Electronic Supporting Information

Liquid crystal behavior, photoluminescence and gas sensing: New series of ionic liquid crystal imidazole and benzoimidazole derived bearing a chalcone groups, synthesis and characterization

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2. 2 Measurements

Chemical structures of synthesized compounds were characterized by (**FT-IR**, PerkinElmer 1000) Spectroscopy and proton, carbon nuclear magnetic resonance spectra were recorded in **DMSO-d_6** (**^{1}H-NMR**, Bruker 400 MHz and **^{13}C-NMR,** Varian 500 MHz) spectrometer, using Me_4Si as an internal standard. EAs were carried out for all the final compounds using an (Model Euro EA3000) elemental analyzer. The phase transition temperatures and enthalpy values of the title compounds were measured by differential scanning calorimetry (**DSC**, Linseis Pyris 1), and LC textures of the mesophases were studied using polarizing optical microscope (**POM**, Carl Zeiss Axioskop 40).

The analytical, **FT-IR**, **^{1}H** and **^{13}C NMR** for title compounds are summarized as follows:

4- **3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop1enyl)phe nox y)butyl)-1H-imidazol-3-ium 4a-4i**

3-(4-(4-(3-(4-(hexyloxy)phenyl)-3-oxoprop-1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4a

Yield 68 %, m.p 176.50 °C, Chem.Form: $C_{28}H_{35}BrN_2O_3$, M.Wt: 527.5. IR: υ_{max}(KBr) (cm^{-1}): 3363.20(N-H), 2923.08(C-H aliphatic), 1665.73(C=O), 1588.86(C=C olefinic), 1582.65-1464.38(C=C aromatic), 1298.26(C-N), 1240.39(OCH_2), 817.76 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.01-6.97(d, 4H, Ar-H), 6.95-6.88(d, 2H, imidazole ring), 4.66(t, 2H, -NCH_2), 4.15-4.03(t, 4H, -OCH_2), 2.15-1.27(m, 12H, $(CH_2)_6$), 0.81(t, 3H, CH_3). ^{13}C-NMR δ(ppm): 188.72(C=O), 164.1, 160.41(-OAr), 143.40(-C=C-), 135.33(imidazole ring), 131.56, 130.93, 130.45(C-Ar), 127.0(-C=C-), 123.97(imidazole ring), 119.91, 114.99, 114.13(C-Ar), 68.61, 67.71(-OCH_2), 47.71(-NCH_2), 31.78(-CH_2-CH_2-N), 28.80-22.81((-CH_2)$_5$), 14.25(-CH_3). Anal: Found for $C_{28}H_{35}BrN_2O_3$ (%): C, 63.79; H, 6.65; N, 5.35. Calc. C, 63.75; H, 6.69; N, 5.31.

3-(4-(4-(3-(4-(heptyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4b

Yield 70 %, m.p 174.75 °C, Chem.Form: $C_{29}H_{37}BrN_2O_3$, M.Wt: 541.5. IR: υ_{max}(KBr) (cm^{-1}): 3363.18(N-H), 2923.85, 2858.63(C-H aliphatic), 1665.60(C=O), 1589.36(C=C olefinic), 1582.25-1464.38(C=C aromatic), 1299.50(C-N), 1240.39(OCH_2), 817.37 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.11(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.95-

6.87(d, 2H, imidazole ring), 4.66(t, 2H, -NCH_2), 4.14-4.03(t, 4H, -OCH_2), 2.15-1.26(m, 14H, $(CH_2)_7$), 0.81(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.74(C=O), 163.23, 160.70(-OAr), 143.47(-C=C-), 135.00(imidazole ring), 131.29, 130.77, 130.22(C-Ar), 127.52(-C=C-), 124.03(imidazole ring), 119.86, 114.99, 114.14(C-Ar), 68.53, 67.69(-OCH_2), 47.65(-NCH_2), 31.83(-CH_2-CH_2-N), 28.99-22.80((-CH_2)$_6$), 14.23(-CH_3). Anal: Found for $C_{29}H_{37}BrN_2O_3$ (%): C, 64.36; H, 6.85; N, 5.14. Calc. C, 64.32; H, 6.89; N, 5.17.

3-(4-(4-(3-(4-(octyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4c

Yield 52 %, m.p 170.5 °C, Chem.Form: $C_{30}H_{39}BrN_2O_3$, M.Wt: 555.5. IR: υ_{max}(KBr) (cm^{-1}): 3364.67(N-H), 2971.07(C-H aliphatic), 1662.43(C=O), 1591.39(C=C olefinic), 1582.24-1464.84(C=C aromatic), 1300.01(C-N), 1245.10(OCH_2), 818.10 p-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.09(s, 1H, imidazole ring), 7.01-6.96(d, 4H, Ar-H), 6.94-6.88(d, 2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.15-4.04(t, 4H, -OCH_2), 2.14-1.27(m, 16H, $(CH_2)_8$), 0.80(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.75(C=O), 163.10, 160.69(-OAr), 143.56(-C=C-), 135.04(imidazole ring), 131.29, 130.72, 130.21(C-Ar), 127.55(-C=C-), 124.05(imidazole ring), 119.80, 114.98, 114.15(C-Ar), 68.50, 67.68(-OCH_2), 47.61(-NCH_2), 31.87(-CH_2-CH_2-N), 29.20-22.79((-CH_2)$_7$), 14.22(-CH_3). Anal: Found for $C_{30}H_{39}N_2O_3$ (%): C, 64.82; H, 7.04; N, 5.08. Calc. C, 64.86; H, 7.08; N, 5.04.

3-(4-(4-(3-(4-(nonyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4d

Yield 78 %, m.p 162.7 °C, Chem.Form: $C_{31}H_{41}BrN_2O_3$, M.Wt: 569.6. IR: υ_{max}(KBr) (cm^{-1}): 3363.97(N-H), 2920.92(C-H aliphatic), 1663.64(C=O), 1591.95(C=C olefinic), 1584.25-1464.48(C=C aromatic), 1299.64(C-N), 1243.82(OCH_2), 818.74 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.60(d, 2H, Ar-H),

7.48(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.94-6.89(d, 2H, imidazole ring), 4.66(t, 2H, -NCH_2), 4.14-4.04(t, 4H, -OCH_2), 2.15-1.26(m, 18H, $(CH_2)_9$), 0.81(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.78(C=O), 163.07-160.75(-OAr), 143.73(-C=C-), 136.77(imidazole ring), 131.29, 130.71, 130.18(C-Ar), 127.92(-C=C-), 125.33(imidazole ring), 119.70, 114.90, 114.15(C-Ar), 68.47-67.66(-OCH_2), 47.43(-NCH_2), 31.90(-CH_2-CH_2-N), 29.40-22.76((-$CH_2)_8$), 14.18(-CH_3). Anal: Found for $C_{31}H_{41}N_2O_3$ (%): C, 65.33; H, 7.29; N, 4.96. Calc C, 65.37; H, 7.26; N, 4.92.

3-(4-(4-(3-(4-(decyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4e

Yield 85 %, m.p 156 °C, Chem.Form: $C_{32}H_{43}BrN_2O_3$, M.Wt: 583.6. IR: υ_{max}(KBr) (cm^{-1}): 3367.21(N-H), 2921.52(C-H aliphatic), 1665.67(C=O), 1593.67(C=C olefinic), 1583.02-1467.01(C=C aromatic), 1301.57(C-N), 1245.76(OCH_2), 818.00 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.01-6.96(d, 4H, Ar-H), 6.95-6.89(d, 2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.15-4.03(t, 4H, -OCH_2), 2.15-1.27(m, 20H, $(CH_2)_{10}$), 0.81(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.80(C=O), 163.04, 160.83(-OAr), 143.61(-C=C-), 138.76(imidazole ring), 131.27, 130.70, 130.14(C-Ar), 127.4(-C=C-), 126.46(imidazole ring), 119.66, 114.87, 114.15(C-Ar), 68.41-67.64(-OCH_2), 47.18(-NCH_2), 31.93(-CH_2-CH_2-N), 29.57-22.75((-$CH_2)_9$), 14.14(-CH_3). Anal: Found for $C_{32}H_{43}BrN_2O_3$ (%): C, 65.82; H, 7.48; N, 4.84. Calc C, 65.86; H, 7.43; N, 4.80.

3-(4-(4-(3-(4-(undecyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4f

Yield 69 %, m.p 164.2 °C, Chem.Form: $C_{33}H_{45}BrN_2O_3$, M.Wt: 597.6. IR: υ_{max}(KBr) (cm^{-1}): 3364.98(N-H), 2918.29(C-H aliphatic), 1662.41(C=O), 1592.77 (C=C olefinic), 1584.26-1464.54(C=C aromatic), 1300.16(C-N), 1245.41(OCH_2), 820.29 *p*-position. ^{1}H-NMR δ(ppm,

$CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.00-6.94(d, 4H, Ar-H), 6.93-6.90(d, 2H, imidazole ring), 4.65(t, 2H, $-NCH_2$), 4.16-4.04(t, 4H, $-OCH_2$), 2.14-1.29(m, 22H, $(CH_2)_{11}$), 0.81(t, 3H,CH_3).^{13}C-NMR δ(ppm): 188.83(C=O), 163.01, 160.90(-OAr), 143.66(-C=C-), 140.85(imidazole ring), 132.26, 130.69, 130.12(C-Ar), 128.71(-C=C-), 127.87(imidazole ring), 119.52, 114.86, 114.16(C-Ar), 68.34, 67.62($-OCH_2$), 46.61($-NCH_2$), 31.97($-CH_2-CH_2-$N), 29.65 -22.72 (($-CH_2)_{10}$), 14.13($-CH_3$). Anal: Found for $C_{33}H_{45}BrN_2O_3$ (%): C, 66.36; H, 7.55; N, 4.66. Calc C, 66.32; H, 7.59; N, 4.69.

3-(4-(4-(3-(4-(dodecyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4g

Yield 29 %, m.p 156 °C, Chem.Form: $C_{34}H_{47}BrN_2O_3$, M.Wt: 611.7. IR: υ_{max}(KBr) (cm^{-1}): 3366.36(N-H), 2918.17(C-H aliphatic), 1661.51(C=O), 1592.88(C=C olefinic), 1584.78-1465.31(C=C aromatic), 1300.47(C-N), 1245.65(OCH_2), 821.74 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.01-6.96(d, 4H, Ar-H), 6.94-6.89(d, 2H, imidazole ring), 4.66(t, 2H, $-NCH_2$), 4.15-4.04(t, 4H, $-OCH_2$), 2.14-1.27(m, 24H, $(CH_2)_{12}$), 0.80(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.85(C=O), 163.00, 160.93(-OAr), 143.75(-C=C-), 140.91(imidazole ring), 131.22, 130.66, 130.09(C-Ar), 128.83(-C=C-), 127.94(imidazole ring), 119.49, 114.83, 114.16(C-Ar), 68.31, 67.59($-OCH_2$), 46.60($-NCH_2$), 31.99($-CH_2-CH_2-$N), 29.72-22.71(($-CH_2)_{11}$), 14.11($-CH_3$). Anal: Found for $C_{34}H_{47}BrN_2O_3$ (%): C, 66.73; H, 7.79; N, 4.54. Calc C, 66.76; H, 7.75; N, 4.58.

3-(4-(4-(3-(4-(tridecyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4h

Yield 41 %, m.p 158.7 °C, Chem.Form: $C_{35}H_{49}BrN_2O_3$, M.Wt: 625.7. IR: υ_{max}(KBr) (cm^{-1}): 3366.17(N-H), 2922.67(C-H aliphatic), 1661.48(C=O), 1592.09(C=C olefinic), 1584.15-1464.68(C=C aromatic), 1301.37(C-N), 1244.60(OCH_2), 824.01 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.76 (d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.95-6.89(d, 2H, imidazole ring), 4.66(t, 2H, -NCH_2), 4.14-4.04(t, 4H, -OCH_2), 2.15-1.28(m, 26H, $(CH_2)_{13}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.87(C=O), 162.97, 160.98(-OAr), 144.02(-C=C-), 140.91(imidazole ring), 131.20, 130.63, 130.07(C-Ar), 128.86(-C=C-), 127.98(imidazole ring), 119.41, 114.79, 114.16(C-Ar), 68.28, 67.57(-OCH_2), 46.58(-NCH_2), 32.02(-CH_2-CH_2-N), 29.78-22.68((-CH_2)$_{13}$), 13.98(-CH_3). Anal: Found for $C_{35}H_{49}BrN_2O_3$ (%): C, 67.15; H, 7.84; N, 4.45. Calc C, 67.19; H, 7.89; N, 4.48.

3-(4-(4-(3-(4-(tridecyloxy)phenyl)-3-oxoprop1enyl)phenoxy)butyl)-1H-imidazol-3-ium bromide: 4i

Yield 42 %, m.p 150.5 °C, Chem.Form: $C_{36}H_{51}BrN_2O_3$, M.Wt: 639.7. IR: υ_{max}(KBr) (cm-1): 3367.30(N-H), 2919.66(C-H aliphatic), 1664.34(C=O), 1593.06(C=C olefinic), 1583.71-1465.79(C=C aromatic), 1301.55(C-N), 1244.13(OCH_2), 820.57 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.01-6.97(d, 4H, Ar-H), 6.95-6.89(d, 2H, imidazole ring), 4.66(t, 2H, -NCH_2), 4.15-4.03(t, 4H, -OCH_2), 2.14-1.27(m, 28H, $(CH_2)_{14}$), 0.81(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.89(C=O), 162.91-160.99(-OAr), 144.08(-C=C-), 141.10(imidazole ring), 131.19, 130.61, 130.05(C-Ar), 128.90(-C=C-), 128.01(imidazole ring), 119.39, 114.74, 114.16(C-Ar), 68.17-67.54, 67.53(-OCH_2), 46.51(-NCH_2), 32.11(-CH_2-CH_2-N), 29.81-22.64((-CH_2)$_{14}$), 13.97(-CH_3). Anal: Found for $C_{36}H_{51}BrN_2O_3$ (%): C, 67.55; H, 8.08; N, 4.34. Calc C, 67.59; H, 8.04; N, 4.38.

5- **3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1enyl)phenoxy)hexyl)-1H-imidazol-3-ium 5a-5i**

3-(6-(4-(3-(4-(hexyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5a

Yield 66 %, m.p 181.3 °C, Chem.Form: $C_{30}H_{39}BrN_2O_3$, M.Wt: 555.5. IR: υ_{max}(KBr) (cm^{-1}): 3366.36(N-H), 2919.27(C-H aliphatic), 1664.59(C=O), 1594.36(C=C olefinic), 1584.42-1465.16(C=C aromatic), 1301.73(C-N), 1243.25(OCH_2), 819.84 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.01-6.97(d, 4H, Ar-H), 6.94-6.88(d, 2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.08-4.03(t, 4H, -OCH_2), 1.95-1.29(m, 16H, $(CH_2)_8$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.67(C=O), 163.20, 160.74(-OAr), 143.67(-C=C-), 134.83(imidazole ring), 131.23, 130.66, 130.10(C-Ar), 127.58(-C=C-), 124.13(imidazole ring), 119.60, 114.99, 114.27(C-Ar), 68.30-68.07(-OCH_2), 48.31(-NCH_2), 31.80(-CH_2-CH_2-N), 29.59-22.70((-CH_2)$_7$), 14.18(-CH_3). Anal: Found for $C_{30}H_{39}BrN_2O_3$ (%): C, 64.83; H, 7.05; N, 5.08. Calc C, 67.59; H, 8.04; N, 4.38.

3-(6-(4-(3-(4-(heptyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5b

Yield 69 %, m.p 179.1 °C, Chem.Form: $C_{31}H_{41}BrN_2O_3$, M.Wt: 569.6. IR: υ_{max}(KBr) (cm^{-1}): 3366.72(N-H), 2928.83(C-H aliphatic), 1646.83(C=O), 1592.08(C=C olefinic), 1585.45-1466.21(C=C aromatic), 1296.49 (C-N), 1253.88(OCH_2), 817.68 p-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.94-6.89(d,

2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.08-4.04(t, 4H, -OCH_2), 1.95-1.30(m, 18H, $(CH_2)_9$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.69(C=O), 163.17, 160.80(-OAr), 143.69(-C=C-), 135.32(imidazole ring), 131.21, 130.65, 130.09(C-Ar), 127.64(-C=C-), 124.17(imidazole ring), 119.58, 114.95, 114.29(C-Ar), 68.29, 68.05(-OCH_2), 48.30(-NCH_2), 31.82(-CH_2-CH_2-N), 29.59-22.68((-$CH_2)_8$), 14.17(-CH_3). Anal: Found for $C_{31}H_{41}BrN_2O_3$ (%): C, 65.35; H, 7.23; Br, 14.07; N, 4.96. Calc C, 65.37; H, 7.26; N, 4.92.

3-(6-(4-(3-(4-(octyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5c

Yield 55 %, m.p 171.7 °C, Chem.Form: $C_{32}H_{43}BrN_2O_3$, M.Wt: 583.6. IR: υ_{max}(KBr) (cm^{-1}): 3368.23(N-H), 2916.56(C-H aliphatic), 1660.92(C=O), 1592.78(C=C olefinic), 1584.88-1465.01(C=C aromatic), 1300.83(C-N), 1245.99(OCH_2), 821.08 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.00-6.96(d, 4H, Ar-H), 6.93-6.89(d, 2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.07-4.03(t, 4H, -OCH_2), 1.95-1.30(m, 120H, $(CH_2)_{10}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.73(C=O), 163.00, 160.84(-OAr), 143.76(-C=C-), 135.28(imidazole ring), (C-Ar), 131.20, 130.64, 130.09(C-Ar), 127.74(-C=C-), 124.20(imidazole ring), 119.55, 114.90, 114.26(C-Ar), 68.29, 67.00(-OCH_2), 48.29(-NCH_2), 31.83(-CH_2-CH_2-N), 29.58-22.67((-$CH_2)_9$), 14.17(-CH_3). Anal: Found for $C_{32}H_{43}BrN_2O_3$ (%):C, 65.83; H, 7.47; N, 4.84. Calc C, 65.86; H, 7.43; N, 4.80.

3-(6-(4-(3-(4-(nonyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5d

Yield 76 %, m.p 168.2 °C, Chem.Form: $C_{33}H_{45}BrN_2O_3$, M.Wt: 597.6. IR: υ_{max}(KBr) (cm^{-1}): 3367.21(N-H), 2920.05(C-H aliphatic), 1661.34(C=O), 1593.92(C=C olefinic), 1585.69-1467.88(C=C aromatic), 1300.56(C-N), 1245.63(OCH_2), 819.45 *p*-position. ^{1}H-NMR δ(ppm,

$CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.01-6.97(d, 4H, Ar-H), 6.94-6.88(d, 2H, imidazole ring), 4.65(t, 2H, $-NCH_2$), 4.07-4.04(t, 4H, $-OCH_2$), 1.95-1.31(m, 22H, $(CH_2)_{11}$), 0.82(t, 3H, CH_3). ^{13}C-NMR δ(ppm): 188.75(C=O), 163.02, 160.99(-OAr), 143.77(-C=C-), 135.24(imidazole ring), 131.18, 130.63, 130.08(C-Ar), 127.80(-C=C-), 124.26(imidazole ring), 119.52, 114.92, 114.24(C-Ar), 68.29-67.99($-OCH_2$), 48.28($-NCH_2$), 31.85($-CH_2-CH_2-$N), 29.58-22.66($(-CH_2)_{10}$), 14.16($-CH_3$). Anal: Found for $C_{33}H_{45}BrN_2O_3$ (%): C, 66.35; H, 7.55; N, 4.65. Calc C, 66.32; H, 7.59; N, 4.69.

3-(6-(4-(3-(4-(decyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)-hexyl)-1Himidazol-3-ium bromide: 5e

Yield 57 %, m.p 154.7 °C, Chem.Form: $C_{34}H_{47}BrN_2O_3$, M.Wt: 611.7. IR: υ_{max}(KBr) (cm^{-1}): 3367.35(N-H), 2921.65(C-H aliphatic), 1660.69(C=O), 1593.71(C=C olefinic), 1585.35-1467.34(C=C aromatic), 1301.56(C-N), 1246.56(OCH_2), 819.03 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.02(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.93-6.88(d, 2H, imidazole ring), 4.65(t, 2H, $-NCH_2$), 4.07-4.04(t, 4H, $-OCH_2$), 1.93-1.31(m, 24H, $(CH_2)_{12}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.76(C=O), 163.00-161.03(-OAr), 143.79(-C=C-), 135.16(imidazole ring), 131.18, 130.62, 130.07(C-Ar), 127.96(-C=C-), 124.76(imidazole ring), 119.51, 114.91, 114.23(C-Ar), 67.8, 67.92($-OCH_2$), 48.26($-NCH_2$), 31.87($-CH_2-CH_2-$N), 29.58-22.64($(-CH_2)_{11}$), 14.12($-CH_3$). Anal: Found for $C_{34}H_{47}BrN_2O_3$ (%): C, 66.73; H, 7.79; N, 4.54. Calc C, 66.76; H, 7.75; N, 4.58.

3-(6-(4-(3-(4-(undecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5f

Yield 66 %, m.p 167 °C, Chem.Form: $C_{35}H_{49}BrN_2O_3$, M.Wt: 625.7. IR: υ_{max}(KBr) (cm^{-1}): 3366.95(N-H), 2919.45(C-H aliphatic), 1632.67(C=O), 1593.75(C=C olefinic), 1585.34-

1467.29(C=C aromatic), 1300.28(C-N), 1250.47(OCH_2), 821.40 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.01-6.96(d, 4H, Ar-H), 6.94-6.89(d, 2H, imidazole ring), 4.64(t, 2H, -NCH_2), 4.08-4.03(t, 4H, -OCH_2), 1.93-1.29(m, 26H, $(CH_2)_{13}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.78(C=O), 162.98, 161.04(-OAr), 143.81(-C=C-), 135.07.(imidazole ring), 131.15, 130.61, 130.05(C-Ar), 128.06(-C=C-), 125.21(imidazole ring), 119.52, 114.91, 114.23(C-Ar), 68.29-67.89(-OCH_2), 48.25(-NCH_2), 31.89(-CH_2-CH_2-N), 29.59-22.64((-CH_2)$_{12}$), 14.09(-CH_3). Anal: Found for $C_{35}H_{49}BrN_2O_3$ (%): C, 67.15; H, 7.86; N, 4.44. Calc C, 67.19; H, 7.89; N, 4.48.

3-(6-(4-(3-(4-(dodecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5g

Yield 62 %, m.p 158.2 °C, Chem.Form: $C_{36}H_{51}BrN_2O_3$, M.Wt: 639.7. IR: υ_{max}(KBr) (cm^{-1}): 3368.43(N-H), 2919.36(C-H aliphatic), 1660.99(C=O), 1595.44(C=C olefinic), 1585.21-1467.45(C=C aromatic), 1301.71(C-N), 1247.20(OCH_2), 829.28 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.95-6.89(d, 2H, imidazole ring), 4.65(t, 2H, -NCH_2), 4.06-4.04(t, 4H, -OCH_2), 1.90-1.31(m, 28H, $(CH_2)_{14}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.79(C=O), 162.97, 161.05(-OAr), 143.83(-C=C-), 135.05(imidazole ring), 131.10, 130.61, 130.04(C-Ar), 128.31(-C=C-), 125.87(imidazole ring), 119.51, 114.90, 114.22(C-Ar), 68.29- 67.87(-OCH_2), 48.23(-NCH_2), 31.91(-CH_2-CH_2-N), 29.59-22.64((-CH_2)$_{13}$), 14.07(-CH_3). Anal: Found for $C_{36}H_{51}BrN_2O_3$ (%): C, 67.55; H, 8.08; N, 4.35. Calc C, 67.59; H, 8.04; N, 4.38.

3-(6-(4-(3-(4-(tridecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide :5h

Yield 59.5 %, m.p 160.2 °C, Chem.Form: $C_{37}H_{53}BrN_2O_3$, M.Wt: 653.7. IR:υ_{max} (KBr) (cm^{-1}): 3368.89(N-H), 2920.63(C-H aliphatic), 1660.70(C=O), 1593.56(C=C olefinic), 1585.22 - 1466.07(C=C aromatic), 1300.36(C-N), 1247.68(OCH_2), 821.53 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.47(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.00-6.97(d, 4H, Ar-H), 6.95-6.88(d, 2H, imidazole ring), 4.64(t, 2H, -NCH_2), 4.08-4.03(t, 4H, -OCH_2), 1.89-1.29(m, 30H, $(CH_2)_{15}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.80(C=O), 162.95, 161.05(-OAr), 143.83(-C=C-), 135.05(imidazole ring), 131.08, 130.60, 130.04(C-Ar), 128.46(-C=C-), 126.66(imidazole ring), 119.50, 114.89, 114.21(C-Ar), 68.29-67.84(-OCH_2), 48.21(-NCH_2), 31.92(-CH_2-CH_2-N), 29.58-22.63((-CH_2)$_{14}$), 14.06(-CH_3). Anal: Found for $C_{37}H_{53}BrN_2O_3$ (%): C, 67.95; H, 8.14; N, 4.25. Calc C, 67.98; H, 8.17; N, 4.29.

3-(6-(4-(3-(4-(tetradecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazol-3-ium bromide: 5i

Yield 61.6 %, m.p 161.5 °C, Chem.Form: $C_{38}H_{55}BrN_2O_3$, M.Wt: 667.8. IR: υ_{max}(KBr) (cm^{-1}): 3368.94(N-H), 2916.97(C-H aliphatic), 1637.39(C=O), 1592.15(C=C olefinic), 1584.08-1467.67(C=C aromatic), 1300.48(C-N), 1249.44(OCH_2), 822.32 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.48(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.00-6.96(d, 4H, Ar-H), 6.93-6.89(d, 2H, imidazole ring), 4.64(t, 2H, -NCH_2), 4.10-4.03(t, 4H, -OCH_2), 1.85-1.28(m, 32H, $(CH_2)_{16}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.81(C=O), 162.94, 161.06(-OAr), 143.84(-C=C-), 134.81(imidazole ring), 131.06, 130.57, 130.02(C-Ar), 128.53(-C=C-), 127.64(imidazole ring), 119.49, 114.89, 114.21(C-Ar), 68.29-67.80(-OCH_2), 48.20 (-NCH_2), 31.92(-CH_2-CH_2-N), 29.58-22.63((-CH_2)$_{15}$), 14.03(-CH_3). Anal: Found for $C_{38}H_{55}BrN_2O_3$ (%): C, 68.39; H, 8.34; N, 4.24. Calc C, 68.35; H, 8.30; N, 4.20.

6- **3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d]imidazole-3-ium (6a-6i)**

3-(4-(4-(3-(4-(hexyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6a

Yield 76%, m.p 176.6°C, Chem.Form: $C_{32}H_{37}BrN_2O_3$, M.Wt: 577.6. IR: υ_{max}(KBr) (cm^{-1}): 3383.06(N-H), 2920.89(C-H aliphatic), 1664.55(C=O), 1593.67(C=C olefinic), 1584.89-1467.34(C=C aromatic), 1301.21(C-N), 1245.89(OCH_2), 820.12 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.05-7.04 (d, 2H, Ar-H), 7.01-6.96(d, 4H, Ar-H), 6.95-6.92(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.05 (t, 2H, -OCH_2), 2.05-1.31(m, 12H, $(CH_2)_6$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.75(C=O), 162.32-161.96(O-Ar), 144.25(imidazole ring), 139.22(-C=C-), 131.10, 130.20, 130.02(C-Ar), 130.00, 127.33(Be-Imi ring), 124.10(-C=C-), 119.80, 115.04, 114.44(C-Ar), 108.23(Be-Imi ring), 68.3, 67.63(O-CH2), 57.88(-NCH_2), 32.10(-CH_2-CH_2-imi), 29.65-22.74((-CH_2)$_5$), 14.21(-CH_3). Anal: Found for $C_{32}H_{37}BrN_2O_3$ (%): C, 66.59; H, 6.42; N, 4.89. Calc C, 66.55; H, 6.46; N, 4.85.

3-(4-(4-(3-(4-(heptyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6b

Yield 76 %, m.p 174.5 °C, Chem.Form: $C_{33}H_{39}BrN_2O_3$, M.Wt: 591.6. IR: υ_{max}(KBr) (cm^{-1}): 3382.87(N-H), 2921.45(C-H aliphatic), 1667.23(C=O), 1592.33(C=C olefinic), 1583.64-1465.61(C=C aromatic), 1301.13(C-N), 1246.83(OCH_2), 819.27 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.45(d, 1H, olefinic H), 7.07(s, 1H, imidazole ring), 7.05-7.04(d, 2H, Ar-H), 7.01-6.96(d, 4H, Ar-H), 6.95-6.91(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.06(t, 2H, -OCH_2), 2.05-1.30(m, 14H, $(CH_2)_7$), 0.89(t, 3H, CH_3). ^{13}C-NMR δ(ppm): 188.77(C=O), 162.43-161.78 (O-Ar),

144.13(imidazole ring), 139.11(-C=C-), 131.11, 130.37, 130.03(C-Ar), 129.88-127.47(Be-Imi ring), 123.81(-C=C-), 119.73, 115.01, 114.41(C-Ar), 108.27(Be-Imi ring), 68.34, 67.61(O-CH2), 57.87(-NCH_2), 32.07(-CH_2-CH_2-imi), 29.64-22.73((-CH_2)$_6$), 14.19(-CH_3). Anal: Found for $C_{33}H_{39}BrN_2O_3$ (%): C, 67.04; H, 6.60; N, 4.71. Calc C, 67.00; H, 6.64; N, 4.74.

3-(4-(4-(3-(4-(octyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6c

Yield 51%, m.p 165.5 °C, Chem.Form: $C_{34}H_{41}BrN_2O_3$, M.Wt: 605.6. IR: υ_{max}(KBr) (cm^{-1}): 3382.89(N-H), 2922.44(C-H aliphatic), 1661.49(C=O) , 1591.62(C=C olefinic), 1583.35-1465.60(C=C aromatic), 1300.09(C-N), 1243.93(OCH_2), 818.27 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.76(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.45(d, 1H, olefinic H), 7.09(s, 1H, imidazole ring), 7.06-7.05(d, 2H, Ar-H), 7.00-6.96(d, 4H, Ar-H), 6.95-6.92(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.05(t, 2H, -OCH_2), 2.04-1.31(m, 16H, (CH_2)$_8$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.78(C=O), 162.56, 161.66(O-Ar), 144.05(imidazole ring), 138.94(-C=C-), 131.11, 130.46, 130.06(C-Ar), 129.76, 127.55(Be-Imi ring), 123.64(-C=C-), 119.67, 114.99, 114.39(C-Ar), 108.32(Be-Imi ring), 68.34, 67.60(O-CH2), 57.86(-NCH_2), 31.99(-CH_2-CH_2-imi), 29.64-22.73((-CH_2)$_7$), 14.17(-CH_3). Anal: Found for $C_{34}H_{41}BrN_2O_3$ (%): C, 67.47; H, 6.85; N, 4.67. Calc C, 67.43; H, 6.82; N, 4.63.

3-(4-(4-(3-(4-(nonyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6d

Yield 67 %, m.p 165.2 °C, Chem.Form: $C_{35}H_{43}BrN_2O_3$, M.Wt: 619.6. IR: υ_{max}(KBr) (cm^{-1}): 3382.84(N-H), 2920.64(C-H aliphatic), 1663.71(C=O), 1591.95(C=C olefinic), 1584.89-1465.00(C=C aromatic), 1300.30(C-N), 1245.46(OCH2), 819.31 *p*-position. ^{1}H-NMR δ(ppm,

$CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.05-7.04(d, 2H, Ar-H), 7.01-6.96(d, 4H, Ar-H), 6.95-6.92(t, 2H, Ar-H), 4.65(t, 2H, $-NCH_2$), 4.06(t, 2H, $-OCH_2$), 2.05-1.30(m, 18H, $(CH_2)_9$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.80(C=O), 162.66-161.44(O-Ar), 143.93(imidazole ring), 138.81(-C=C-), 131.11, 130.53, 130.07(C-Ar), 129.49-127.61(Be-Imi ring), 123.44(-C=C-), 119.50, 114.99, 114.31(C-Ar), 108.38(Be-Imi ring), 68.34, 67.59(O-CH2), 57.85($-NCH_2$), 31.98($-CH_2$-CH_2-imi), 29.64-73(($-CH_2)_8$), 14.16($-CH_3$). Anal: Found for $C_{35}H_{43}BrN_2O_3$ (%): C, 67.88; H, 6.95; N, 4.56. Calc C, C, 67.84; H, 6.99; N, 4.52.

3-(4-(4-(3-(4-(decyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6e

Yield 77%, m.p 153°C, Chem.Form: $C_{36}H_{45}BrN_2O_3$, M.Wt: 633.7. IR: υ_{max}(KBr) (cm^{-1}): 3384.19(N-H), 2920.58(C-H aliphatic), 1663.78(C=O), 1592.53(C=C olefinic), 1584.38-1467.32(C=C aromatic), 1300.66(C-N), 1248.24(OCH_2), 818.51 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.08(s, 1H, imidazole ring), 7.05-7.03(d, 2H, Ar-H), 7.00-6.97(d, 4H, Ar-H), 6.96-6.93(t, 2H, Ar-H), 4.65(t, 2H, $-NCH_2$), 4.05(t, 2H, $-OCH_2$), 2.05-1.29(m, 20H, $(CH_2)_{10}$), 0.89(t, 3H,CH_3).^{13}C-NMR δ(ppm): 188.82(C=O), 162.96-161.01 (O-Ar), 143.82(imidazole ring), 138.74(-C=C-), 131.11, 130.68, 130.08(C-Ar), 129.47, 127.70(Be-Imi ring), 123.36(-C=C-), 119.46, 114.98, 114.24(C-Ar), 108.41(Be-Imi ring), 68.34, 67.58($O-CH_2$), 57.84($-NCH_2$), 31.96($-CH_2$-CH_2-imi), 29.64-22.72(($-CH_2)_9$), 14.16($-CH_3$). Anal: Found for $C_{36}H_{45}BrN_2O_3$ (%): C, 68.28; H, 7.12; N, 4.46. Calc C, 68.24; H, 7.16; N, 4.42.

3-(4-(4-(3-(4-(undecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo [d]imidazol-3-ium bromide 6f:

Yield 65 %, m.p 163.5 °C, Chem.Form: $C_{37}H_{47}BrN_2O_3$, M.Wt: 647.7. IR: υ_{max}(KBr) (cm^{-1}): 3387.05(N-H), 2918.59(C-H aliphatic), 1663.25(C=O), 1592.24(C=C olefinic), 1584.67-1464.61(C=C aromatic), 1299.98(C-N), 1244.52(OCH_2), 821.26 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.45(d, 1H, olefinic H), 7.11(s, 1H, imidazole ring), 7.08-7.06(d, 2H, Ar-H), 7.00-6.96(d, 4H, Ar-H), 6.93-6.91(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.05(t, 2H, -OCH_2), 2.05-1.24(m, 22H, $(CH_2)_{11}$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.82(C=O), 162.99-160.96(O-Ar), 143.81(imidazole ring), 138.20(-C=C-), 131.11, 130.70, 130.12(C-Ar), 129.13, 127.79(Be-Imi ring), 122.84(-C=C-), 119.40, 114.95, 114.21(C-Ar), 108.91(Be-Imi ring), 68.34, 67.57(O-CH_2), 57.82(-NCH_2), 31.92(-CH_2-CH_2-imi), 29.34-22.71((-CH_2)$_{10}$), 14.14(-CH_3). Anal: Found for $C_{37}H_{47}BrN_2O_3$ (%): C, 68.65; H, 7.34; N, 4.37. Calc C, 68.61; H, 7.31; N, 4.33.

3-(4-(4-(3-(4-(dodecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo [d]imidazol-3-ium bromide: 6g

Yield 61 %, m.p 161 °C, Chem.Form: $C_{38}H_{49}BrN_2O_3$, M.Wt: 661.7. IR: υ_{max}(KBr) (cm^{-1}): 3387.33(N-H), 2918.15(C-H aliphatic), 1661.56(C=O), 1593.01(C=C olefinic), 1585.06-1465.38(C=C aromatic), 1300.48(C-N), 1245.97(OCH_2), 820.96 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.17(s, 1H, imidazole ring), 7.11, 7.08(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 2.04-1.20(m, 24H, $(CH_2)_{12}$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.85(C=O), 163.04-161.90(O-Ar), 143.81(imidazole ring), 137.24(-C=C-), 131.11, 130.82, 130.20(C-Ar), 128.82, 127.91(Be-Imi ring), 122.40(-C=C-), 119.63, 114.92, 114.16(C-Ar), 109.59(Be-Imi ring), 68.34, 67.56(O-CH2), 57.81(-NCH_2), 31.90(-CH_2-CH_2-imi), 29.64-22.71((-CH_2)$_{11}$), 14.14(-CH_3).

Anal: Found for $C_{38}H_{49}BrN_2O_3$ (%): C, 68.94; H, 7.49N, 4.27. Calc C, 68.61; H, 7.31; N, 4.33.

3-(4-(4-(3-(4-(tridecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6h

Yield 63 %, m.p 162.5 °C, Chem.Form: $C_{39}H_{51}BrN_2O_3$, M.Wt: 675.7. IR: υ_{max}(KBr) (cm^{-1}): 3386.91(N-H), 2919.89(C-H aliphatic), 1662.67(C=O), 1592.09(C=C olefinic), 1584.35-1465.61(C=C aromatic), 1301.19(C-N), 1246.73(OCH_2), 818.77 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.62(d, 2H, Ar-H), 7.45(d, 1H, olefinic H), 7.18(s, 1H, imidazole ring), 7.11-7.07(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 2.04-1.20(m, 26H, $(CH_2)_{13}$), 0.89(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.87(C=O), 163.06-160.89(O-Ar), 143.79(imidazole ring), 137.18(-C=C-), 131.11, 130.92, 130.16(C-Ar), 128.77, 127.97(Be-Imi ring), 125.1(-C=C-), 119.73, 114.94, 114.14(C-Ar), 109.70(Be-Imi ring), 68.34, 67.53(O-CH2), 57.78(-NCH_2), 31.89(-CH_2-CH_2-imi), 29.64-22.68((-CH_2)$_{12}$), 14.14(-CH_3). Anal: Found for $C_{39}H_{51}BrN_2O_3$ (%): C, 69.36; H, 7.65; N, 4.11. Calc C, 69.32; H, 7.61; N, 4.15.

3-(4-(4-(3-(4-(tetradecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium bromide: 6i

Yield 61 %, m.p 154.5 °C, Chem.Form: $C_{40}H_{53}BrN_2O_3$, M.Wt: 689.8. IR: υ_{max}(KBr) (cm^{-1}): 3387.96(N-H), 2920.87(C-H aliphatic), 1662.01(C=O), 1593.46(C=C olefinic), 1584.16-1466.93(C=C aromatic), 1300.66(C-N), 1245.41(OCH_2), 821.53 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.45(d, 1H, olefinic H), 7.17(s, 1H, imidazole ring), 7.12-7.08(d, 2H, Ar-H), 7.01-6.95(d, 4H, Ar-H), 6.91-6.88(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 2.04-1.21(m, 28H, $(CH_2)_{14}$), 0.88(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.88(C=O), 163.10, 160.83(O-Ar), 143.77(imidazole ring), 137.13(-C=C-), 131.10, 130.98, 130.18(C-Ar), 128.61, 127.99(Be-

Imi ring), 125.1(-C=C-), 119.74, 114.94, 114.11(C-Ar), 109.73(Be-Imi ring), 68.34, 67.50(O-CH_2), 57.78(-NCH_2), 31.87(-CH_2-CH_2-imi), 29.65- 22.62((-CH_2)$_{13}$), 14.11(-CH_3). Anal: Found for $C_{40}H_{53}BrN_2O_3$ (%): C, 69.69; H, 7.78; N, 4.02. Calc C, 69.32; H, 7.61; N, 4.15.

7- **3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d]imidazol-3-ium 7a-7i**

3-(6-(4-(3-(4-(hexyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7a

Yield 58.5 %, m.p 178.7 °C, Chem.Form: $C_{34}H_{41}BrN_2O_3$, M.Wt: 605.6. IR: υ_{max}(KBr) (cm^{-1}): 3374.23(N-H), 2921.19(C-H aliphatic), 1662.07(C=O), 1592.76(C=C olefinic), 1585.12-1465.78(C=C aromatic), 1300.53(C-N), 1244.66(OCH_2), 821.71 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.60 (d, 2H, Ar-H), 7.43(d, 1H, olefinic H), 7.12(s, 1H, imidazole ring), 7.10-7.08(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.93-6.91(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 1.96-1.23(m, 16H, (CH_2)$_8$), 0.83(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.70(C=O), 162.81, 161.01(O-Ar), 143.68(imidazole ring), 139.72(-C=C-), 130.98, 130.40, 129.88(C-Ar), 129.55, 127.49(Be-Imi ring), 123.20 (-C=C-), 119.12, 114.78, 114.08(C-Ar), 108.0(Be-Imi ring), 68.28.27, 68.02(O-CH2), 57.40(-NCH_2), 31.63(-CH_2-CH_2-imi), 29.09-22.40((-CH_2)$_7$), 13.91(-CH_3). Anal: Found for $C_{34}H_{41}BrN_2O_3$ (%): C, 67.47; H, 6.86; N, 4.67. Calc C, 67.43; H, 6.82; N, 4.63.

3-(6-(4-(3-(4-(heptyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7b

Yield 62 %, m.p 177.2 °C, Chem.Form: $C_{35}H_{43}BrN_2O_3$, M.Wt: 619.6. IR: υ_{max}(KBr) (cm^{-1}): 3374.83(N-H), 2929.31(C-H aliphatic), 1647.24(C=O), 1592.07(C=C olefinic), 1585.27-

1466.56(C=C aromatic), 1296.95(C-N), 1254.26(OCH_2), 818.26 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.09-7.08(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.03(t, 2H, -OCH_2), 1.95-1.23(m, 18H, $(CH_2)_9$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.73(C=O), 162.84, 161.02(O-Ar), 143.73(imidazole ring), 139.60(-C=C-), 131.00, 130.56, 129.98(C-Ar), 129.43, 127.57(Be-Imi ring), 123.22(-C=C-), 119.24, 114.83, 114.12(C-Ar), 108.41(Be-Imi ring), 68.28, 67.99(O-CH_2), 57.53(-NCH_2), 31.75(-CH_2-CH_2-imi), 29.11-22.54($(-CH_2)_8$), 13.99(-CH_3). Anal: Found for $C_{35}H_{43}BrN_2O_3$ (%): C, 67.88; H, 6.95; N, 4.56. Calc C, 67.84; H, 6.99; N, 4.52.

3-(6-(4-(3-(4-(octyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7c

Yield 73 %, m.p 174 °C, Chem.Form: $C_{36}H_{45}BrN_2O_3$, M.Wt: 633.7. IR: υ_{max}(KBr) (cm^{-1}): 3375.16(N-H), 2968.83(C-H aliphatic), 1661.59(C=O), 1592.35(C=C olefinic), 1584.98-1465.43(C=C aromatic), 1300.71(C-N), 1246.40(OCH_2), 822.20 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.09(s, 1H, imidazole ring), 7.09-7.07(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 1.95-1.22(m, 20H, $(CH_2)_{10}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.85(C=O), 162.93, 161.01 (O-Ar), 143.85(imidazole ring), 139.15(-C=C-), 131.15, 130.60, 130.08(C-Ar), 129.24, 127.75(Be-Imi ring), 123.69(-C=C-), 119.55, 114.92, 114.24(C-Ar), 110.70(Be-Imi ring), 68.31, 68.01(O-CH2), 57.82(-NCH_2), 31.84(-CH_2-CH_2-imi), 29.38-22.70($(-CH_2)_9$), 14.13(-CH_3). Anal: Found for $C_{36}H_{45}BrN_2O_3$ (%): C, 68.28; H, 7.12; N, 4.45. Calc C, 68.24; H, 7.16; N, 4.42.

3-(6-(4-(3-(4-(nonyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7d

Yield 76 %, m.p 173.2 °C, Chem.Form: $C_{37}H_{47}BrN_2O_3$, M.Wt: 647.7. IR: υ_{max}(KBr) (cm^{-1}): 3375.14(N-H), 2973.17(C-H aliphatic), 1662.50(C=O), 1592.65(C=C olefinic), 1585.04-1465.36(C=C aromatic), 1300.80(C-N), 1246.61(OCH_2), 821.78 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.09-7.08(d, 2H, Ar-H), 7.01-6.95(d, 4H, Ar-H), 6.93-6.91(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.03(t, 2H, -OCH_2), 1.96-1.23(m, 22H, $(CH_2)_{11}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.87(C=O), 162.94, 160.98(O-Ar), 143.87(imidazole ring), 139.17(-C=C-), 131.19, 130.62, 130.10(C-Ar), 129.21, 127.77(Be-Imi ring), 123.71(-C=C-), 119.56, 114.94, 114.26(C-Ar), 110.77(Be-Imi ring), 68.35, 68.05(O-CH2), 57.84(-NCH_2), 31.85(-CH_2-CH_2-imi), 29.40-22.68((-CH_2)$_{10}$), 14.15(-CH_3). Anal: Found for $C_{37}H_{47}BrN_2O_3$ (%): C, 68.65; H, 7.34; N, 4.30. Calc C, 68.61; H, 7.31; N, 4.33.

3-(6-(4-(3-(4-(decyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7e

Yield 51 %, m.p 168 °C, Chem.Form: $C_{38}H_{49}BrN_2O_3$, M.Wt: 661.7. IR: υ_{max}(KBr) (cm^{-1}): 3374.81(N-H), 2921.24(C-H aliphatic), 1662.53(C=O), 1592.86(C=C olefinic), 1585.10-1467.40(C=C aromatic), 1301.21(C-N), 1246.77(OCH_2), 824.23 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.77(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.43(d, 1H, olefinic H), 7.09(s, 1H, imidazole ring), 7.09-7.07(d, 2H, Ar-H), 7.00-6.93(d, 4H, Ar-H), 6.92-6.89(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.03(t, 2H, -OCH_2), 1.95-1.23(m, 24H, $(CH_2)_{12}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.88(C=O), 162.96, 160.01 (O-Ar), 143.88(imidazole ring), 139.20(-C=C-), 131.24, 130.63, 130.13(C-Ar), 129.19, 127.79(Be-

Imi ring), 123.75(-C=C-), 119.59, 114.94, 114.28(C-Ar), 110.82(Be-Imi ring), 68.38, 68.12(O-CH2), 57.84(-NCH_2), 31.85(-CH_2-CH_2-imi), 29.41-22.68((-CH_2)$_{11}$), 14.15(-CH_3). Anal: Found for $C_{38}H_{49}BrN_2O_3$ (%): C, 68.94; H, 7.49; N, 4.26. Calc C, 68.97; H, 7.46; N, 4.23.

3-(6-(4-(3-(4-(undecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7f

Yield 51 %, m.p 171 °C, Chem.Form: $C_{39}H_{51}BrN_2O_3$, M.Wt: 675.7. IR: υ_{max}(KBr) (cm^{-1}): 3378.77(N-H), 2919.33(C-H aliphatic), 1661.75(C=O), 1592.85(C=C olefinic), 1584.78-1467.20(C=C aromatic), 1300.65(C-N), 1248.47(OCH_2), 827.79 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.11(s, 1H, imidazole ring), 7.10-7.08(d, 2H, Ar-H), 7.01-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 1.95-1.22(m, 26H, (CH_2)$_{13}$), 0.83(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.89(C=O), 162.97, 160.01 (O-Ar), 143.91(imidazole ring), 139.23(-C=C-), 131.24, 130.64, 130.15(C-Ar), 129.16, 127.79(Be-Imi ring), 123.75(-C=C-), 119.62, 114.94, 114.29(C-Ar), 110.83(Be-Imi ring), 68.41, 68.15(O-CH_2), 57.86(-NCH_2), 31.85(-CH_2-CH_2-imi), 29.44-22.68((-CH_2)$_{12}$), 14.16(-CH_3). Anal: Found for $C_{39}H_{51}BrN_2O_3$ (%): C, 69.36; H, 7.64; N, 4.11. Calc C, 69.32; H, 7.61; N, 4.15.

3-(6-(4-(3-(4-(dodecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7g

Yield 65 %, m.p 160 °C, Chem.Form: $C_{40}H_{53}BrN_2O_3$, M.Wt: 689.8. IR: υ_{max}(KBr) (cm^{-1}): 3380.06(N-H), 2920.13(C-H aliphatic), 1662.24(C=O), 1595.44(C=C olefinic), 1586.51-1467.50(C=C aromatic), 1302.54(C-N), 1246.48(OCH_2), 829.31 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.90(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.10-7.07(d, 2H, Ar-H), 7.00-6.95(d, 4H,

Ar-H), 6.93-6.91(t, 2H, Ar-H), 4.64(t, 2H, -NCH_2), 4.04(t, 2H, -OCH_2), 1.97-1.23(m, 28H, $(CH_2)_{14}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.91(C=O), 162.98, 161.00 (O-Ar), 143.91(imidazole ring), 139.24(-C=C-), 131.26, 130.65, 130.15(C-Ar), 129.14, 127.82(Be-Imi ring), 123.75(-C=C-), 119.63, 114.96, 114.33(C-Ar), 110.83(Be-Imi ring), 68.44, 68.17(O-CH_2), 57.91(-NCH_2), 31.87(-CH_2-CH_2-imi), 29.56-22.64((-CH_2)$_{13}$), 14.16(-CH_3). Anal: Found for $C_{40}H_{53}BrN_2O_3$ (%): C, 69.61; H, 7.78; N, 4.06. Calc C, 69.65; H, 7.74; N, 4.06.

3-(6-(4-(3-(4-(tridecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7h

Yield 73 %, m.p 166.5 °C, Chem.Form: $C_{41}H_{55}BrN_2O_3$, M.Wt: 703.8. IR: υ_{max}(KBr) (cm^{-1}): 3379.97(N-H), 2921.27(C-H aliphatic), 1662.56(C=O), 1595.83(C=C olefinic), 1585.72-1467.31(C=C aromatic), 1302.67(C-N), 1245.95(OCH_2), 828.74 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.03(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.61(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.09-7.07(d, 2H, Ar-H), 7.01-6.94(d, 4H, Ar-H), 6.93-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.03(t, 2H, -OCH_2), 1.96-1.22(m, 30H, $(CH_2)_{15}$), 0.83(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.93(C=O), 162.98, 160.99 (O-Ar), 143.93(imidazole ring), 139.24(-C=C-), 131.26, 130.66, 130.16(C-Ar), 129.15, 127.86(Be-Imi ring), 123.77(-C=C-), 119.67, 114.99, 114.37(C-Ar), 110.86(Be-Imi ring), 68.47, 68.21(O-CH_2), 57.91(-NCH_2), 31.88(-CH_2-CH_2-imi), 29.56-22.66((-CH_2)$_{14}$), 14.16(-CH_3). Anal: Found for $C_{41}H_{55}BrN_2O_3$ (%): C, 69.93; H, 7.85; N, 4.01. Calc C, 69.97; H, 7.88; N, 3.98.

3-(6-(4-(3-(4-(tetradecyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium bromide: 7i

Yield 76 %, m.p 165.5 °C, Chem.Form: $C_{42}H_{57}BrN_2O_3$, M.Wt: 717.8. IR: υ_{max}(KBr) (cm^{-1}): 3380.49(N-H), 2916.94(C-H aliphatic), 1637.79(C=O), 1593.54(C=C olefinic), 1586.18-1468.21(C=C aromatic), 1299.94(C-N), 1251.64(OCH_2), 827.31 *p*-position. ^{1}H-NMR δ(ppm, $CDCl_3$): 9.91(s, 1H, -NH), 8.04(d, 2H, Ar-H), 7.78(d, 1H, olefinic H), 7.60(d, 2H, Ar-H), 7.44(d, 1H, olefinic H), 7.10(s, 1H, imidazole ring), 7.09-7.08(d, 2H, Ar-H), 7.00-6.94(d, 4H, Ar-H), 6.92-6.90(t, 2H, Ar-H), 4.65(t, 2H, -NCH_2), 4.03(t, 2H, -OCH_2), 1.95-1.23(m, 32H, $(CH_2)_{16}$), 0.82(t, 3H,CH_3). ^{13}C-NMR δ(ppm): 188.94(C=O), 162.99, 160.99(O-Ar), 143.94(imidazole ring), 139.24(-C=C-), 131.27, 130.66, 130.16(C-Ar), 129.16, 127.87(Be-Imi ring), 123.78(-C=C-), 119.68, 115.01, 114.39(C-Ar), 110.86(Be-Imi ring), 68.47, 68.22(O-CH_2), 57.92(-NCH_2), 31.91(-CH_2-CH_2-imi), 29.57-22.64((-CH_2)$_{15}$), 14.17(-CH_3). Anal: Found for $C_{42}H_{57}BrN_2O_3$ (%): C, 70.24; H, 8.04; N, 3.94. Calc C, 70.28; H, 8.00; N, 3.90.

2.4. FT-IR spectral studied for target compounds 3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazole-3-ium (5a-5i)

The **FT-IR** spectra of compounds **5a-5i** were recorded. The weak band at the region range 3366-3368 cm^{-1} corresponding to N-H stretching vibration. The aromatic C-H stretching vibration appears as very week bands in the frequency region 3053-300 cm^{-1}. The peaks at 2919-2918 cm^{-1} and 2854-2853 cm^{-1} are assigned to asymmetric, and symmetric (-CH_3) and (-CH_2) stretching modes. The C=O stretching vibration appears at 1660-1632 cm^{-1}. The C=C stretching vibrations in aromatic rings and the olefinic group were absorbed in the ranges of 1595-1593 cm^{-1} and 1507-1467 cm^{-1}. The absorption bands at 1250-1247 cm^{-1} assignable to the ether group (C-O).

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d]imida zole-3-ium (6a-6i)

The **FT-IR** spectra of compounds **6a-6i** were recorded. The bands of N-H stretching vibration appear at the range of 3387-3382 cm^{-1}. The C-H stretching modes of aromatic rings occur at the range 3072-3065 cm^{-1}. The C-H asymmetric and symmetric stretching vibration bands of ($–CH_3$) and ($–CH_2$) appeared at 2920-2918 cm^{-1} and 2856-2851 cm^{-1}, respectively. The weak absorption bands in the region 1663-1661 cm^{-1} were attributed to the carbonyl group (C=O). The bands of The C=C skeletal stretching vibrations of aromatic rings and the olefinic group appeared at the ranges of 1592-1591 cm^{-1} and 1506-1464 cm^{-1}. The strong absorption bands at 1248-1244 cm^{-1} assignable to the ether group (C-O).

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d]imida zol-3-ium (7a-7i)

The **FT-IR** spectra of compounds **7a-7i** were shown that, the observed weak band at the range of 3380-3374 cm^{-1} assignable to N-H stretching vibration. The C-H stretching bands of the aromatic ring occur at range 3072-3069 cm^{-1}. The bands that appeared in the frequency range 2929-2919 cm^{-1} and 2860-2854 cm^{-1} are attributable to the C-H aliphatic stretching modes. The absorption bands at 1646-1643 cm^{-1} assignable to the carbonyl group (C=O). The C=C stretching vibration bands of the aromatic rings and the olefinic group appeared in the ranges of 1593-1592 cm^{-1}, and 1506-1466 cm^{-1}. The (C-O) stretching band of the ether group (C-O) are apparent in the frequency of 1254-1248 cm^{-1}.

2.5. ^{1}H and ^{13}C-NMR

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1enyl)phenoxy)butyl)-1H-imidazol-3-ium (4a-4i)

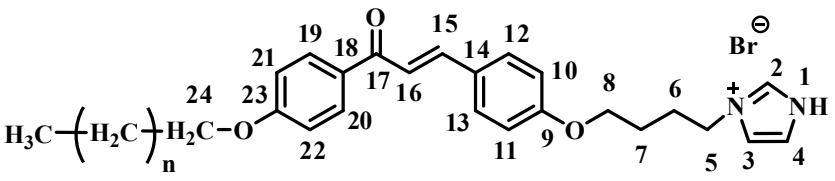

Figure 1: The atoms numbering for compounds **4a-4i.**

The **^{1}H-NMR** spectral data of compounds **4a-4i** were recorded. The N-H proton is in the expected region at δ =9.91-9.89 ppm. A two doublet at δ =8.06-8.03 ppm was assigned for phenyl protons (H19, H20). The appearing doublet at δ =7.78-7.77 ppm has been attributed to the β-proton of the olefinic group (H15). A doublet at the chemical shift δ =7.63-7.61 ppm was assigned for phenyl protons (H12, H13). The α-proton of the olefinic group (H16) appeared at δ =7.48-7.47 ppm. The signals for the (NCHN) in the imidazole ring could be observed in the region of δ =7.09-7.08 ppm. The phenyl ring protons of the (H21, H22, and H10, H11) were given two doublets signals at δ =7.00-6.93 ppm. The peaks of the protons (H4, H3) in the imidazole ring were observed as two doublets at δ =6.94-6.88 ppm. The appearing triplet at δ = 4.66-4.64 ppm has been attributed to the (H5). While the (-OCH_2) was observed as a double triplet in the region of δ =4.16- 4.04 ppm. The protons residing in ((-CH_2)n) in all compounds **4a-4i** chain were observed as multiples at the chemical shift range δ =2.15-1.27 ppm. Likewise, the triplets observed within the range of δ =0.81-0.80 ppm can be assigned to the methyl protons (-CH_3) of terminal alkyl chains.

The **^{13}C-NMR** spectral data for compounds **4a-4i** were recorded and showed that the peak of the carbonyl group (C=O) appeared in the **^{13}C-NMR** chemical shift δ =188.83-188.75 ppm. The signals in the region δ =163.12-160.69 ppm were attributed to aromatic

quaternary carbon atoms (C9, C23). The aromatic carbons in each phenyl and imidazole ring resonate in the range of δ =140.85-114.15 ppm. The peaks of carbon atoms of conjugated double bond resonate in the region of δ =143.66-143.56 and δ =128.71-127.55 which assigned to (C-β) and (C-α), respectively. The signals at the chemical shifts δ =68.50-67.62 ppm were assigned to (-OCH_2) group. The (-N-CH_2) group resonate in the region at δ =47.61-46.61 ppm, while the signal in the region δ =31.97-31.87 ppm was assigned to methylene group (C6), which adjacent to (-CH_2-N) group. The peaks of the aliphatic methylene carbons were observed at δ= 29.65-22.72 ppm, which are corresponding to ((-CH_2)n), while the peak at δ=14.22-14.13 ppm can be attributed to the terminal methyl carbon of the alkyl chains (-CH_3).

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-imidazole-3-ium (5a-5i)

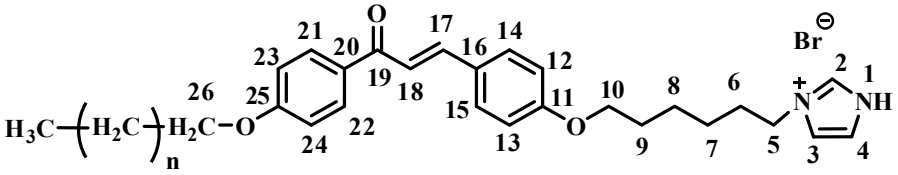

Figure 2: The atoms numbering for compounds **5a-5i.**

The **^{1}H-NMR** spectral data of compounds **5a-5i** were explained in this section. It is observed that showing the signal corresponding for the N-H proton of the imidazole ring is appeared in **^{1}H-NMR** chemical shifts at range δ =9.91-9.90 ppm. The aromatic protons are observed at δ =8.04-8.03 ppm was assigned for phenyl protons (H21, H22). The appearing doublet at δ =7.78-7.77 ppm has arisen from the β-proton of the olefinic group (H17). The two doublets at the chemical shift δ =7.78-7.62 ppm were assigned for phenyl protons (H14, H15). While the α-proton of the olefinic group (H18) is observed at δ =7.48-7.47 ppm. The

signals for the (NCHN) in the imidazole ring resonate in the region of δ =7.08-7.07 ppm. The phenyl ring protons of the (H23, H24, and H12, H13) were given a two doublets signal at δ =7.00-6.96 ppm. The signals of the proton, (H4, H3) in the imidazole ring were observed as a doublet at δ =6.93-6.88 ppm. The appearing triplet at δ =4.65-4.64 ppm has been attributed to the (H5). While the -OCH_2 was observed in the region of δ =4.118-4.03 ppm. The protons residing in ((-CH_2)n) in all compounds **5a-5i** chain observed as multiples at the chemical shift range δ =1.95-1.28 ppm. In the same way, the observed triplets within the range of δ =0.82-0.81 ppm attributed to the methyl protons (-CH_3) of terminal alkyl chains.

The **^{13}C-NMR** spectral data for compounds **5a-5i** were recorded and showed that the peak of the carbonyl group (C=O) appeared in the **^{13}C-NMR** chemical shift δ =188.9-188.7 ppm. The aromatic quaternary carbon atoms resonate in the region of δ =167.3-161.7 ppm (C11 and C25). The signals in the range of δ =135.0-114.7 ppm corresponding to the aromatic carbons in each phenyl and imidazole ring. The peaks of olefinic carbons were observed at the region 144.4-144.2 assigned to (C-β), while (C-α) were observed at the lower chemical shift δ =128.2-127.1 ppm. The signals at the chemical shifts δ =67.5-67.2 ppm were assigned to (-OCH_2) group. The peak in the region at δ =48.4-47.2 ppm can be attributed to the (-N-CH_2) group, while the signal in the region δ =32.5-32.3 ppm was assigned to methylene group (C6) which adjacent to (-CH_2-N) group. The peaks of the aliphatic methylene carbons were observed at δ =29.7-22.6 ppm, which are corresponding to ((-CH_2)n), and at δ=14.5-14.2 ppm can be attributed to the terminal methyl carbon of the alkyl chains (-CH_3).

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)butyl)-1H-benzo[d] imidazol-3-ium (6a-6i)

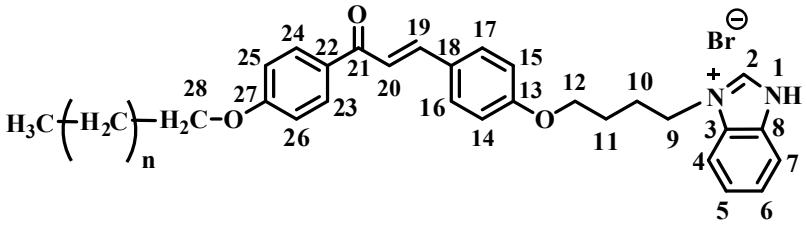

Figure:3 The atoms numbering for compounds **6a-6i.**

The **^{1}H-NMR** spectral data of compounds **6a-6i** were recorded and explained. It is observed that showing the signal corresponding for the N-H proton of the imidazole ring was appeared at **^{1}H-NMR** chemical shifts range δ = 9.91-9.90 ppm. The aromatic protons are observed at δ =8.04-8.03 ppm were assigned for phenyl protons (H23, H24). The appearing doublet at δ =7.78-7.77 ppm has attributed to the β-proton of the olefinic group (H17). A doublet at the chemical shift δ =7.64-7.61 ppm was assigned for phenyl protons (H16, H17). While the α-proton of the olefinic group (H18) resonated in the region of δ =7.48-4.77 ppm. The proton of (NCHN) in the benzimidazole ring could be observed in the region of δ =7.08-7.18 ppm. The signals of benzimidazole ring protons (H4, H7) appear as two doublets at δ =7.11-7.03 ppm. The phenyl ring protons of the (H25, H26, and H14, H15) were given a doublet signal at δ =7.00-6.94 ppm. While, the protons (H5, H6) appear as a triplet at δ =6.96-6.90 ppm. The triplet at the chemical shift δ =4.65-4.64 ppm was assigned for (N-CH_2) group (H9). The -OCH_2 peaks were observed as two triplets in the region of δ =4.14-4.04 ppm. The protons residing in ((-CH_2)n) in all compounds **6a-6i** chain were observed as multiples at the chemical shift range δ =2.05-1.20 ppm. Likewise, the observed triplets at the range of δ =0.90-0.89 ppm attributed to the methyl protons (-CH_3) of terminal alkyl chains.

The **^{13}C-NMR** spectral data for compounds **6a-6i** were recorded. The peak of the carbonyl group (C=O) appeared in the **^{13}C-NMR** chemical shift δ =188.9-188.7 ppm. The

signals in the region δ =167.3-161.7 ppm were attributed to aromatic quaternary carbon atoms (C13, C27). The aromatic carbons in each of phenyl and benzimidazole rings resonate in the region of δ =144.3-109.7 ppm. The peaks of olefinic carbons were observed at the region δ =138.2-137.6 ppm, and δ =124.3-122.7 ppm, which assigned to (C-β) and (C-α), respectively. The signals at the chemical shifts δ =68.1-67.5 ppm were assigned to the (-OCH_2) group. The (-N-CH_2) group resonates in the region of δ =57.8-57.6 ppm, while the signal in the region δ = 32.3-32.0 ppm was assigned to the methylene group (C6) which adjacent to (-CH_2-N) group. The peaks of the aliphatic methylene carbons were observed at δ =29.8-22.3 ppm, which are corresponding to ((-CH_2)n), and at δ=14.1-14.0 ppm can be attributed to the terminal methyl carbon of the alkyl chains (-CH_3).

3-(4-(4-(3-(4-(alkyloxy)phenyl)-3-oxoprop-1-enyl)phenoxy)hexyl)-1H-benzo[d] imidazol-3-ium (7a-7i)

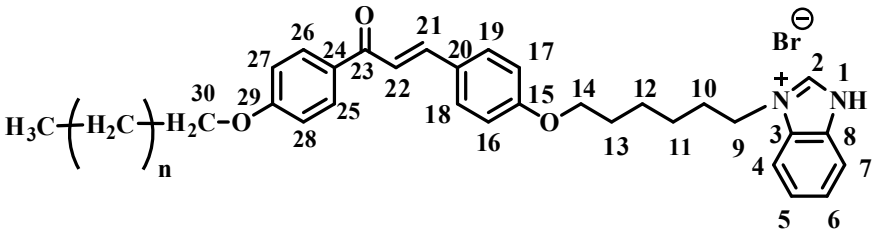

Figure 4: The atoms numbering for compounds **7a-7i.**

The **^{1}H-NMR** spectral data of compounds **7a-7i** were recorded. It is observed that showing the signal corresponding for the N-H proton of the imidazole occurs at **^{1}H-NMR** chemical shifts δ =9.90-9.86 ppm. The observation doublet at δ =8.11-7.98 ppm, were assigned for phenyl protons (H25, H26). The appearing doublet at δ =7.82-7.78 ppm has arisen from the β-proton of the olefinic group (H21). A doublet at the chemical shift δ =7.65-7.58 ppm was assigned for phenyl protons (H18, H19). While the α-proton of the olefinic group (H22) resonates in the region of δ =7.50-7.43 ppm. The proton of (NCHN) in the

benzimidazole ring could be observed in the region of δ =7.11-7.09 ppm. The signals of protons (H4, H7) in the benzimidazole ring were observed as two doublets at δ =7.09-7.06 ppm, while the protons (H5, H6) appear as a triplet at δ =6.91-6.89 ppm. The phenyl ring protons of the (H27, H28, and H16, H17) were given doublet signals at δ =7.01-6.93 ppm. The triplet at the chemical shift δ =4.60-4.58 ppm was assigned for the (-N-CH_2) group (H9). While the (-OCH_2) was observed as a double triplet in the region of δ = 4.10-4.01 ppm. The protons residing in ((-CH_2)n) in all compounds **7a-7i** chain observed as multiples at the chemical shift range δ =1.88-1.26 ppm. In the same way, the observed triplets at the range of δ =0.81-0.80 ppm attributed to the methyl protons (-CH_3) of terminal alkyl chains.

The **^{13}C-NMR** spectral data for compounds **7a-7i** are showed that the peak of the carbonyl group (C=O) appeared in the **^{13}C-NMR** chemical shift δ =188.8-188.6 ppm. The signals in the region δ =163.4-161.3 ppm were attributed to aromatic carbon atoms connected to oxygen (C15, C29). The aromatic carbons in each phenyl and benzimidazole ring resonate in the region of δ =144.4-114.7 ppm. The peaks of carbon atoms of the conjugated double bond were observed at the region δ =138.2-137.6 ppm and δ =124.3-122.7 ppm, which were assigned to (C-β) and (C-α), respectively. The (-OCH_2) signals observed at the chemical shifts δ =68.1-67.5 ppm. The peak of (-N-CH_2) group is appearing in the region at δ =57.8-57.6 ppm, while the signal in the region δ = 32.3-31.9 ppm was assigned to the methylene group (C6) which adjacent to (-CH_2-N) group. The peaks of the aliphatic methylene carbons were observed at δ =29.7-22.4 ppm, which are corresponding to ((-CH_2)n), and at δ=14.5-14.1 ppm can be attributed to the terminal methyl carbon of the alkyl chains (-CH_3).

XRD data of compounds **4d**

Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
10.5519	61.66	0.0787	8.38410	95.52
15.8822	14.74	0.2362	5.58024	22.83
18.4337	21.71	0.1574	4.81320	33.63
21.4271	60.67	0.1181	4.14707	93.99
22.0932	25.56	0.2362	4.02353	39.59
23.6181	43.51	0.1574	3.76709	67.40
24.0014	64.55	0.0787	3.70778	100.00
26.1895	18.12	0.4723	3.40276	28.07
28.1397	14.75	0.4723	3.17121	22.85
31.7502	12.20	0.1574	2.81835	18.91
35.9657	7.47	0.1181	2.49710	11.57
44.2272	5.22	2.5190	2.04795	8.09
51.3835	3.61	0.0787	1.77828	5.59
61.8810	2.48	0.2362	1.49945	3.83
66.8815	2.38	0.4800	1.39781	3.69

XRD data of compounds **5e**

Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
10.3004	60.29	0.0590	8.58820	100.00
13.7947	10.80	0.2362	6.41959	17.91
20.6456	17.64	0.0984	4.30226	29.26
23.6107	13.67	0.4723	3.76826	22.67
27.5945	9.87	0.1574	3.23262	16.37
28.5029	16.40	0.0590	3.13162	27.20
44.1287	8.27	2.5190	2.05229	13.72
56.8519	1.83	0.6298	1.61954	3.04
64.2178	6.13	0.1200	1.44921	10.16

XRD data of compounds **6g**

Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
10.9236	13.27	0.1181	8.09960	34.61
12.5037	17.90	0.0787	7.07940	46.68
16.8495	17.98	0.0787	5.26201	46.88
19.0670	13.23	0.0394	4.65474	34.51
19.9252	22.98	0.1181	4.45614	59.93
20.7546	38.35	0.1181	4.27990	100.00
23.7069	30.54	0.1574	3.75318	79.64
27.6487	12.53	0.9446	3.22641	32.67
32.9706	10.99	0.0787	2.71677	28.65
40.5452	10.61	0.0590	2.22501	27.68
42.3675	7.52	0.1968	2.13343	19.61
43.7548	6.33	0.6298	2.06895	16.50
57.9955	2.14	0.2362	1.59030	5.57
66.6135	1.56	0.0480	1.40278	4.08

XRD data of compounds **7g**

Pos. [°2Th.]	Height [cts]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
18.6540	17.60	0.3149	4.75685	34.39
19.0183	14.30	0.0984	4.66654	27.95
20.3402	30.29	0.2755	4.36616	59.20
21.1222	38.56	0.1574	4.20625	75.36
23.9949	51.17	0.1968	3.70879	100.00
30.7034	10.31	2.5190	2.91201	20.16
41.4210	3.47	0.2362	2.17997	6.77
57.5028	3.00	0.1181	1.60274	5.86
62.7100	4.75	0.1440	1.48038	9.28

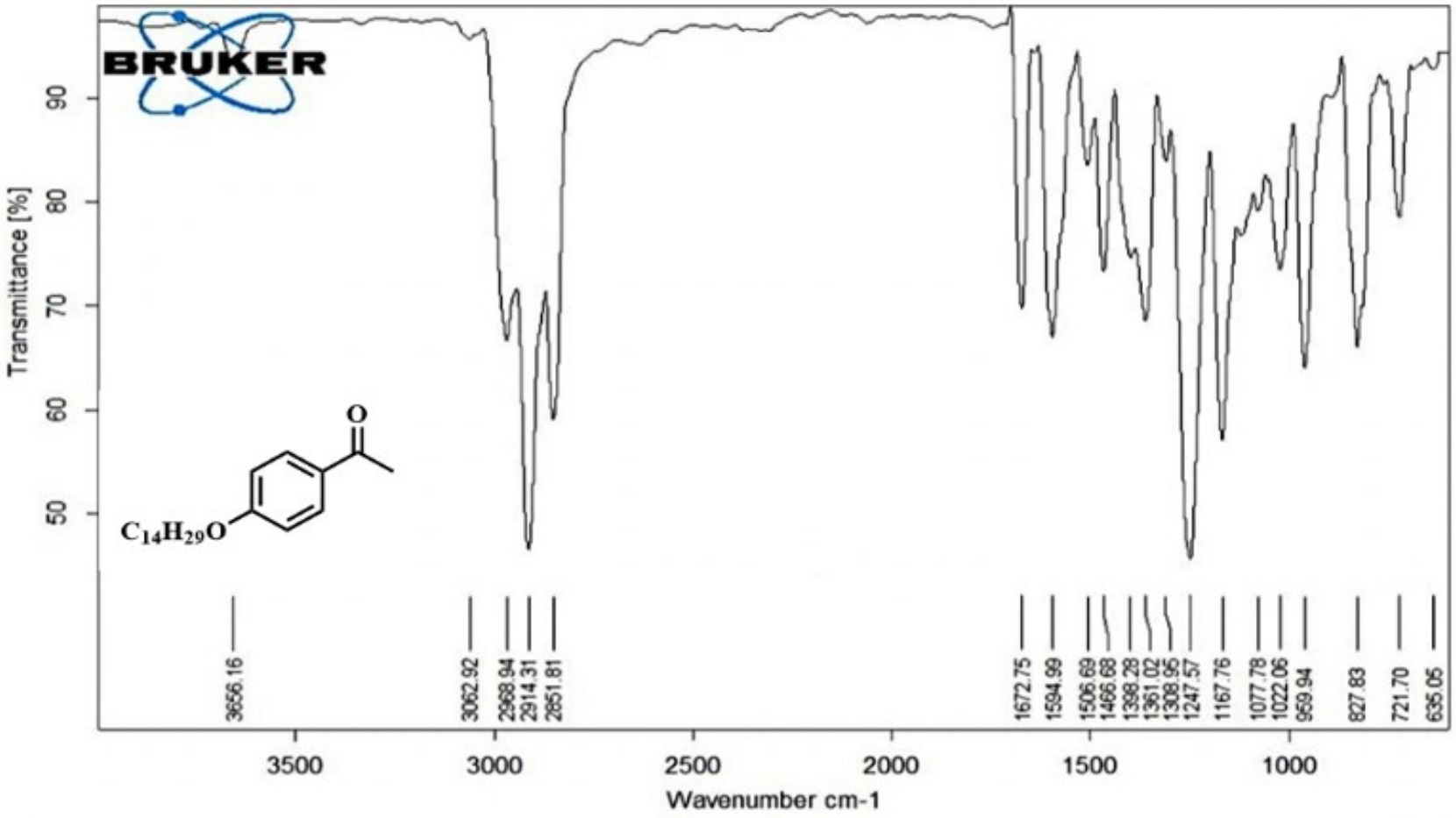

Figure 5: FT-IR spectrum of compound **1i**.

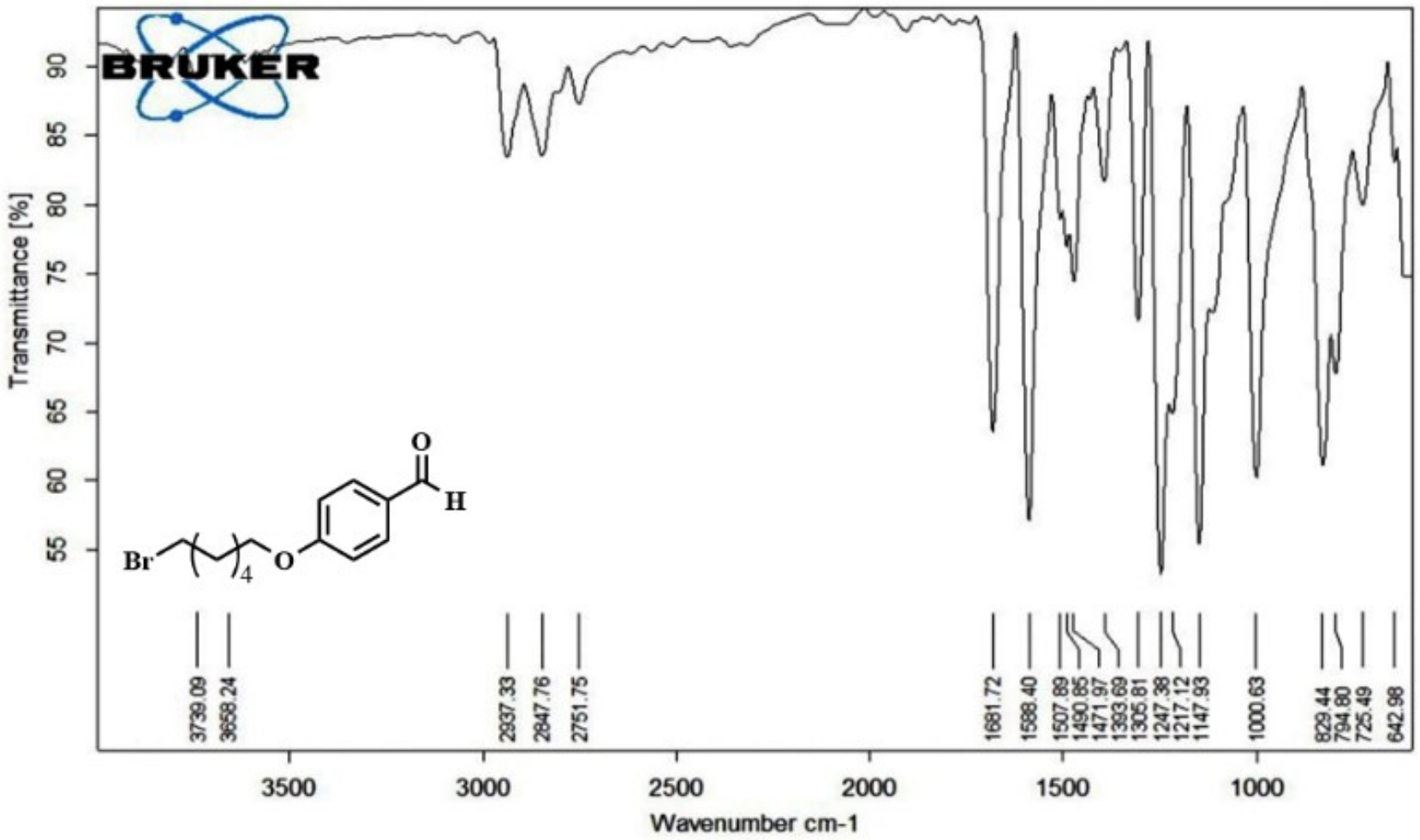

Figure 6: FT-IR spectrum of compound **2b**.

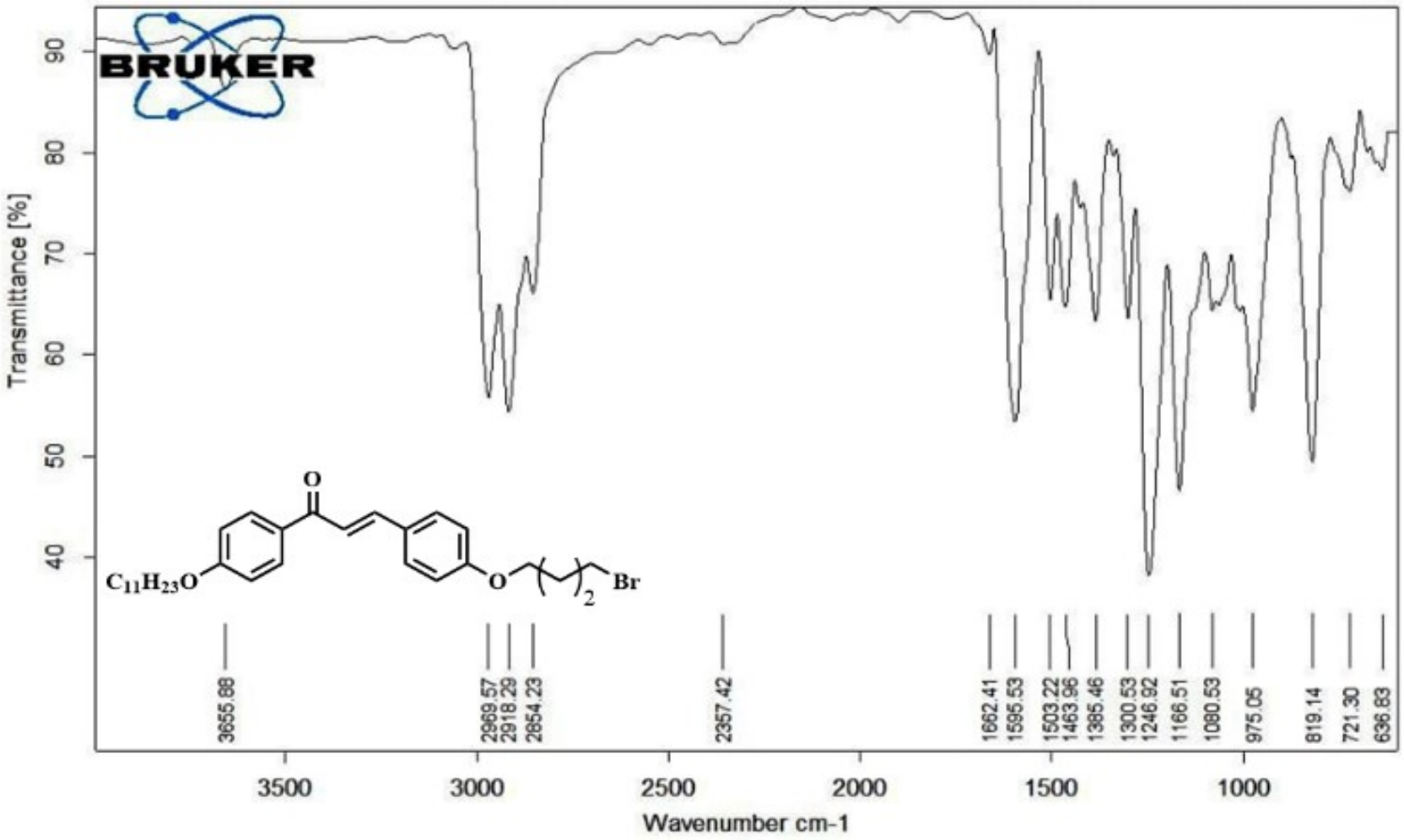

Figure 7: FT-IR spectrum of compound **3f**.

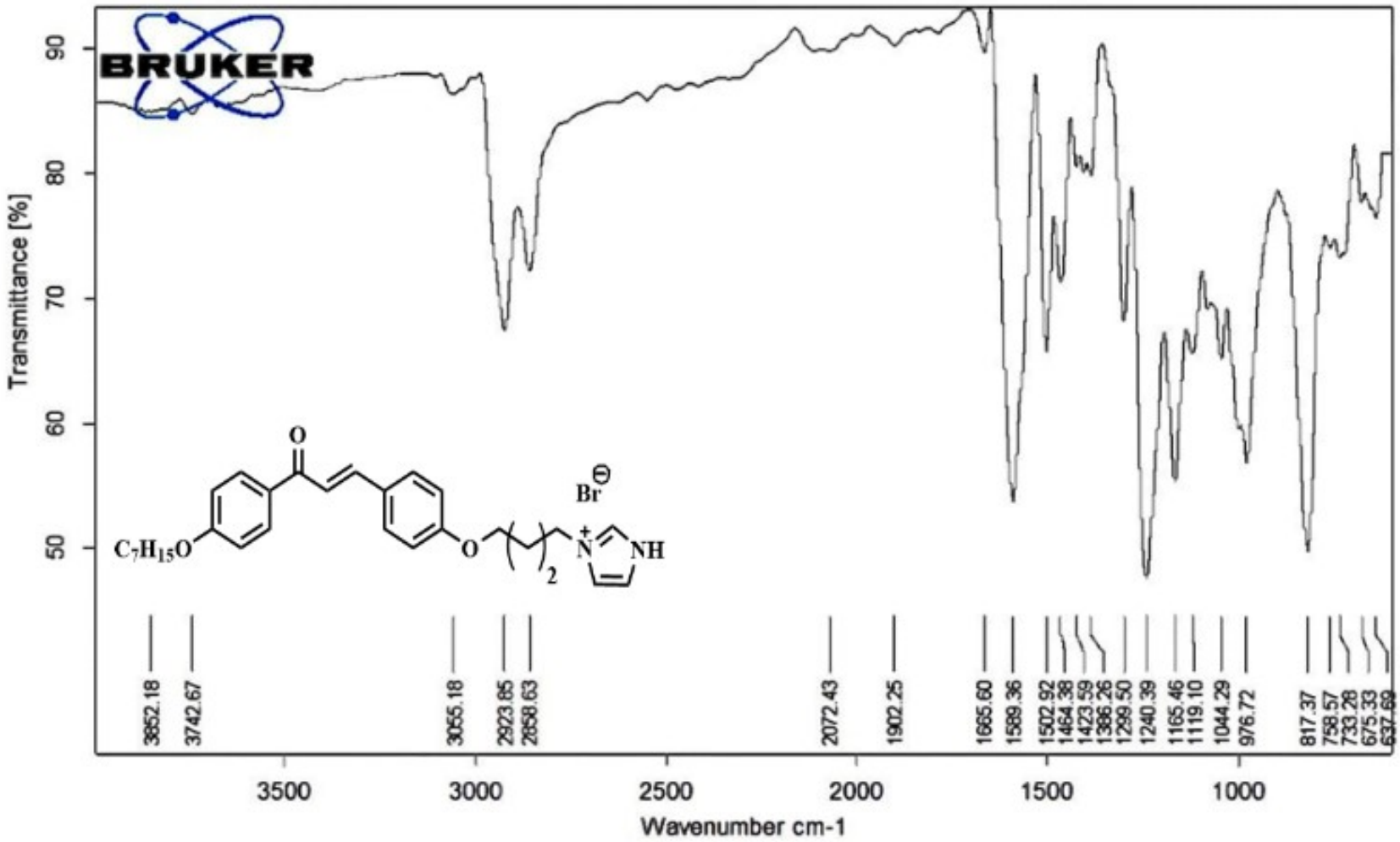

Figure 8: FT-IR spectrum of compound **4b**.

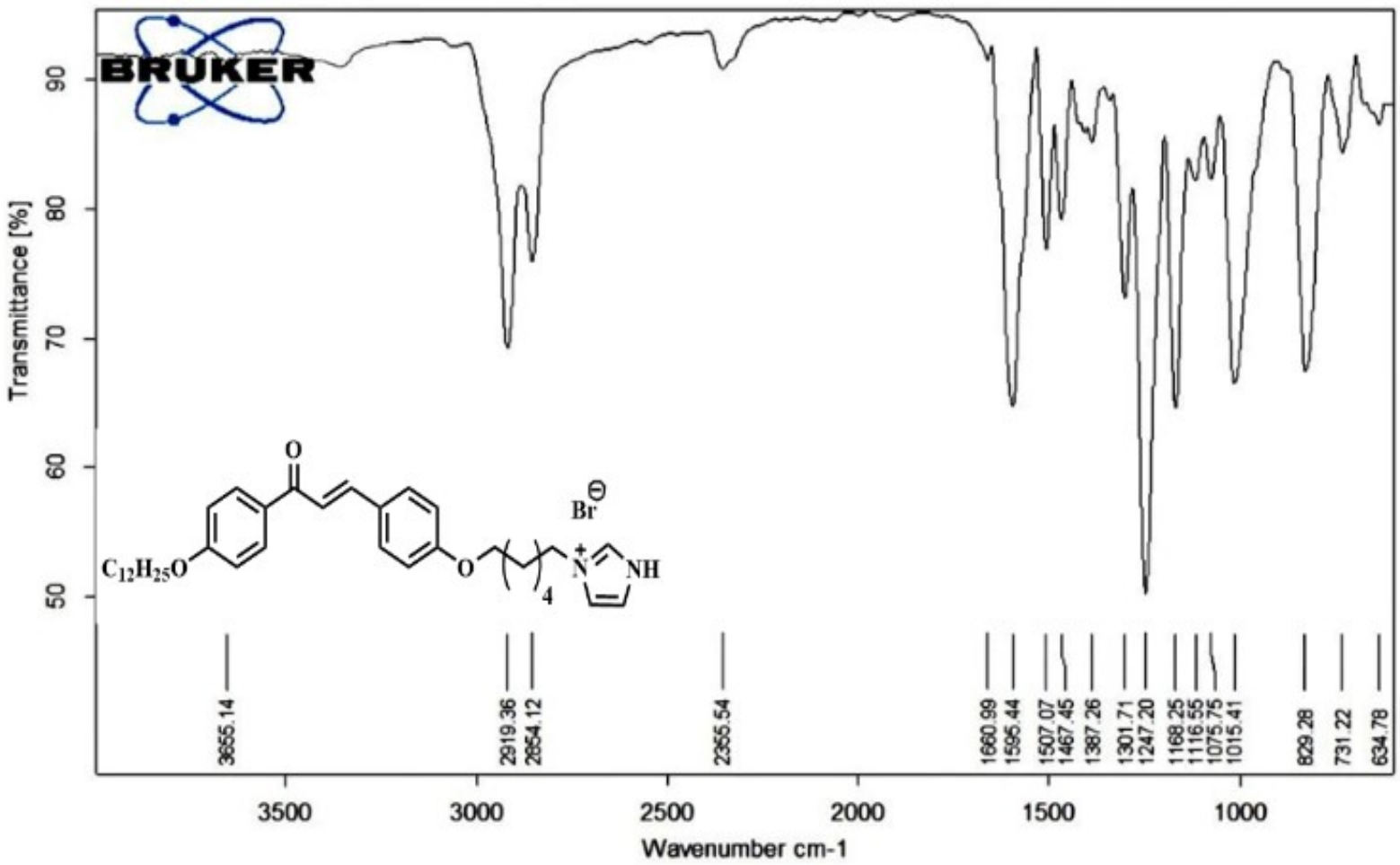

Figure 9: FT-IR spectrum of compound **5g**.

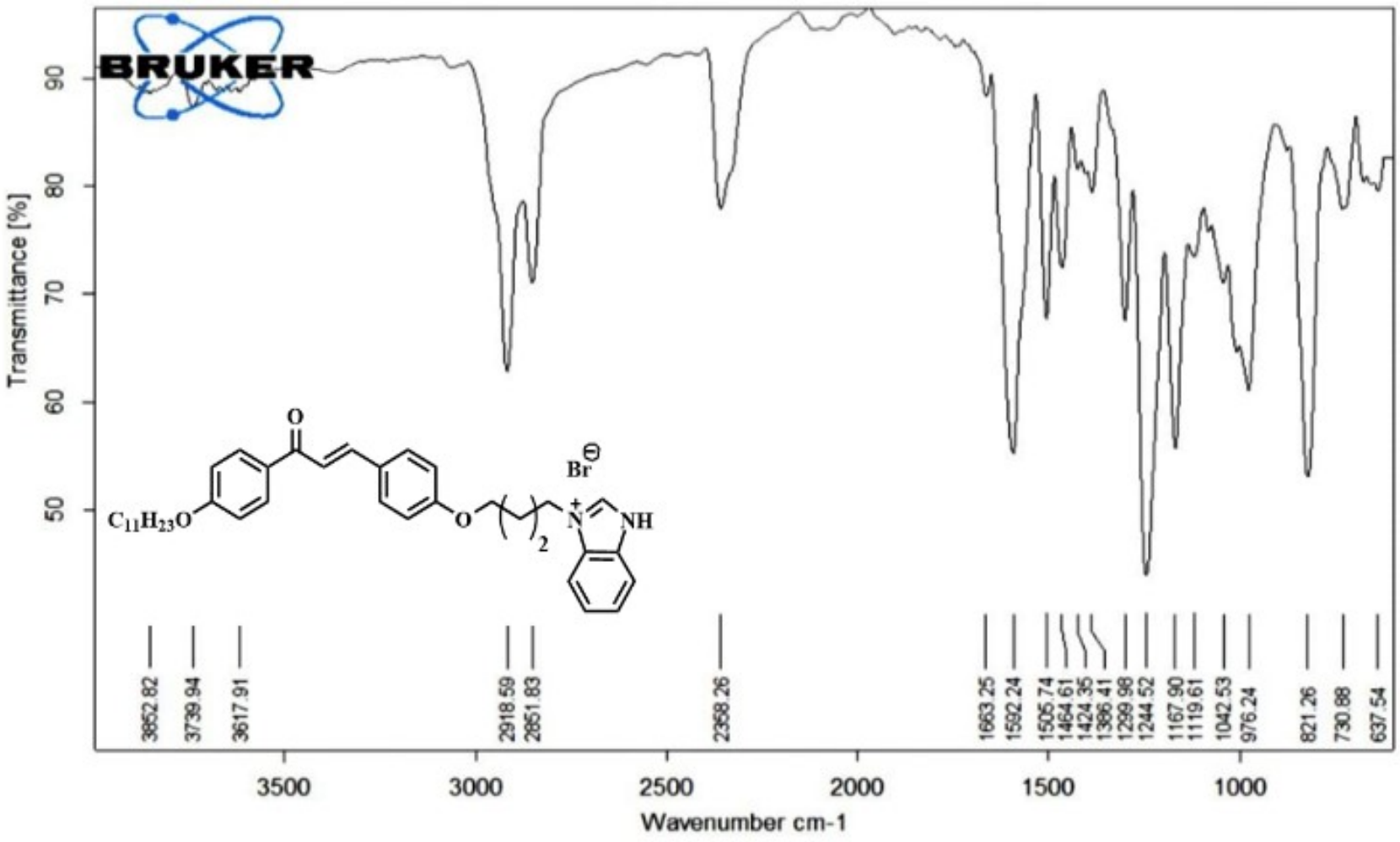

Figure 10: FT-IR spectrum of compound **6f.**

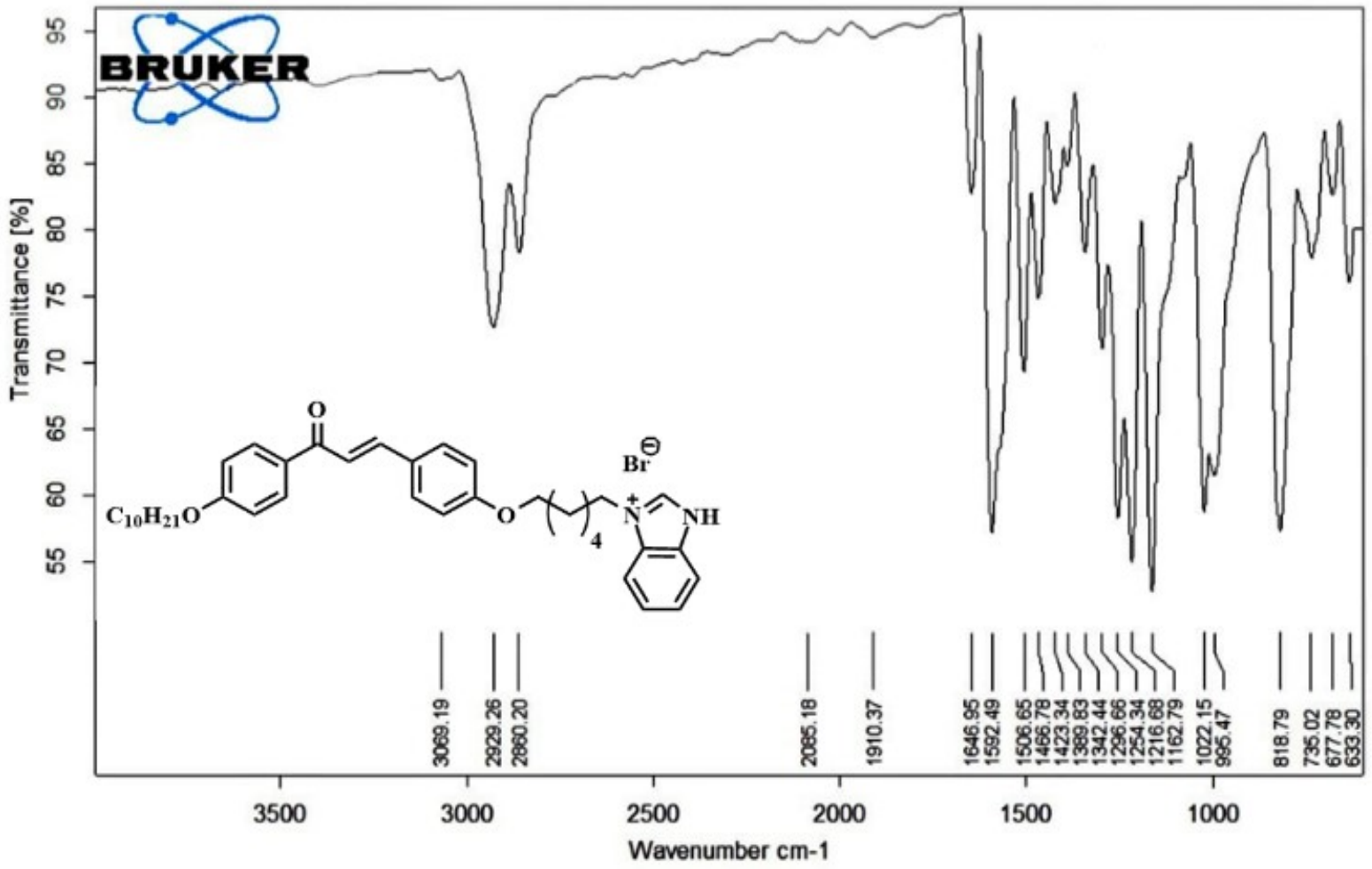
BRUKER
Transmittance [%]
95
90
85
80
75
70
65
60
55
3069.19
2929.26
2860.20
2085.18
1910.37
1646.95
1592.49
1506.65
1466.78
1423.34
1389.83
1342.44
1296.66
1254.34
1216.68
1162.79
1022.15
995.47
818.79
735.02
677.78
633.30
3500
3000
2500
2000
1500
1000
Wavenumber cm-1
O
Br⊖
C10H21O
O
4
N+
NH

Figure 11: FT-IR spectrum of compound **7e**.

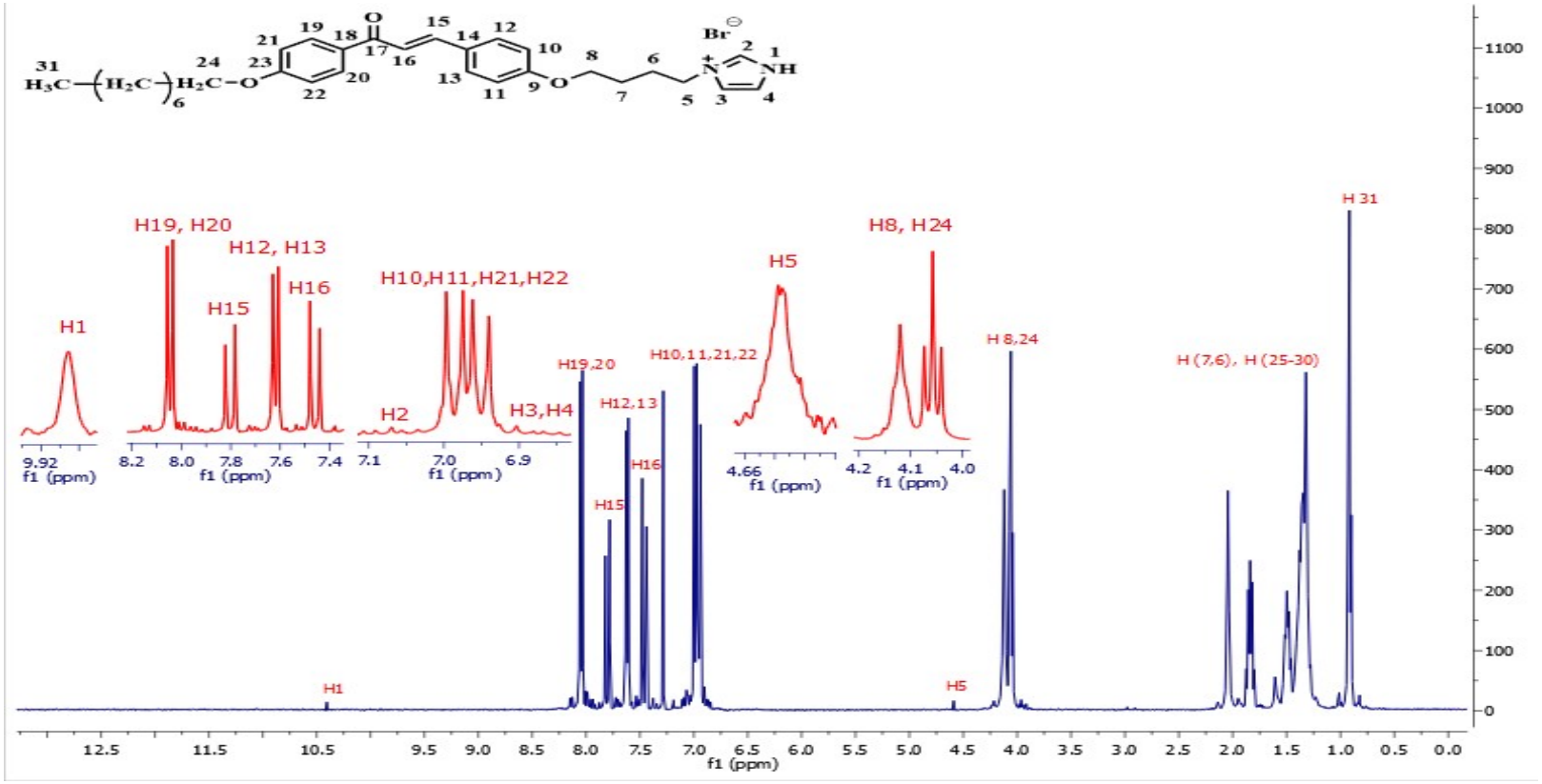

Figure 12 :[1]**H-NMR** spectrum of compound **4c**

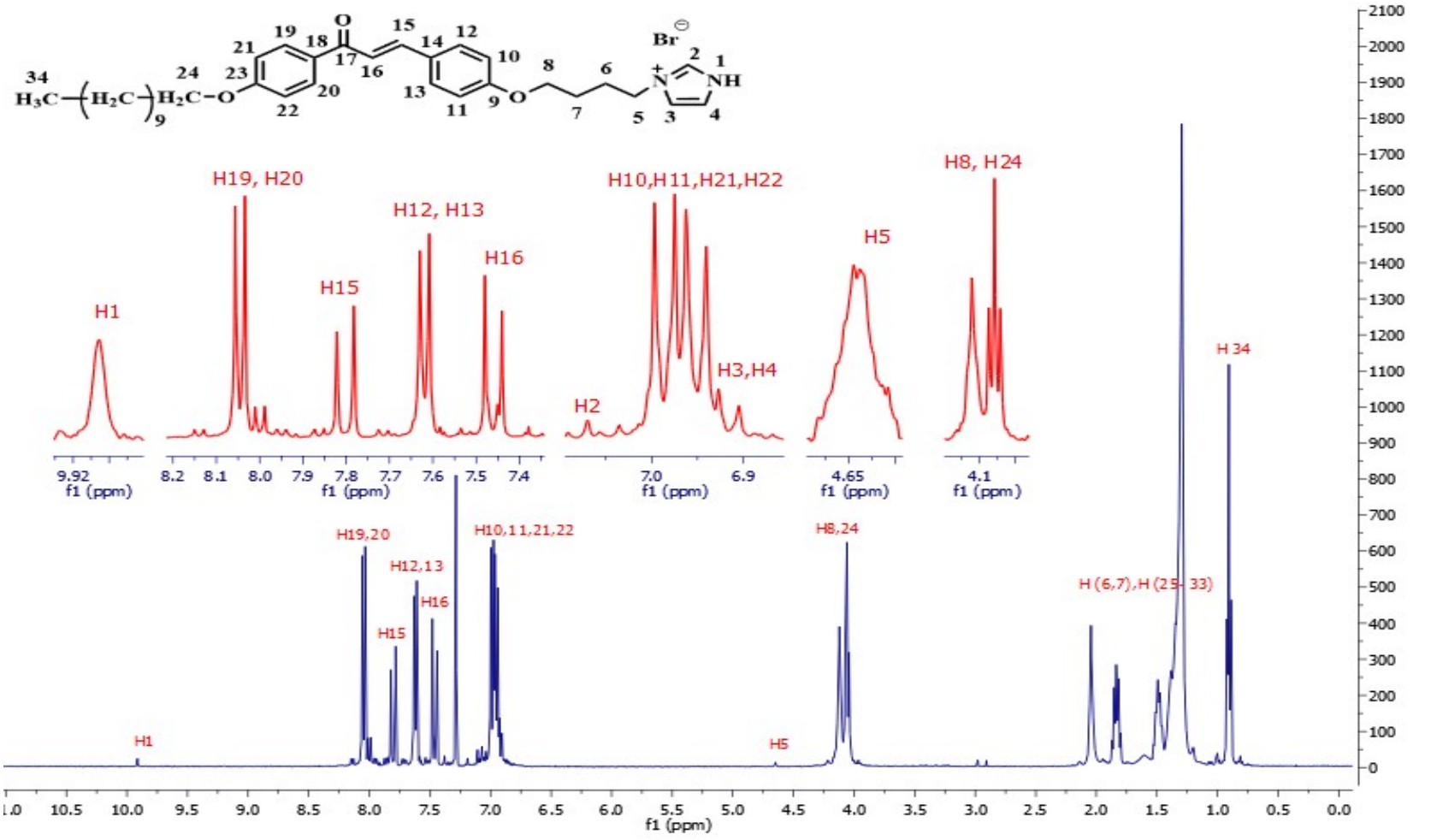

Figure 13:[1]**H-NMR** spectrum of compound **4f**

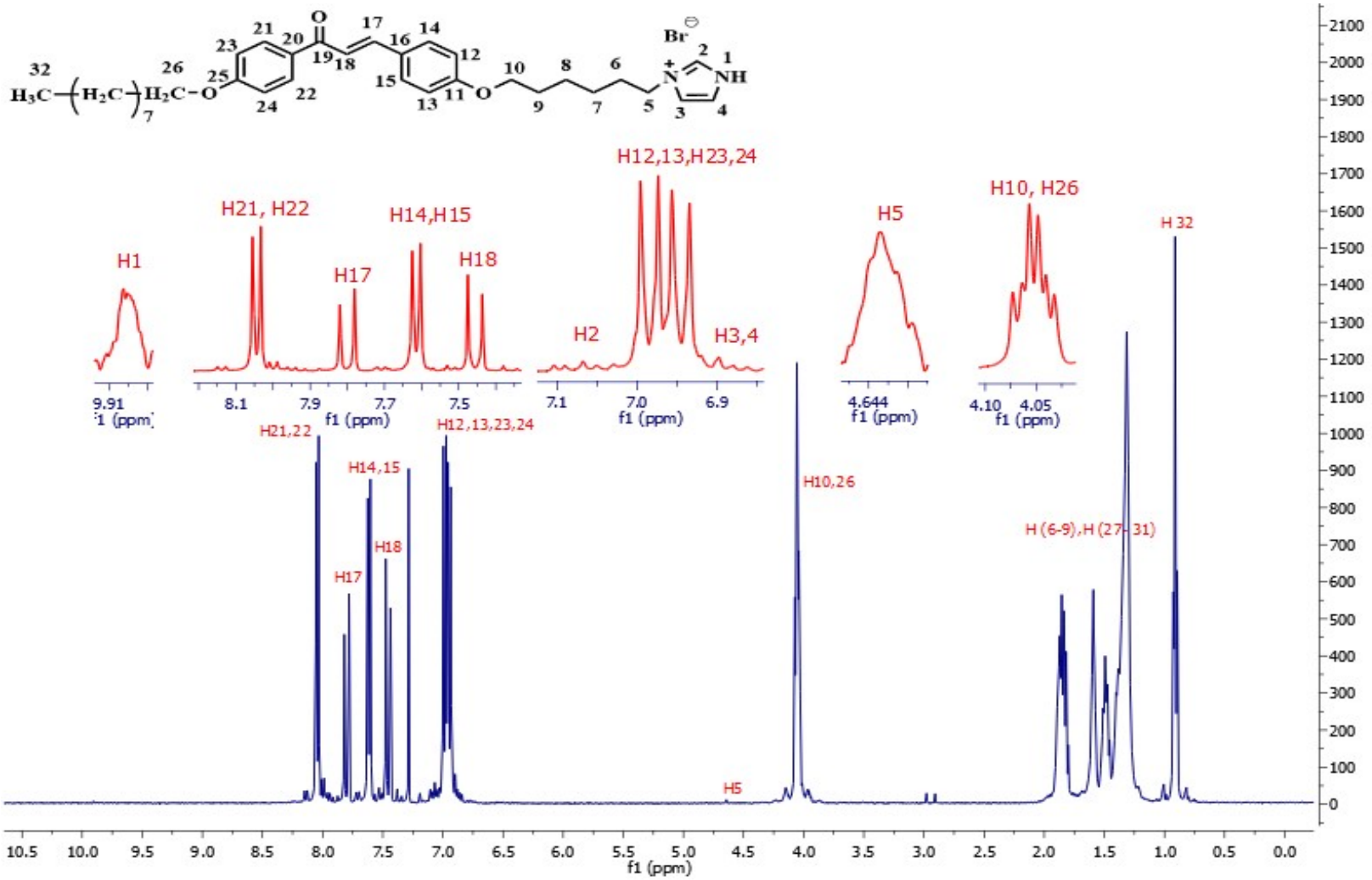

Figure 14 :[1]**H-NMR** spectrum of compound **5d**

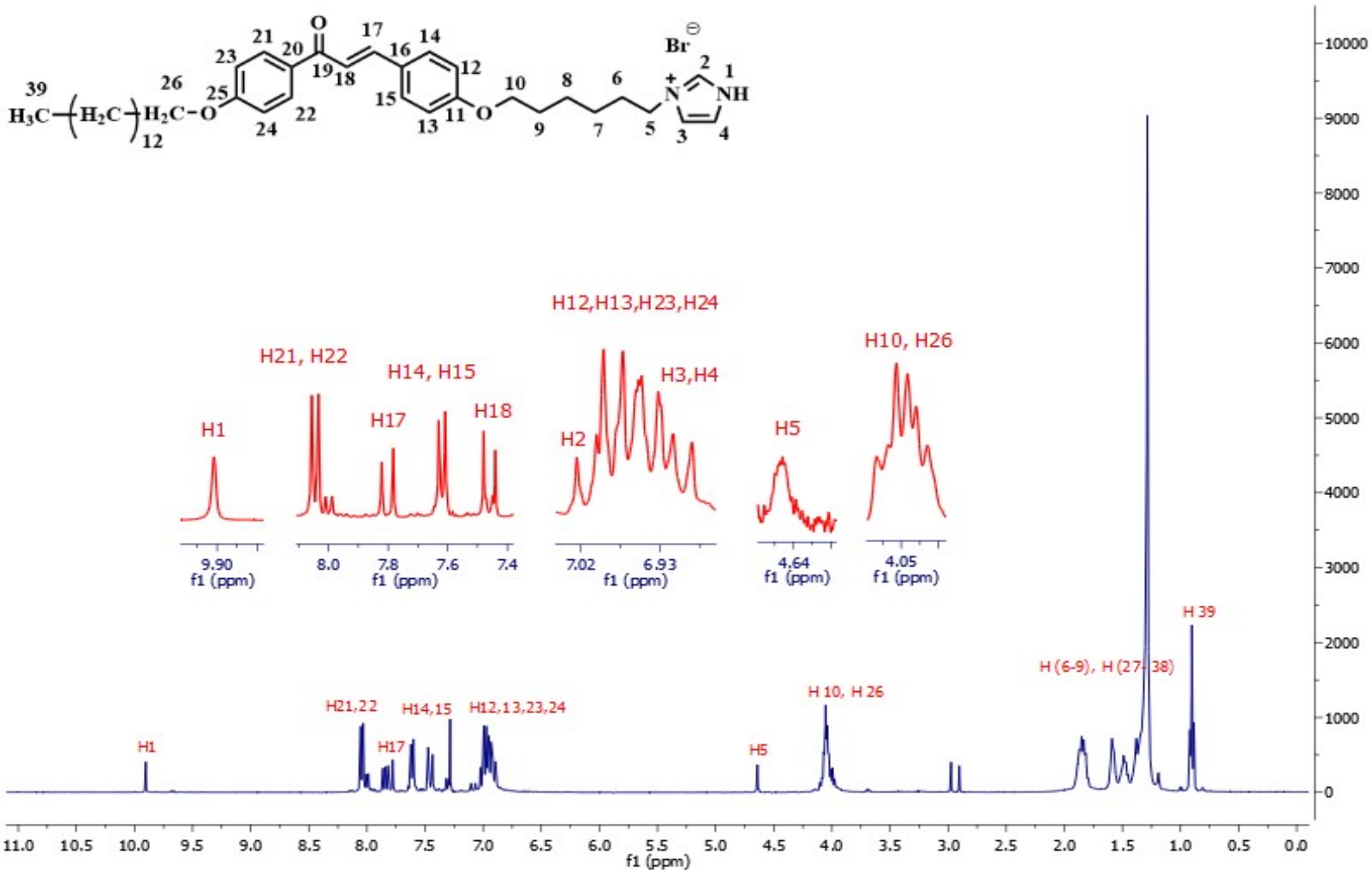

Figure 15 :**^{1}H-NMR** spectrum of compound **5i.**

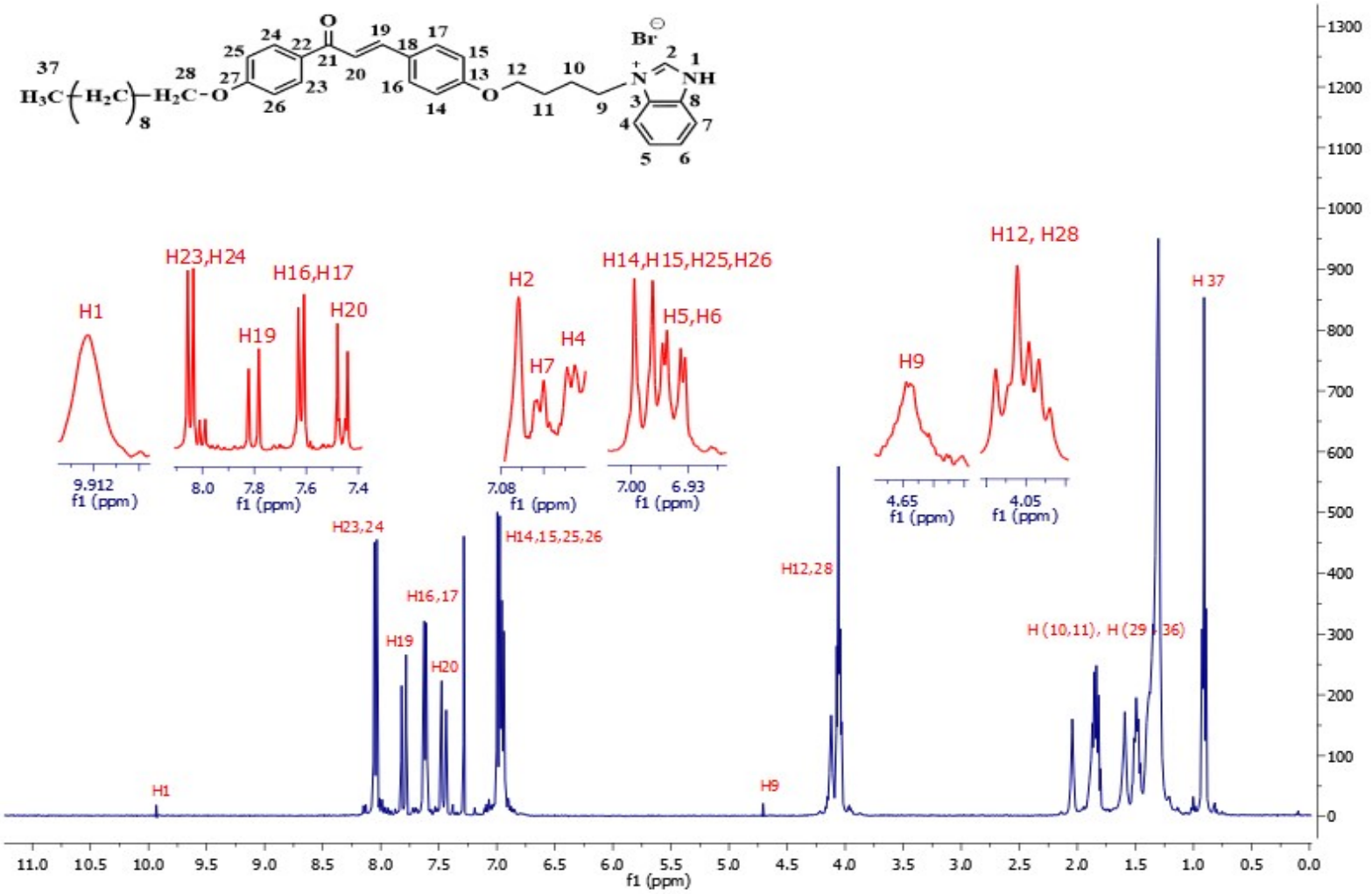

Figure 16:[1]**H-NMR** spectrum of compound **6e**

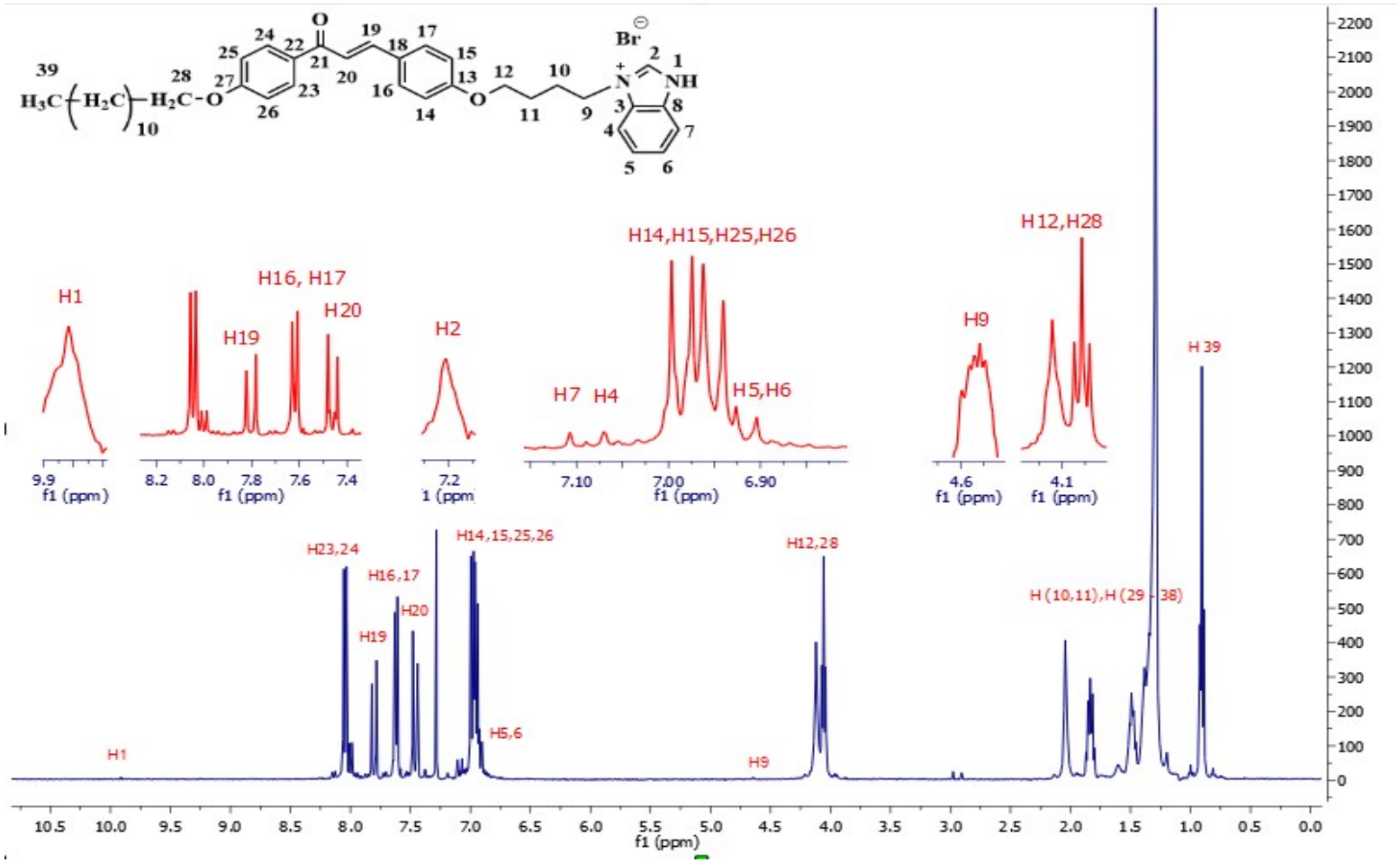

Figure 17 :[1]**H-NMR** spectrum of compound **6g**

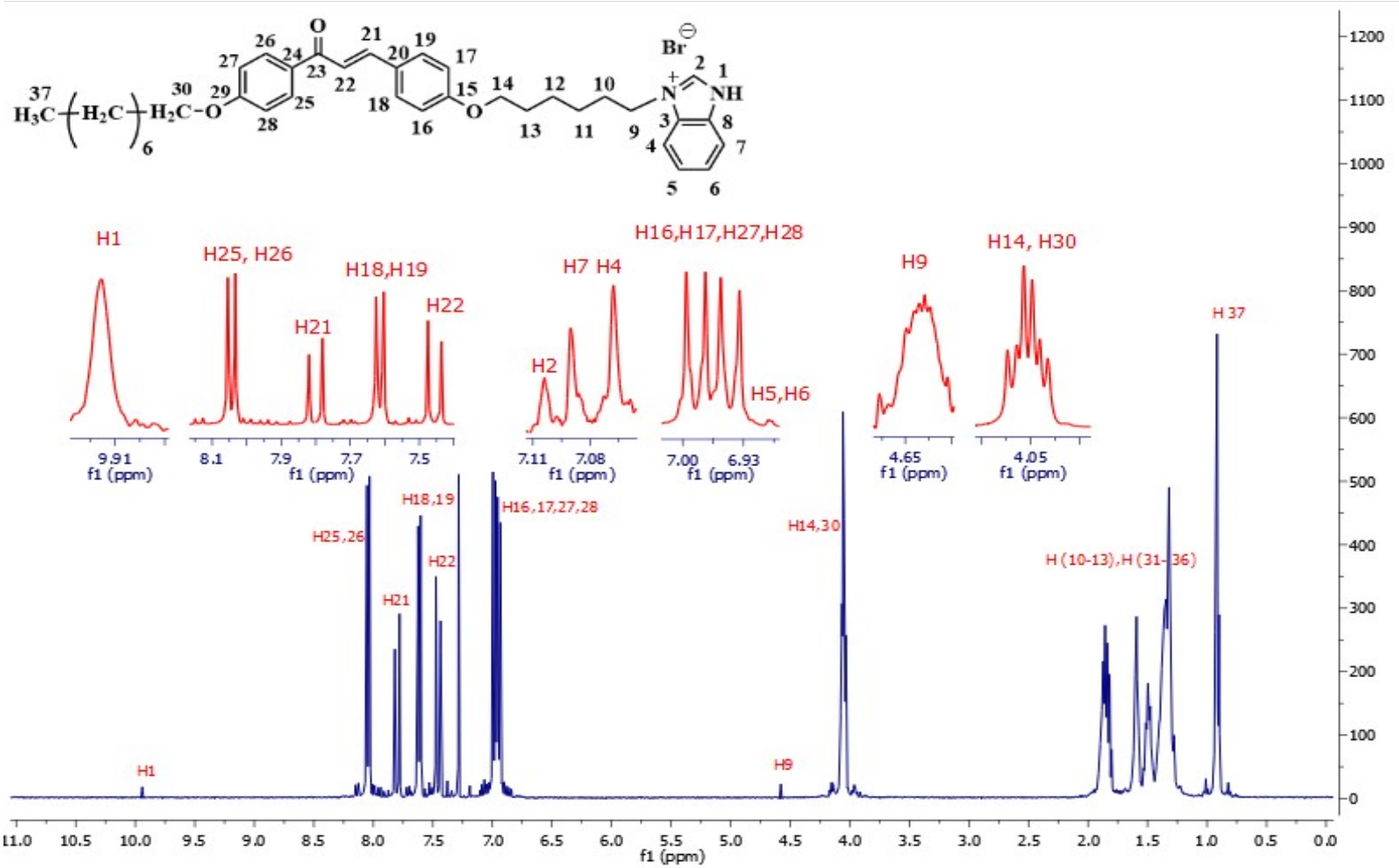

Figure 18 :**^{1}H-NMR** spectrum of compound **7c**

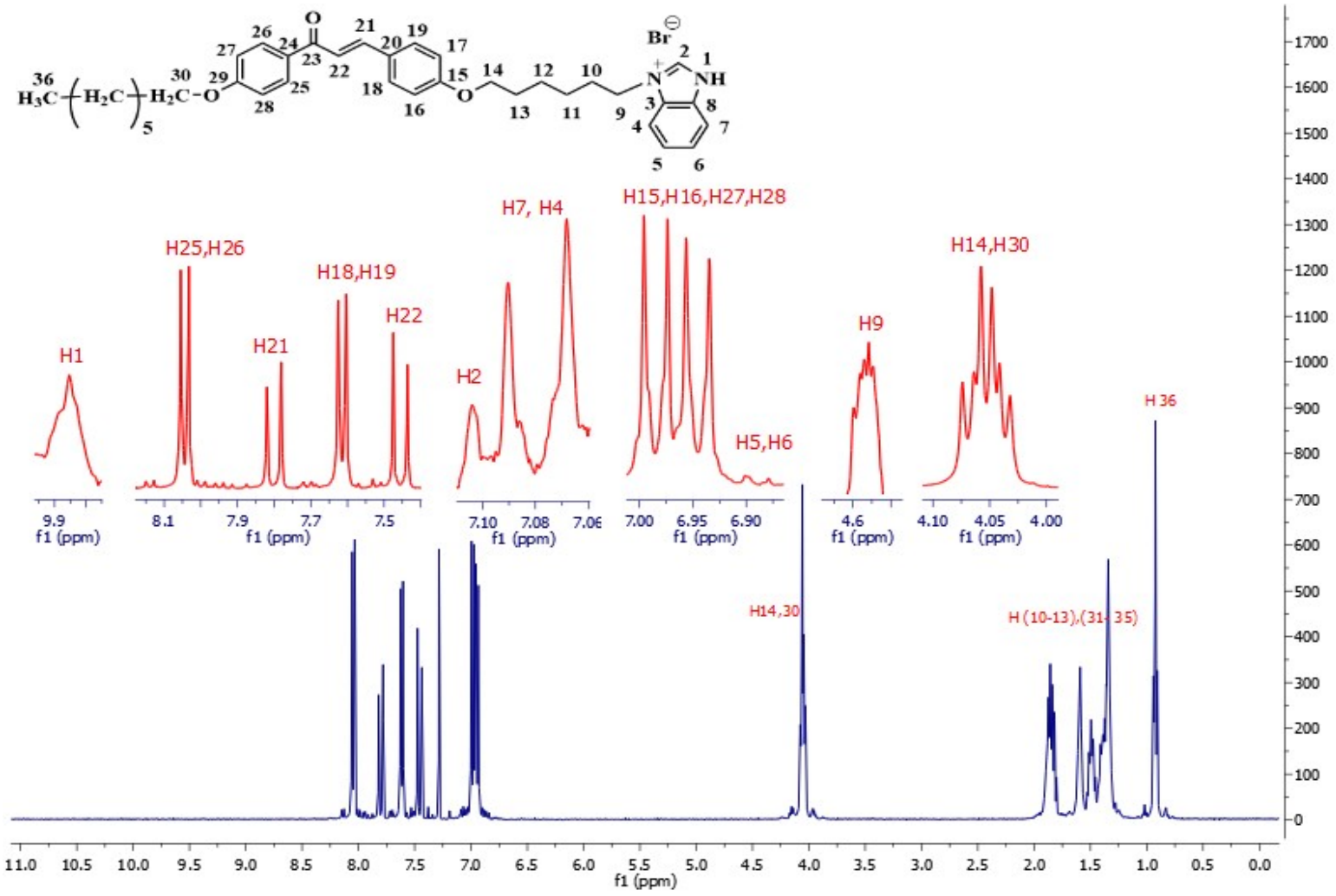

Figure 19 :**^{1}H-NMR** spectrum of compound **7b**

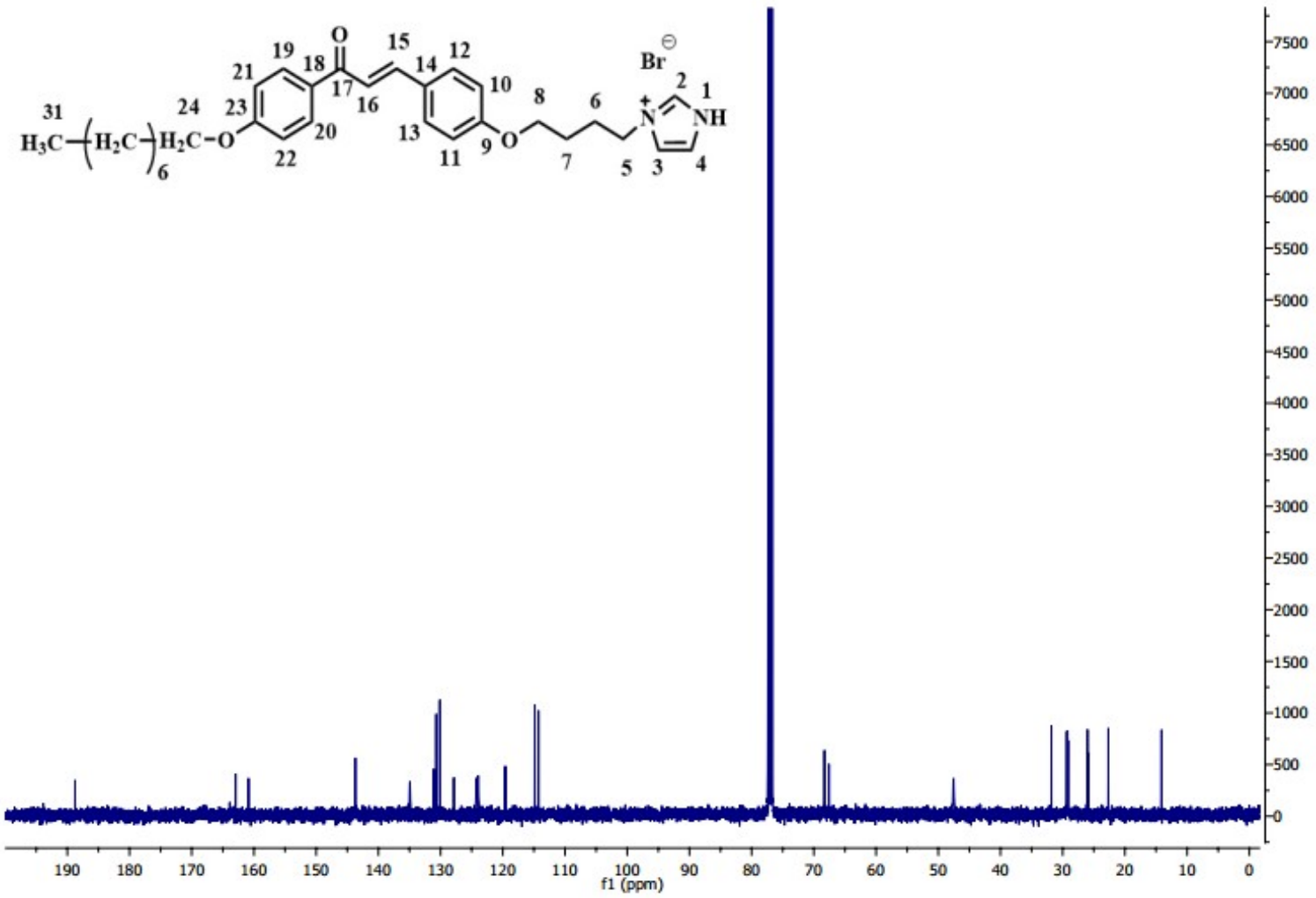

Figure 20 :**^{13}C-NMR** spectrum of compound **4c**

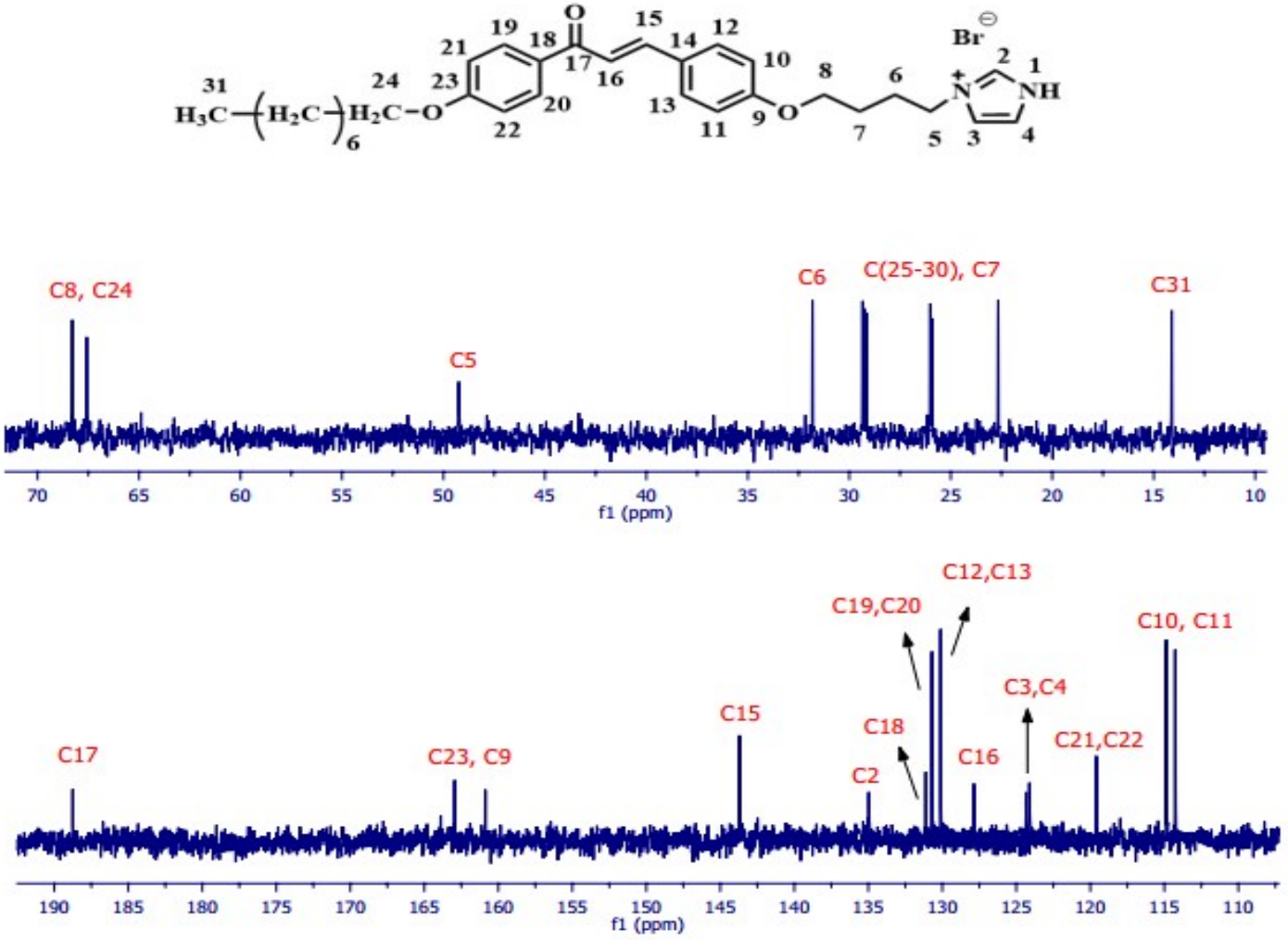

Figure 21: Expansion **^{13}C-NMR** spectrum of compound **4c**

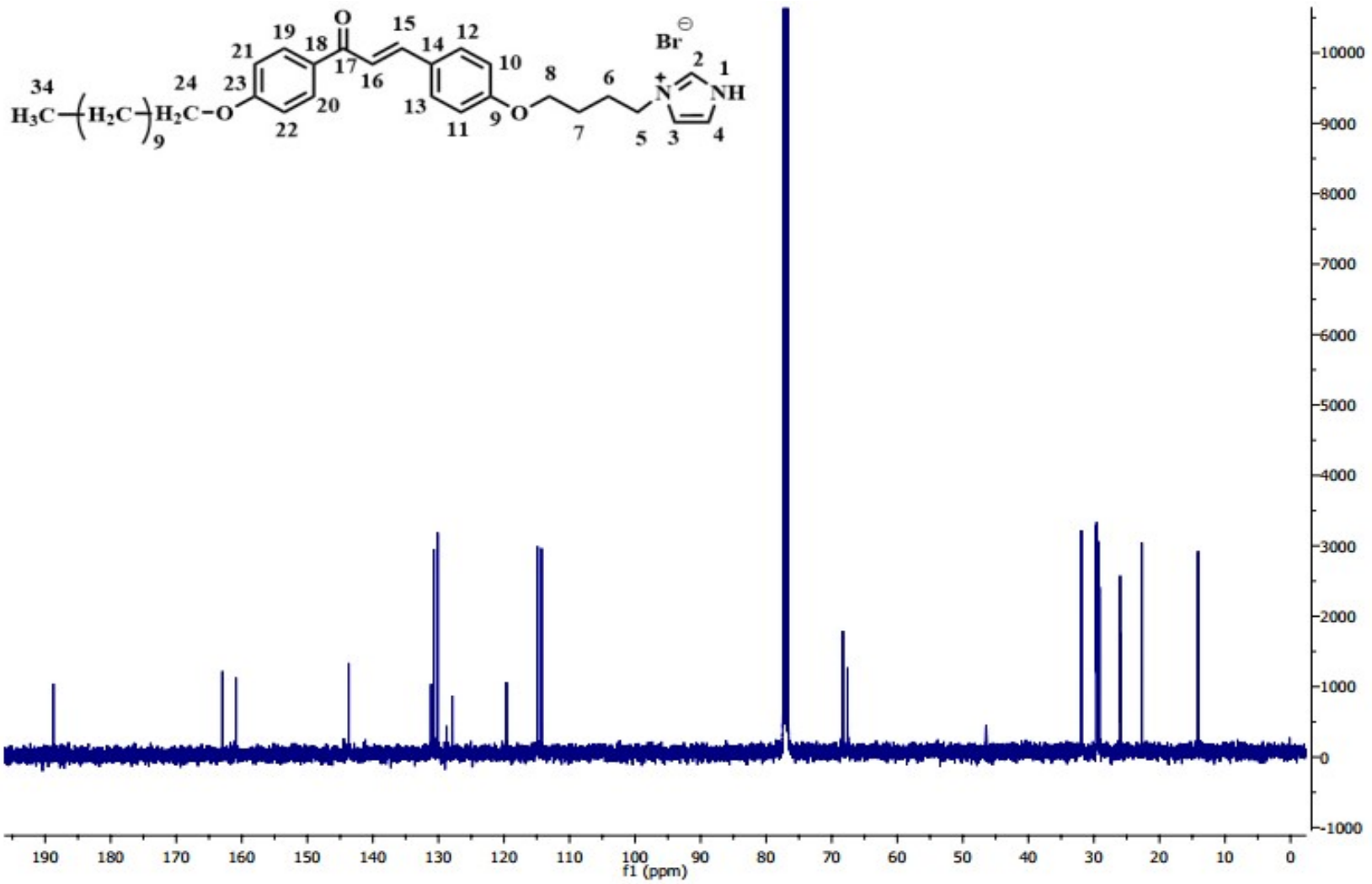

Figure 22:^{13}**C-NMR** spectrum of compound **4f**

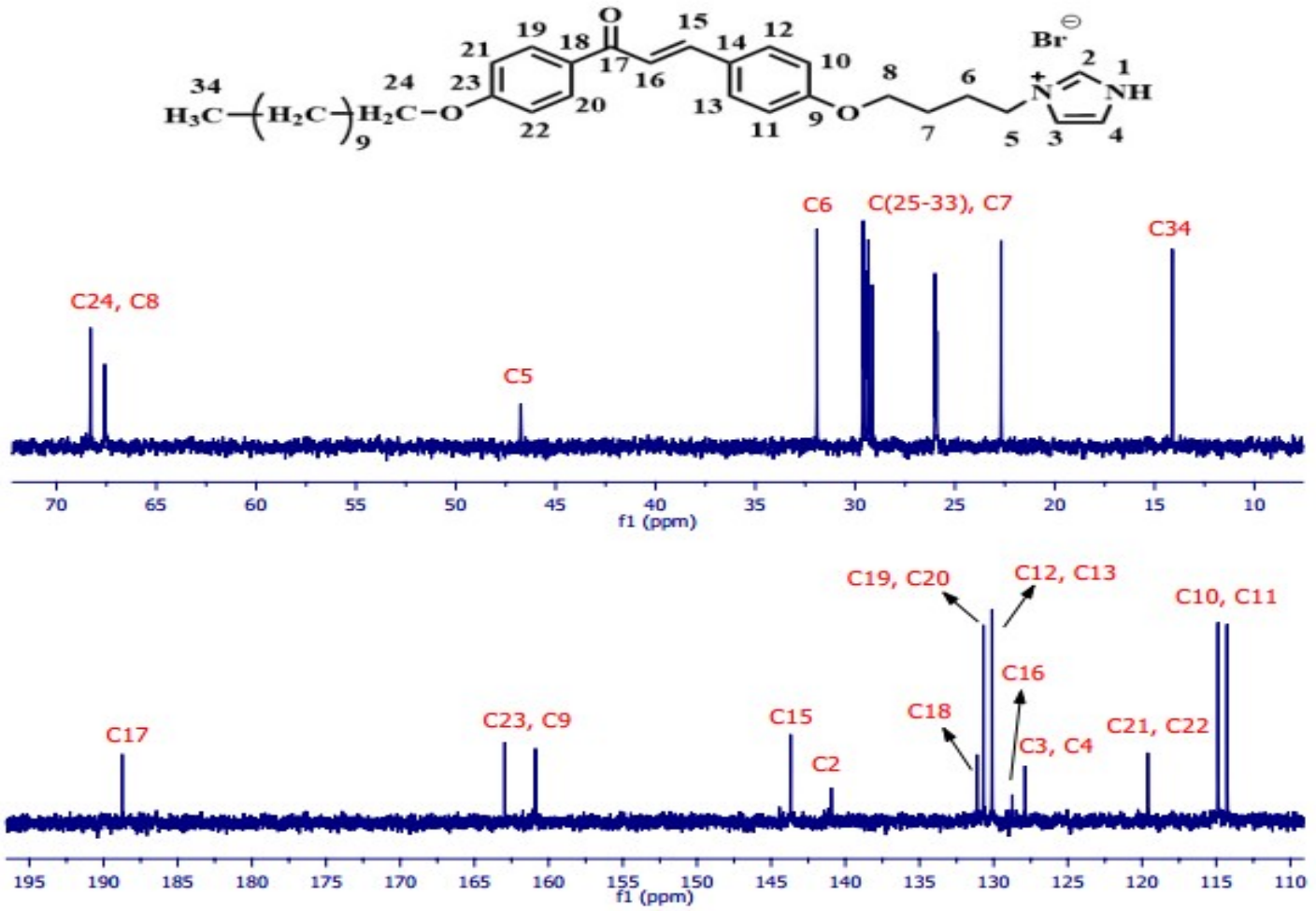

Figure 23: Expansion ^{13}**C-NMR** spectrum of compound **4f**

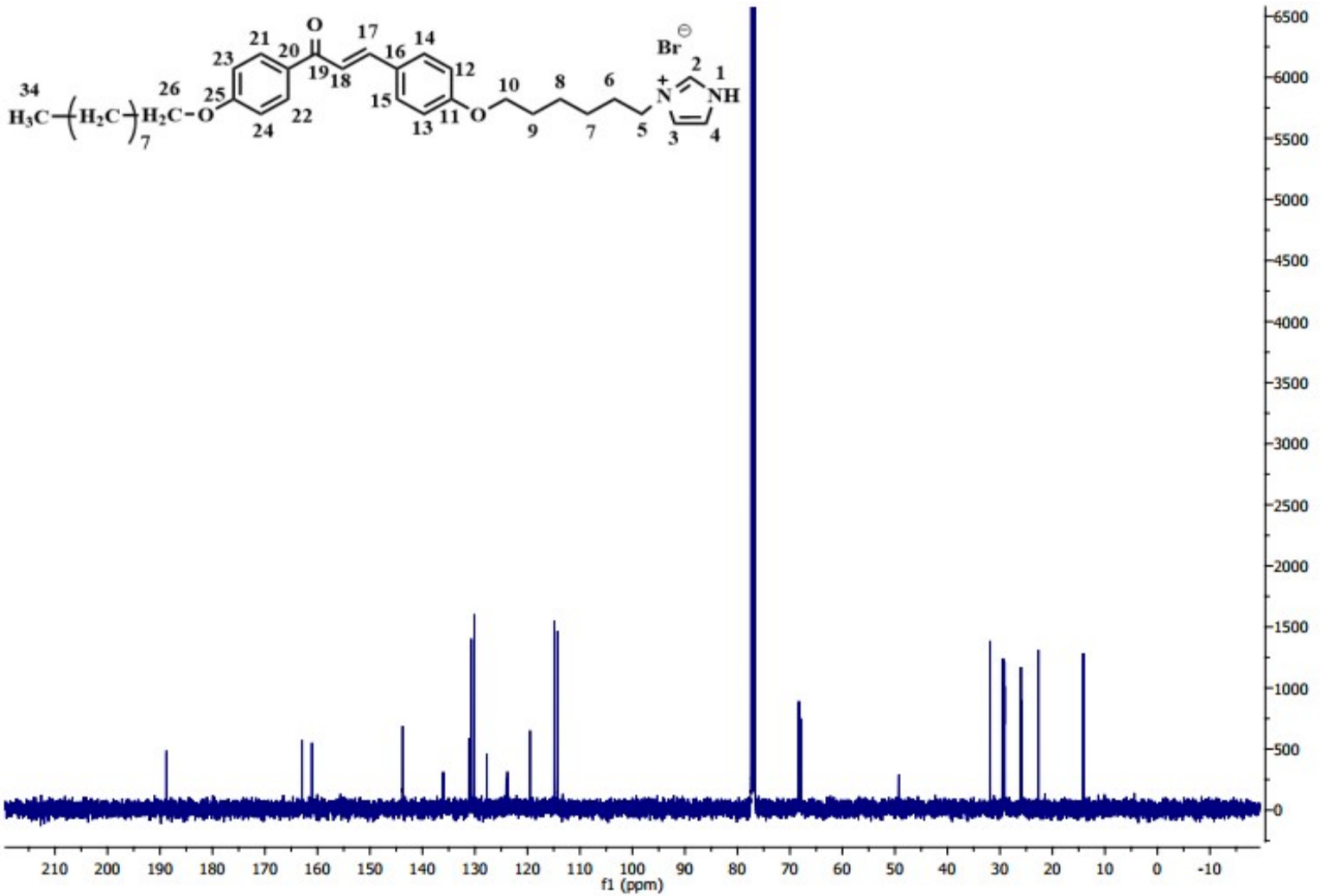

Figure 24:**^{13}C-NMR** spectrum of compound **5d**

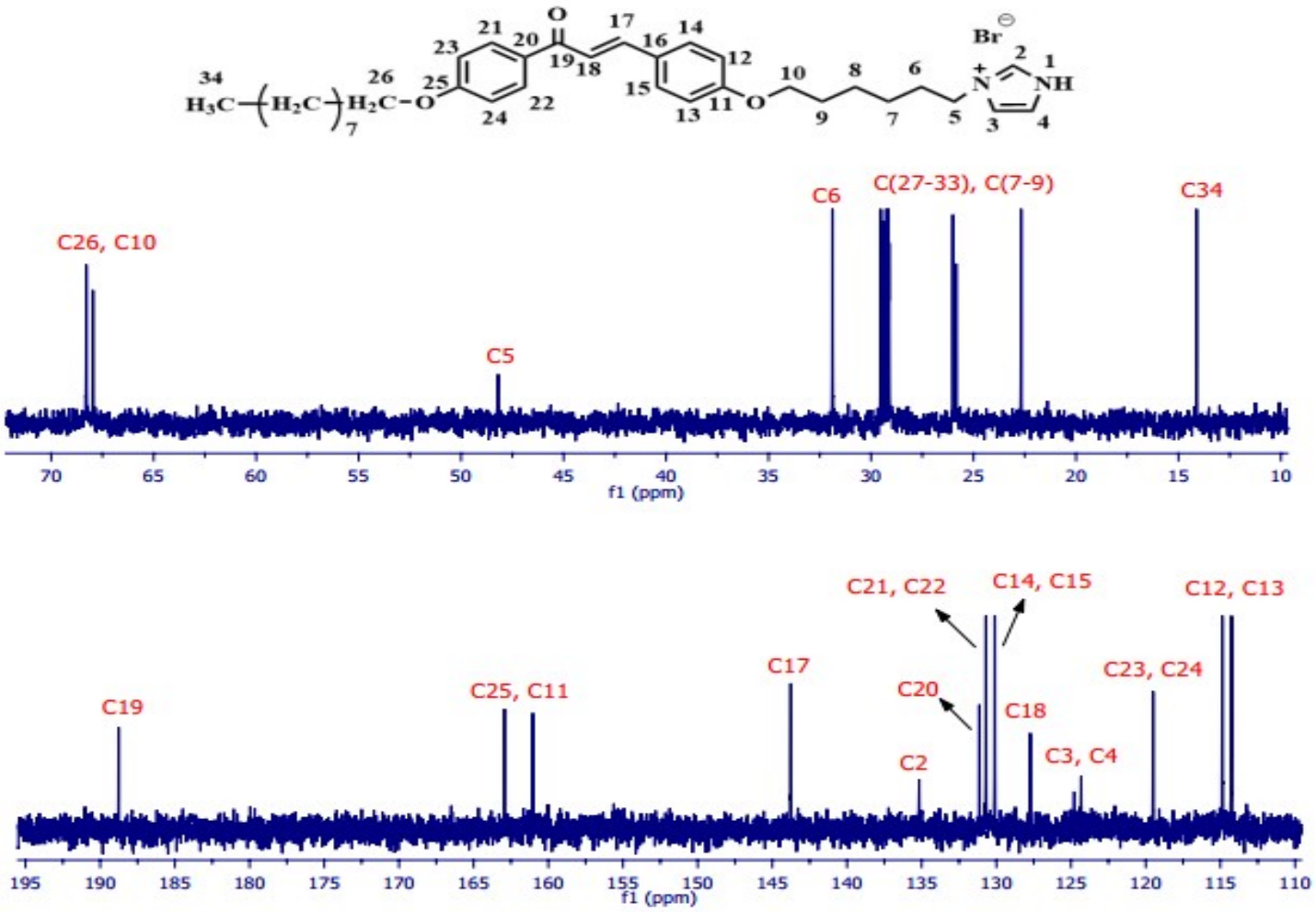

Figure 25: Expansion ^{13}**C-NMR** spectrum of compound **5d**

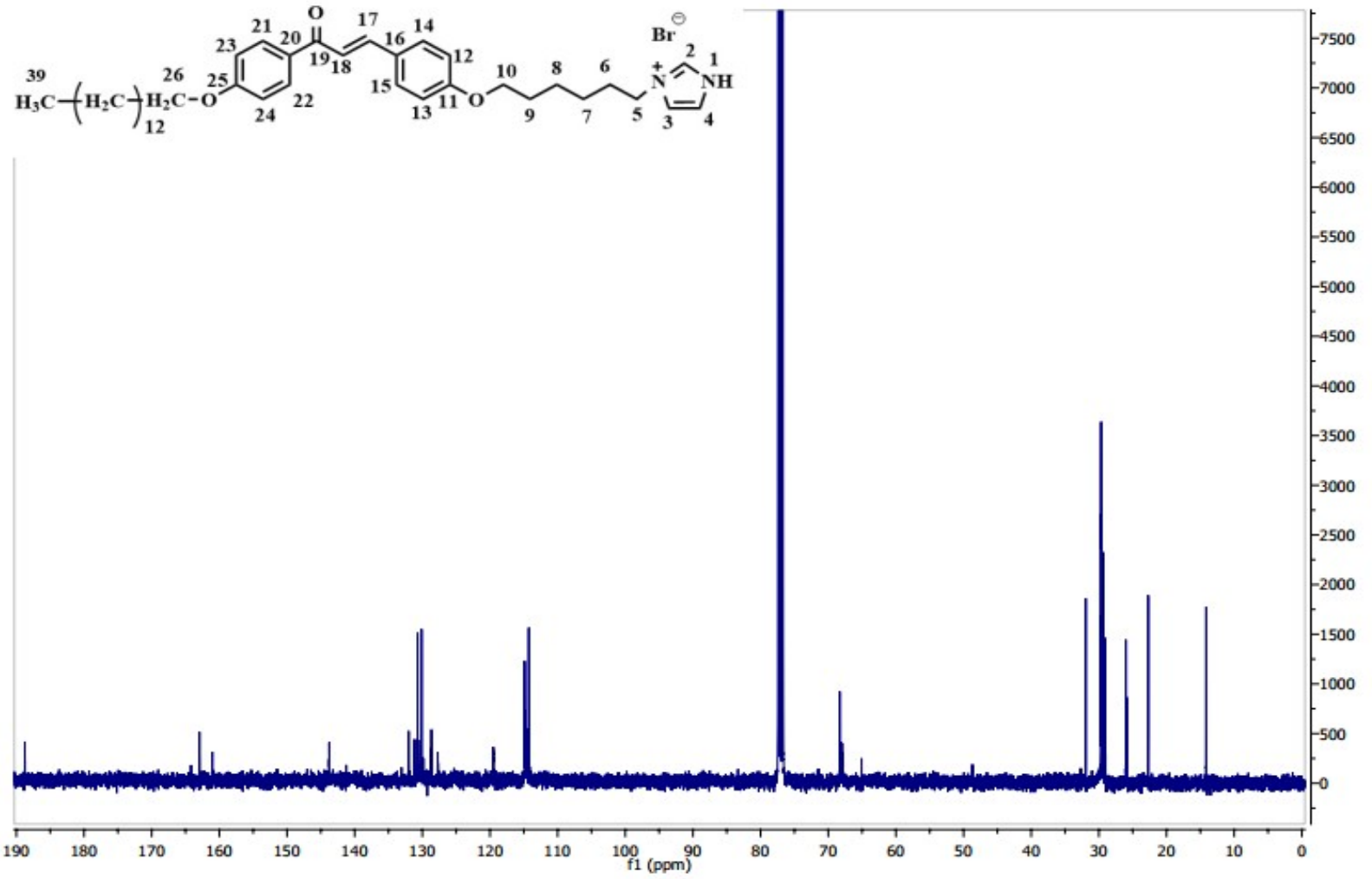

Figure 26: ^{13}**C-NMR** spectrum of compound **5i**

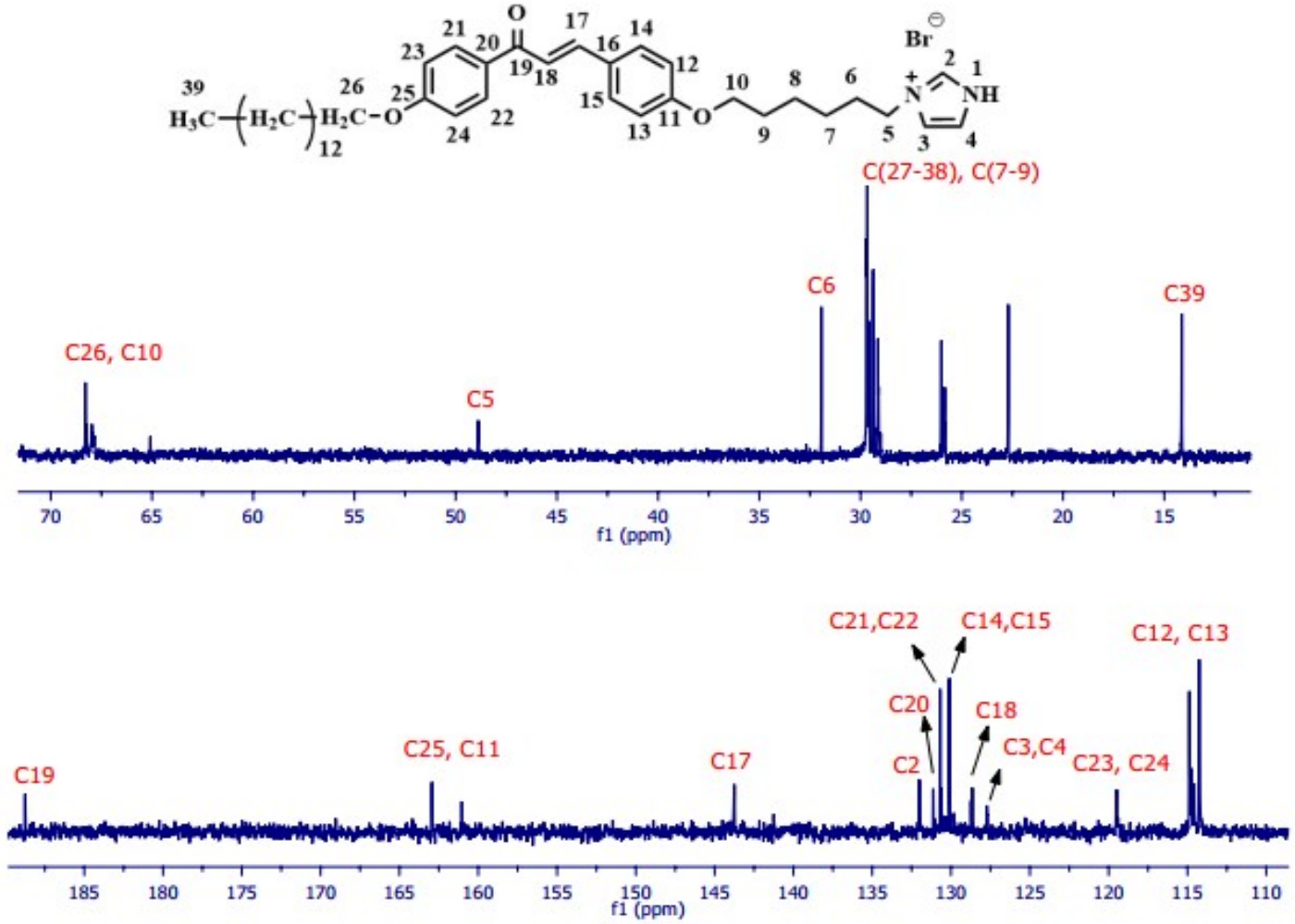

Figure 27: Expansion **^{13}C-NMR** spectrum of compound **5i**

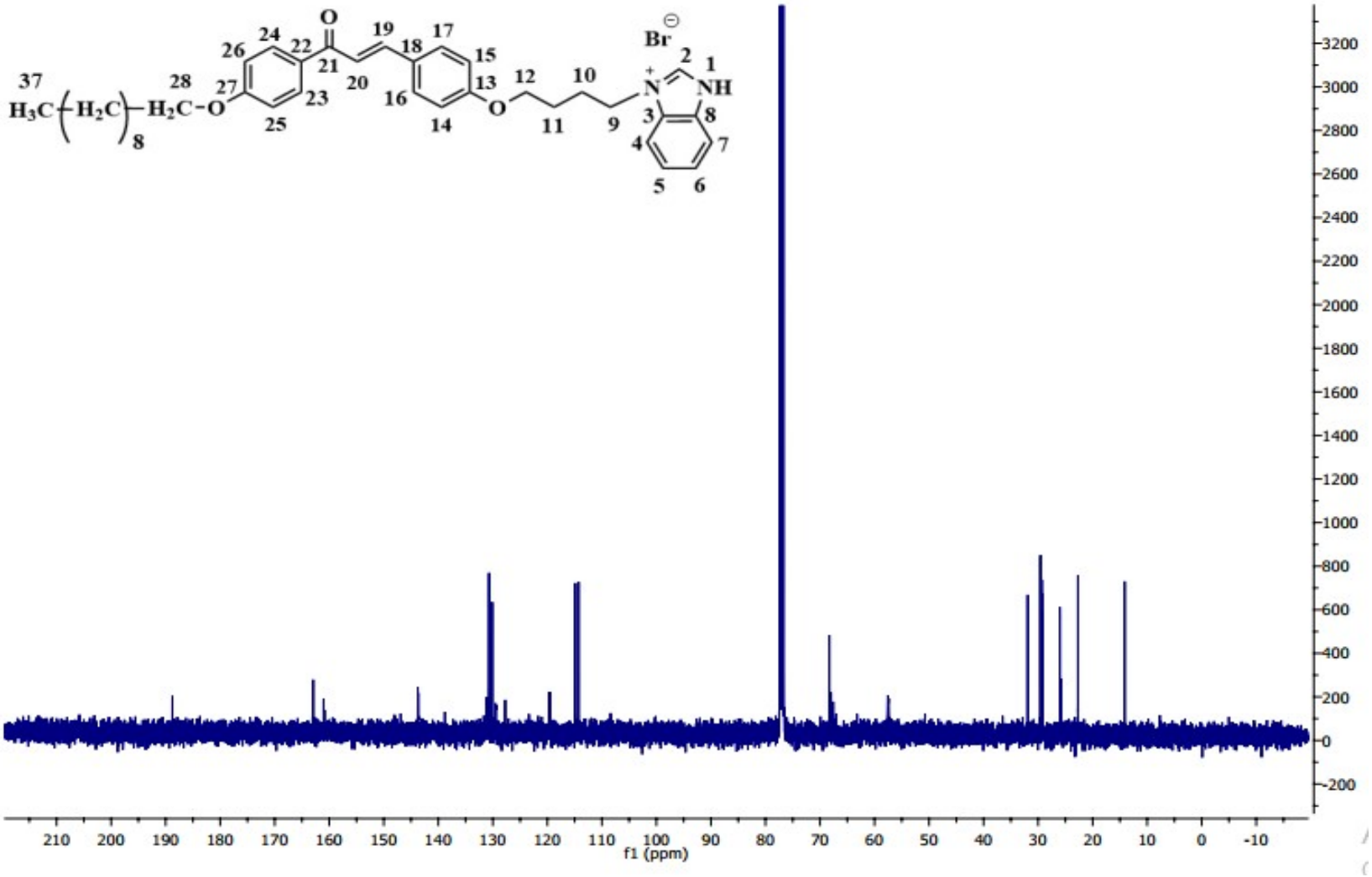

Figure 28: **^{13}C-NMR** spectrum of compound **6e**

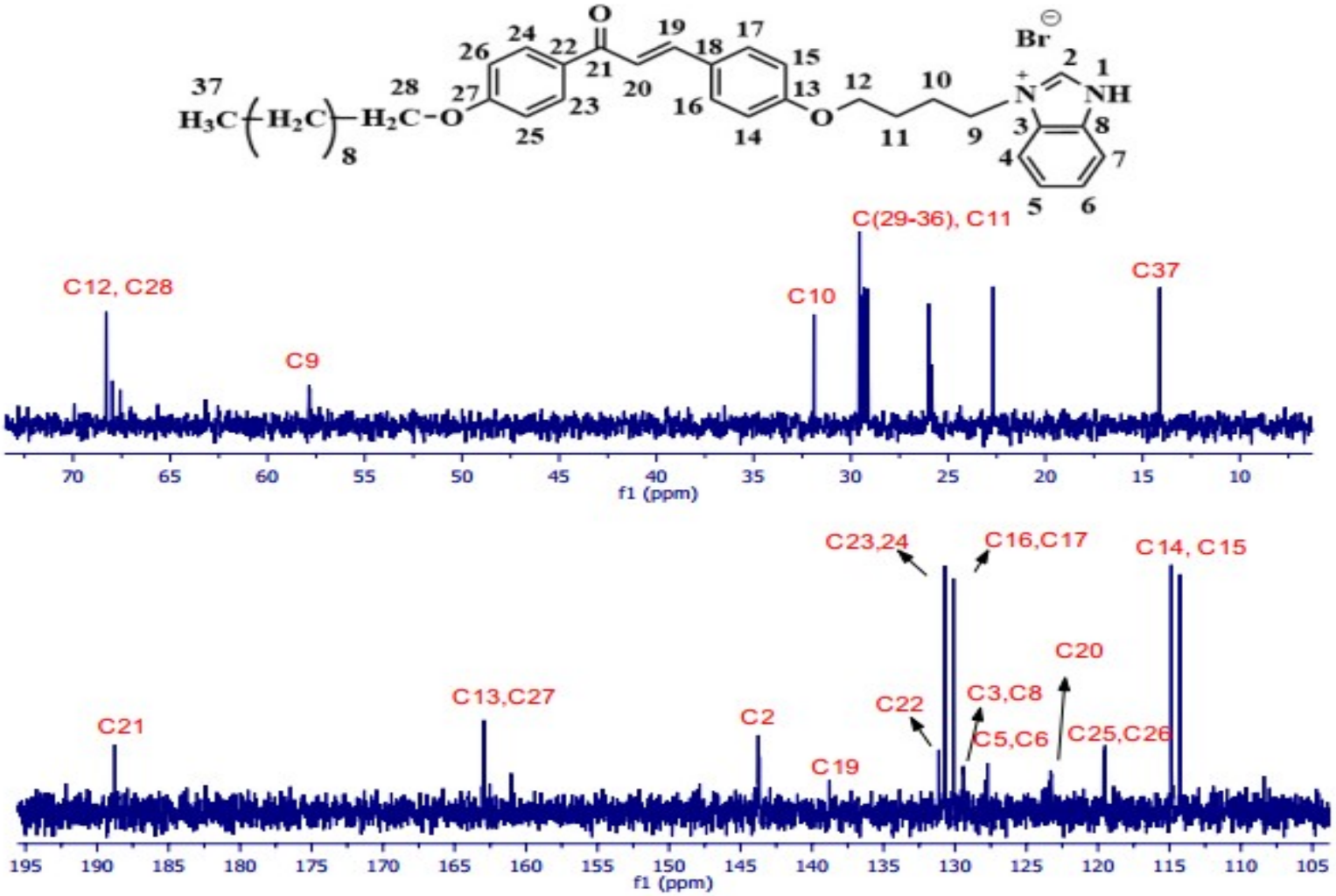

Figure 29: Expansion ^{13}**C-NMR** spectrum of compound **6e**

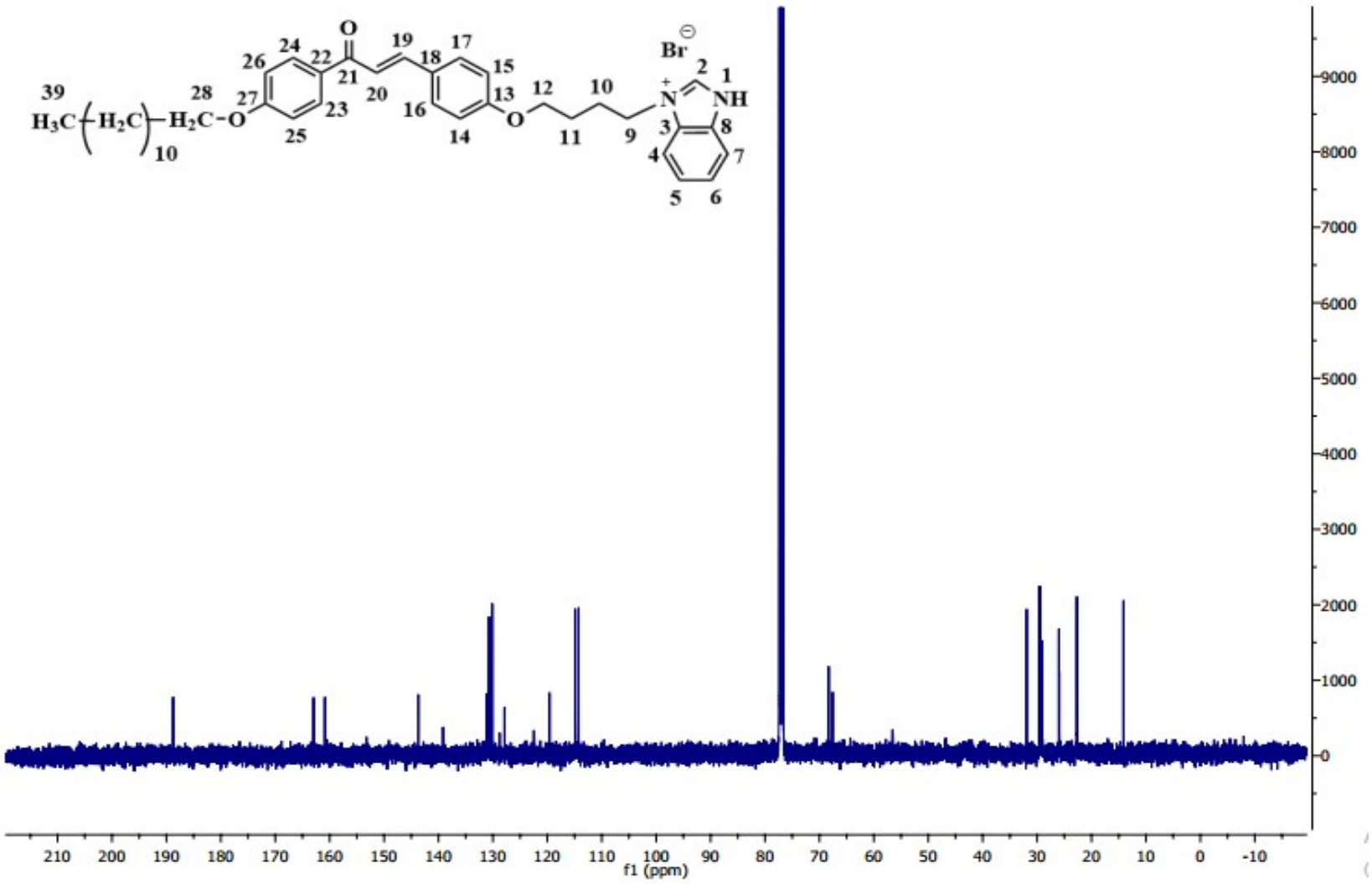

Figure 30: **^{13}C-NMR** spectrum of compound **6g**

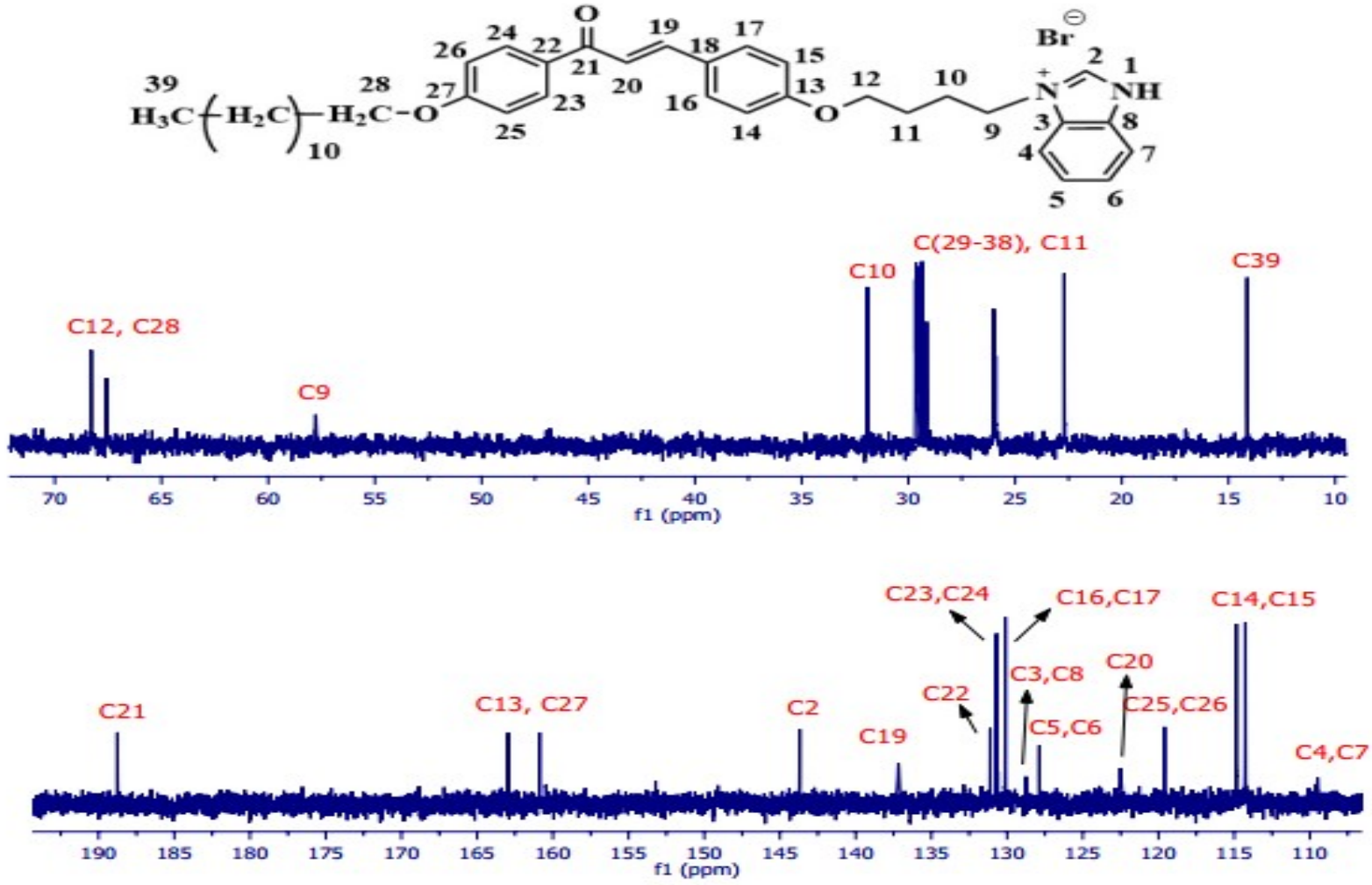

Figure 31: Expansion **^{13}C-NMR** spectrum of compound **6g.**

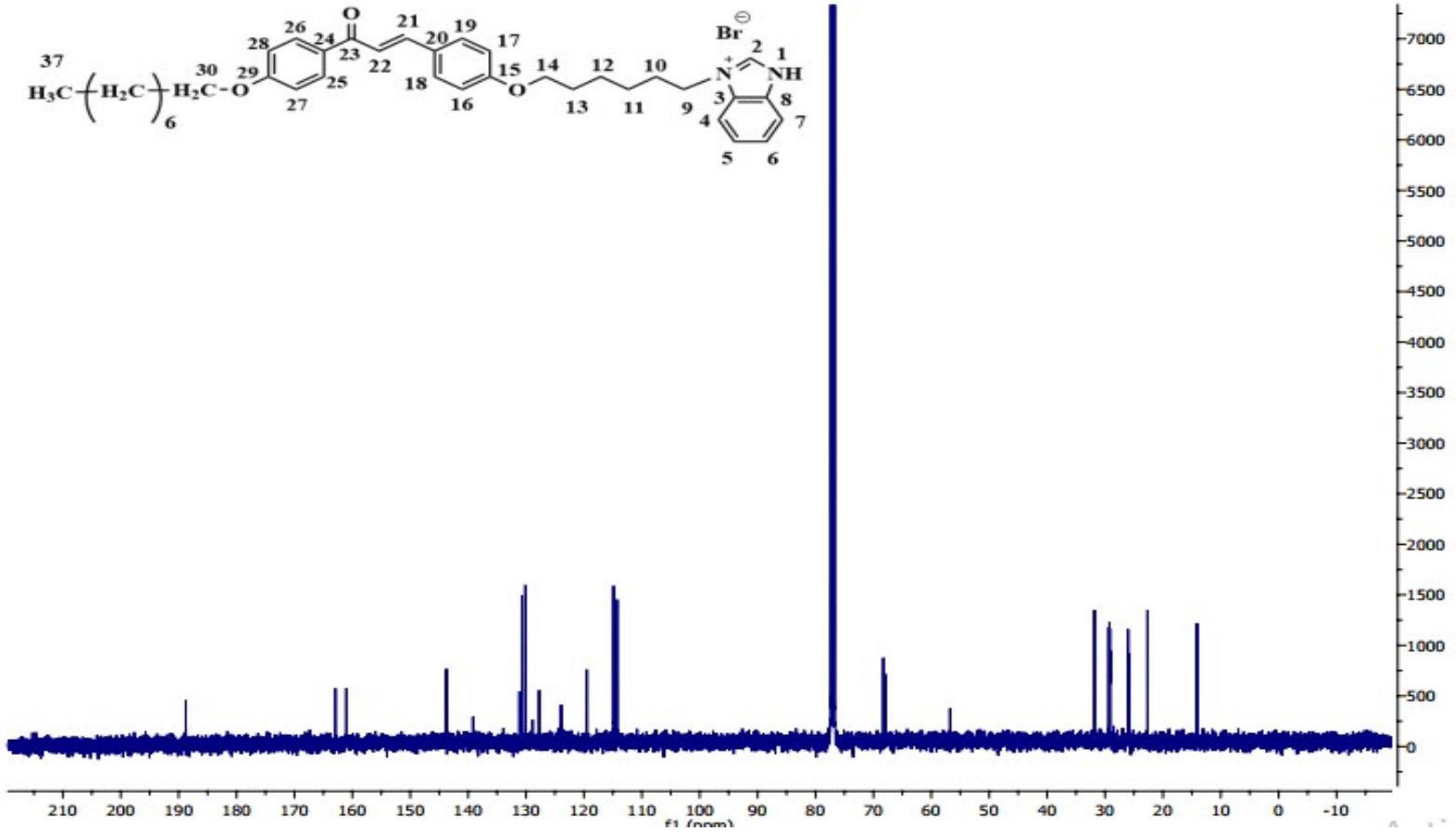

Figure 32: **^{13}C-NMR** spectrum of compound **7c.**

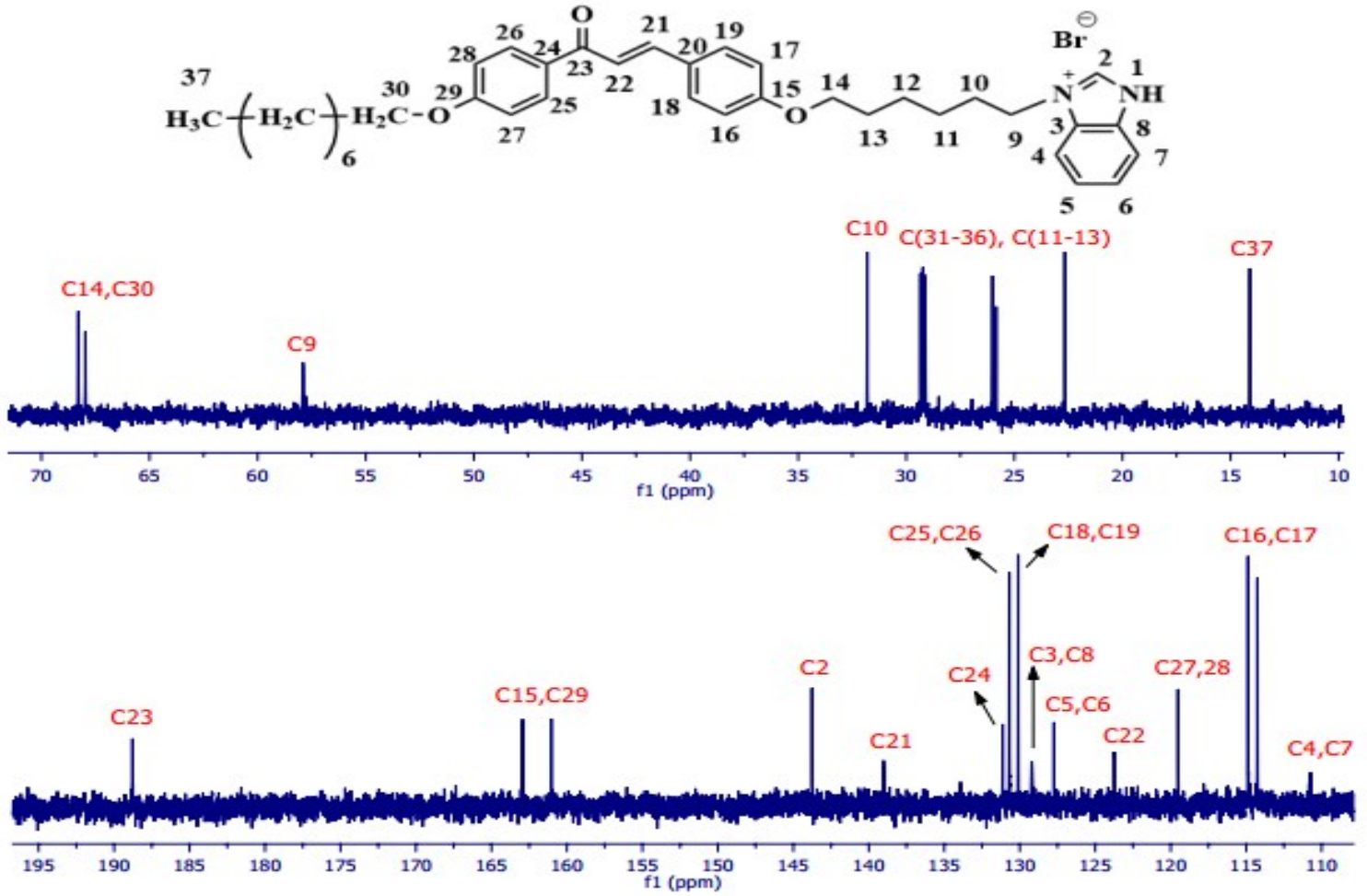

Figure 33: Expansion **^{13}C-NMR** spectrum of compound **7c.**

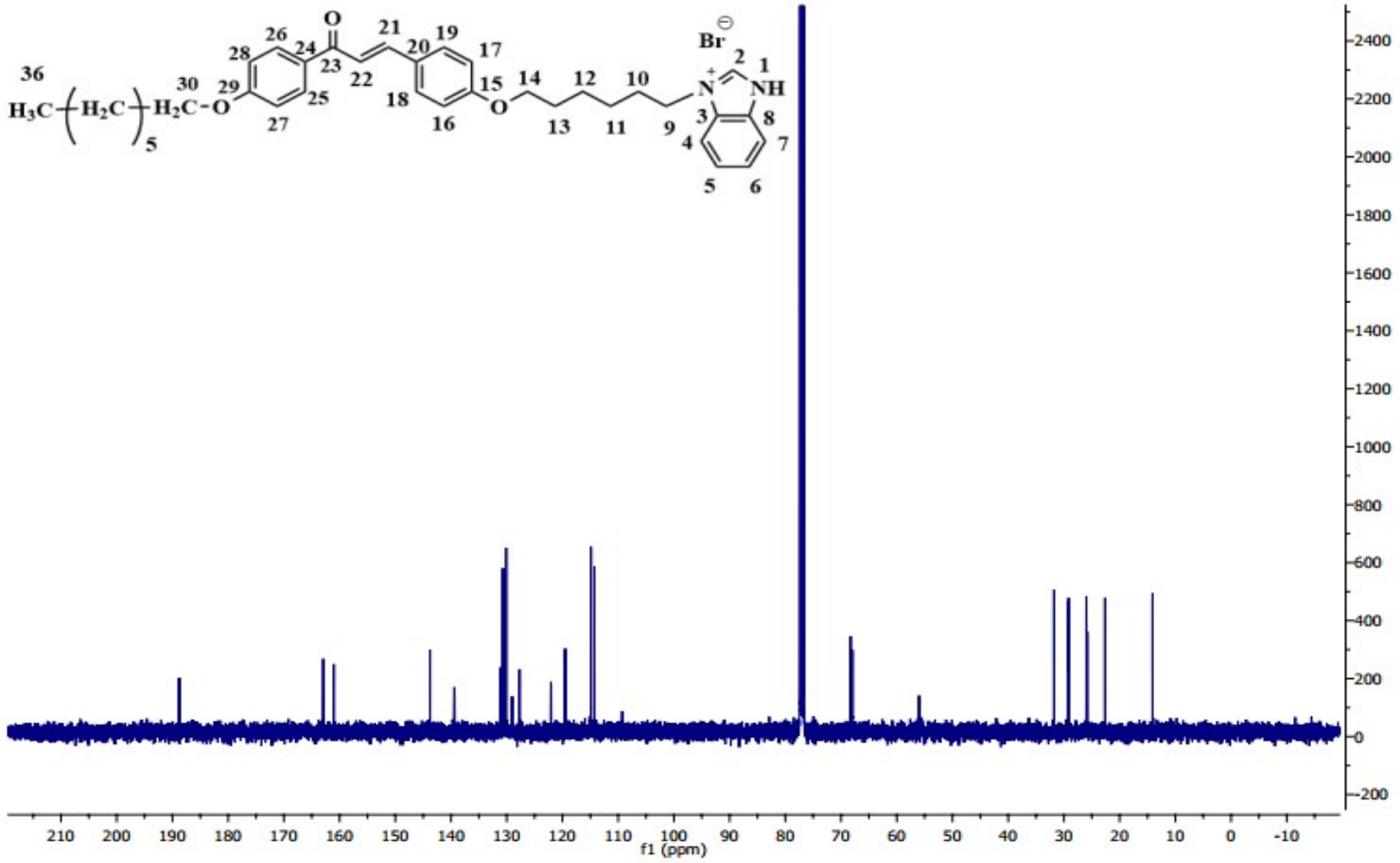

Figure 34: **^{13}C-NMR** spectrum of compound **7b**

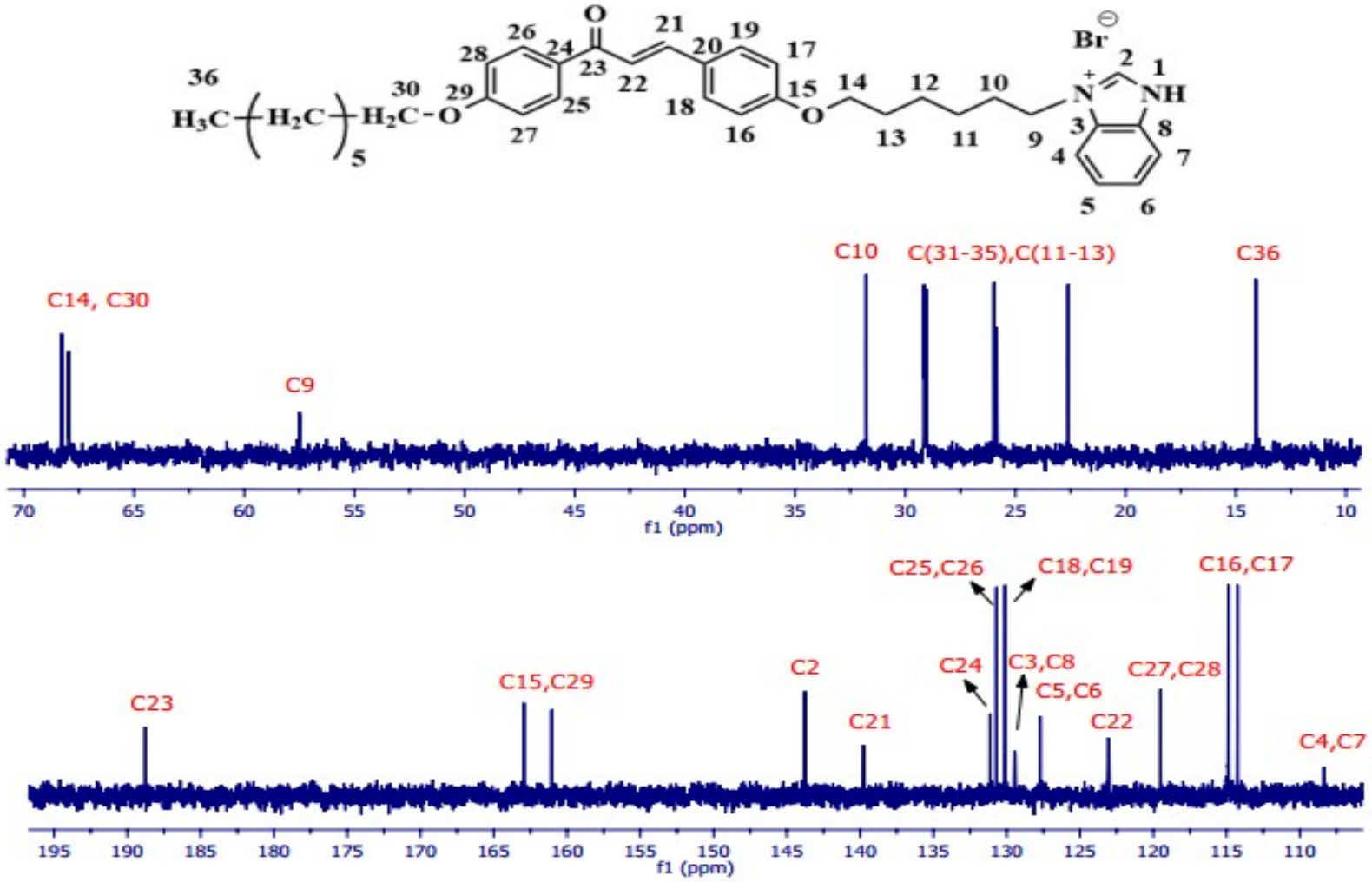

Figure 35: Expansion **^{13}C-NMR** spectrum of compound **7b**

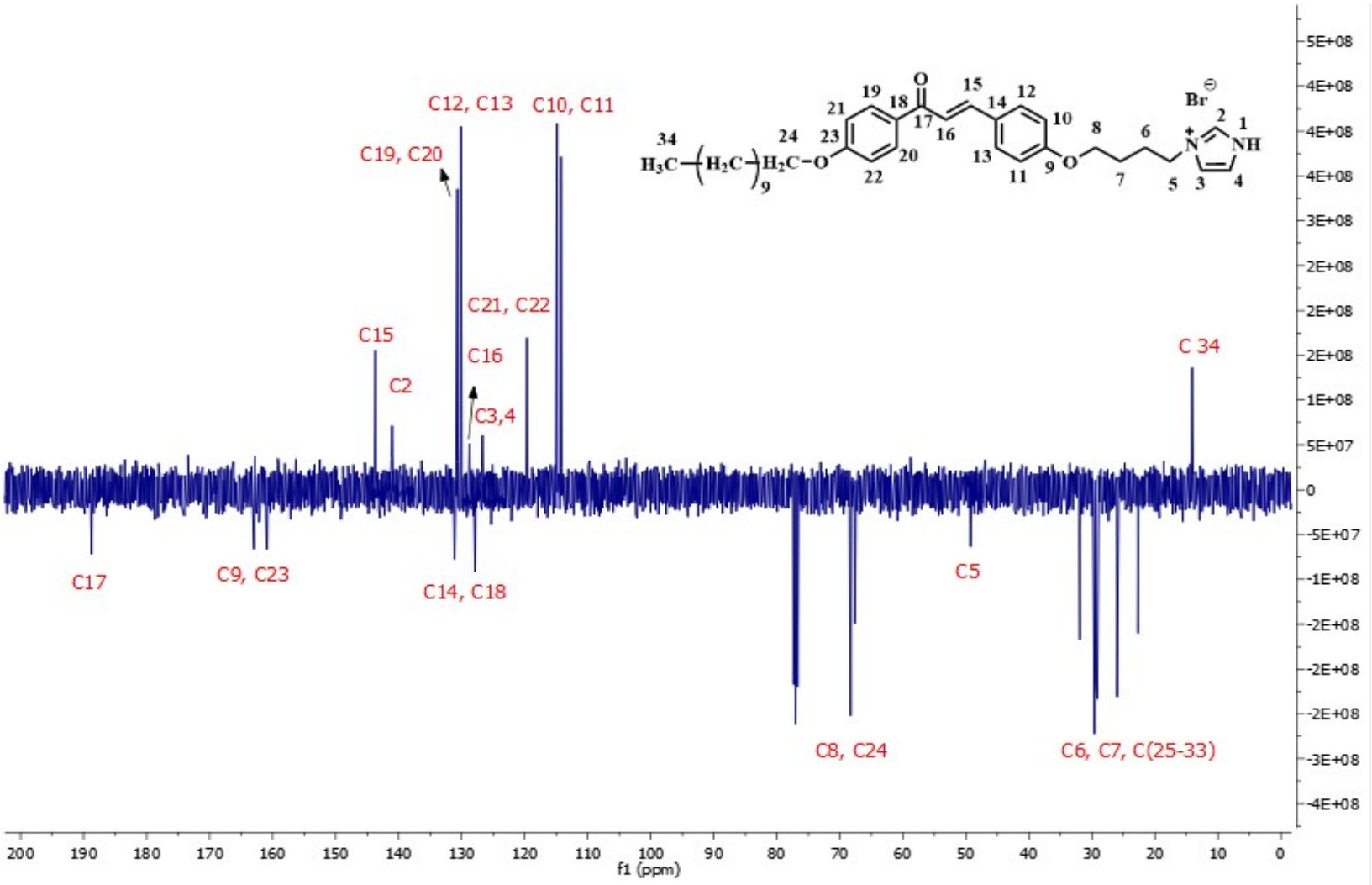

Figure 36: APT spectrum of compound **4f.**

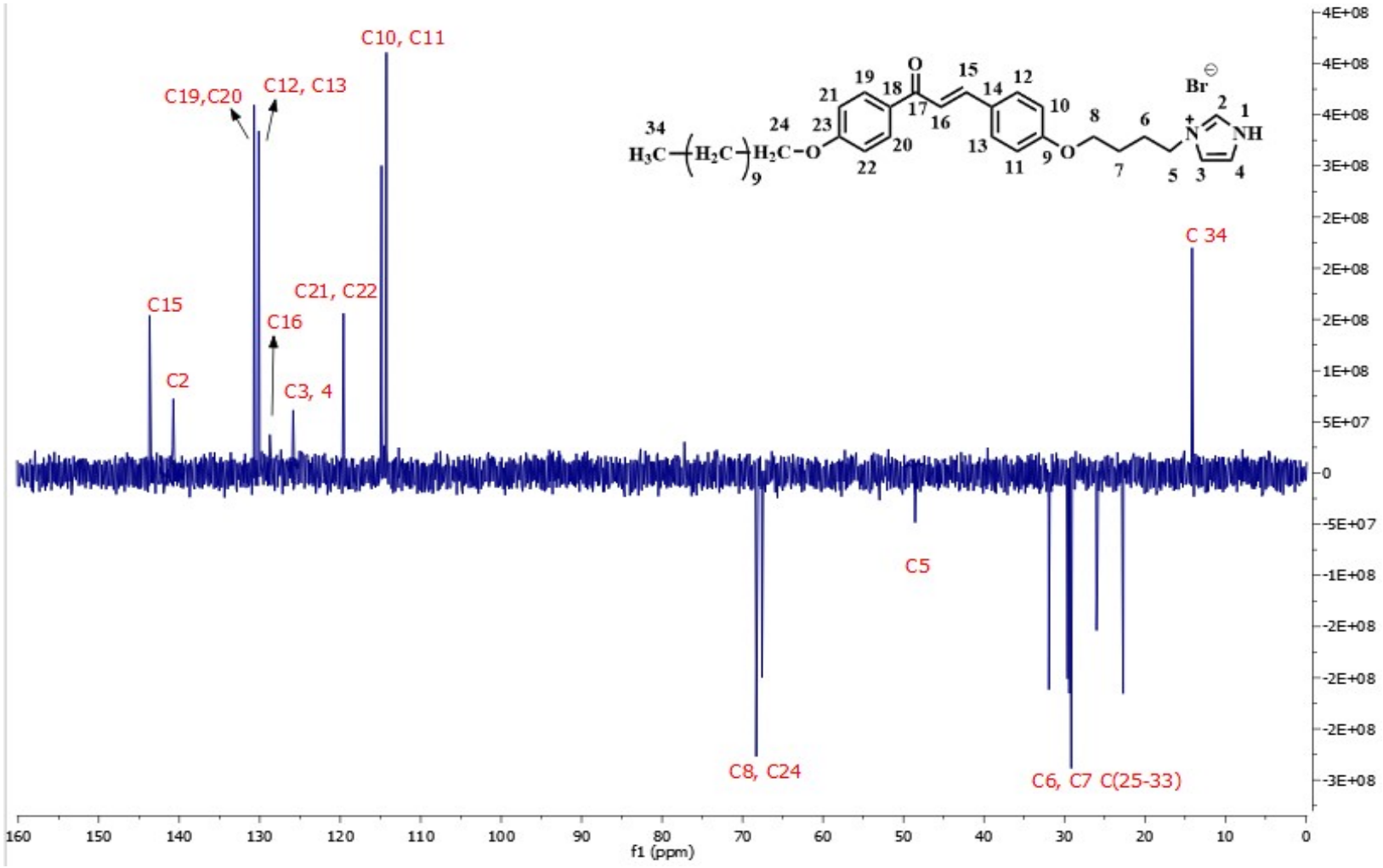

Figure 37: DEPT-135 spectrum of compound **4f.**

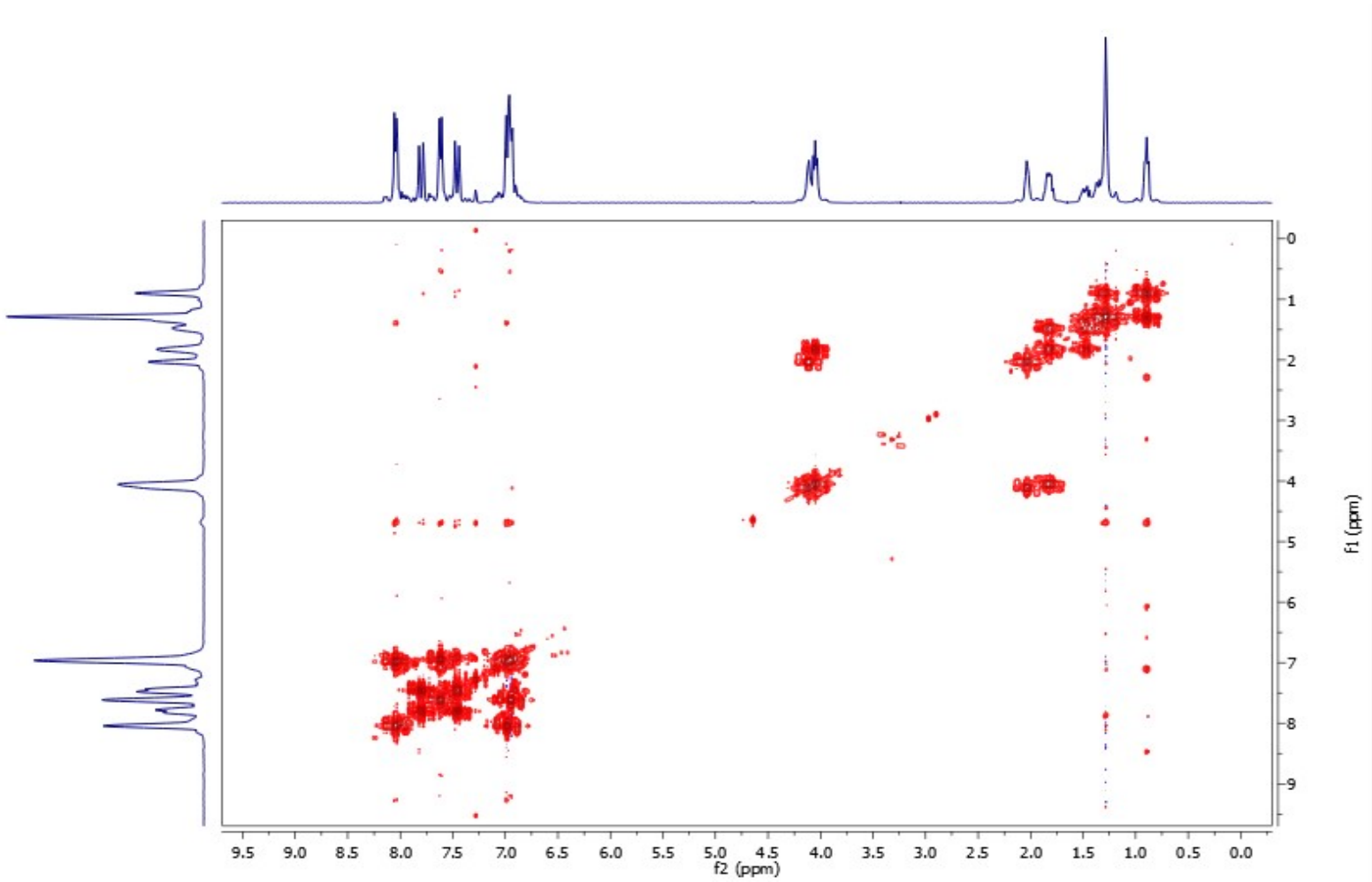

Figure 38: ^{1}H-^{1}H COSY spectrum of compound **4f.**

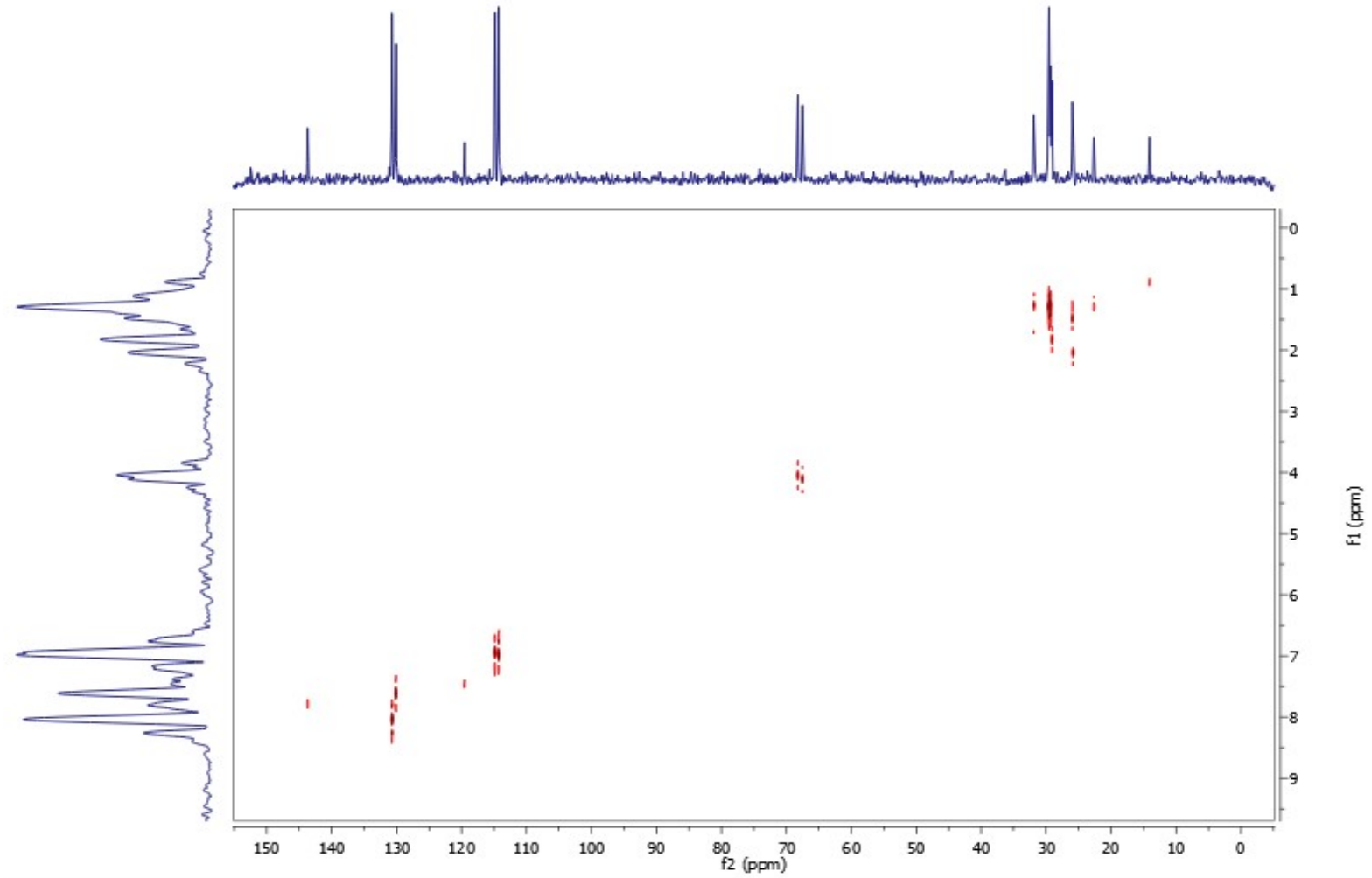

Figure 39: ^{1}H-^{13}C HMQC spectrum of compound **4f.**