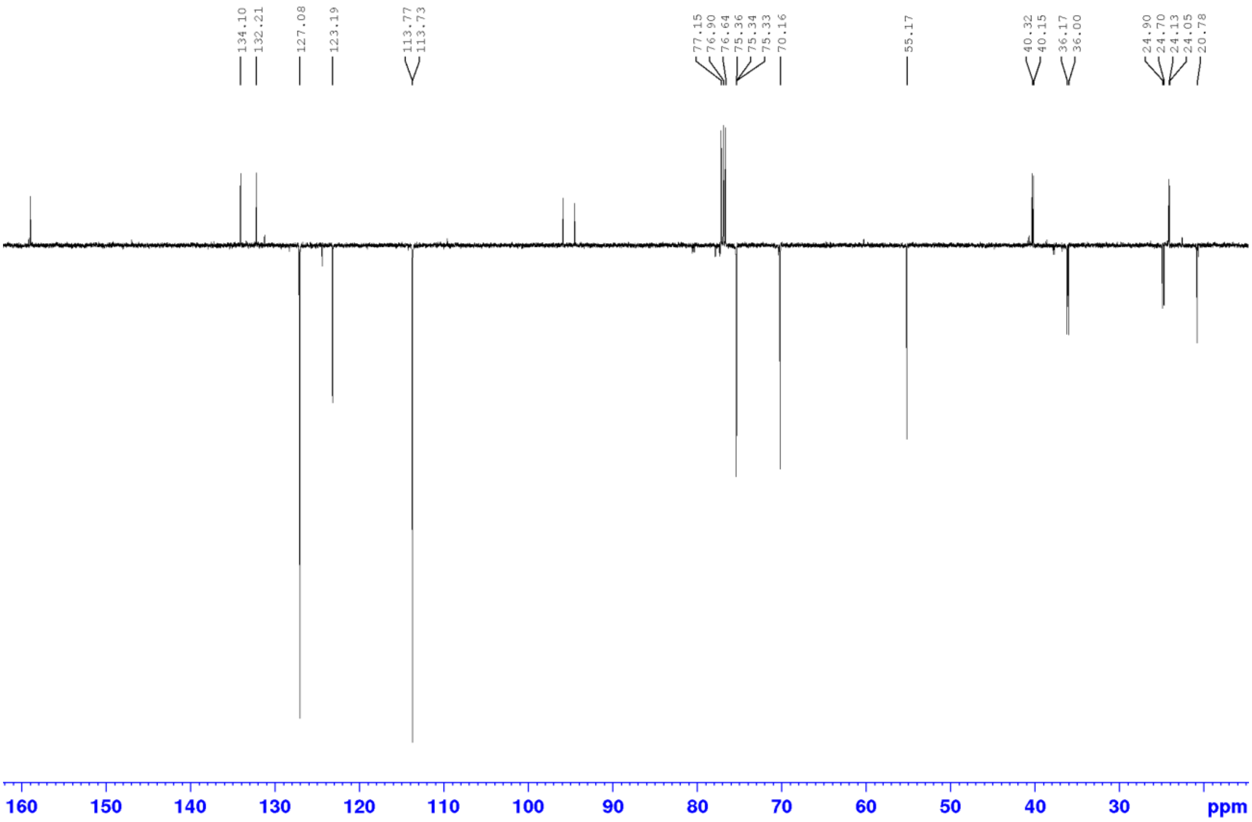


(*R*)-8c **(*S*)-8c**

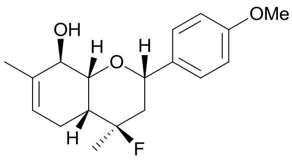
(*R*) : (*S*) = 1 : 0.1



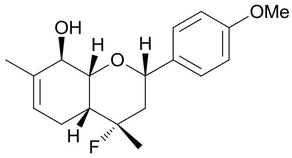
DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-151-2 in CDCl3, 30mg



MO-151-3p; CDCl3



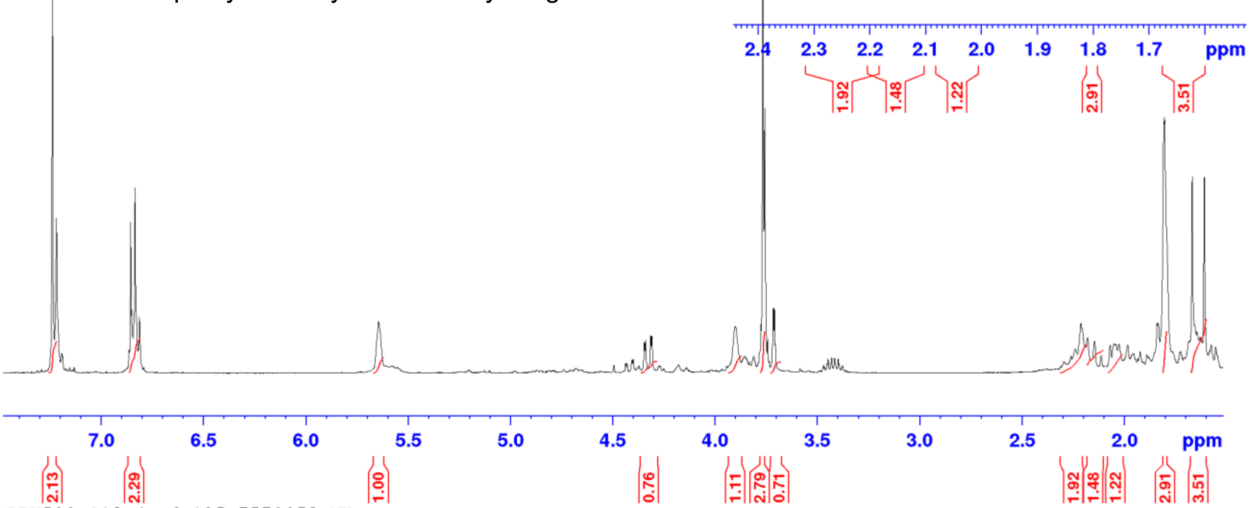
(*R*)-8c



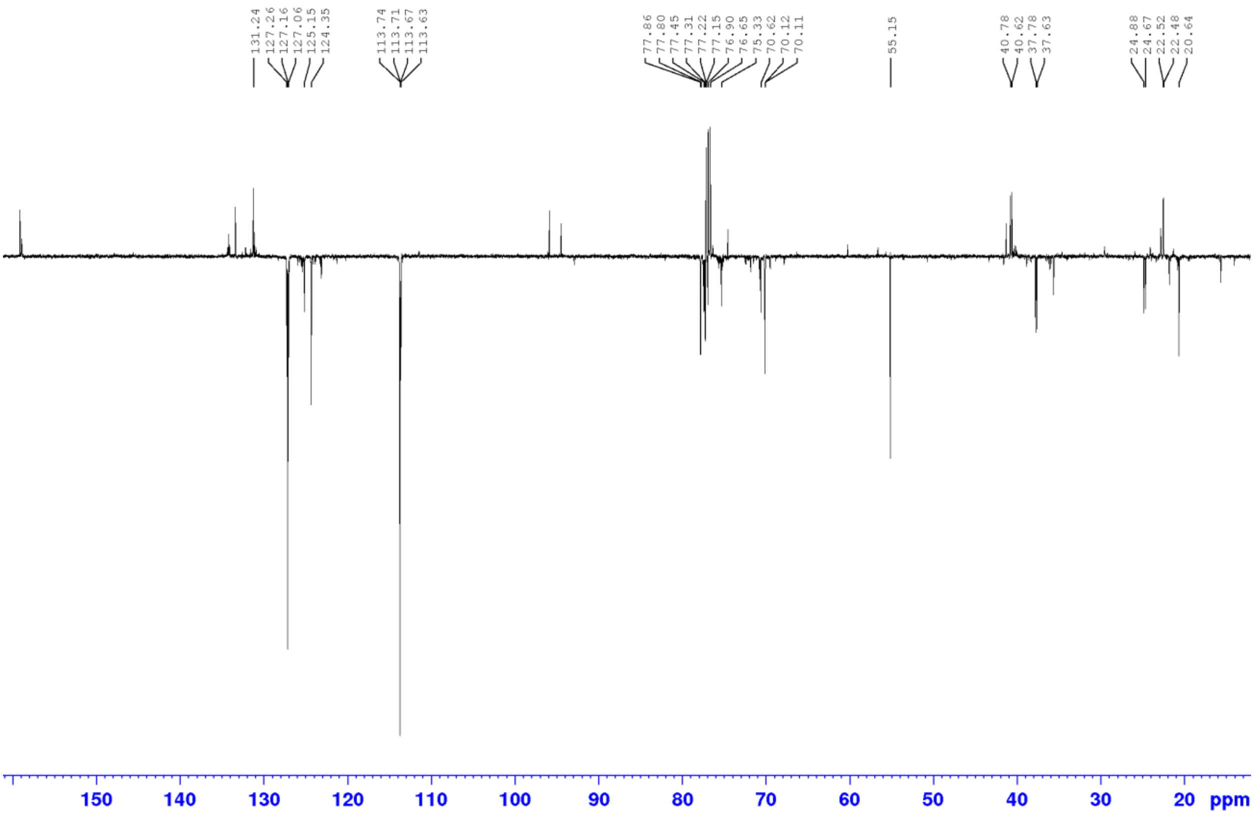
(*S*)-8c

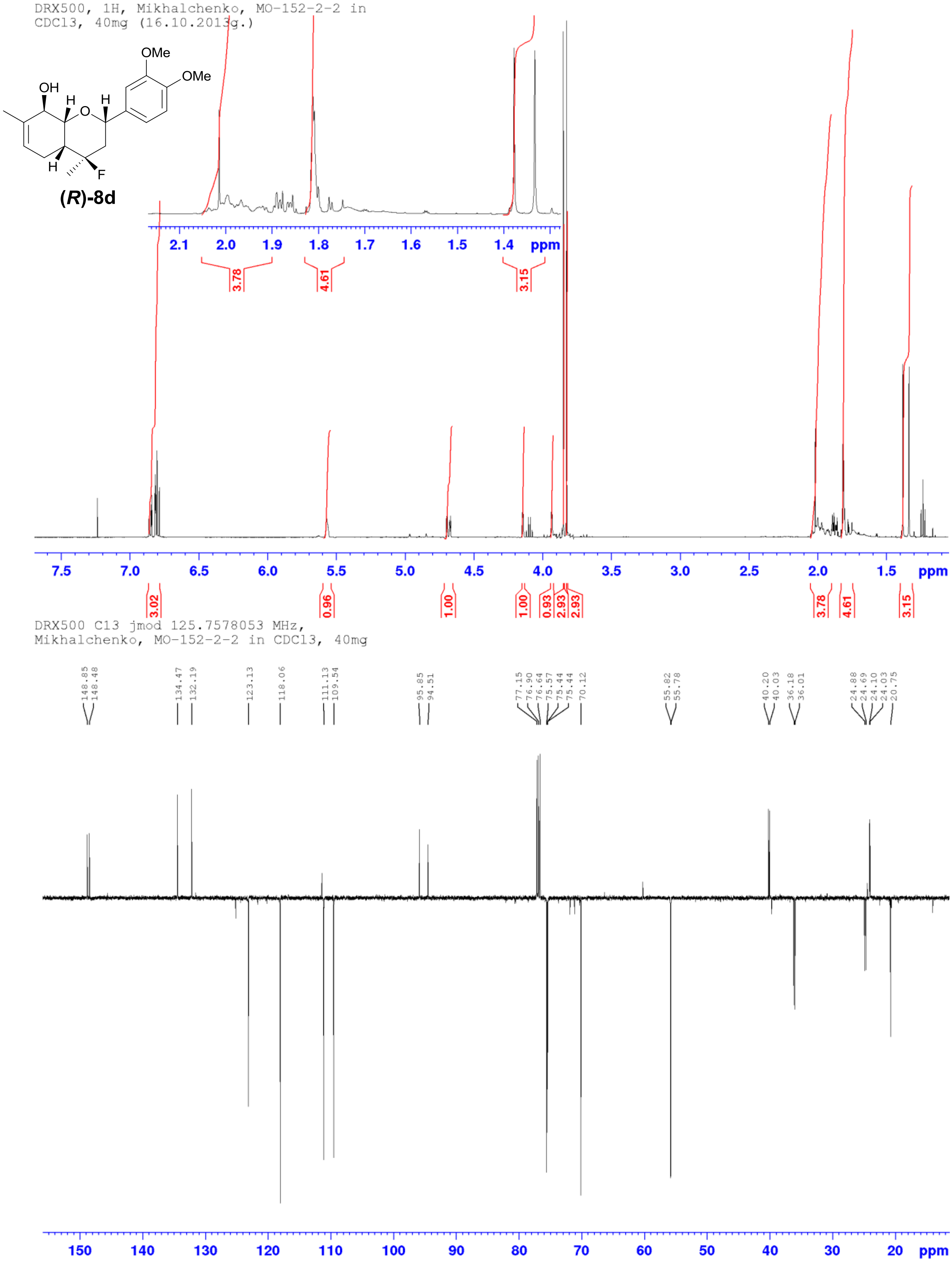
(*R*) : **(*S*)** = 1 : 5

impurity is diethyl ether 4% by weight

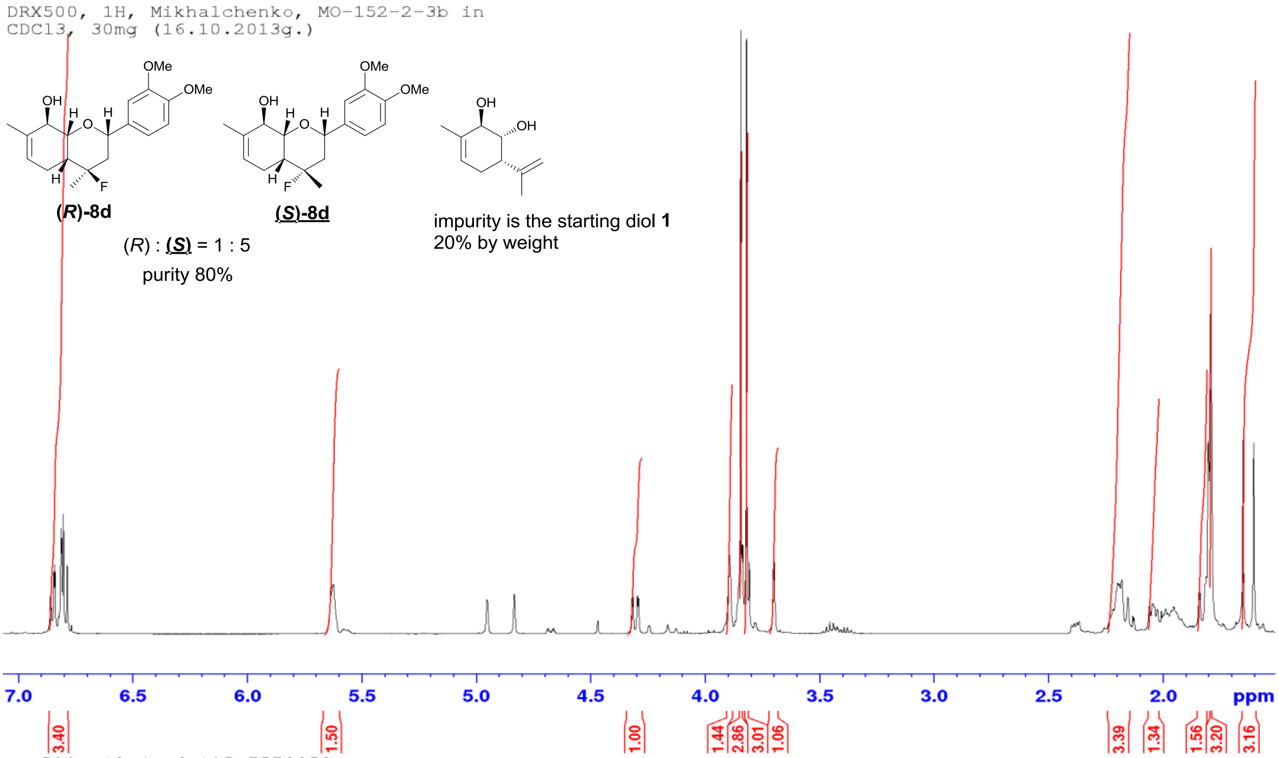


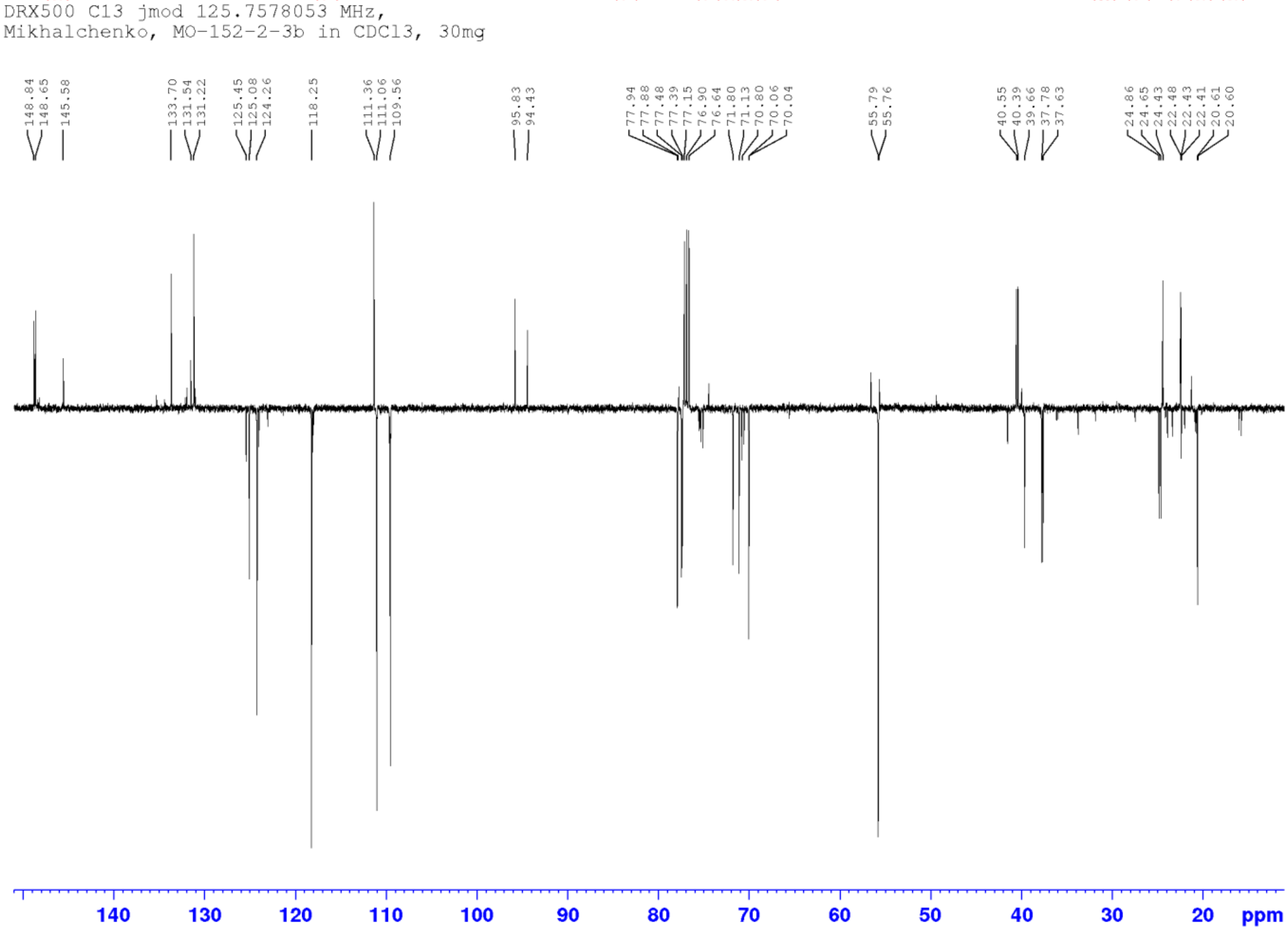
DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-151-3p in CDCl3, 40mg



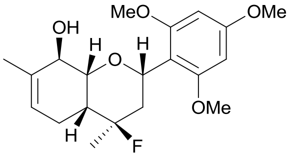


DRX500, 1H, Mikhalchenko, MO-152-2-2 in CDCl3, 40mg (16.10.2013g.)
OMe
OMe
OH
H
O
H
H
F
(R)-8d
2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 ppm
3.78 4.61 3.15
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 ppm
3.02 0.96 1.00 1.00 0.93 2.93 2.93 3.78 4.61 3.15
DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-152-2-2 in CDCl3, 40mg
148.85 148.48 134.47 132.19 123.13 118.06 111.13 109.54 95.85 94.51 77.15 76.90 76.64 75.57 75.44 75.44 70.12 55.82 55.78 40.20 40.03 36.18 36.01 24.88 24.69 24.10 24.03 20.75
150 140 130 120 110 100 90 80 70 60 50 40 30 20 ppm

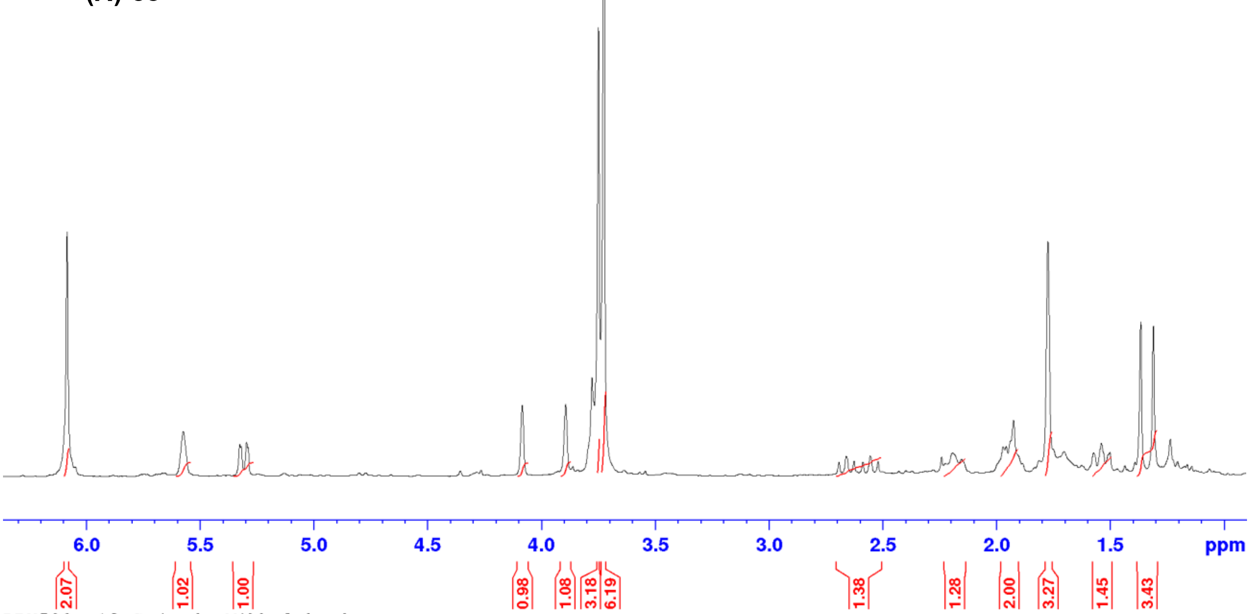

DRX500, 1H, Mikhalchenko, MO-152-2-3b in
CDCl3, 30mg (16.10.2013g.)
OMe
OMe
OH
H
H
O
H
F
(R)-8d
(S)-8d
(R) : (S) = 1 : 5
purity 80%
impurity is the starting diol 1
20% by weight
3.40
1.50
1.00
1.44
2.86
3.01
1.06
3.39
1.34
1.56
3.20
3.16
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
ppm


DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-152-2-3b in CDCl3, 30mg
148.84
148.65
145.58
133.70
131.54
131.22
125.45
125.08
124.26
118.25
111.36
111.06
109.56
95.83
94.43
77.94
77.88
77.48
77.39
77.15
76.90
76.64
71.80
71.13
70.80
70.06
70.04
55.79
55.76
40.55
40.39
39.66
37.78
37.63
24.86
24.65
24.43
22.48
22.43
22.41
20.61
20.60
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm

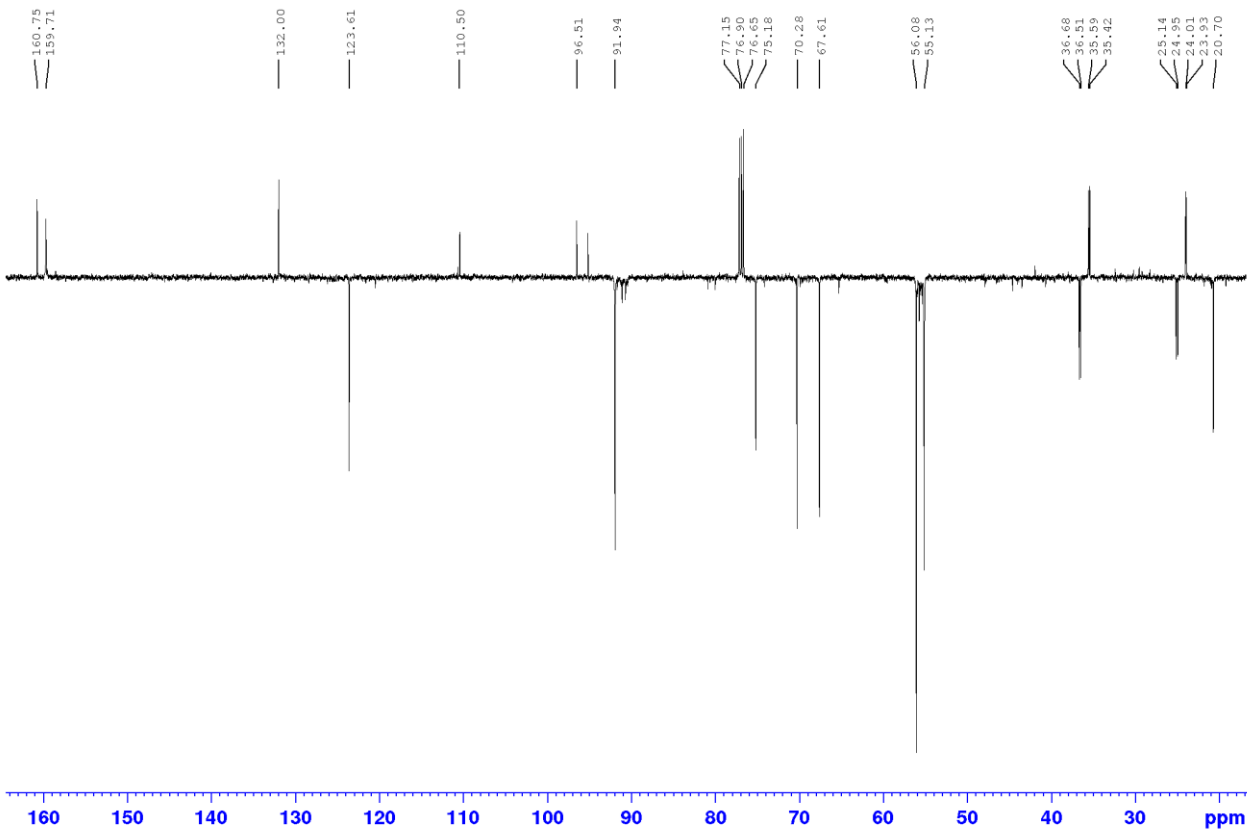
MO-164-2;CDCl3



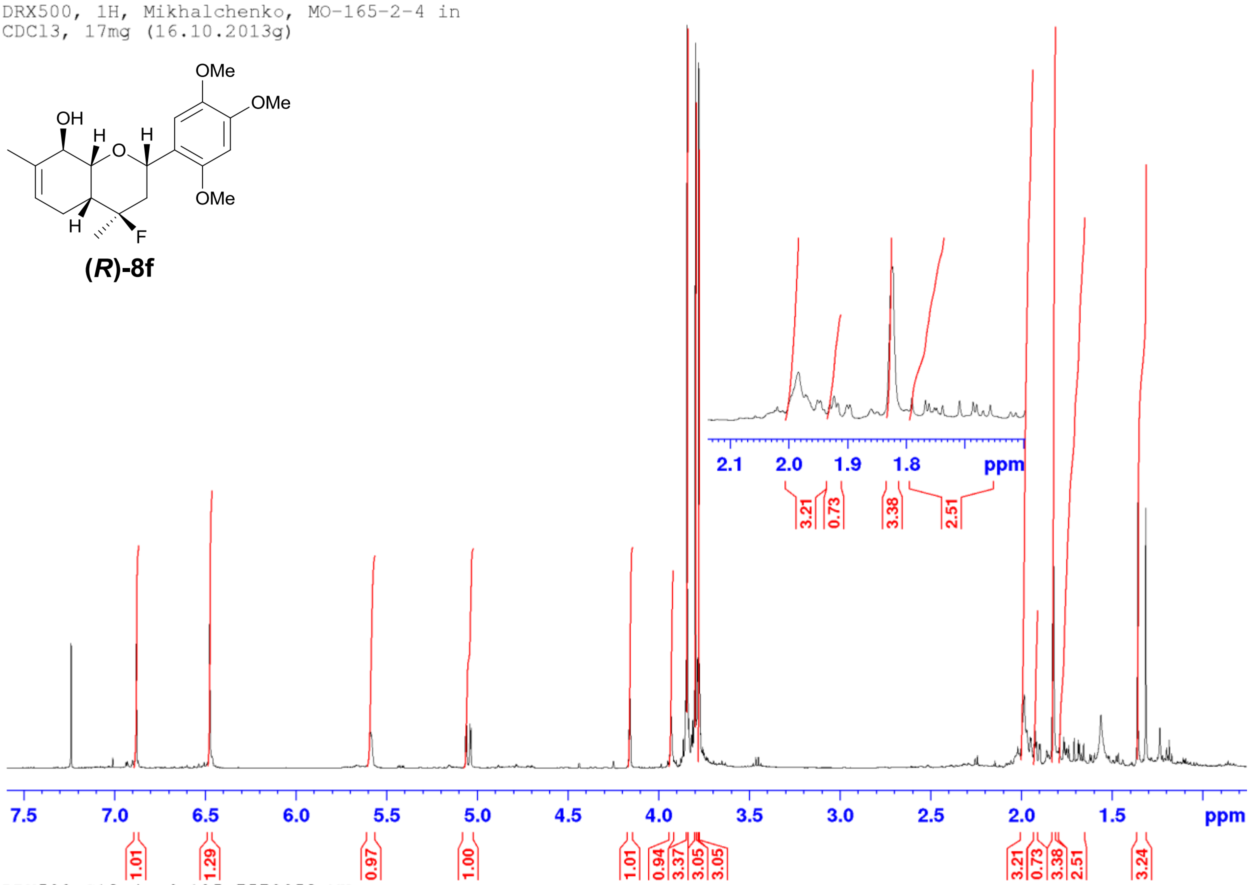
(*R*)-8e



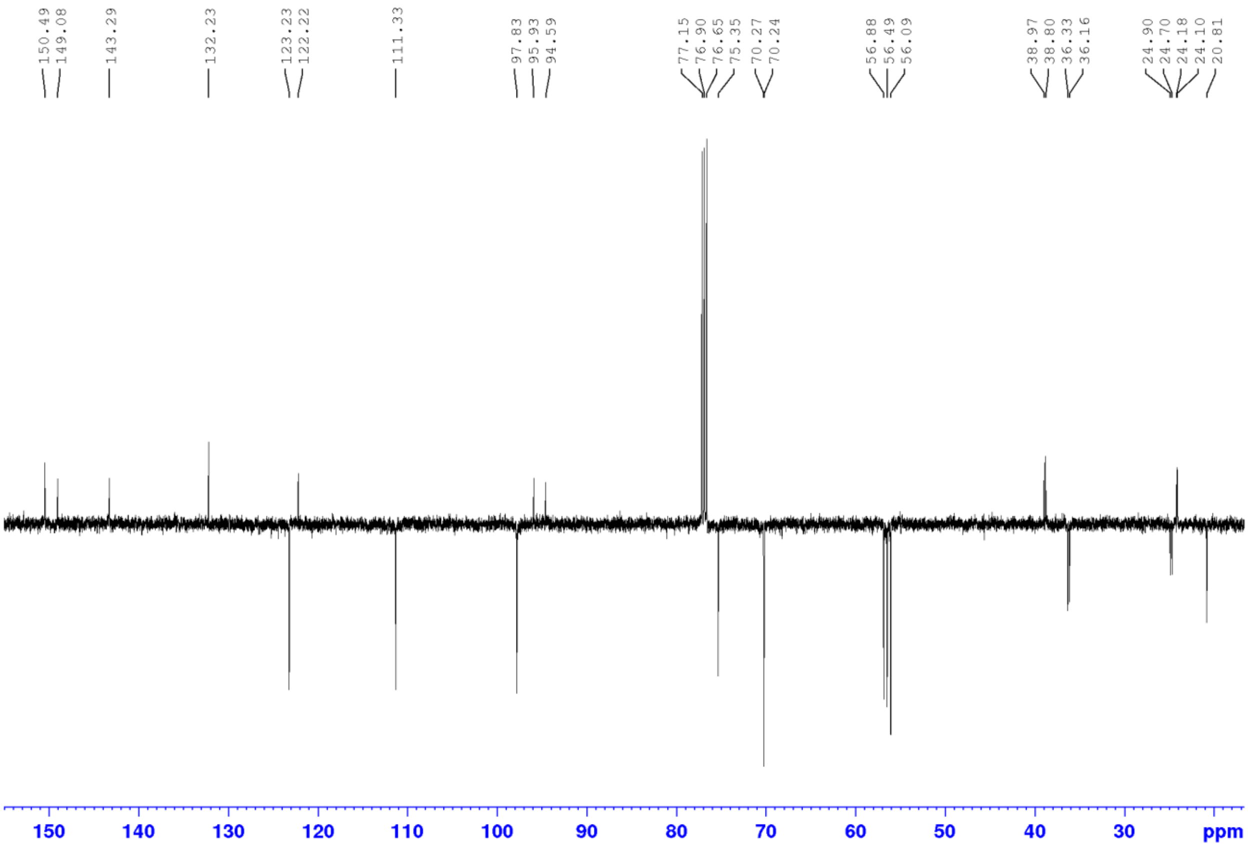
DRX500, 13 C-jmod, Mikhalchenko,
MO-164-2 in CDCl3, 20mg



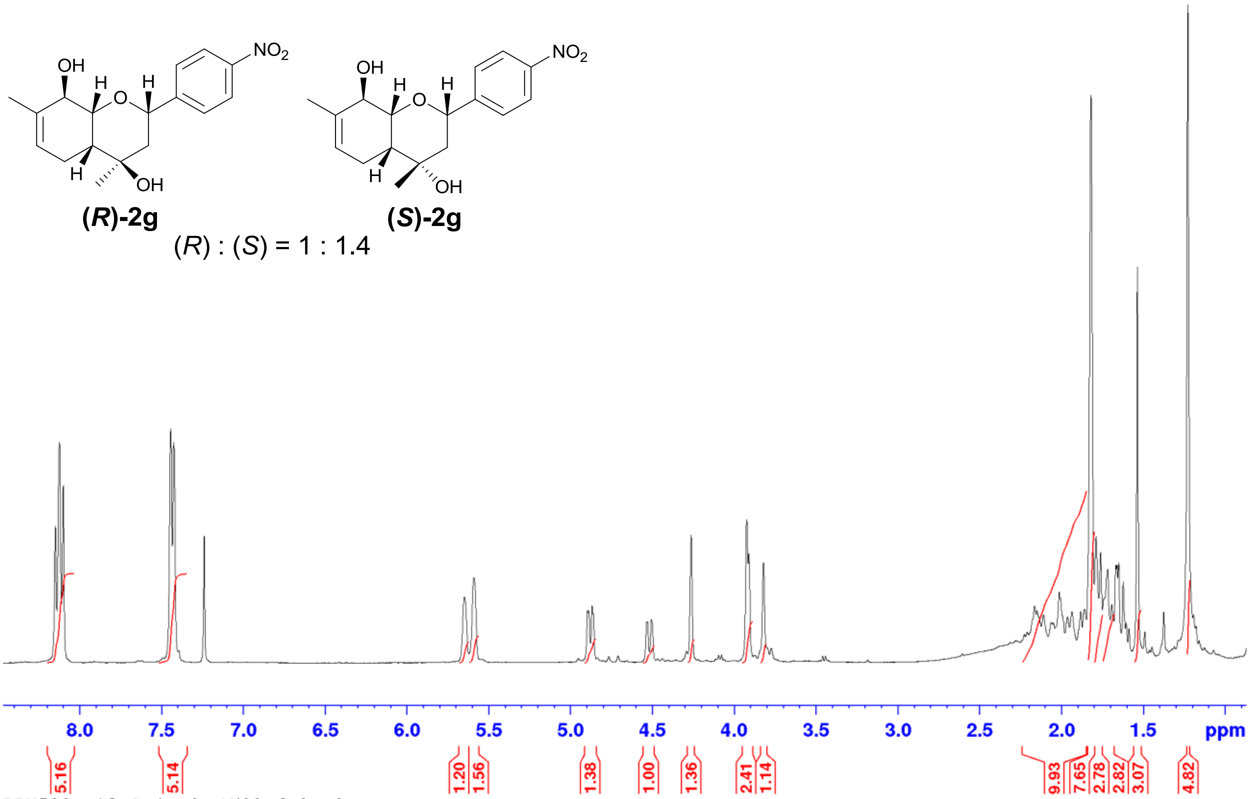
DRX500, 1H, Mikhalchenko, MO-165-2-4 in CDCl3, 17mg (16.10.2013g)



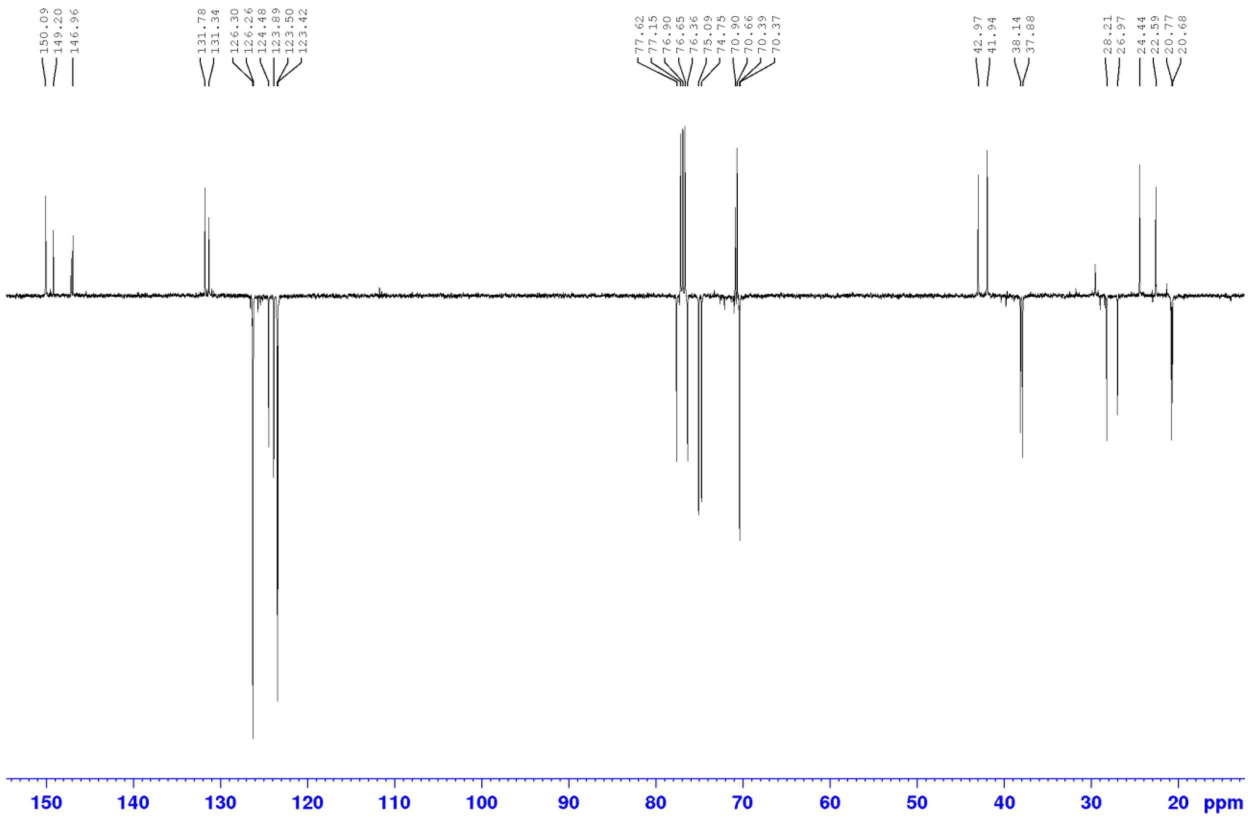
DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-165-2-4 in CDCl3, 17mg

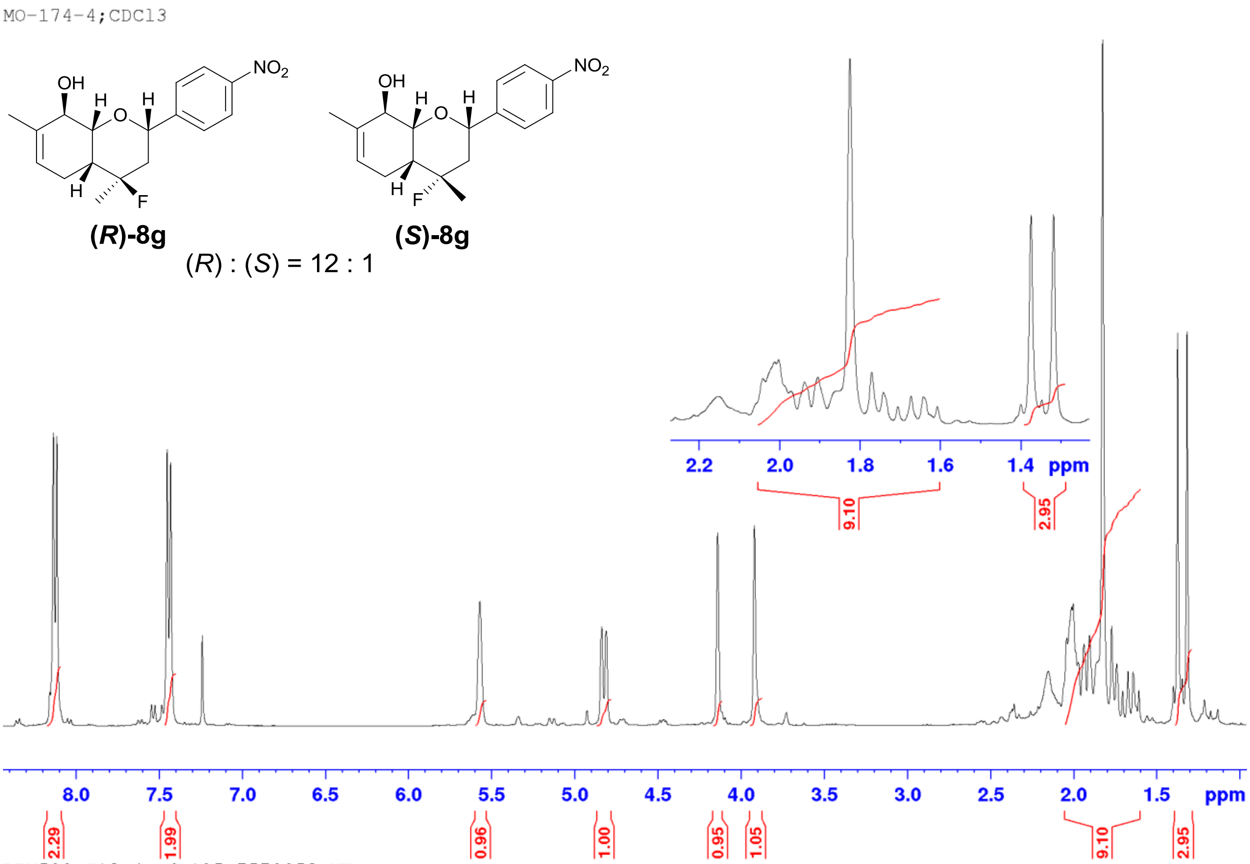


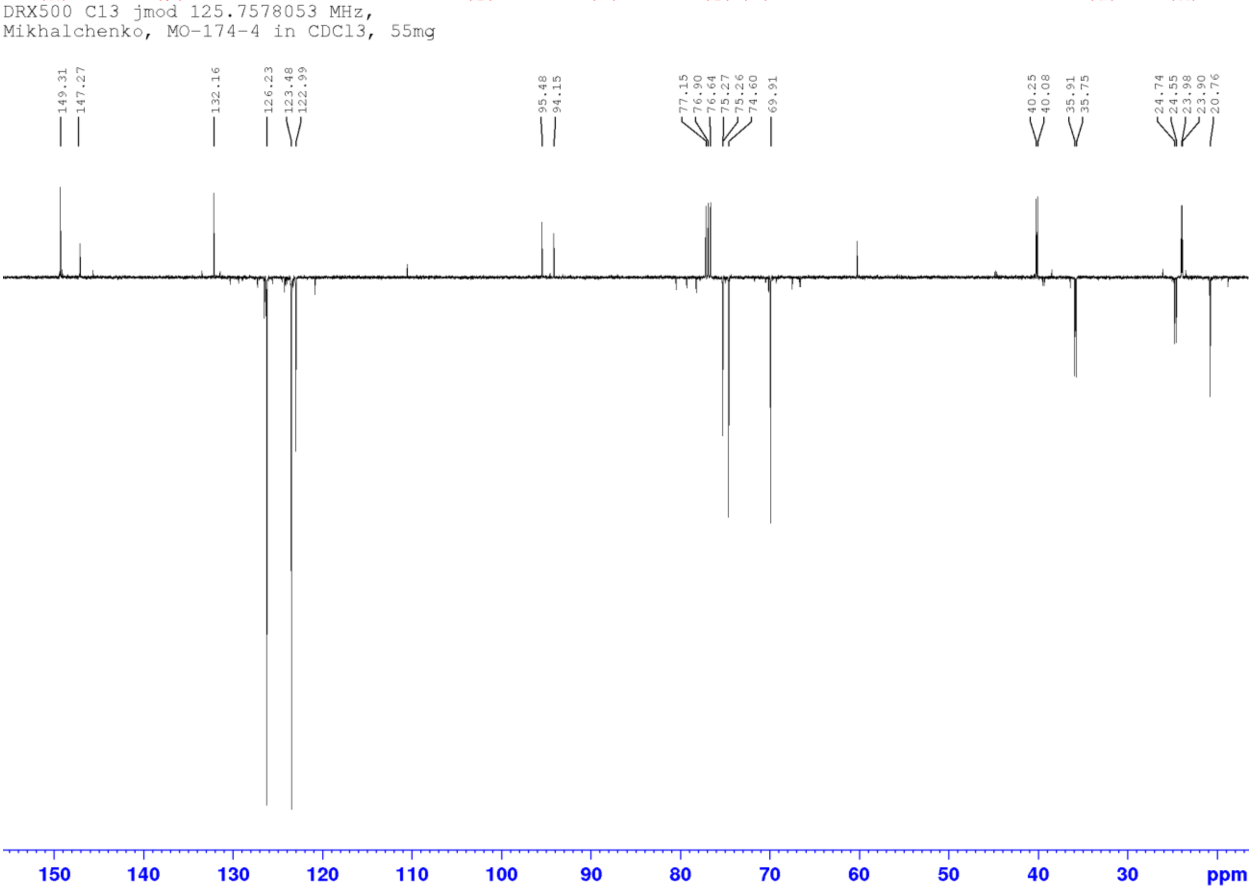
MO-174-7-1;CDCl3



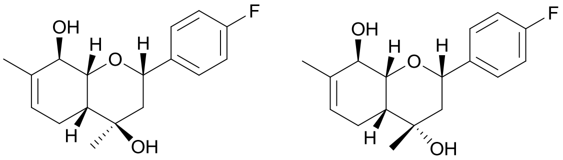
DRX500, 13 C-jmod, Mikhalchenko,
MO-174-7-1 in CDCl3, 20mg




MO-174-4;CDCl3
OH
NO2
(R)-8g
(S)-8g
(R) : (S) = 12 : 1
2.2 2.0 1.8 1.6 1.4 ppm
9.10
2.95
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 ppm
2.29 1.99 0.96 1.00 0.95 1.05 9.10 2.95

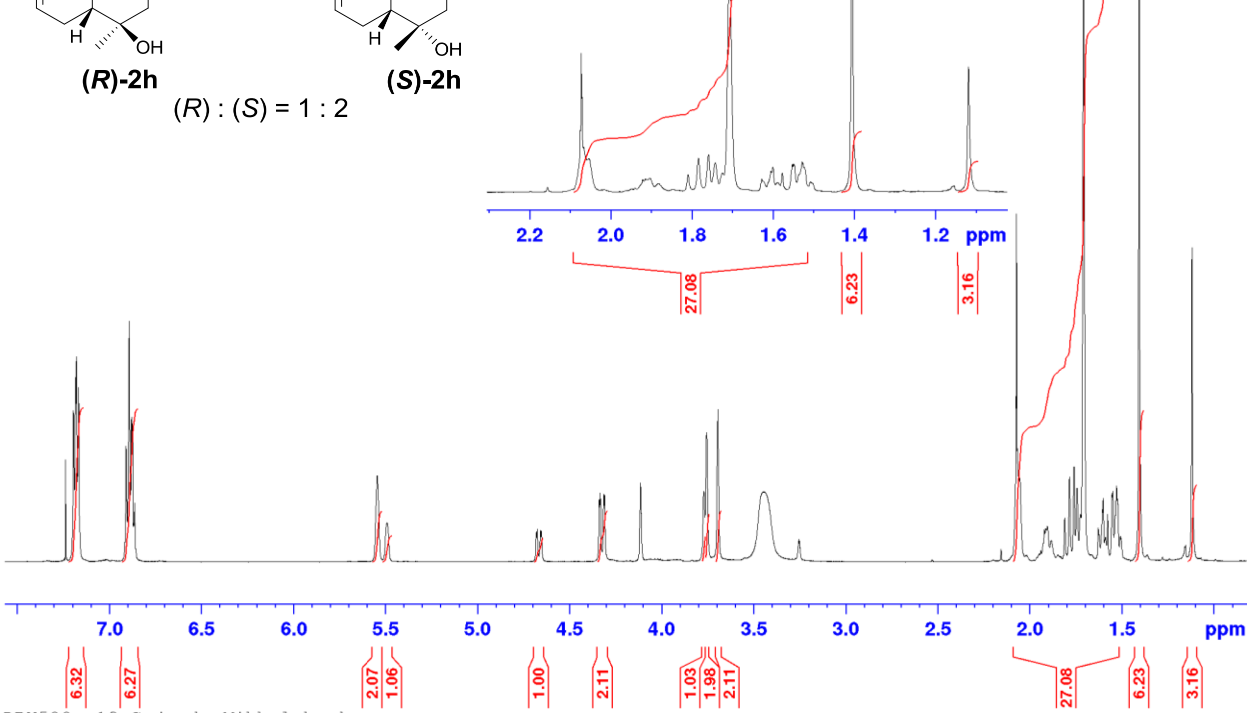

DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-174-4 in CDCl3, 55mg
149.31 147.27 132.16 126.23 123.48 122.99 95.48 94.15 77.15 76.90 76.64 75.27 75.26 74.60 69.91 40.25 40.08 35.91 35.75 24.74 24.55 23.98 23.90 20.76
150 140 130 120 110 100 90 80 70 60 50 40 30 ppm

DRX500, 1H, Mikhalchenko, MO-187-6
in CDCl3+CD3OD, 60mg (26.05.2015g.)

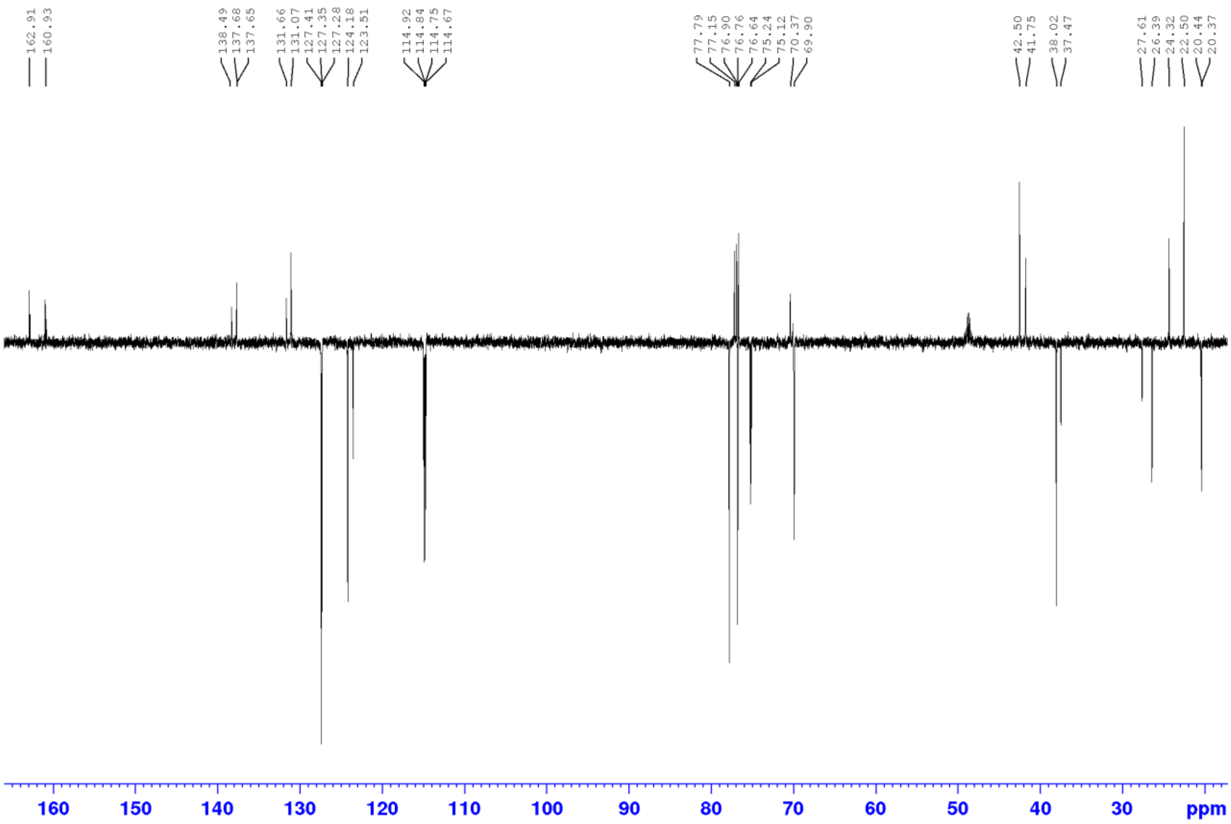


(*R*)-2h (*S*)-2h

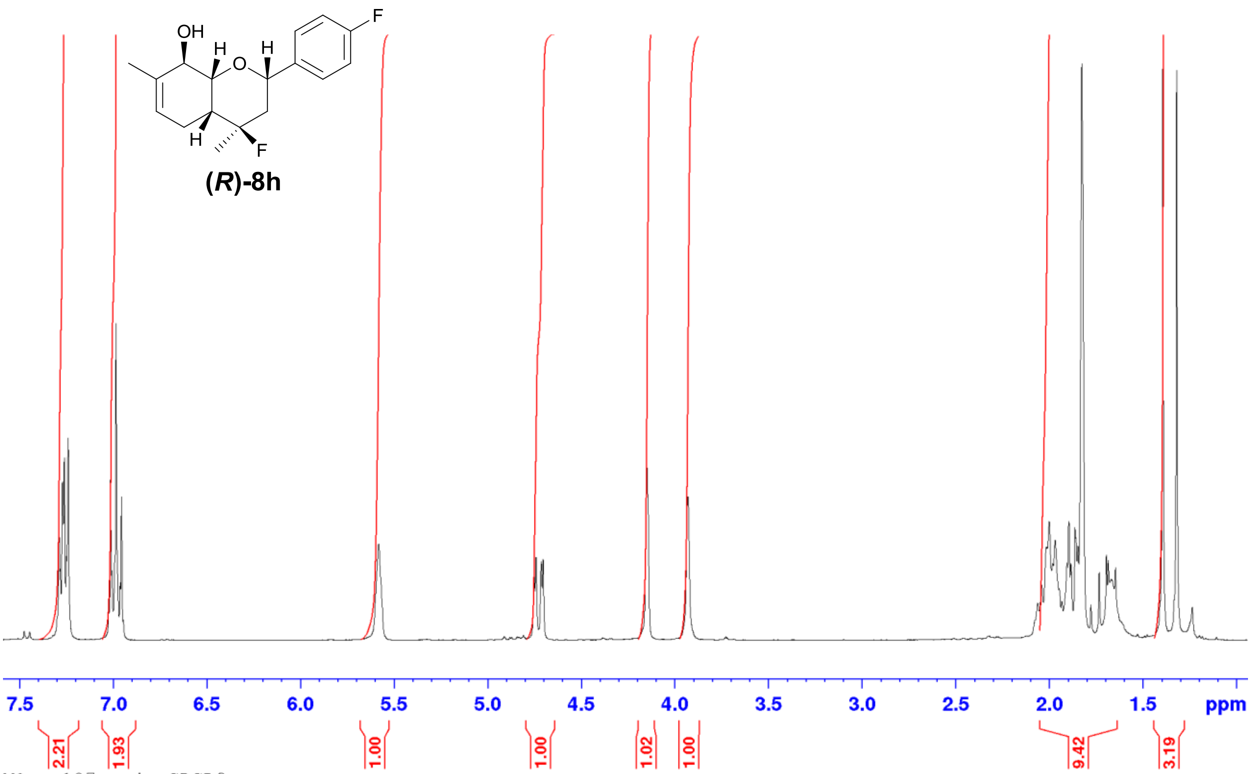
(*R*) : (*S*) = 1 : 2



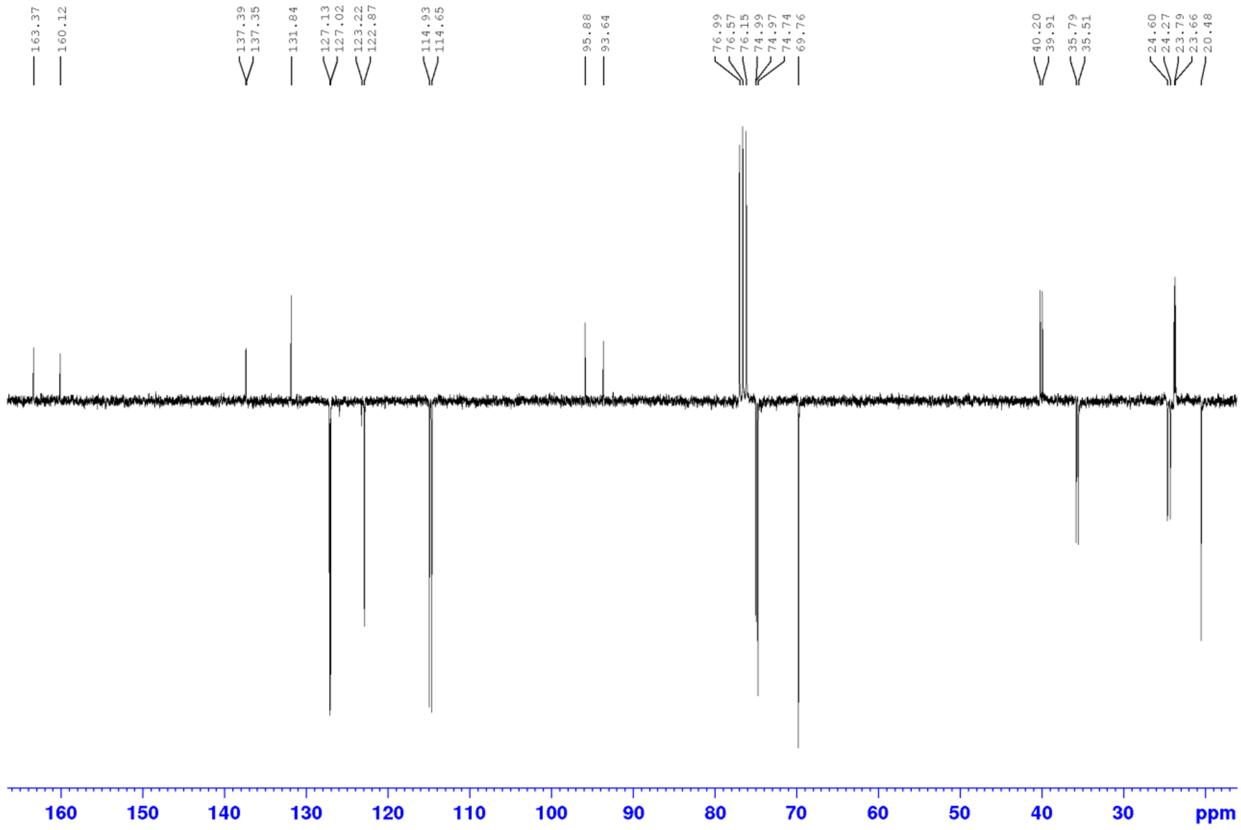
DRX500, 13 C-jmod, Mikhalchenko,
MO-187-6 in CDCl3+CD3OD, 60mg



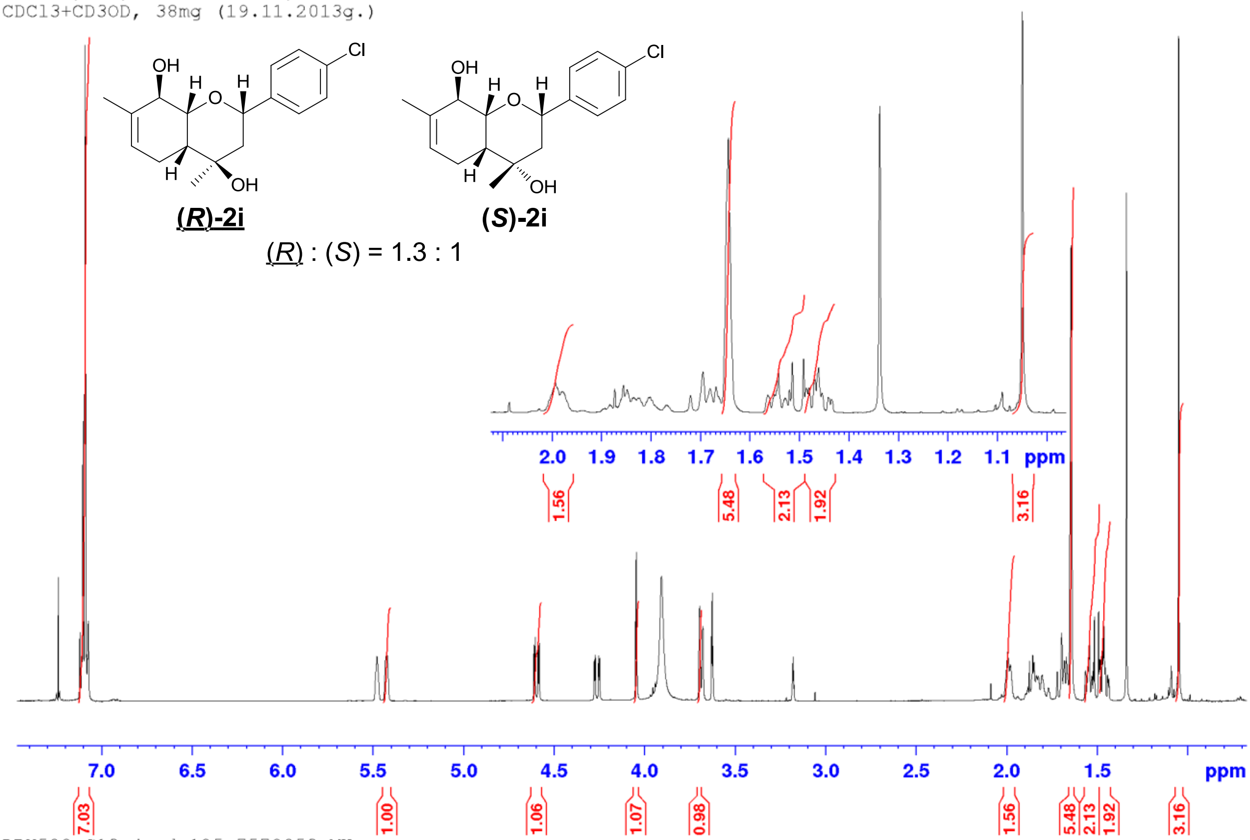
MO - 187 - 4; CDCL3



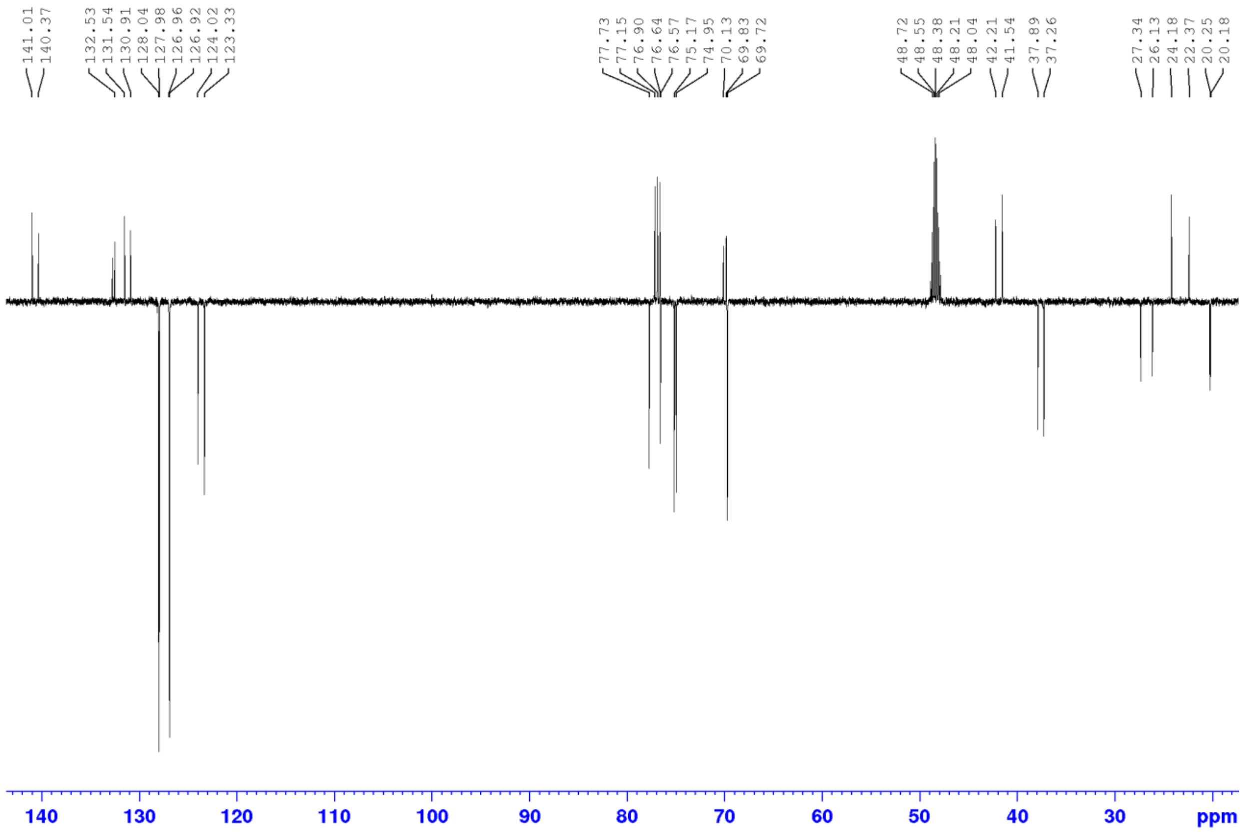
MO - 187 - 4; CDCL3

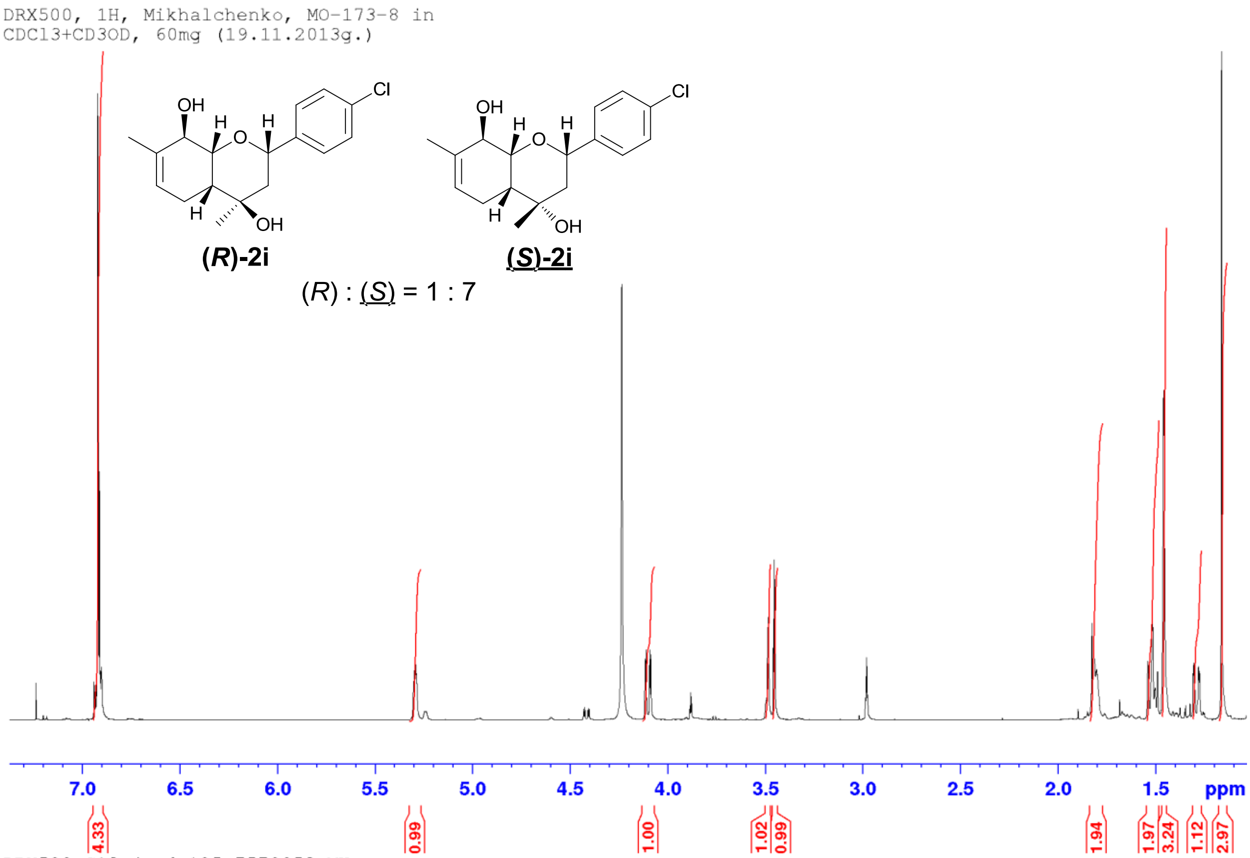


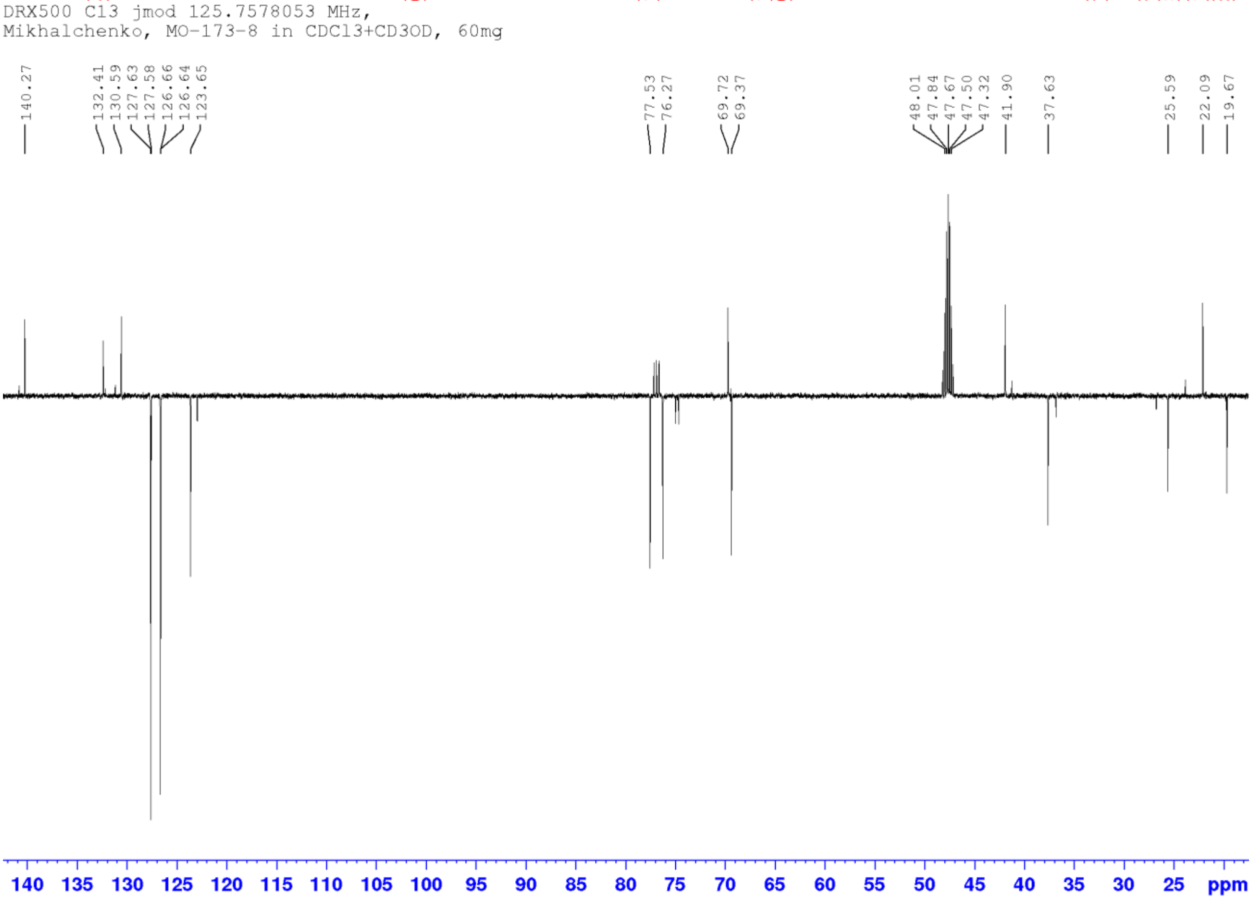
DRX500, 1H, Mikhalchenko, MO-173-7 in CDCl3+CD3OD, 38mg (19.11.2013g.)



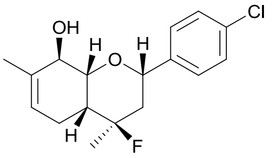
DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-173-7 in CDCl3+CD3OD, 38mg



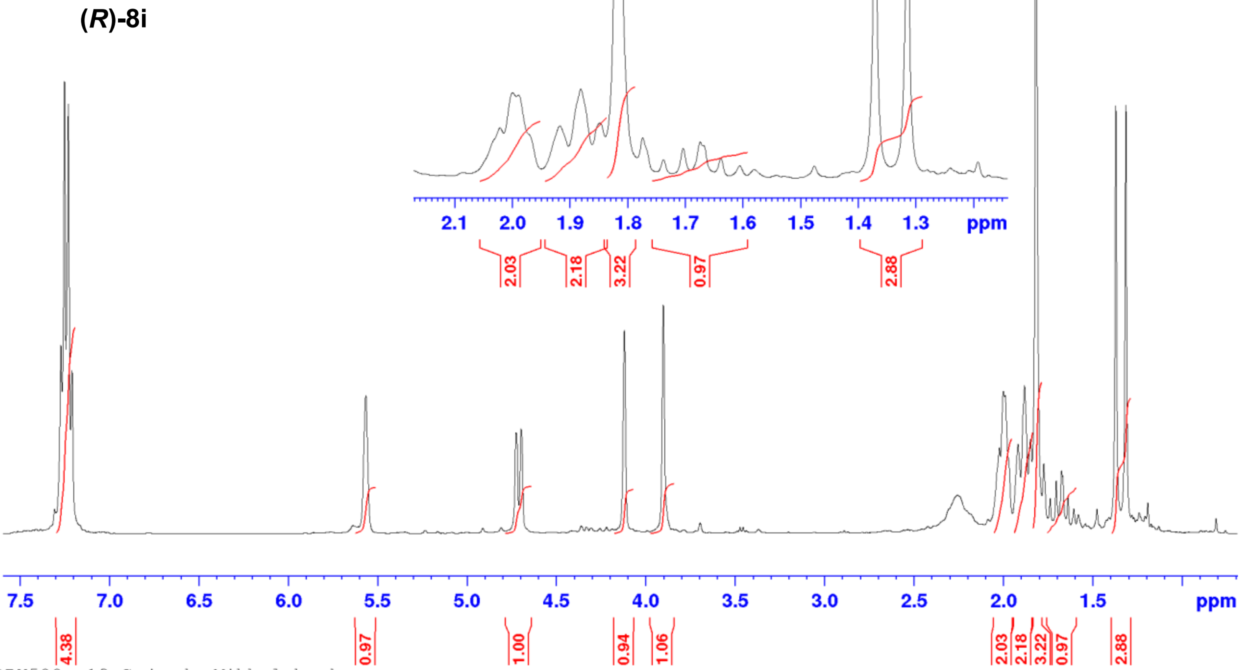

DRX500, 1H, Mikhalchenko, MO-173-8 in
CDCl3+CD3OD, 60mg (19.11.2013g.)
OH
H
H
O
Cl
H
OH
(R)-2i
(S)-2i
(R) : (S) = 1 : 7
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm
4.33
0.99
1.00
1.02
0.99
1.94
1.97
3.24
1.12
2.97


DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-173-8 in CDCl3+CD3OD, 60mg
140.27
132.41
130.59
127.63
127.58
126.66
126.64
123.65
77.53
76.27
69.72
69.37
48.01
47.84
47.67
47.50
47.32
41.90
37.63
25.59
22.09
19.67
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
ppm

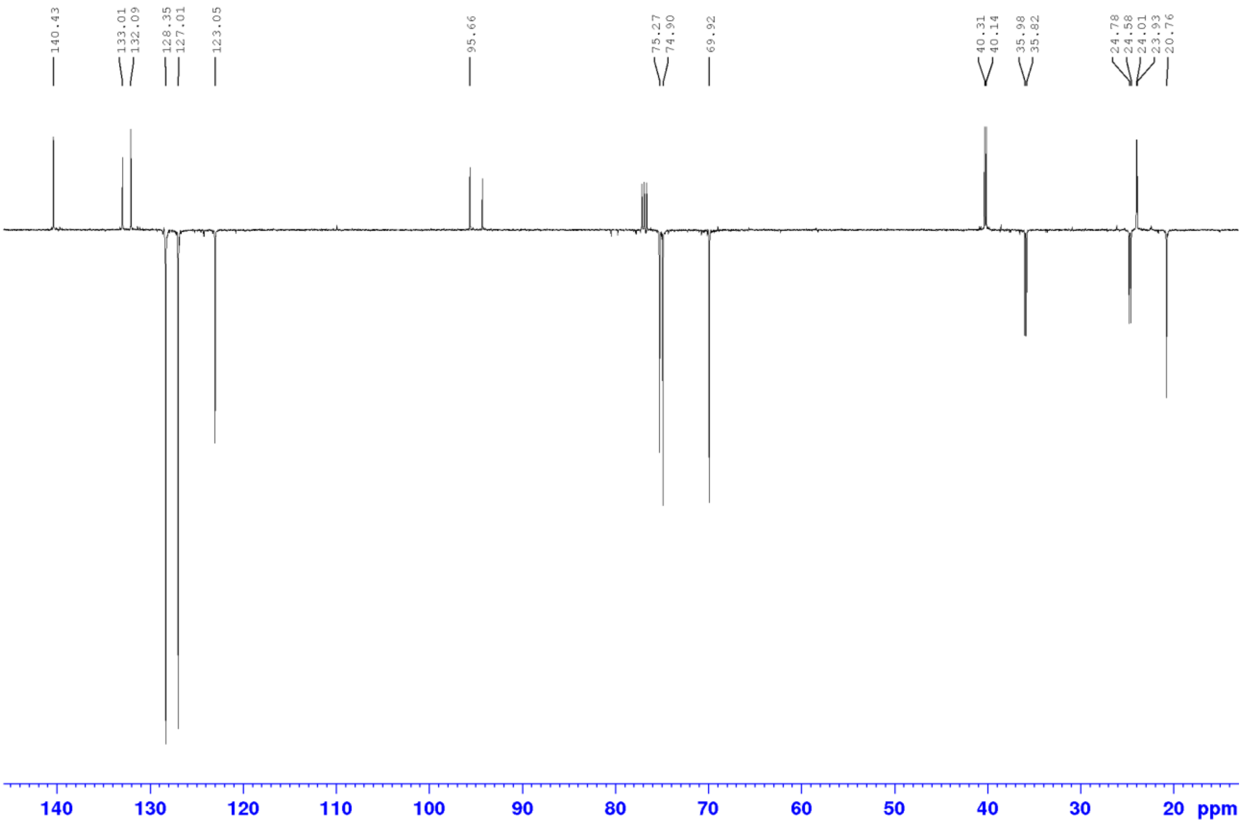
MO-173-3;CDCl3

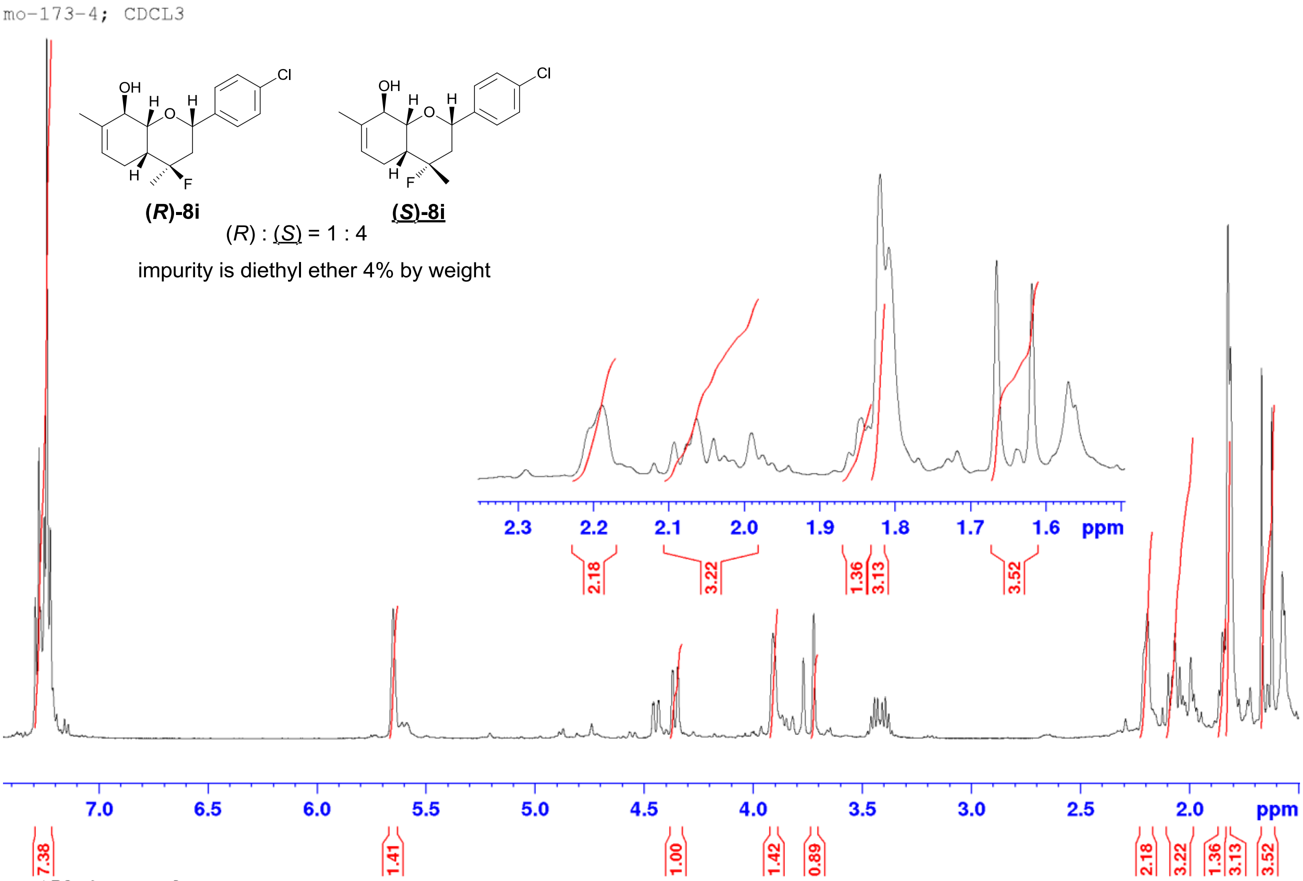


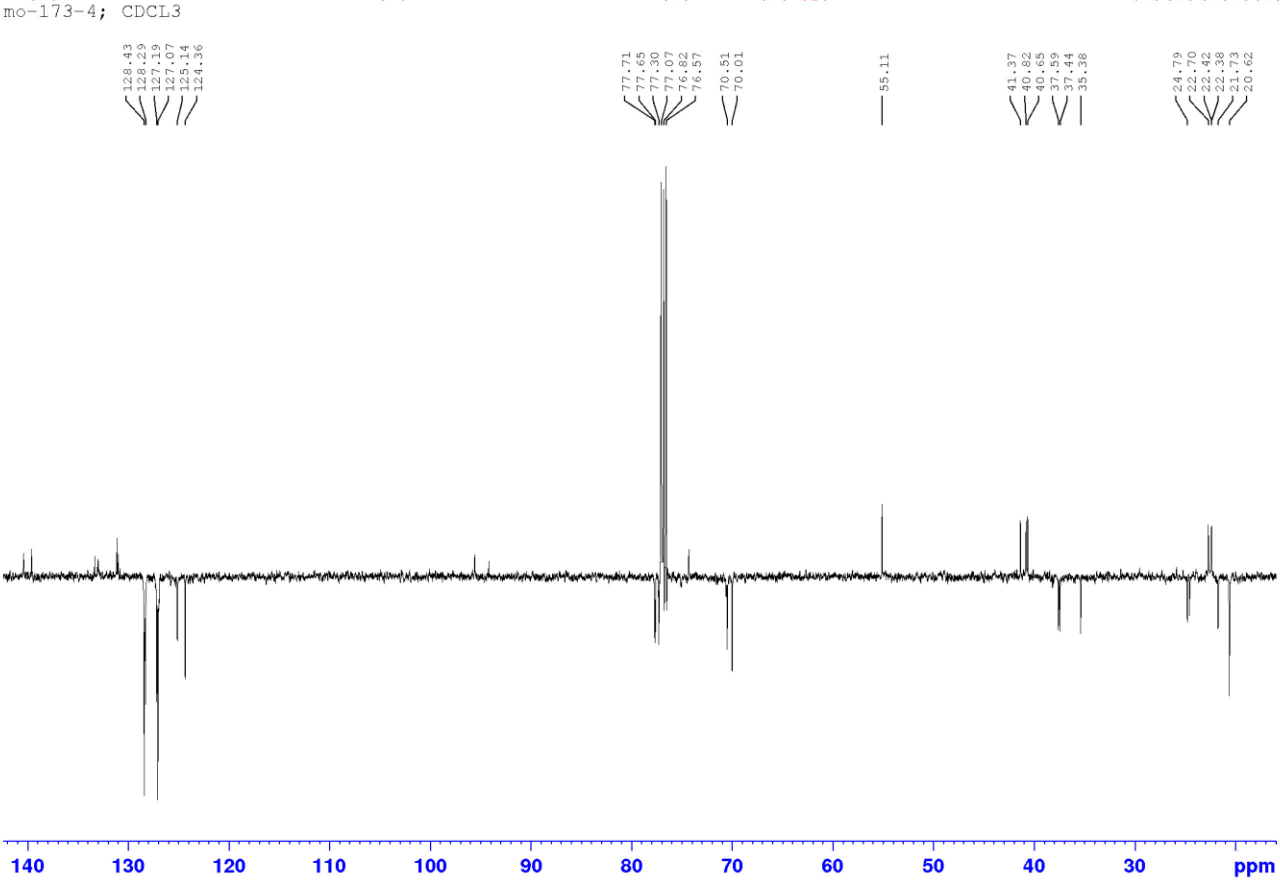
(*R*)-8i

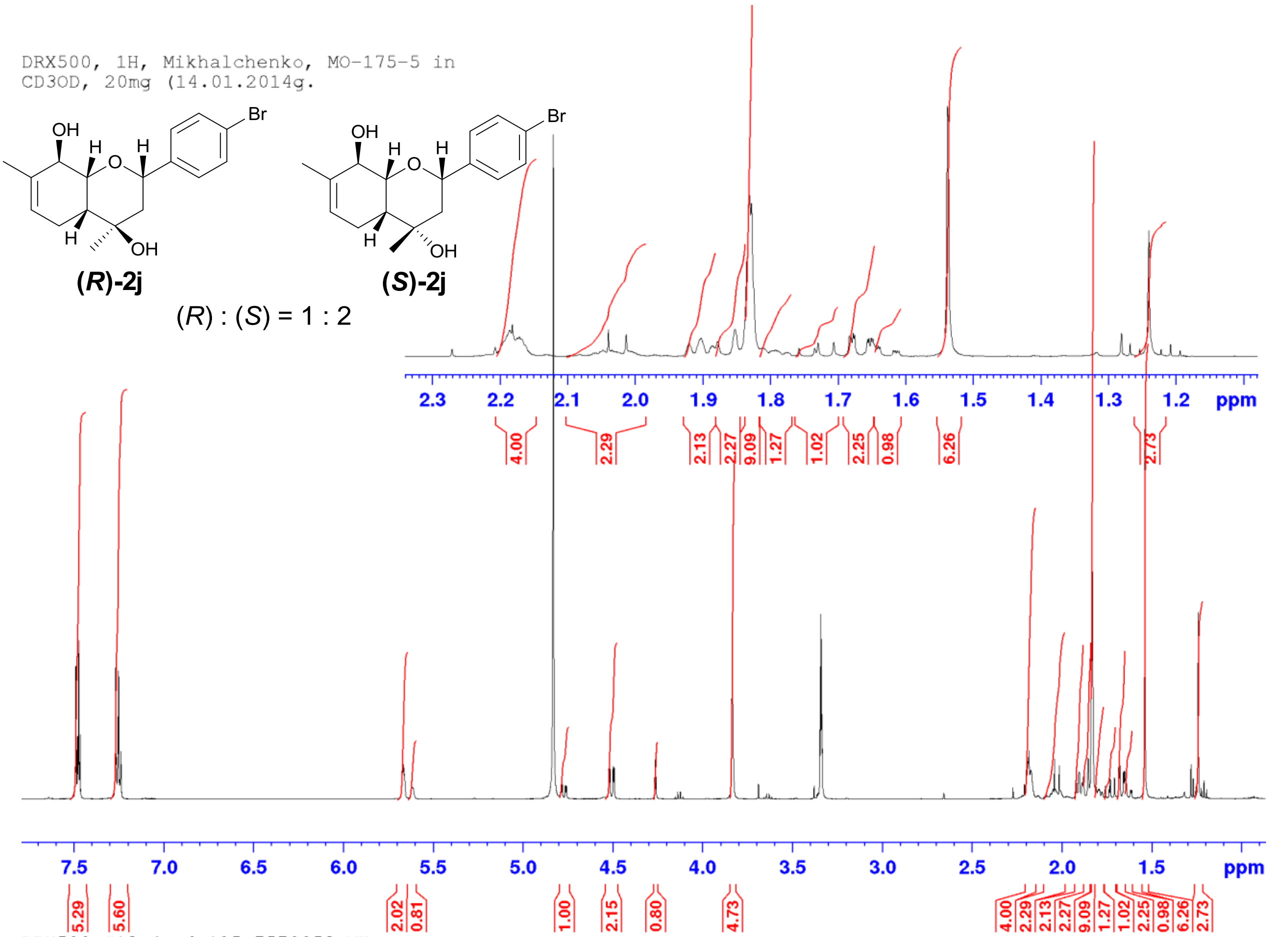


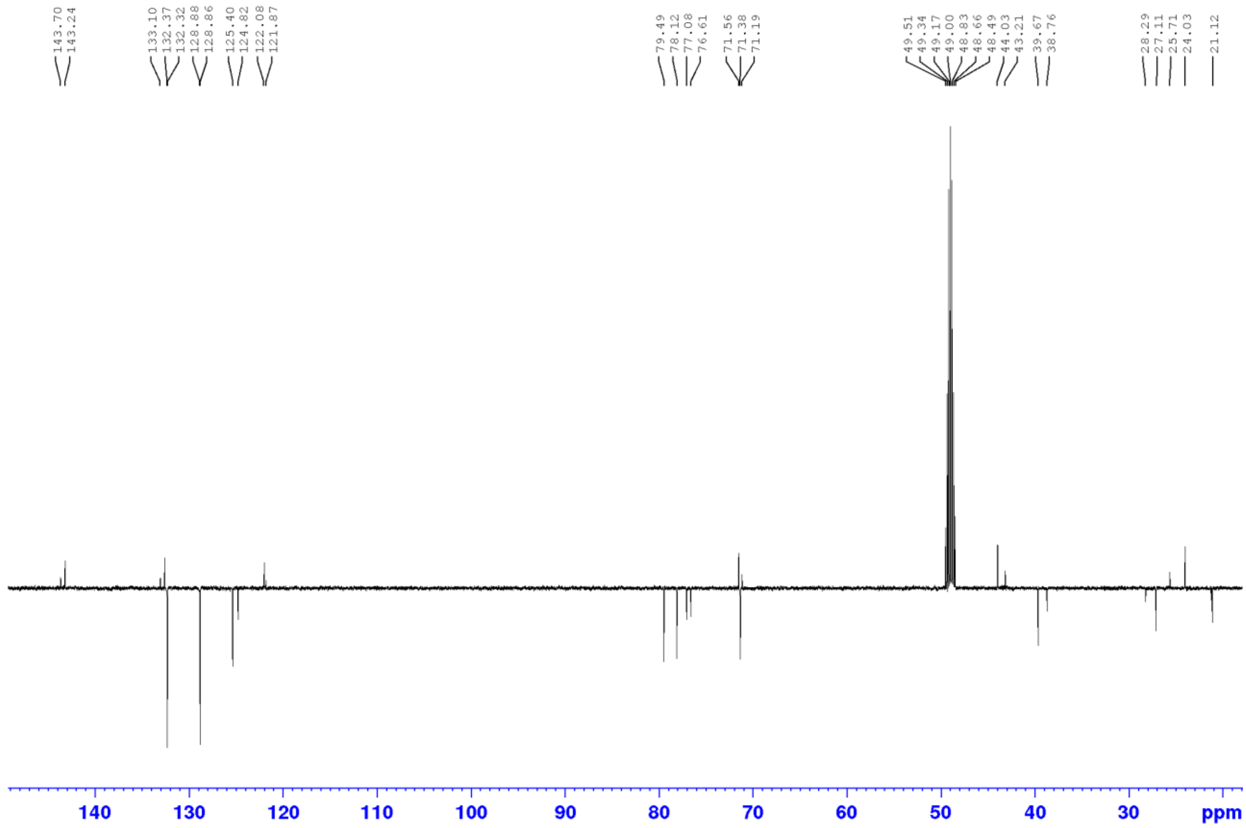
DRX500, 13 C-jmod, Mikhalchenko,
MO-173-3 in CDCl3, 20mg

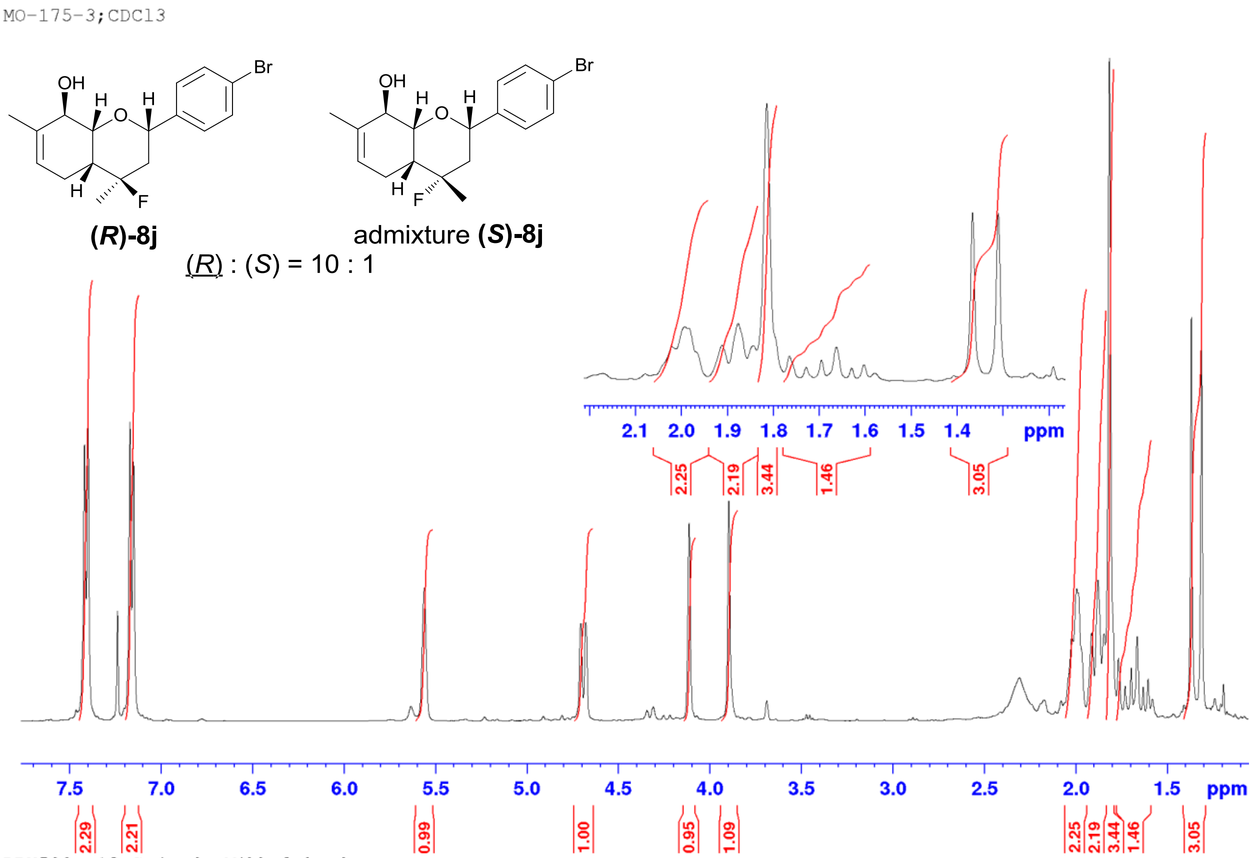


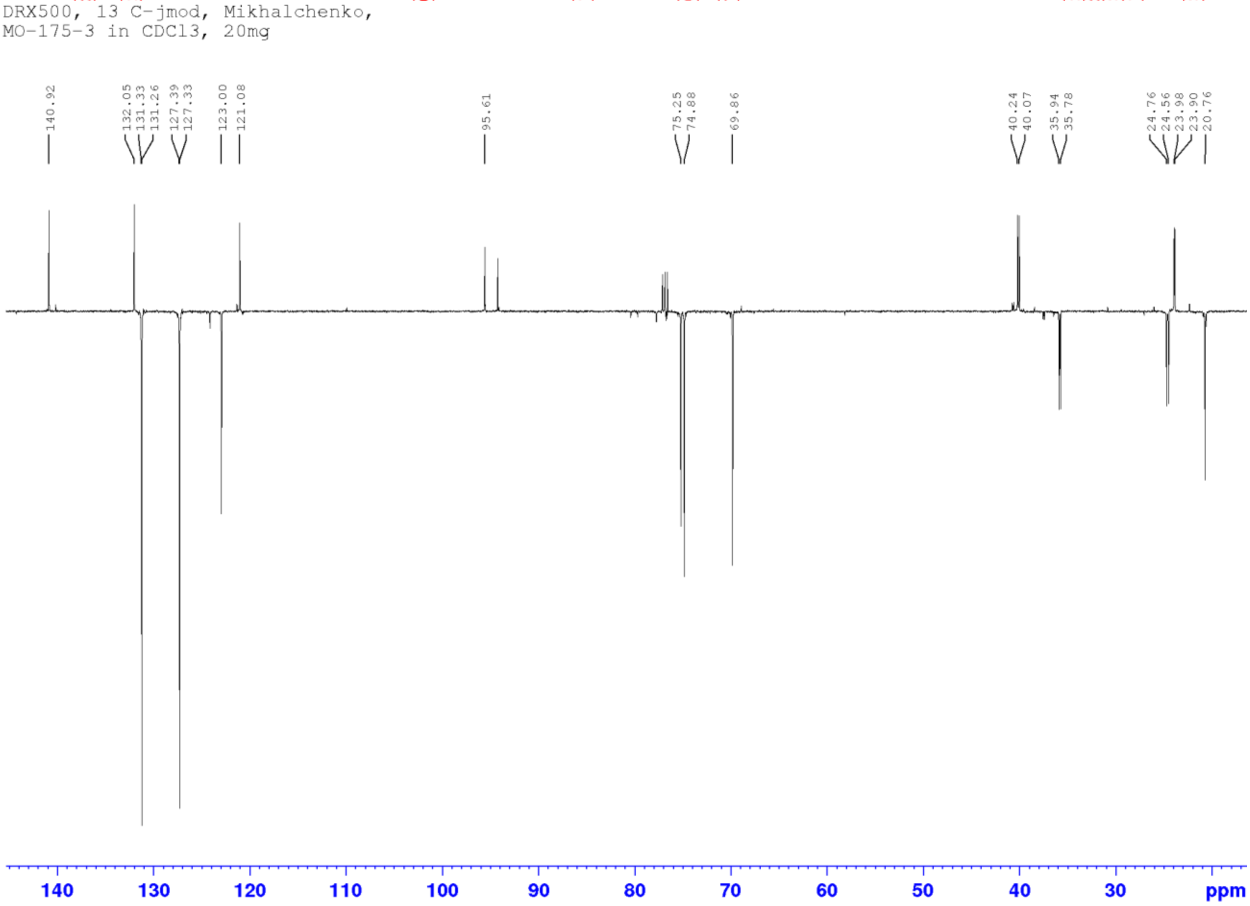

mo-173-4; CDCL3
OH
H
O
H
Cl
H
F
(R)-8i
(S)-8i
(R) : (S) = 1 : 4
impurity is diethyl ether 4% by weight
2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 ppm
2.18 3.22 1.36 3.13 3.52
7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 ppm
7.38 1.41 1.00 1.42 0.89 2.18 3.22 1.36 3.13 3.52


mo-173-4; CDCL3
128.43
128.29
127.19
127.07
125.14
124.36
77.71
77.65
77.30
77.07
76.82
76.57
70.51
70.01
55.11
41.37
40.82
40.65
37.59
37.44
35.38
24.79
22.70
22.42
22.38
21.73
20.62
140 130 120 110 100 90 80 70 60 50 40 30 ppm

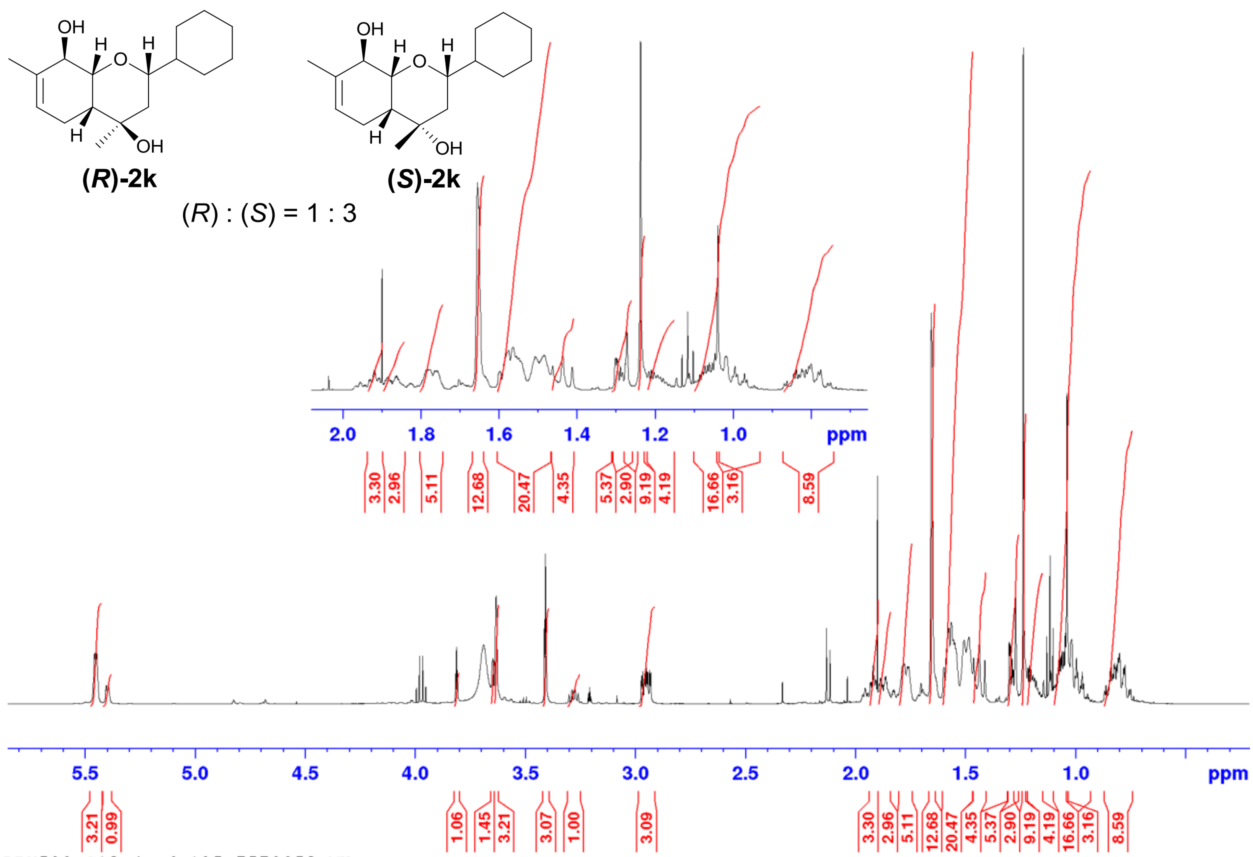

DRX500, 1H, Mikhalchenko, MO-175-5 in CD3OD, 20mg (14.01.2014g.
(R)-2j
(S)-2j
(R) : (S) = 1 : 2
ppm


DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-175-5 in CD3OD, 20mg
143.70 143.24 133.10 132.37 132.32 128.88 128.86 125.40 124.82 122.08 121.87
79.49 78.12 77.08 76.61 71.56 71.38 71.19
49.51 49.34 49.17 49.00 48.83 48.66 48.49 44.03 43.21 39.67 38.76
28.29 27.11 25.71 24.03 21.12
ppm

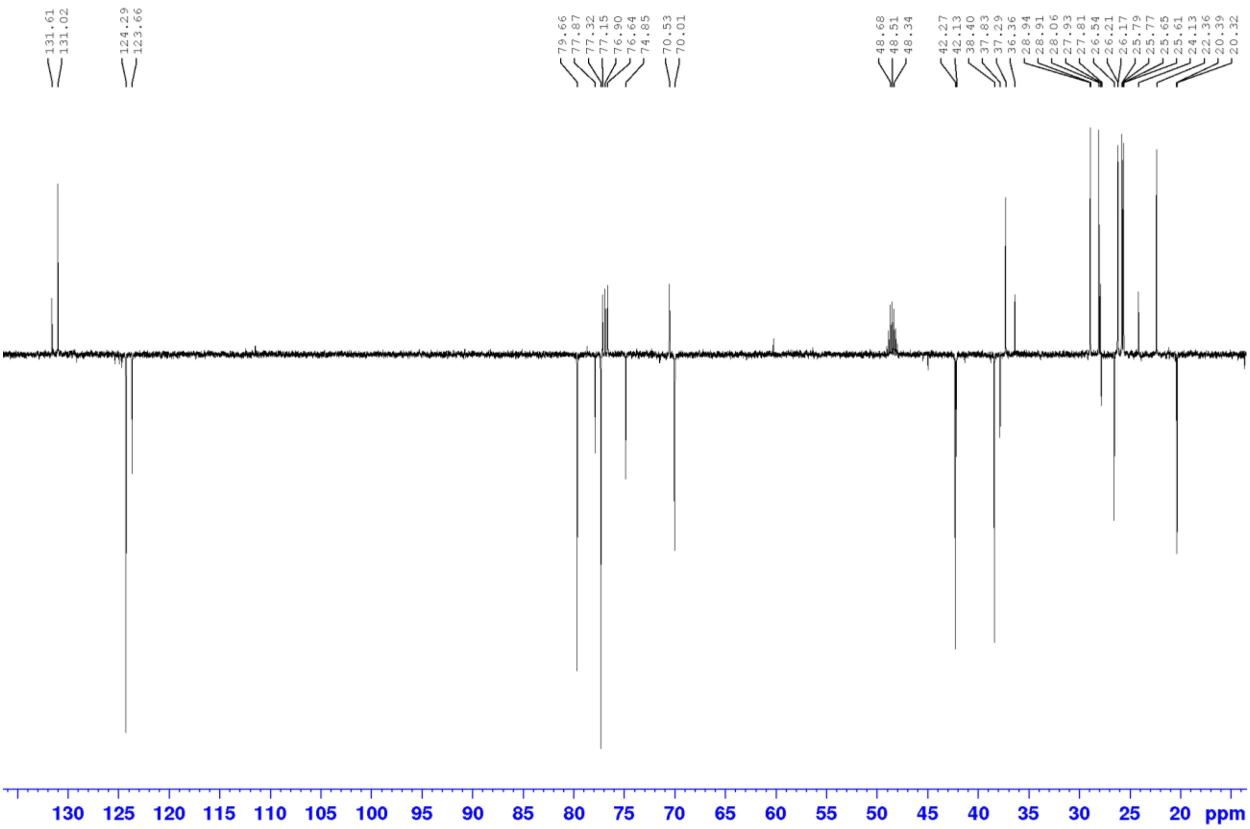

MO-175-3;CDCl3
OH
H
H
O
Br
H
F
(R)-8j
admixture (S)-8j
(R) : (S) = 10 : 1
2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 ppm
2.25 2.19 3.44 1.46 3.05
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 ppm
2.29 2.21 0.99 1.00 0.95 1.09 2.25 2.19 3.44 1.46 3.05


DRX500, 13 C-jmod, Mikhalchenko,
MO-175-3 in CDCl3, 20mg
140.92
132.05
131.33
131.26
127.39
127.33
123.00
121.08
95.61
75.25
74.88
69.86
40.24
40.07
35.94
35.78
24.76
24.56
23.98
23.90
20.76
140 130 120 110 100 90 80 70 60 50 40 30 ppm

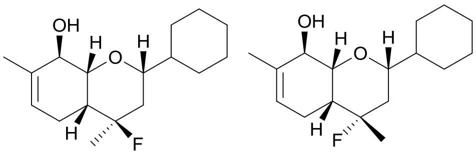
DRX500, 1H, Mikhalchenko, MO-234-3 in
CDCl3+CD3OD, 60mg (27.05.2014g.)



DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-234-3 in CDCl3+CD3OD, 60mg

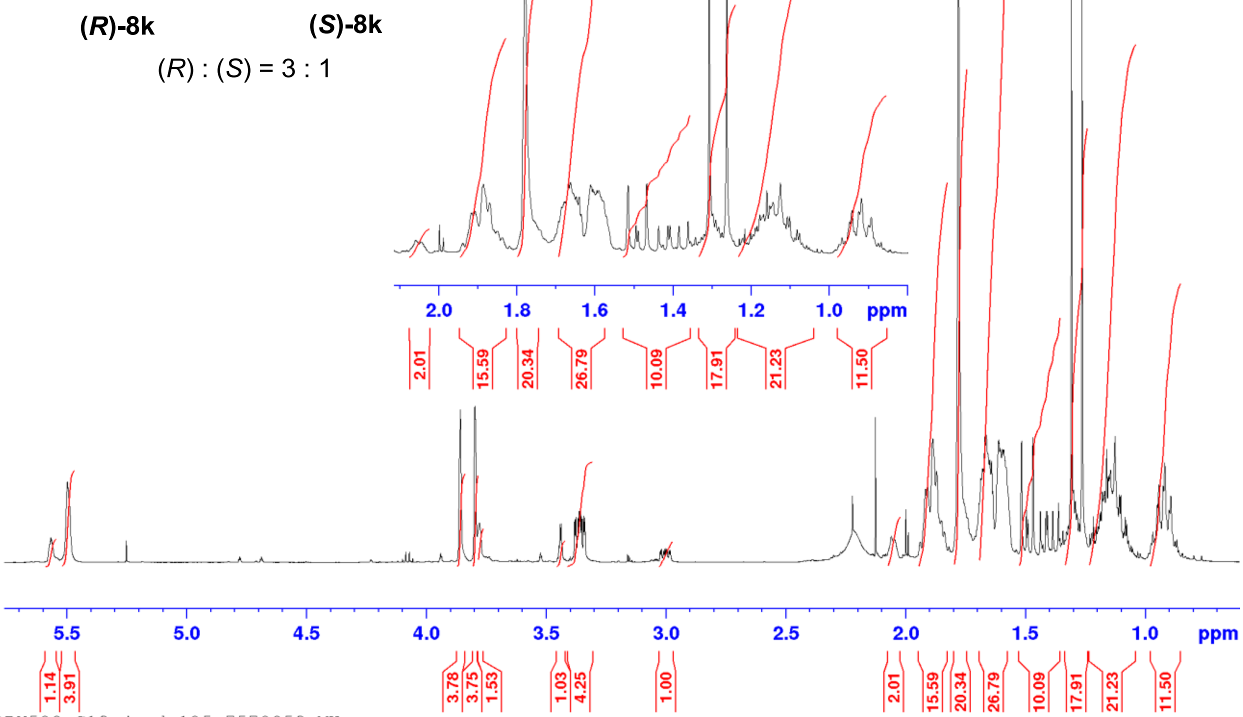


DRX500, 1H, Mikhalchenko, MO-234-1 in
CDCl3, 60mg (27.05.2014g.)

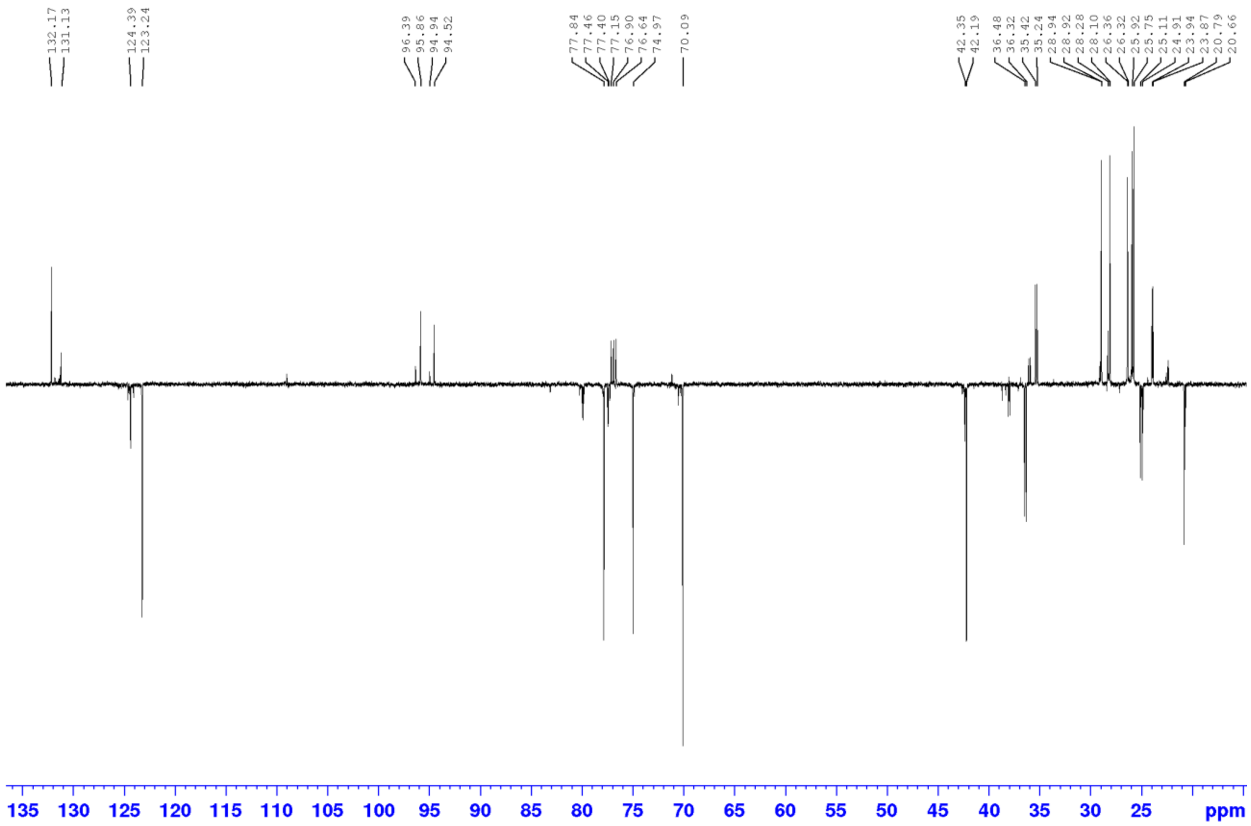


(*R*)-8k **(*S*)-8k**

(*R*) : (*S*) = 3 : 1



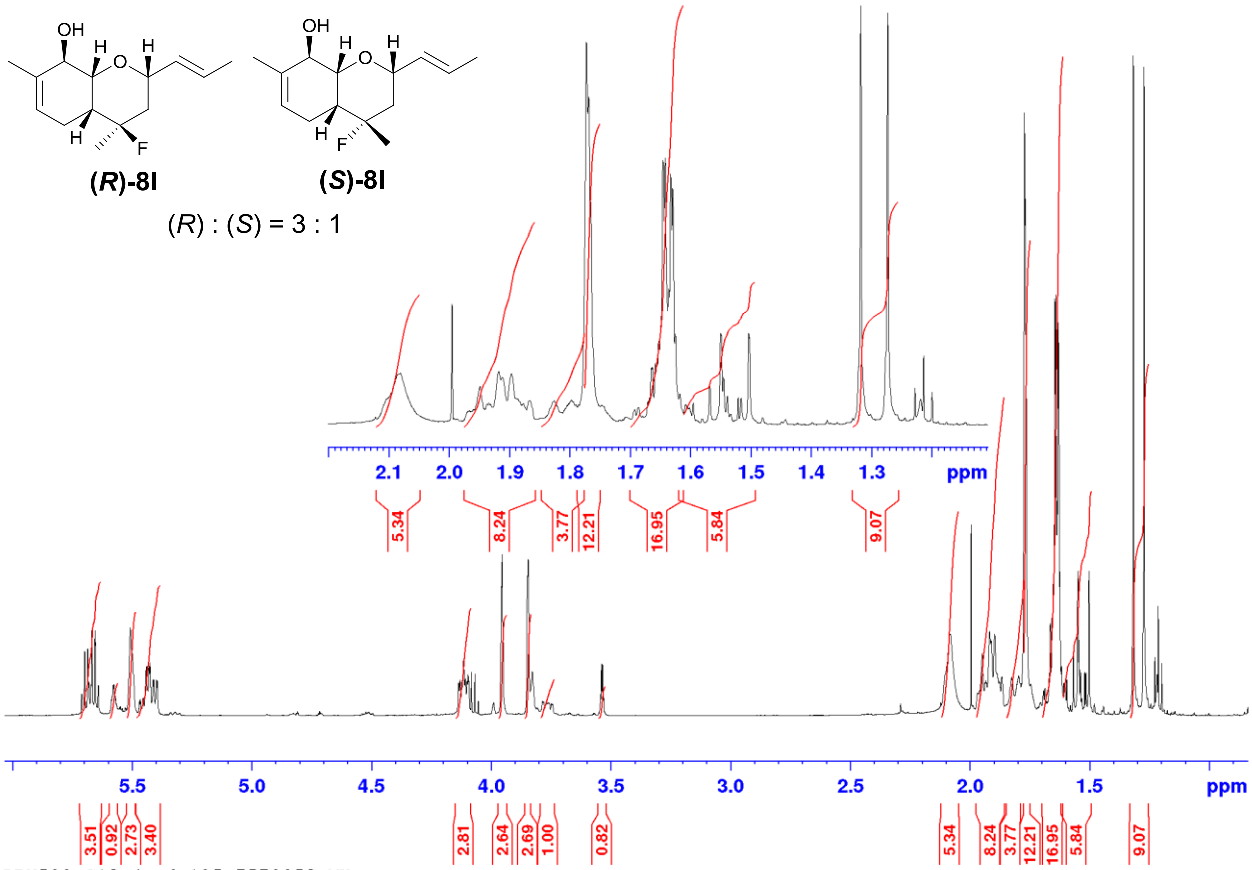
DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-234-1 in CDCl3, 60mg



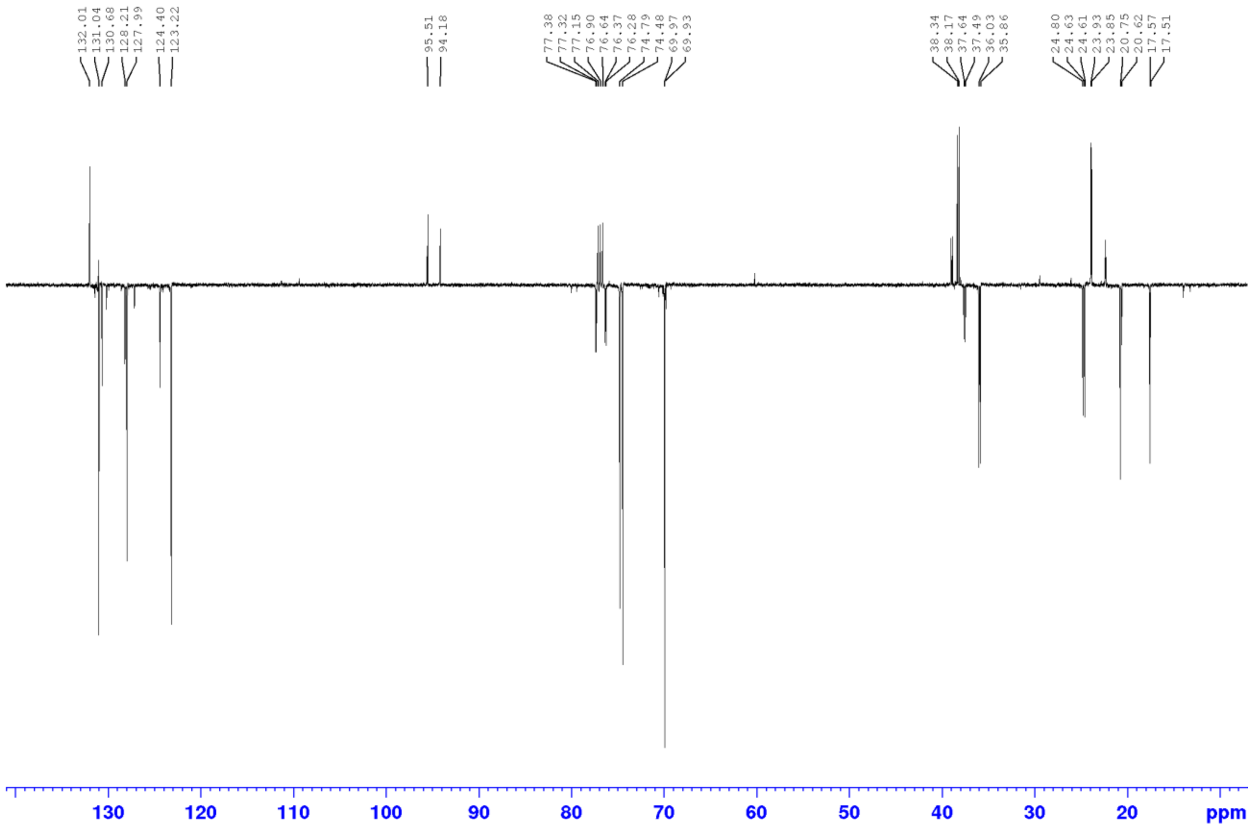
DRX500, 1H, Mikhalchenko, MO-230-1 in
CDCl3, 60mg (04.06.2014g.)

(*R*)-8l **(*S*)-8l**

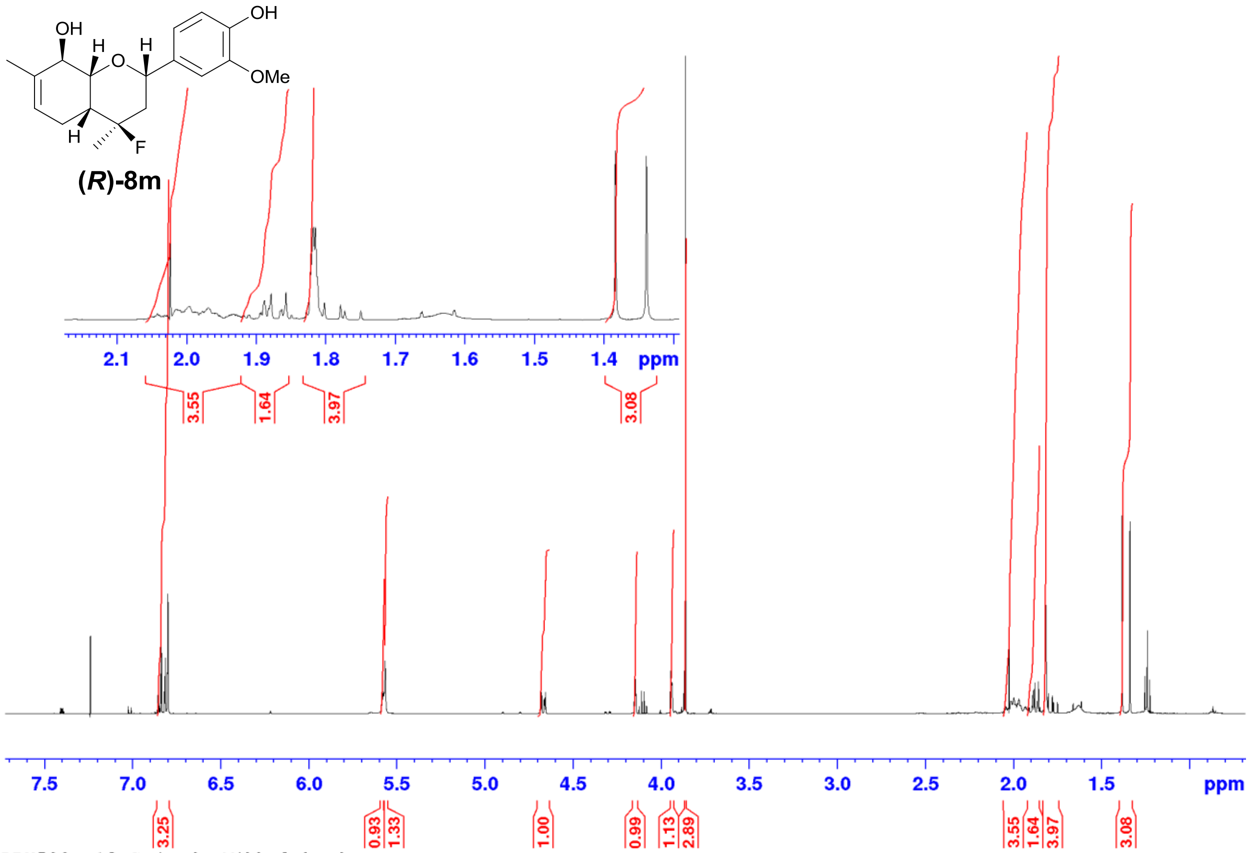
(*R*) : (*S*) = 3 : 1



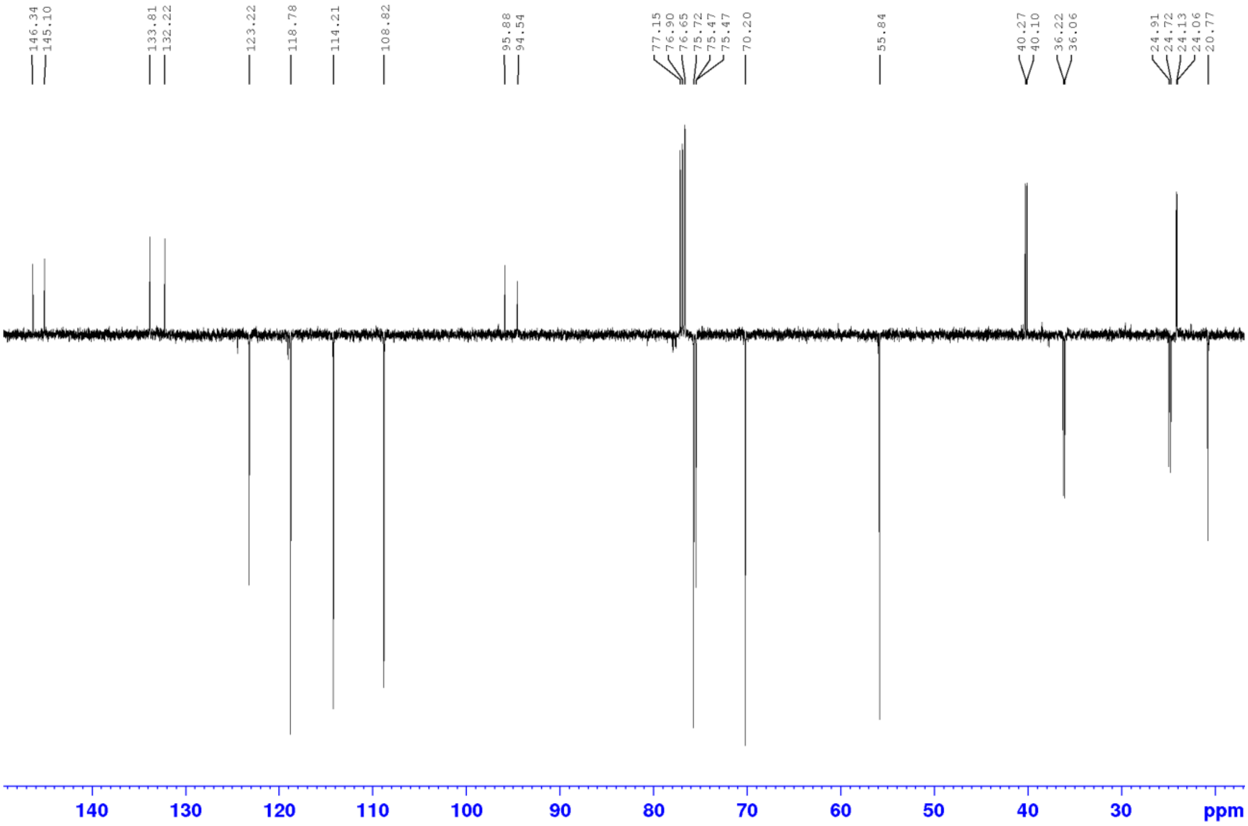
DRX500 C13 jmod 125.7578053 MHz,
Mikhalchenko, MO-230-1 in CDCl3, 60mg



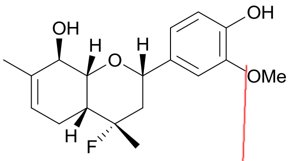
DRX500, 1H, Mikhalchenko,
MO-263-2-1 in CDCl3, 32mg (07.04.2015g.)



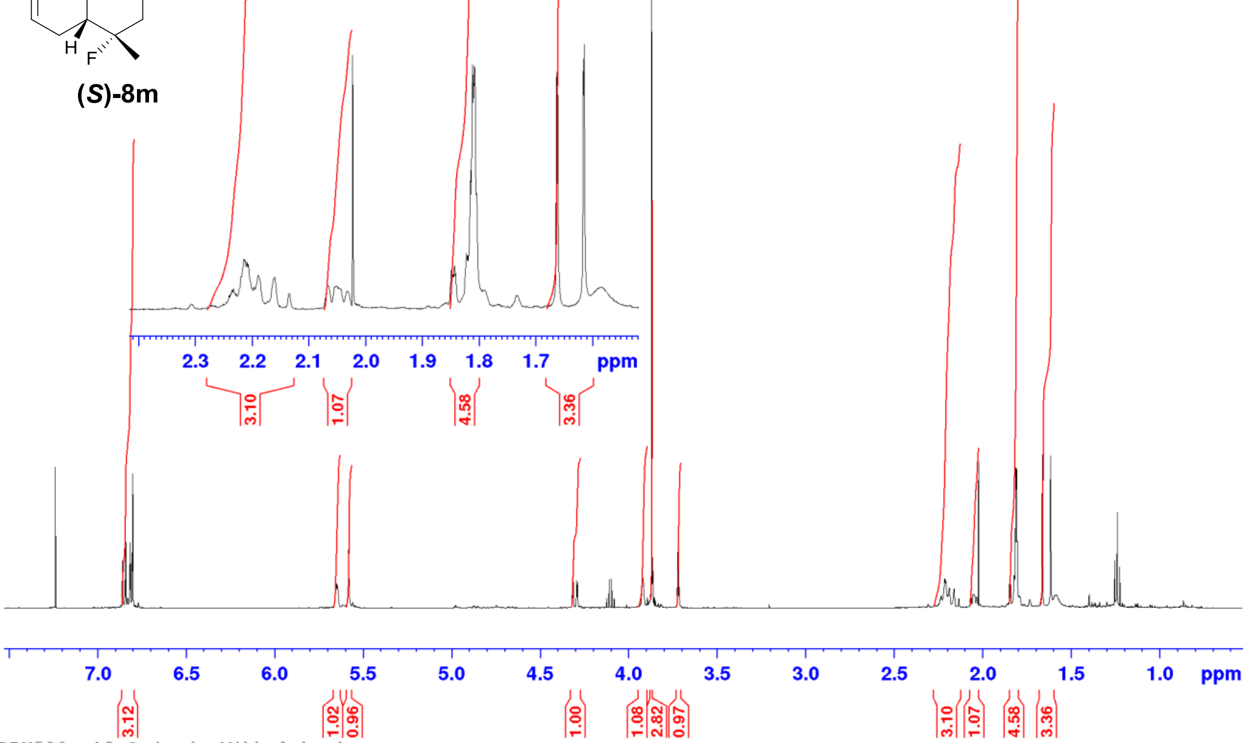
DRX500, 13 C-jmod, Mikhalchenko,
MO-263-2-1 in CDCl3, 32mg



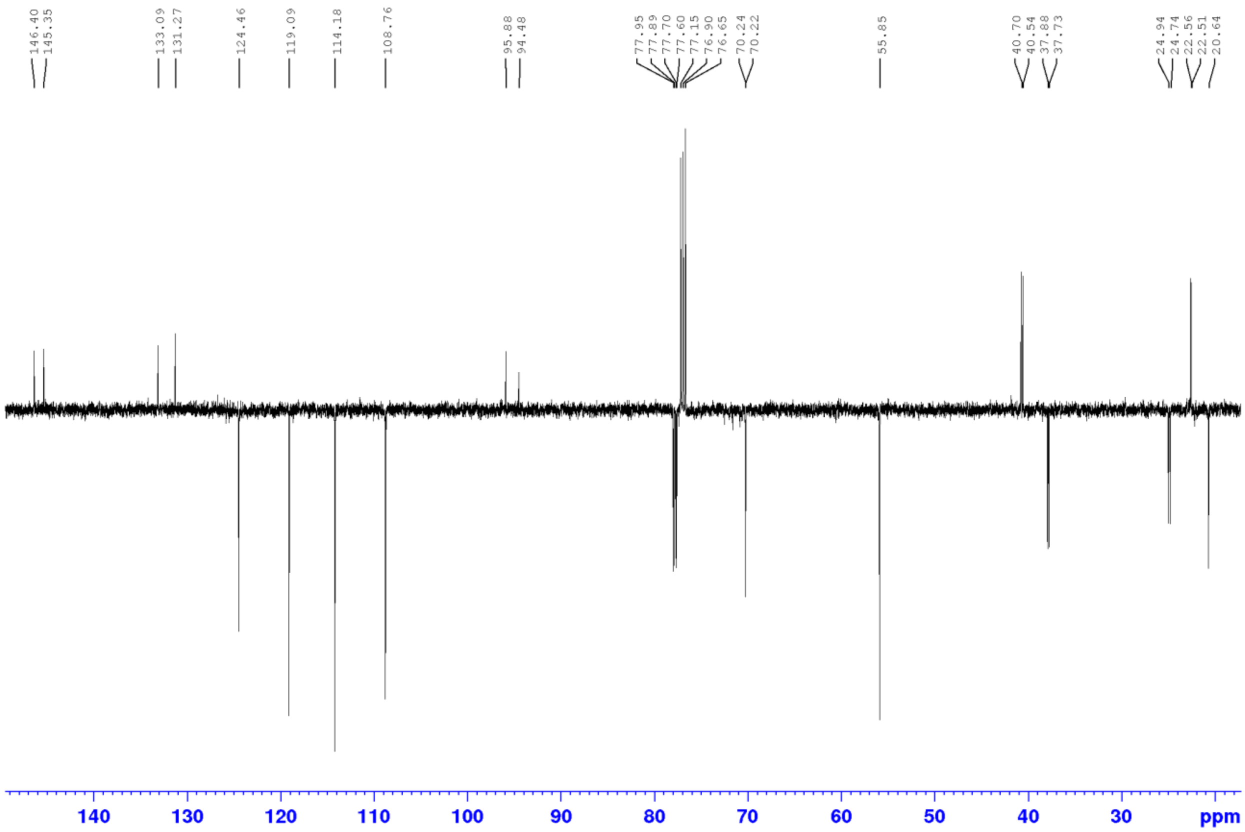
DRX500, 1H, Mikhalchenko,
MO-263-2-2 in CDCl3, 22mg (08.04.2015g.)



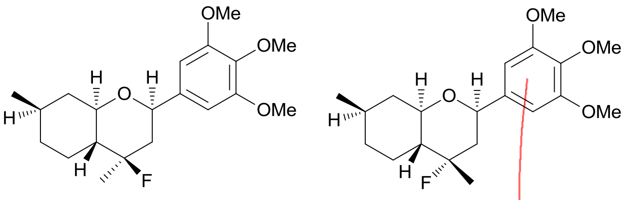
(*S*)-8m



DRX500, 13 C-jmod, Mikhalchenko,
MO-263-2-2 in CDCl3, 22mg

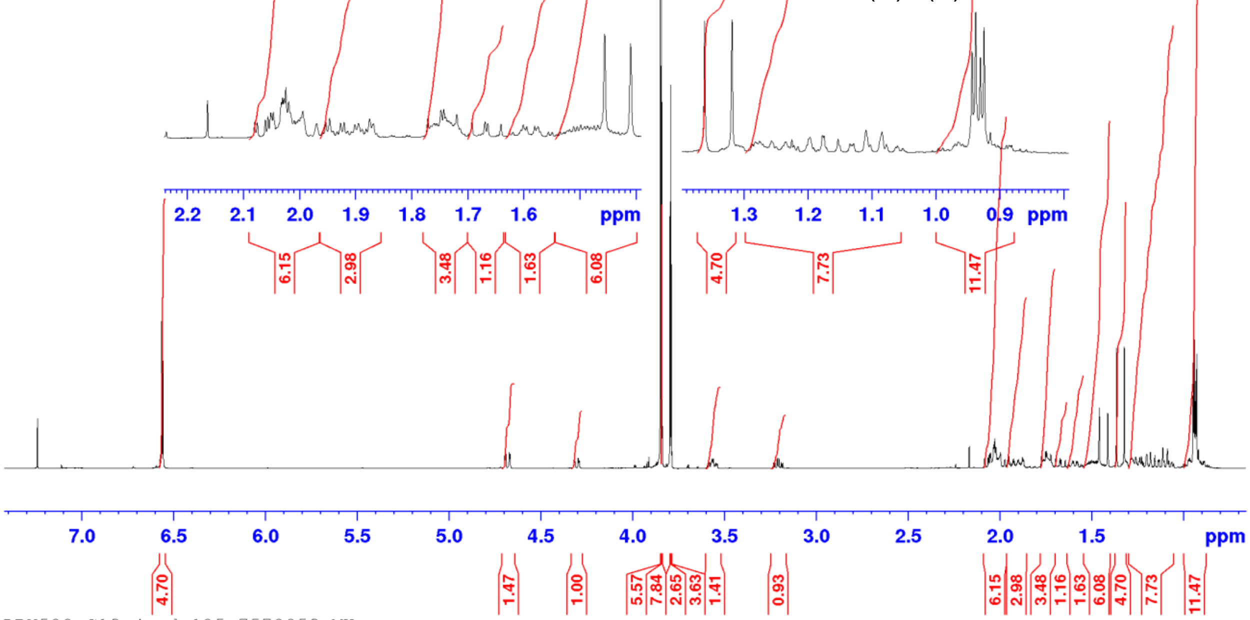


DRX500, 1H, Mikhalchenko, MO-227-3 in CDCl3, 30mg (25.03.2014g.)

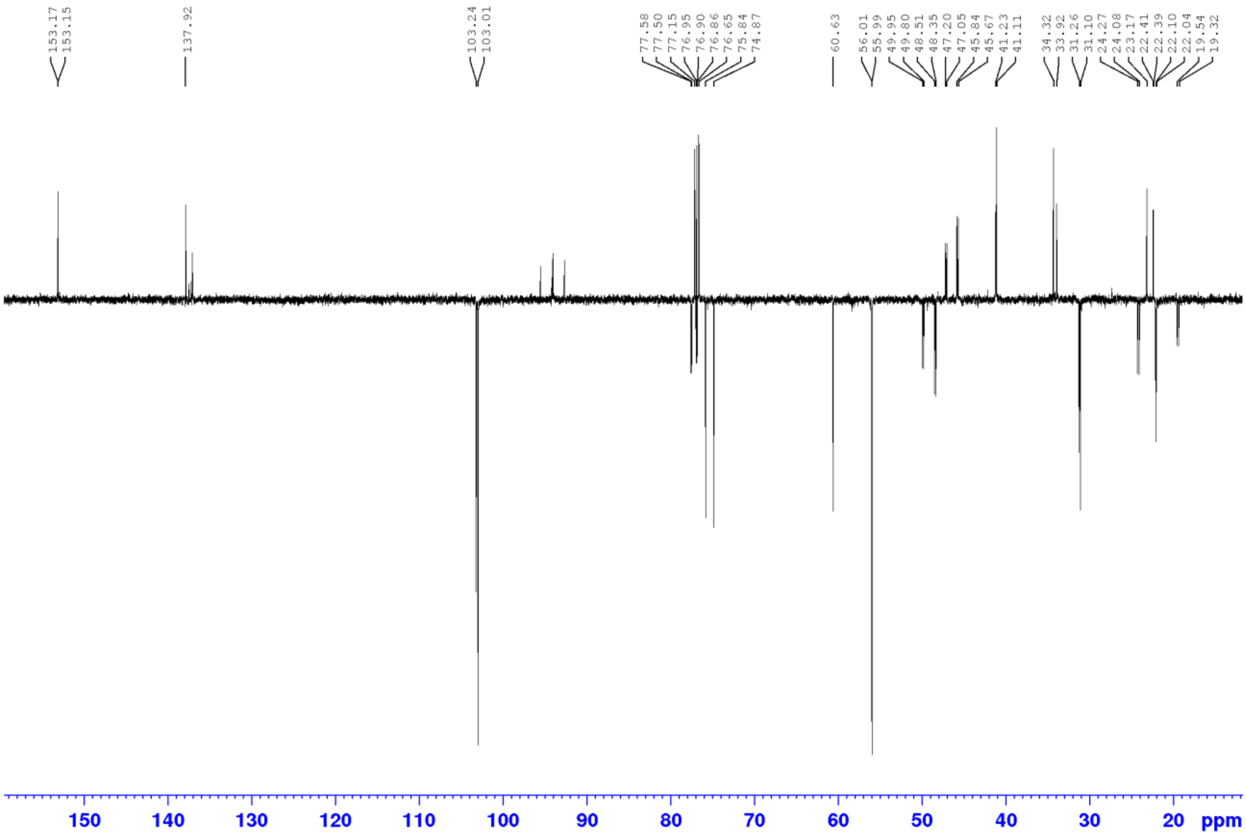


(*R*)-11 **(*S*)-11**

(*R*) : (*S*) = 1.5 : 1



DRX500 C13 jmod 125.7578053 MHz, Mikhalchenko, MO-227-3 in CDCl3, 30mg



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