

Supplementary Material

An efficient synthesis of 3-diethoxyphosphoryl-4-(1*H*-indol-3-yl)-3,4-dihydrocoumarins: a convenient approach to 3-methylene-4-(indol-3-yl)-3,4-dihydrocoumarins

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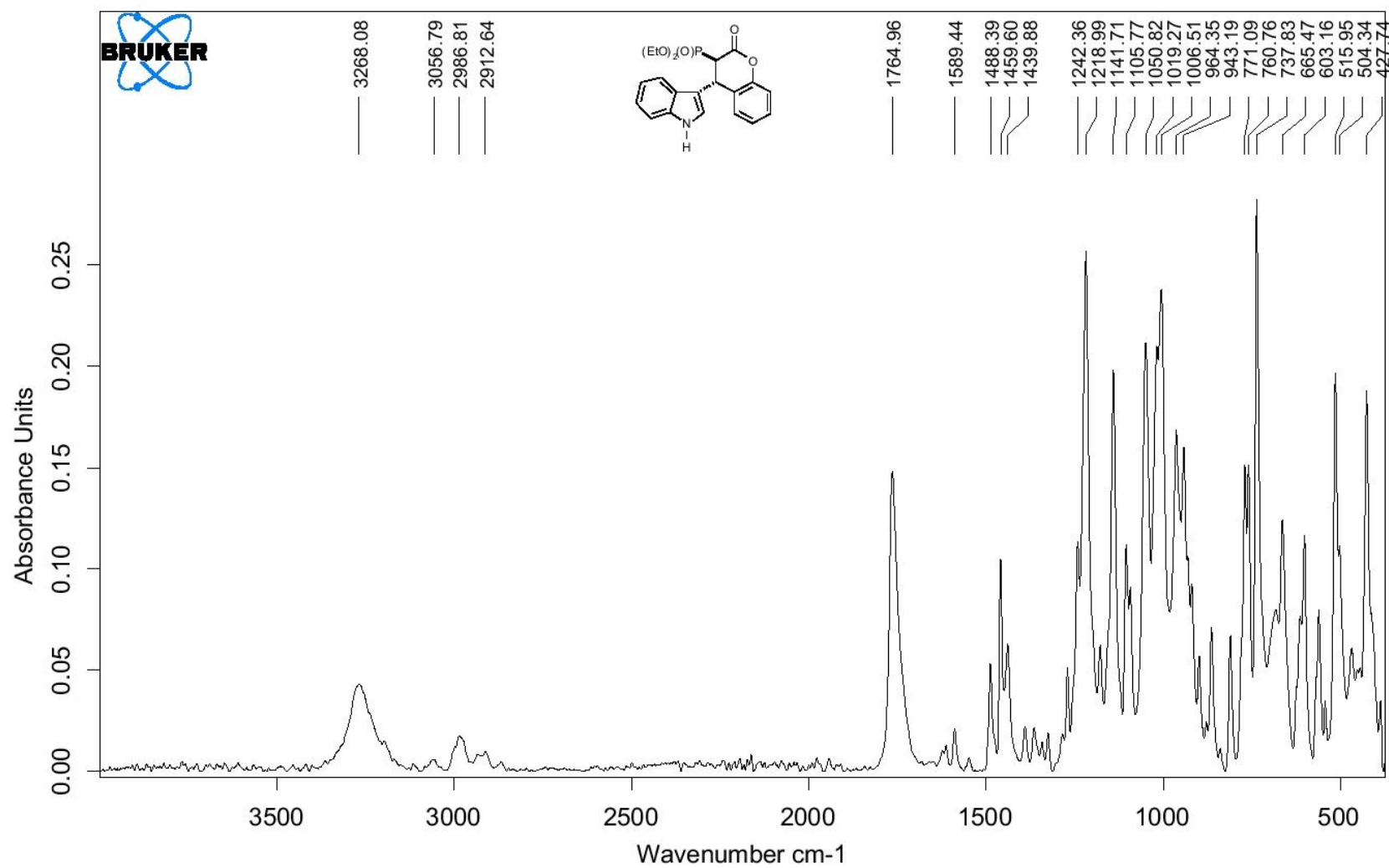
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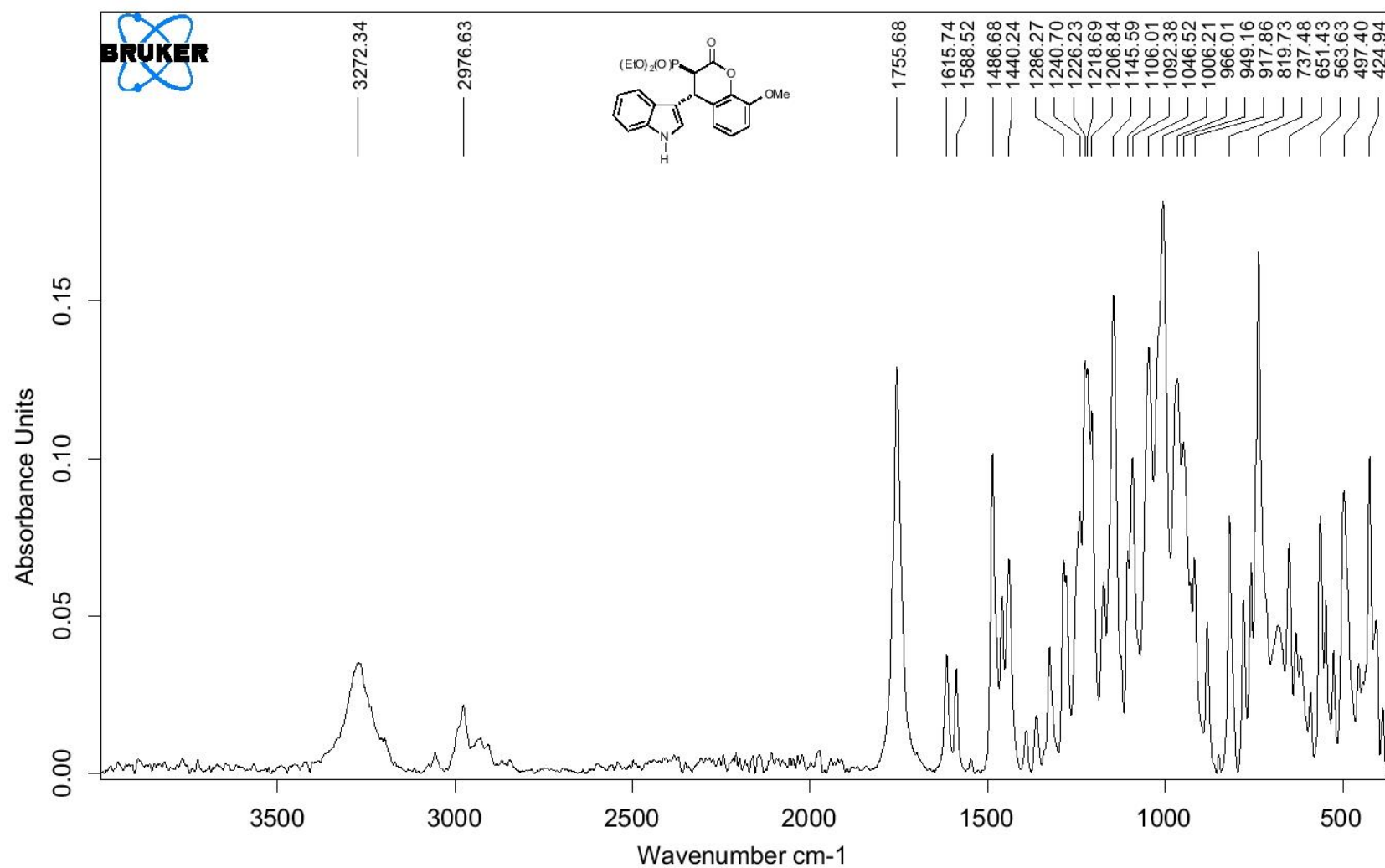
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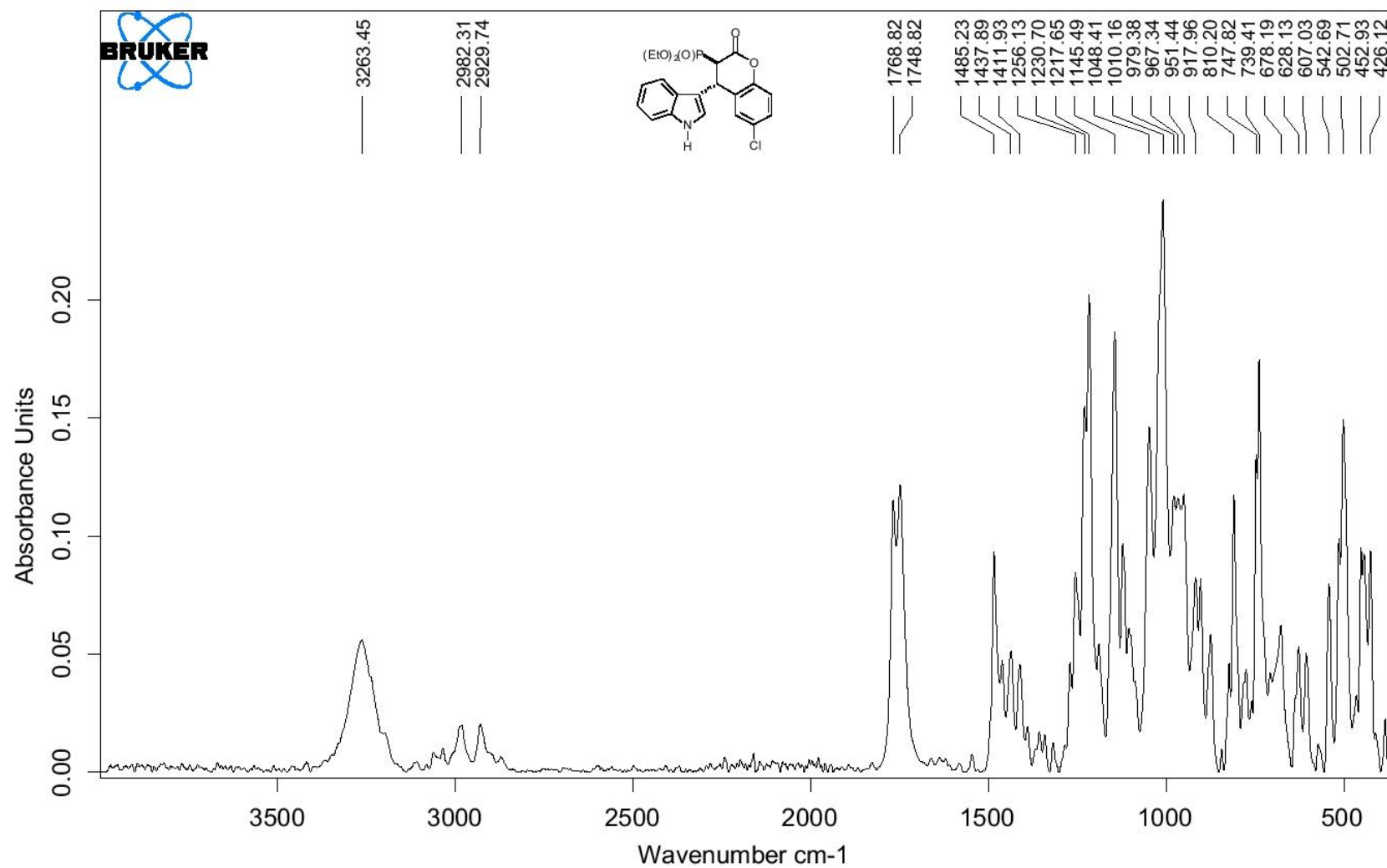
Experimental

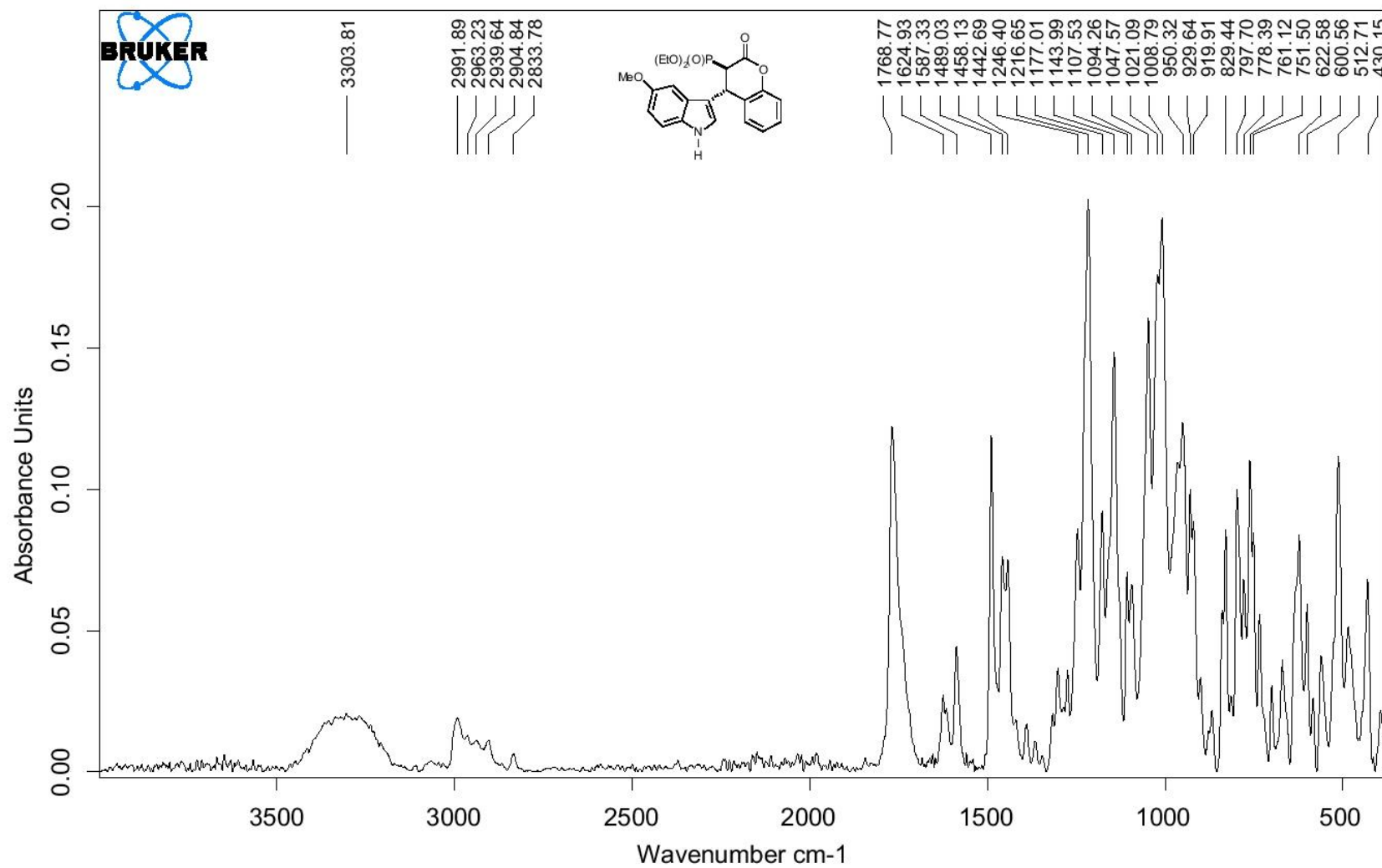
General. NMR spectra were recorded on a Bruker Avance II Plus spectrometer at 700.0 MHz (^1H), 283.3 MHz (^{31}P) and 176.0 MHz (^{13}C) respectively. Measurements were carried out in deuteriochloroform and acetone- d_6 (99.96% d, Aldrich) or acetone- d_6 at 25°C. Chemical shifts were calibrated relative to residual solvent peak (^1H NMR $\delta_{\text{CHCl}_3} = 7.26$ ppm, $\delta_{\text{acetone-}\text{d}_5} = 2.05$ ppm, ^{13}C NMR $\delta_{\text{CDCl}_3} = 77.16$ ppm and $\delta_{\text{CH}_3 \text{ acetone-}\text{d}_6} = 29.84$ ppm) and 85% H_3PO_4 (^{31}P NMR). Chemical shifts are reported in ppm (δ), J values are given in Hz. IR spectra were measured on Bruker Alpha FT-IR ATR spectrometer. Elemental analyses were performed on Perkin-Elmer PE 2400 analyser. Melting points were determined in open capillaries on Büchi SMP 30 apparatus and were uncorrected. Flash chromatography was carried out using silica gel 60 (230-400 mesh). Thin layer chromatography was carried out on commercially available pre-coated plates (Fluka Silica gel on TLC plates).

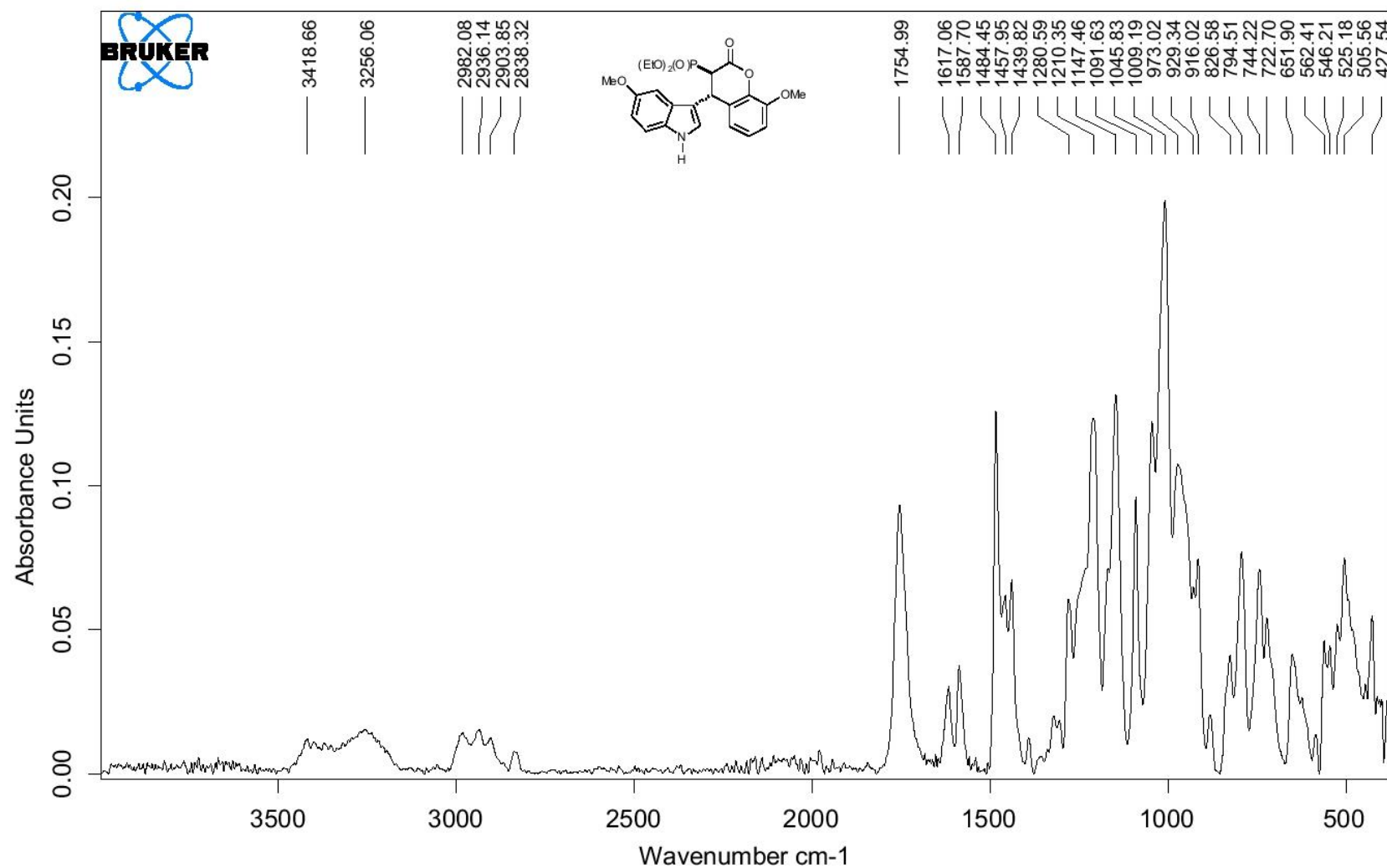
IR spectra

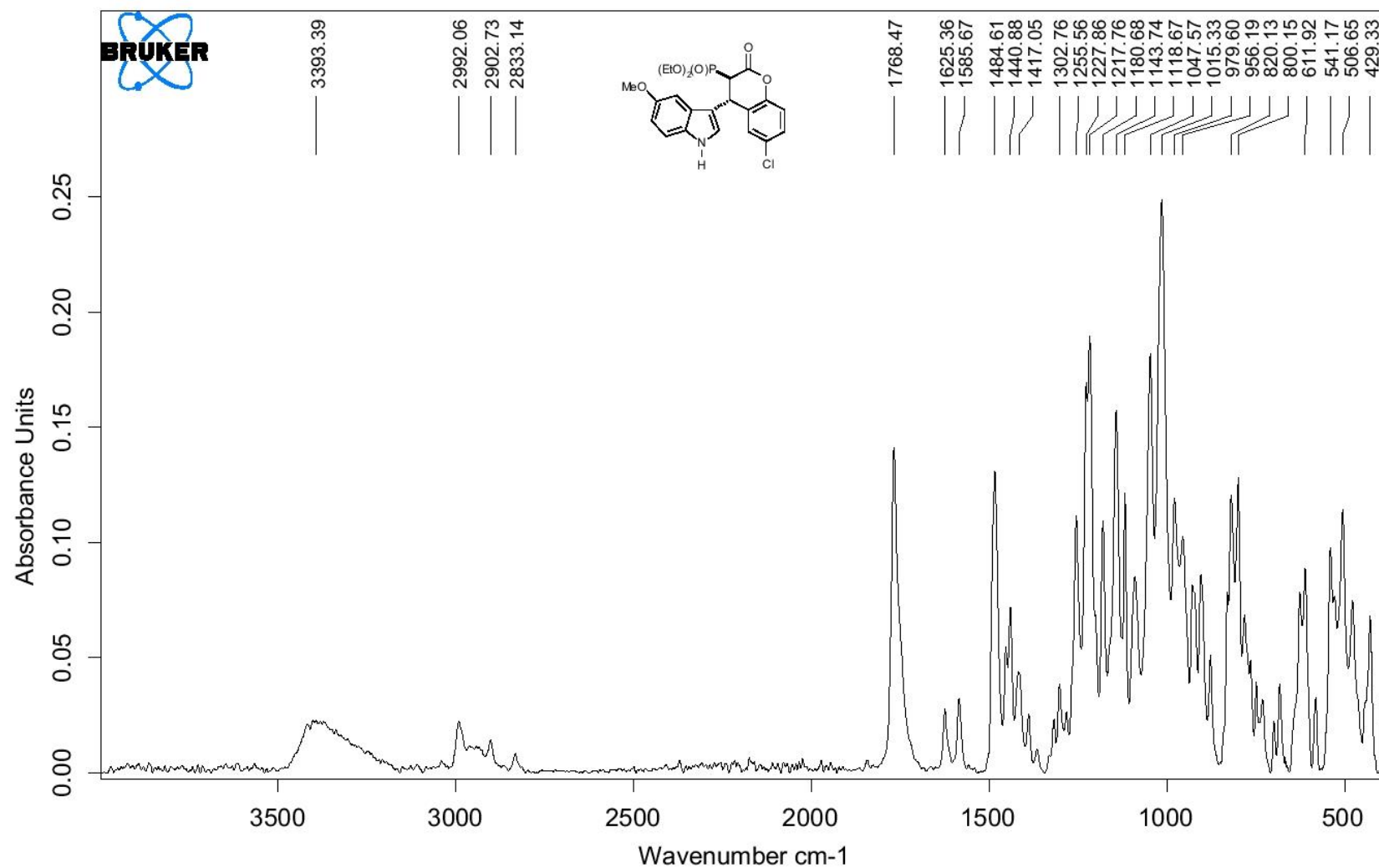
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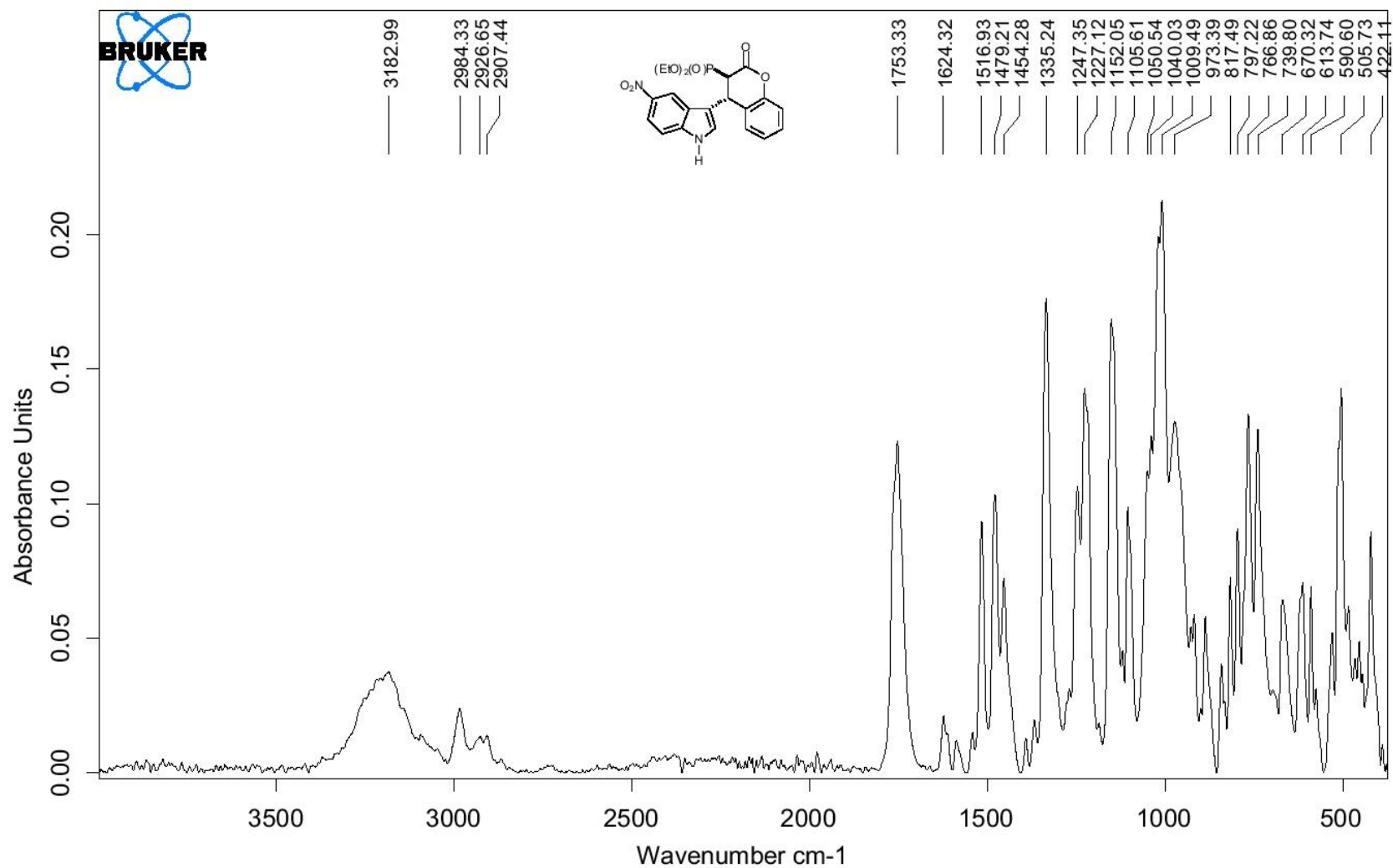
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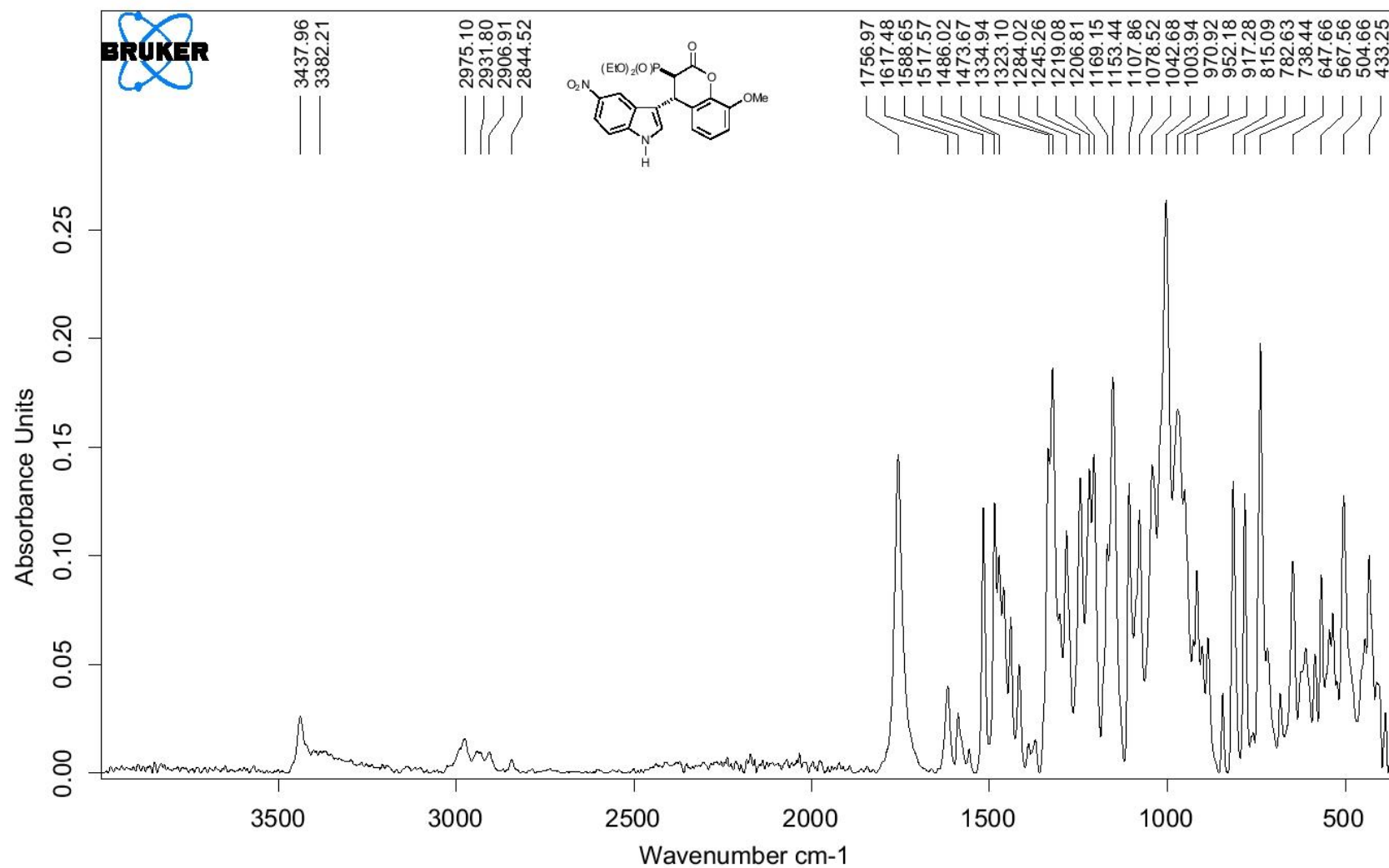
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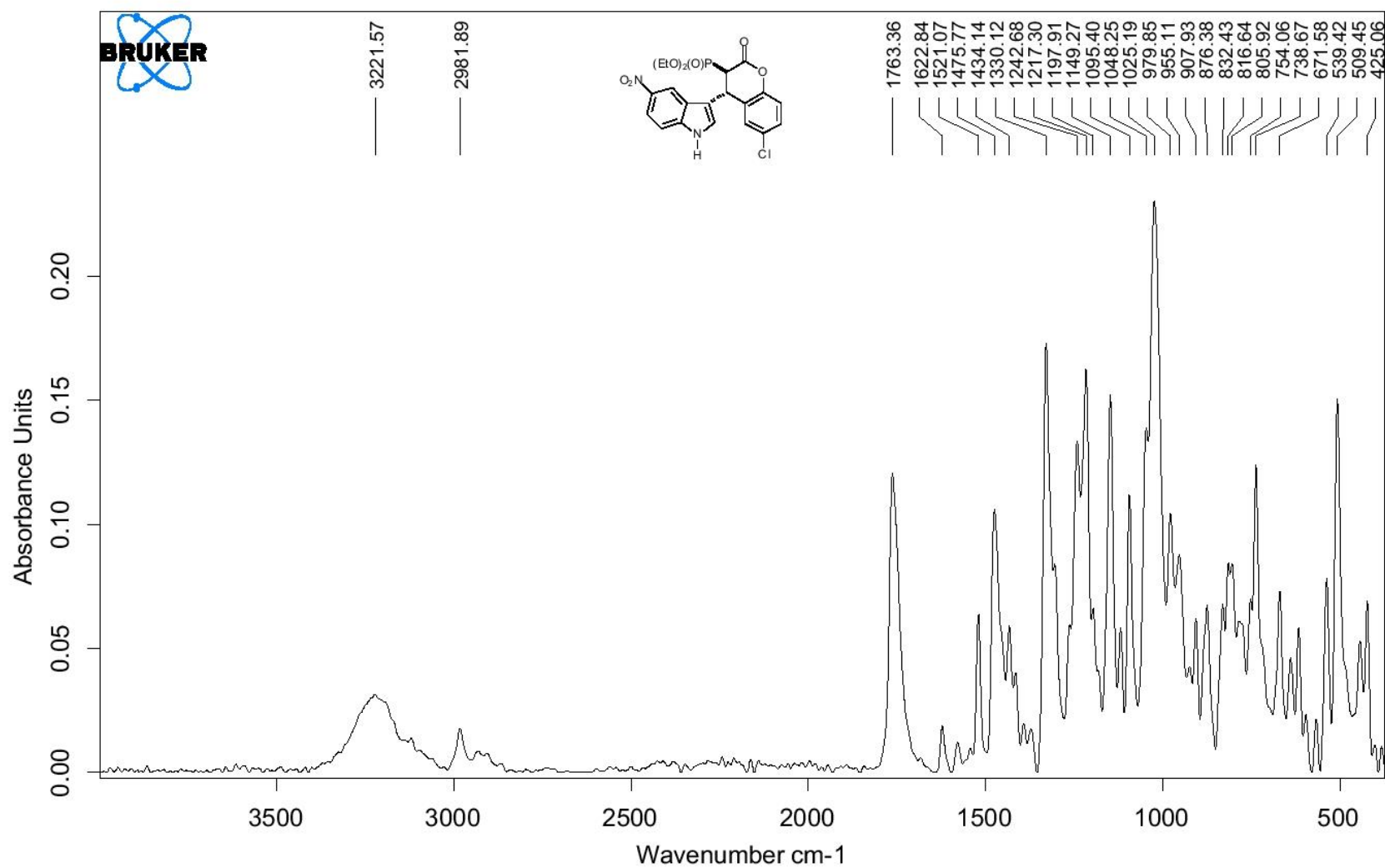
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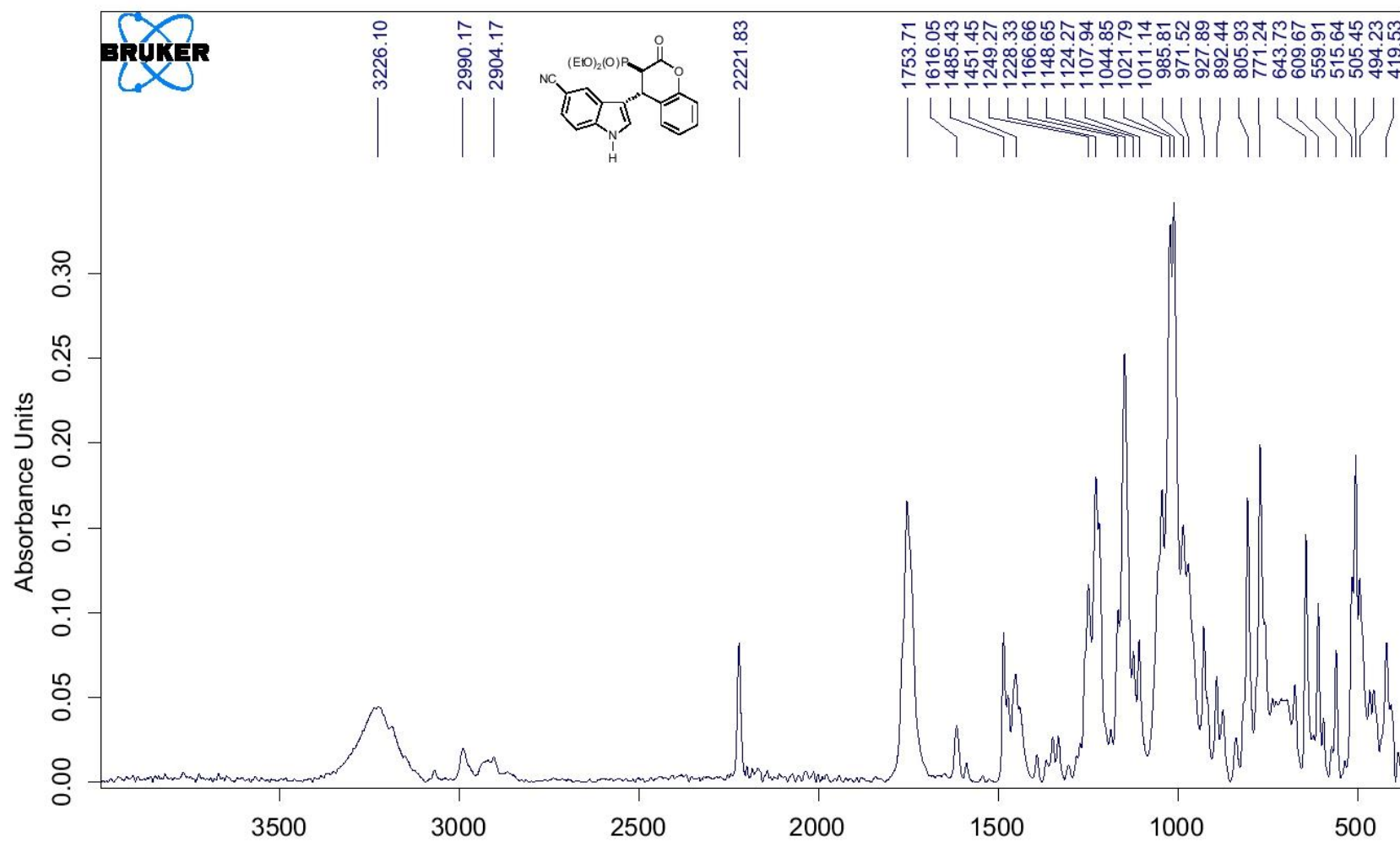
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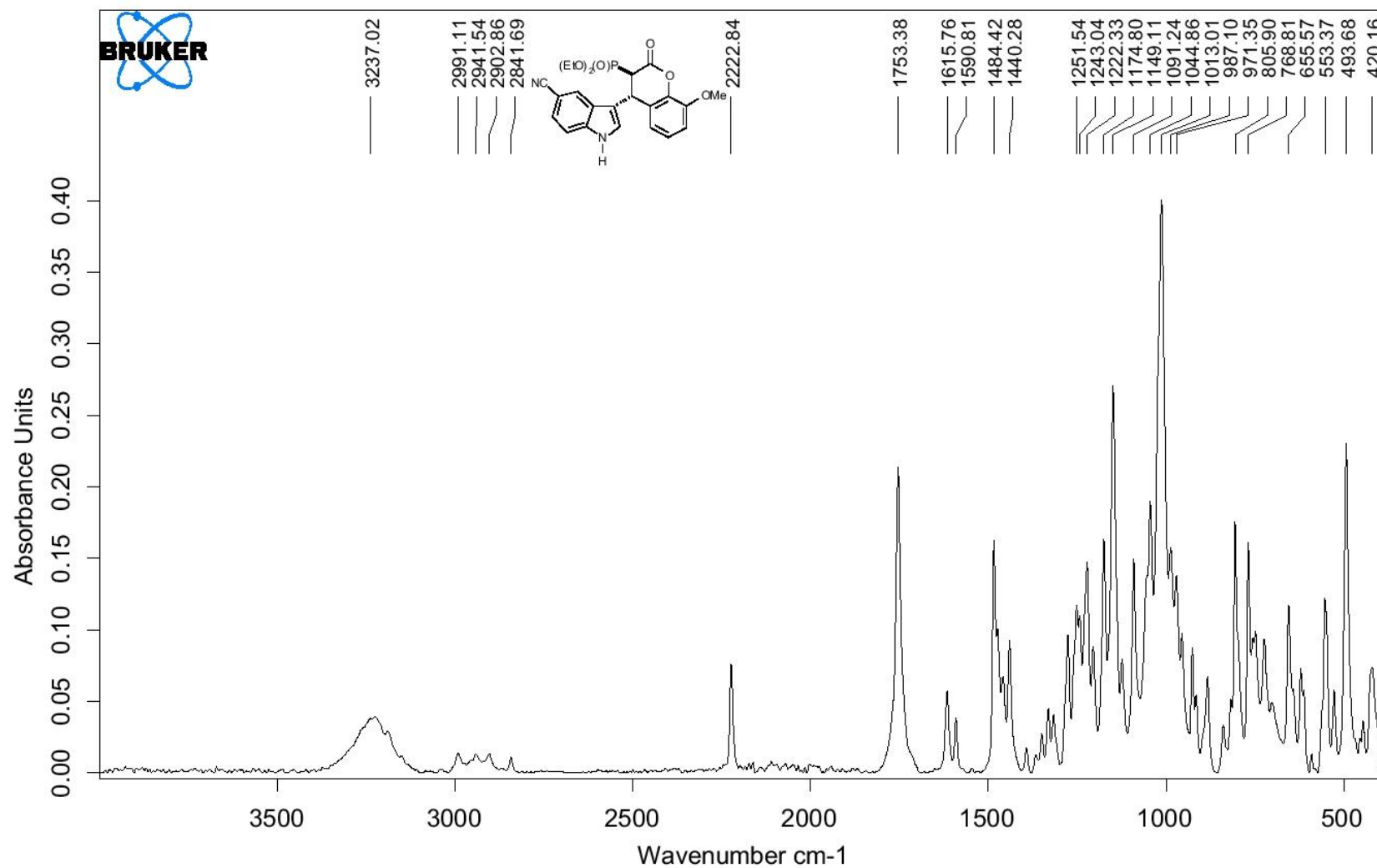
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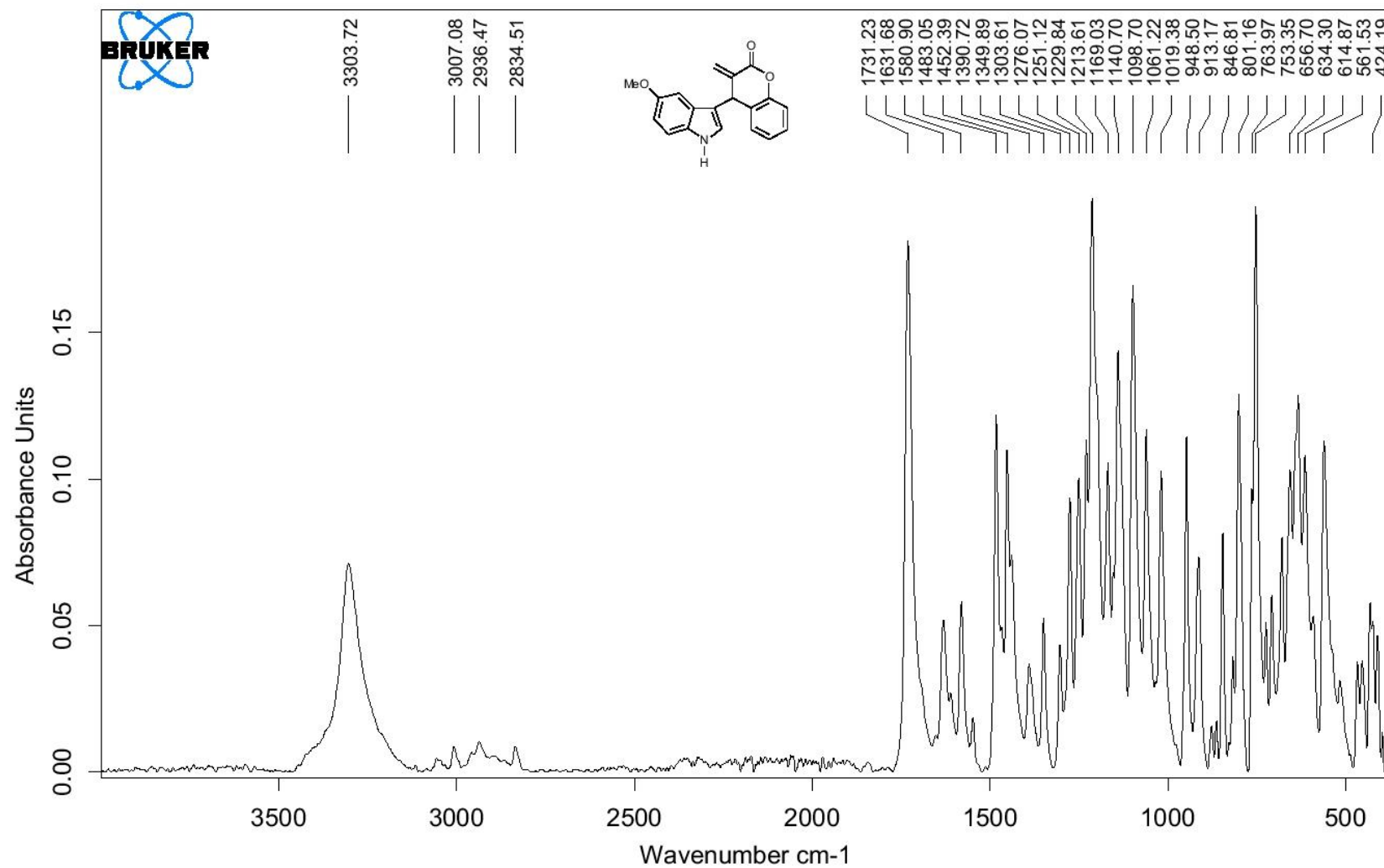
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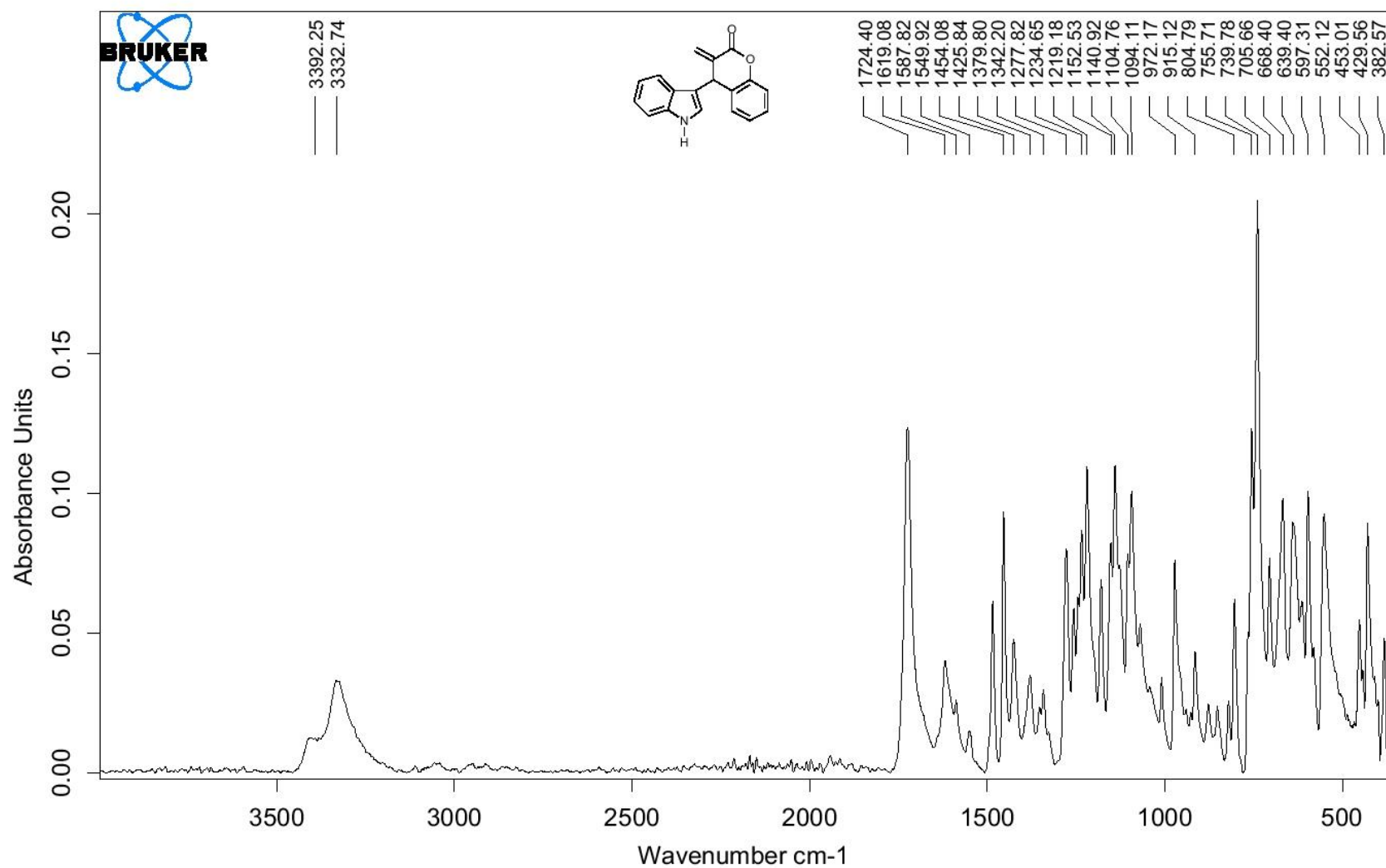
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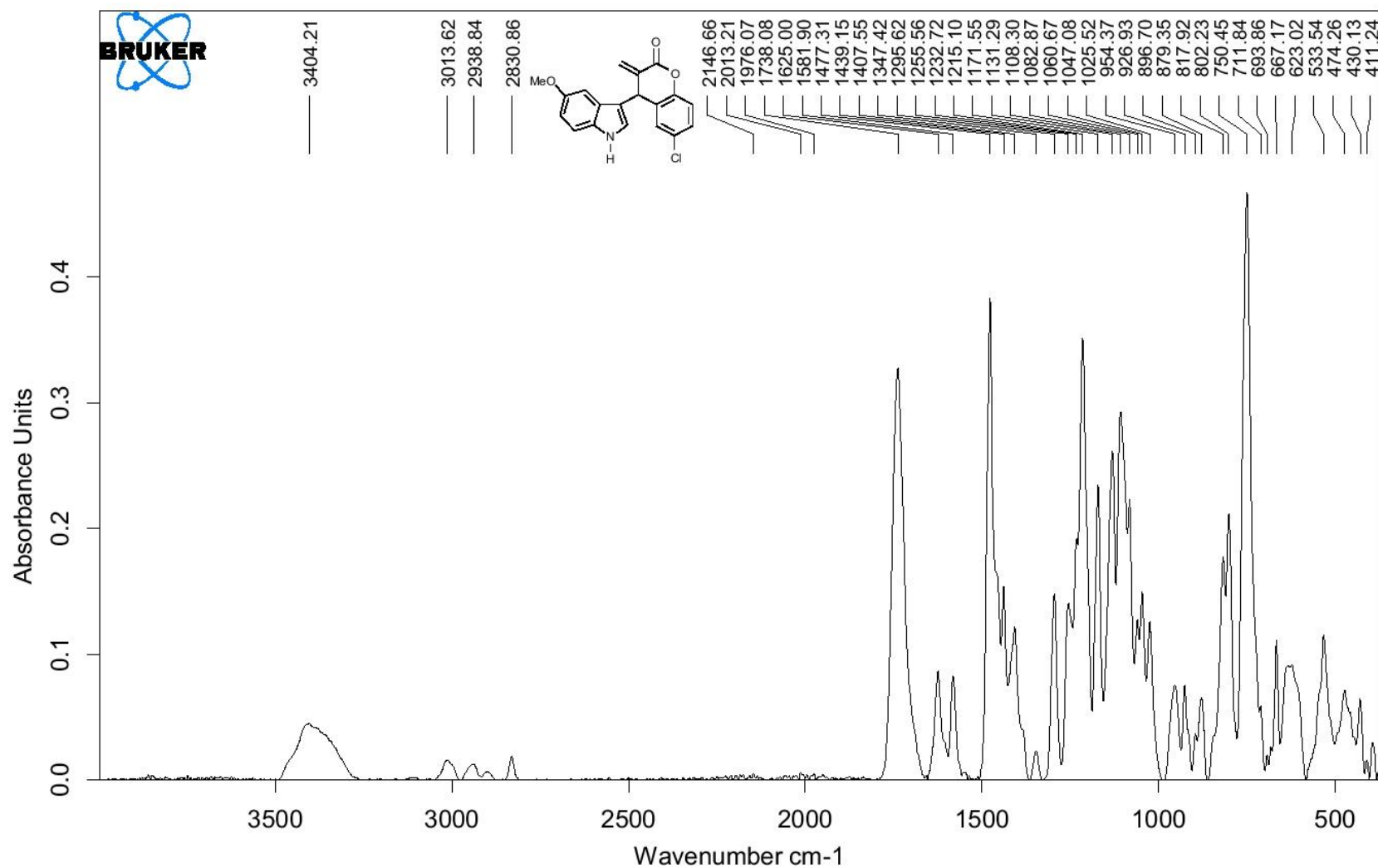
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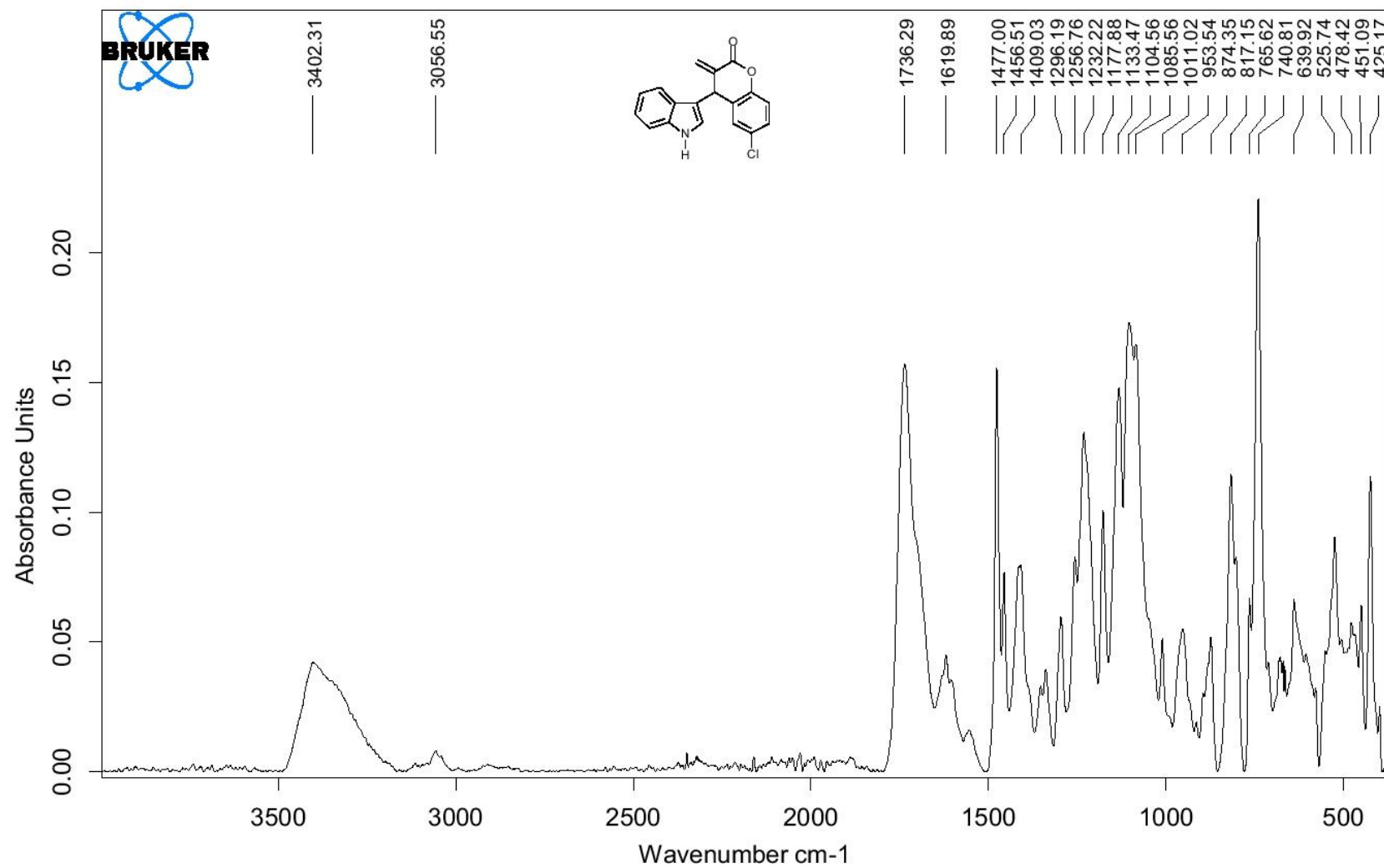
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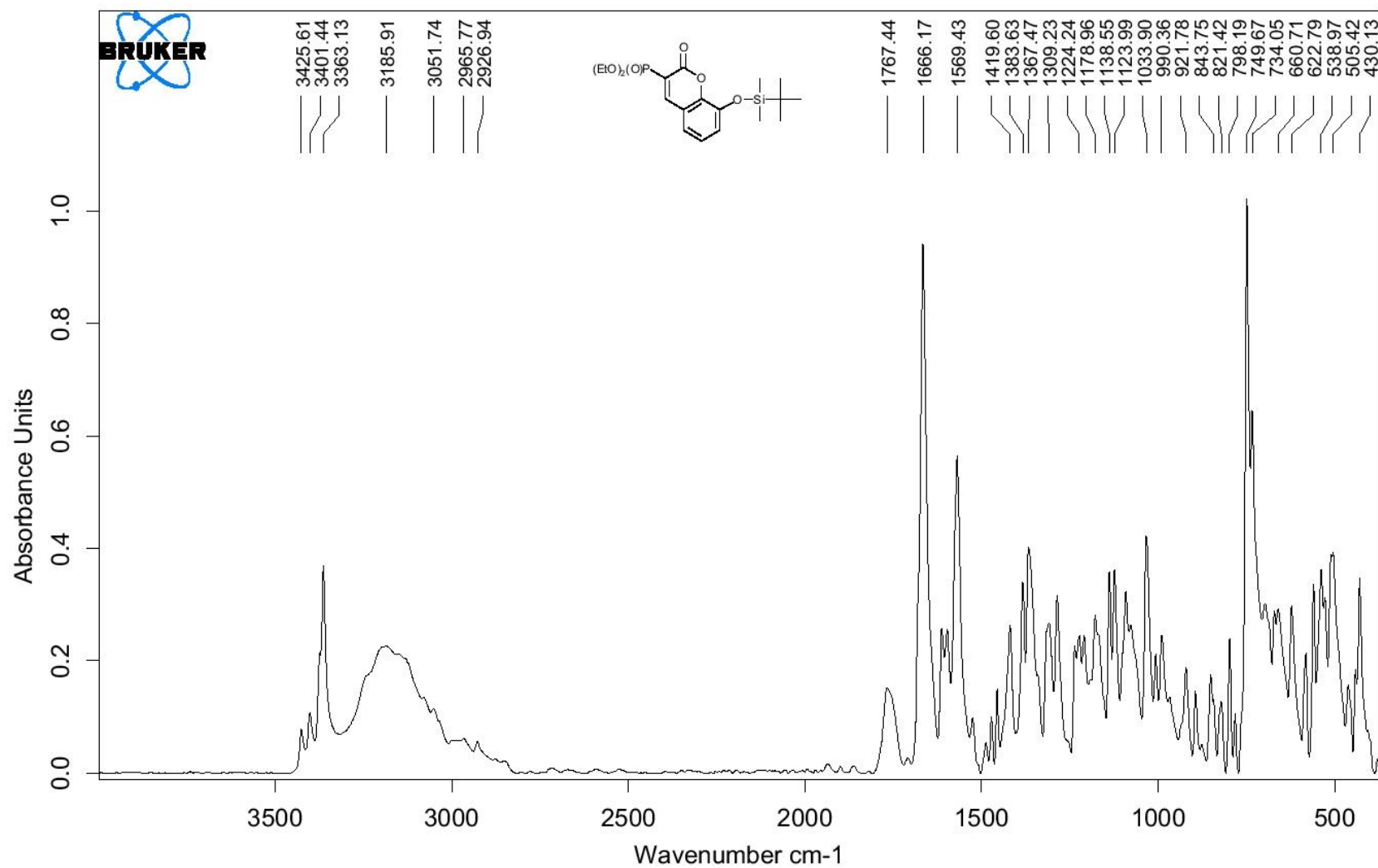
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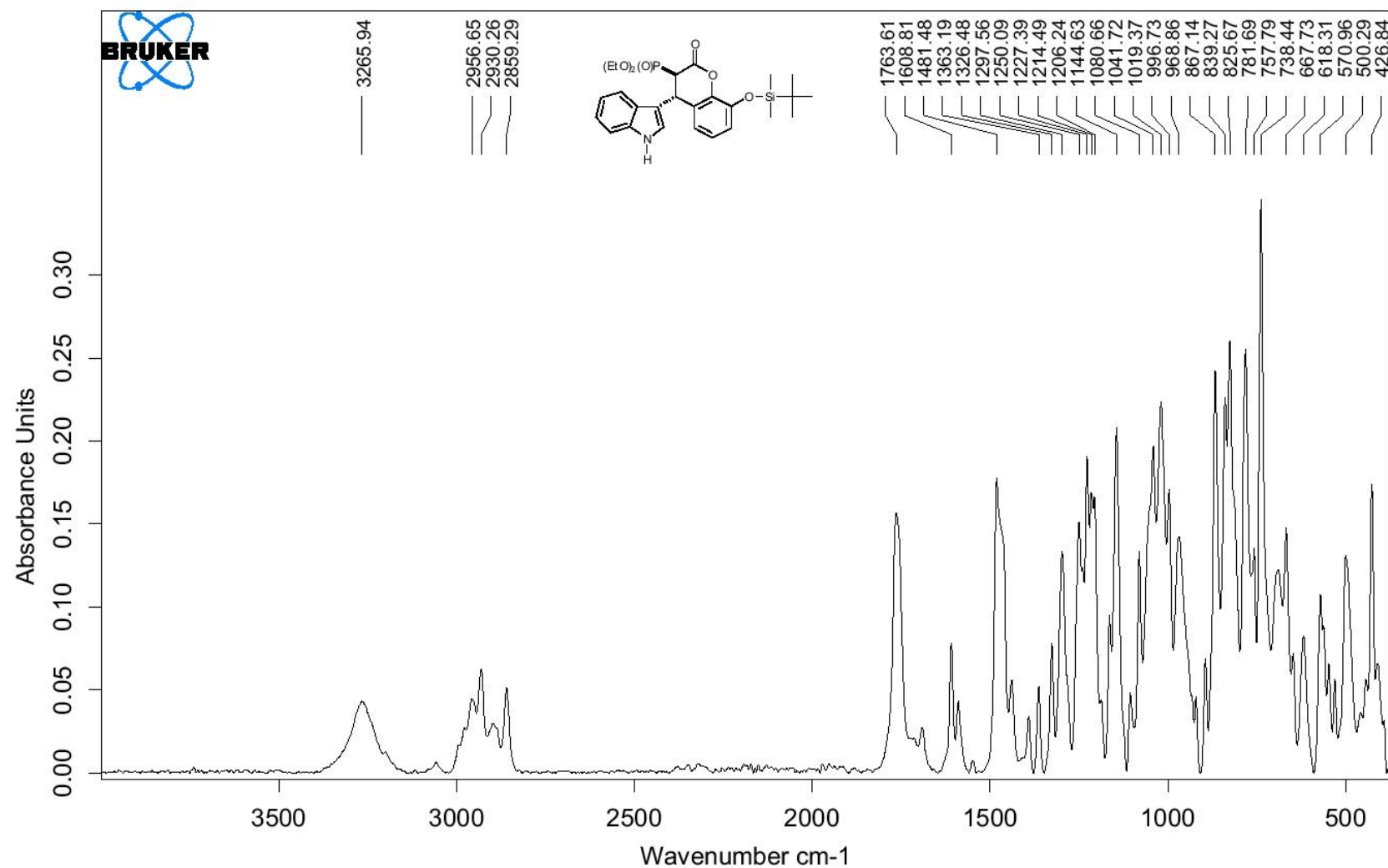
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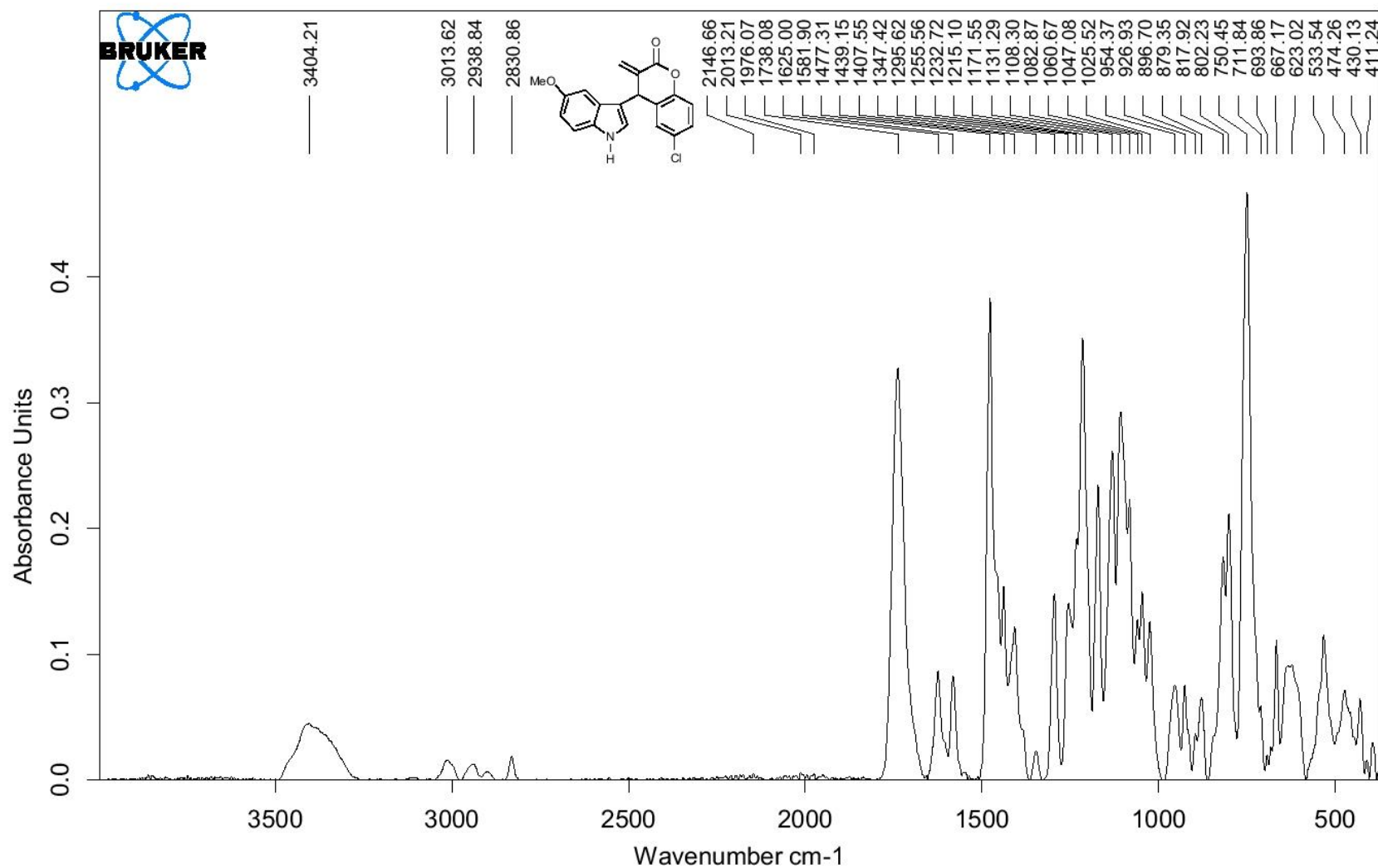
4-(1*H*-Indol-3-yl)-3-methylenechroman-2-one (4a)

4-(1*H*-Indol-3-yl)-8-methoxy-3-methylenechroman-2-one (4b)

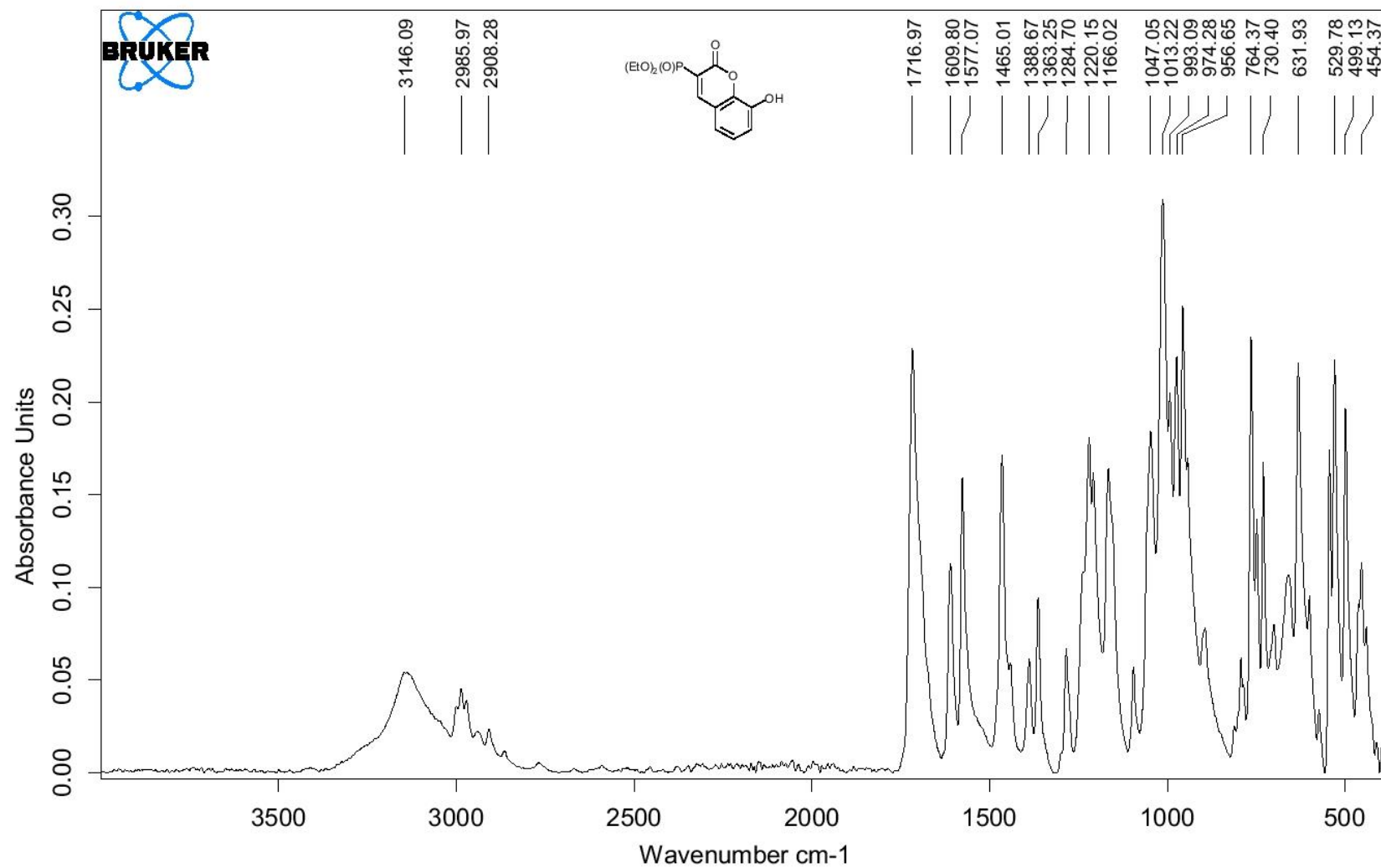
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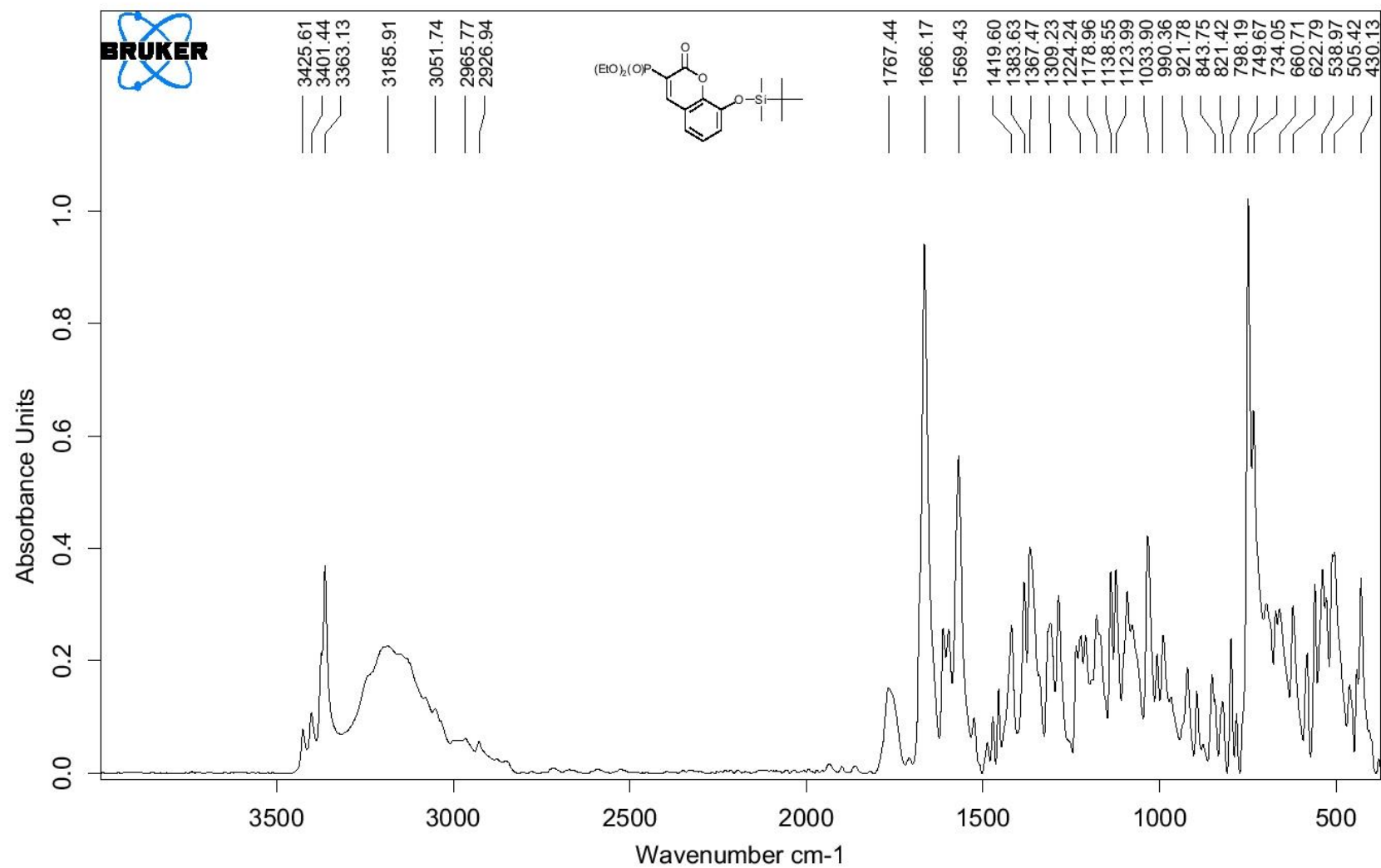
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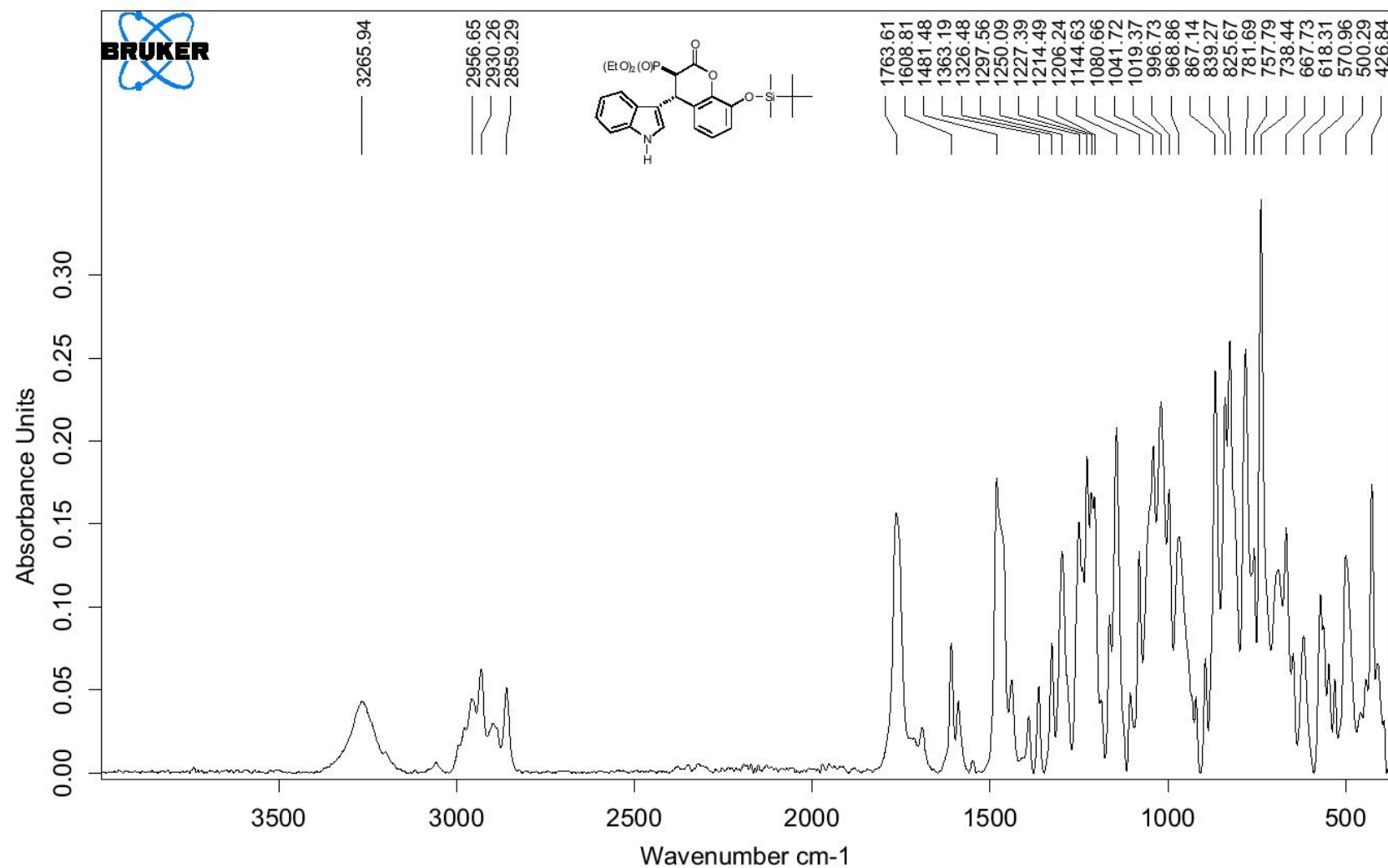
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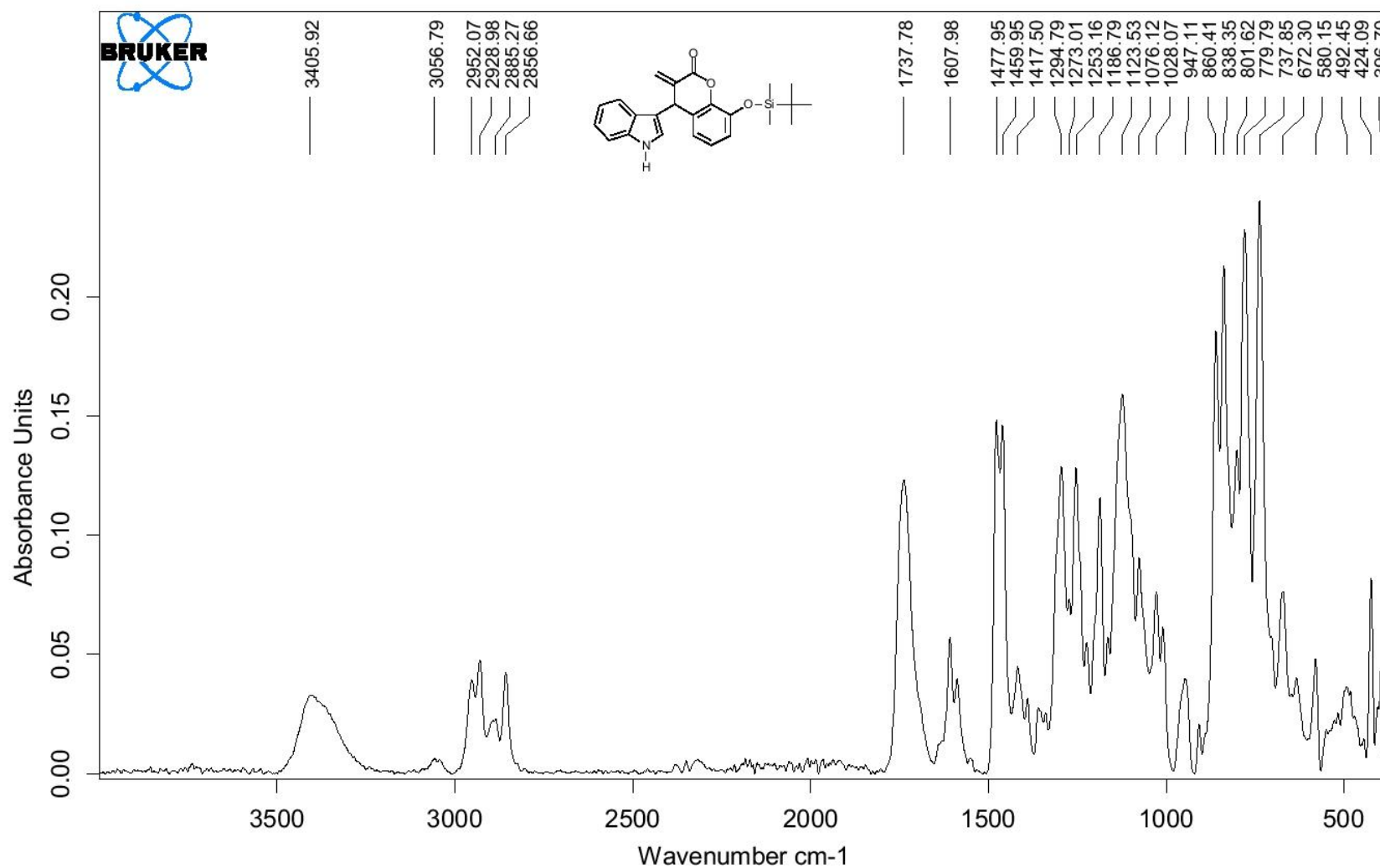
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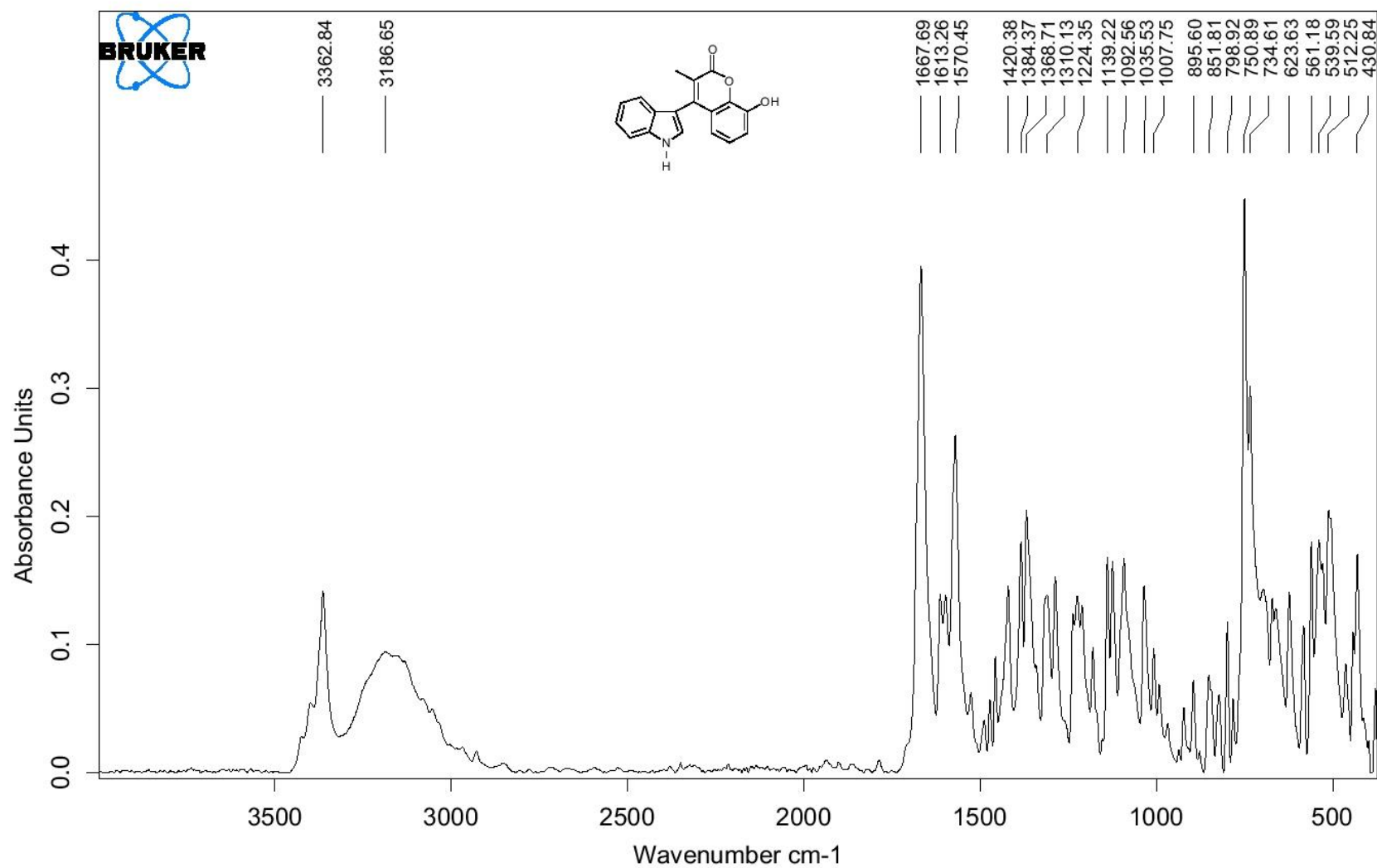
Diethyl (8-hydroxy-2-oxo-2H-chromen-3-yl)phosphonate (7)



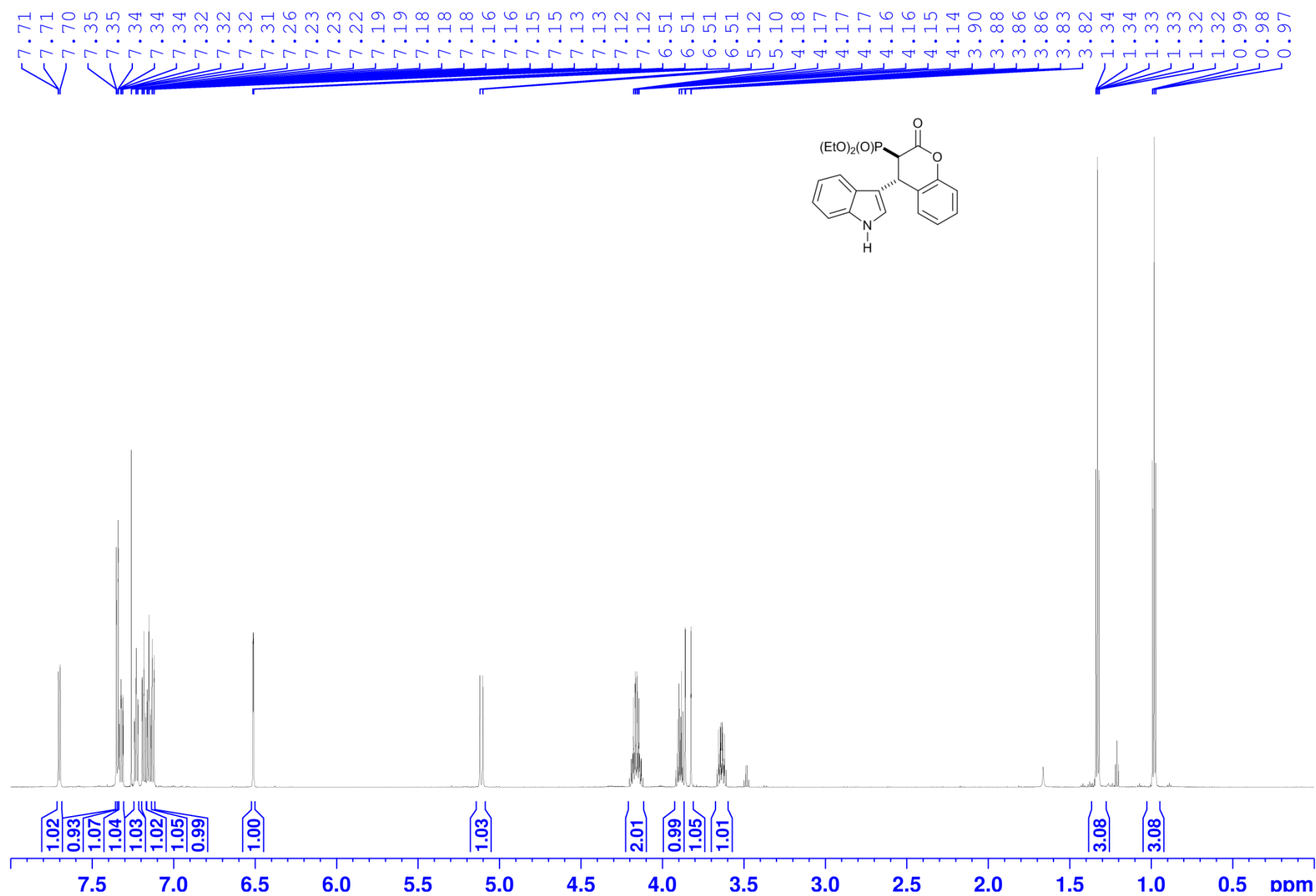
Diethyl (8-((*tert*-butyldimethylsilyl)oxy)-2-oxo-2*H*-chromen-3-yl)phosphonate (8)

Diethyl ((3*R**,4*S**)-8-((*tert*-butyldimethylsilyl)oxy)-4-(1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (9)

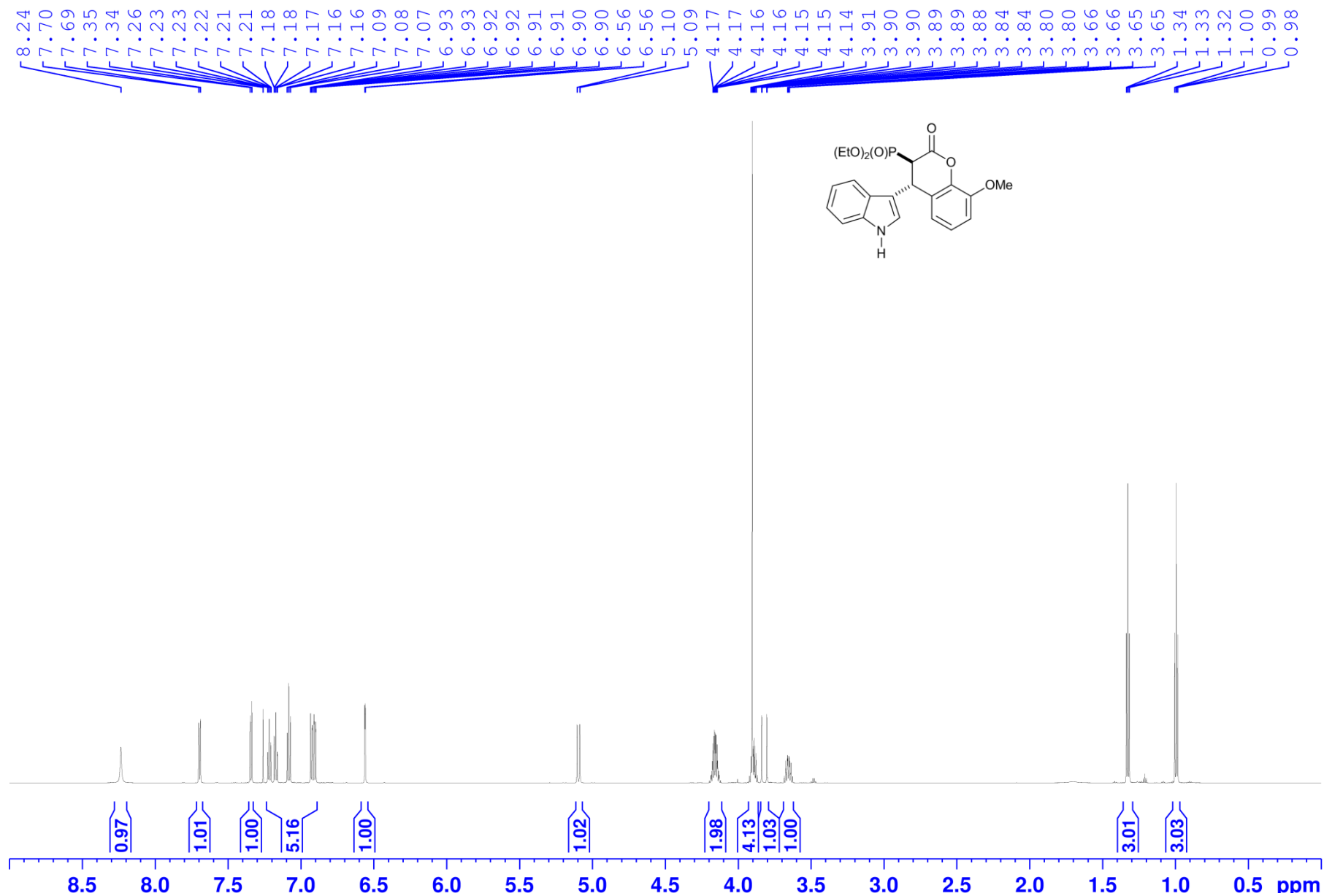
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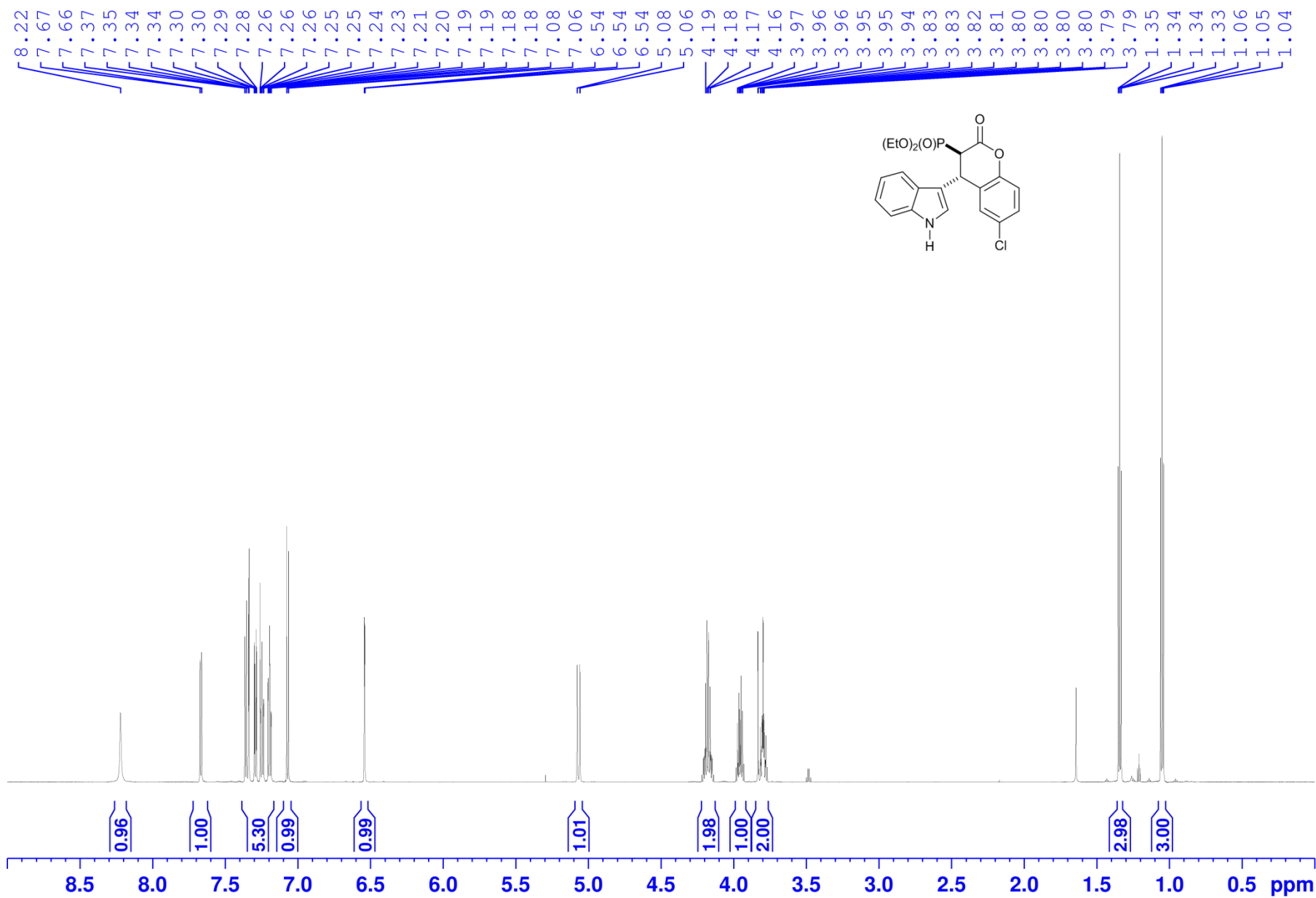
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^1H NMR spectra

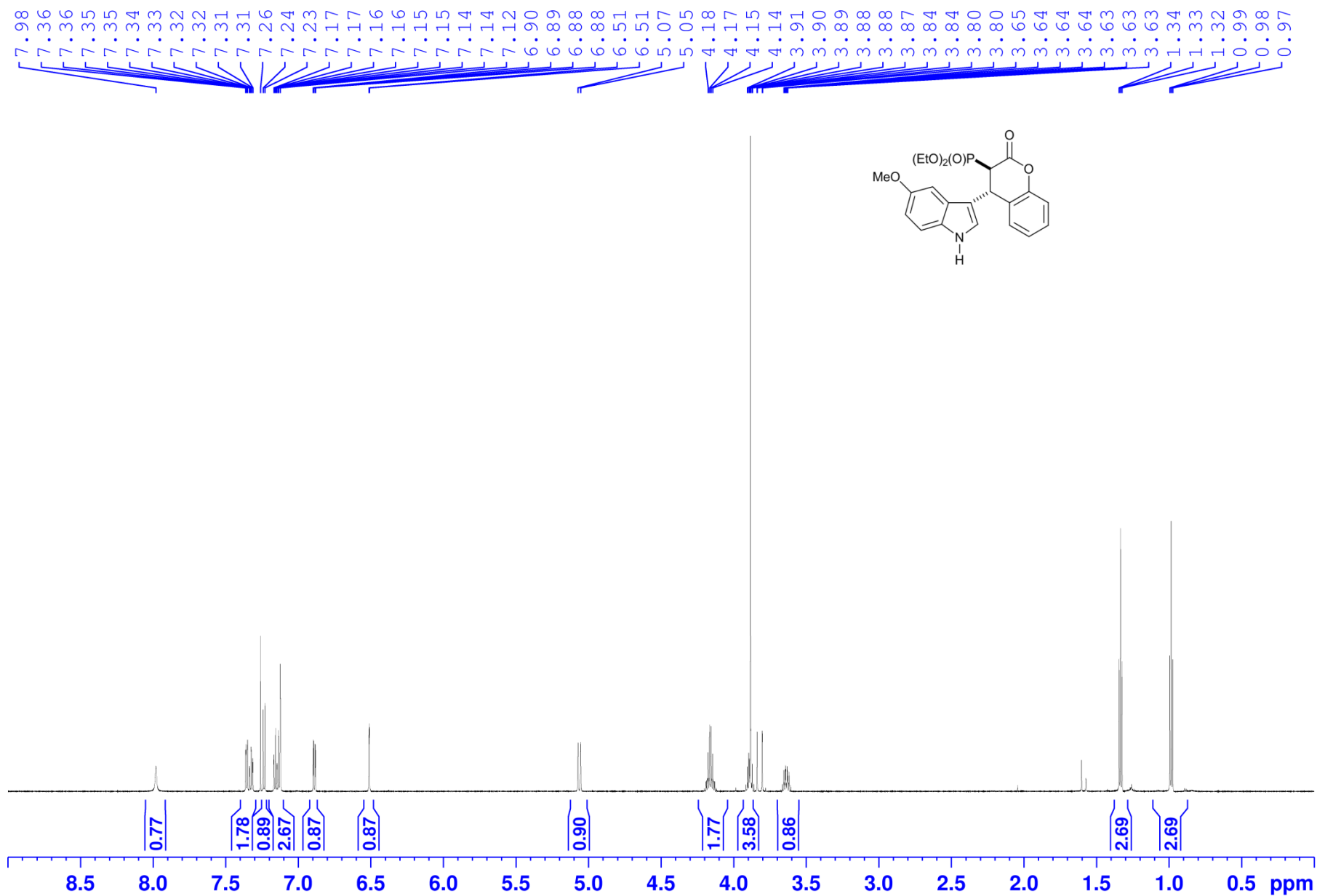
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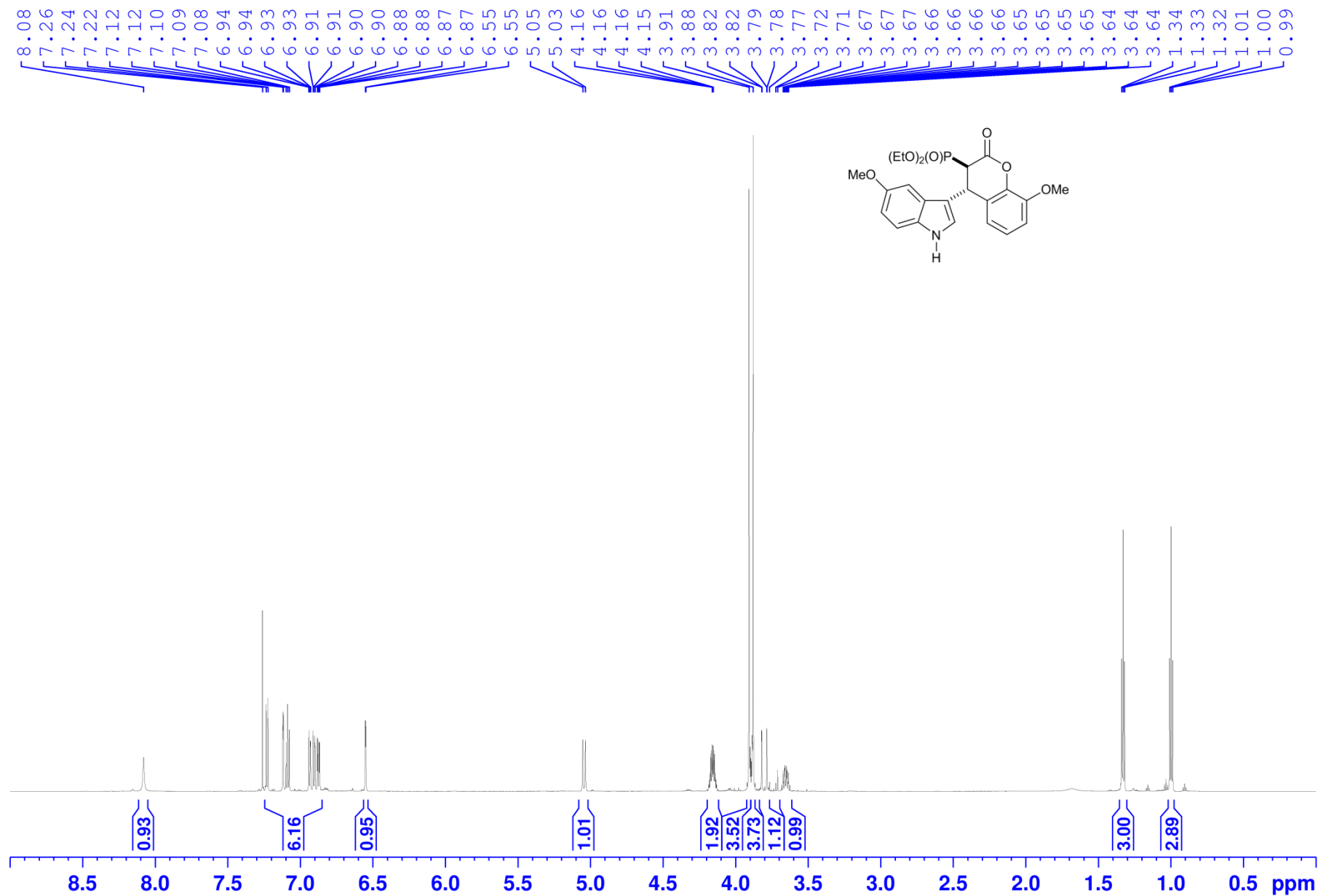
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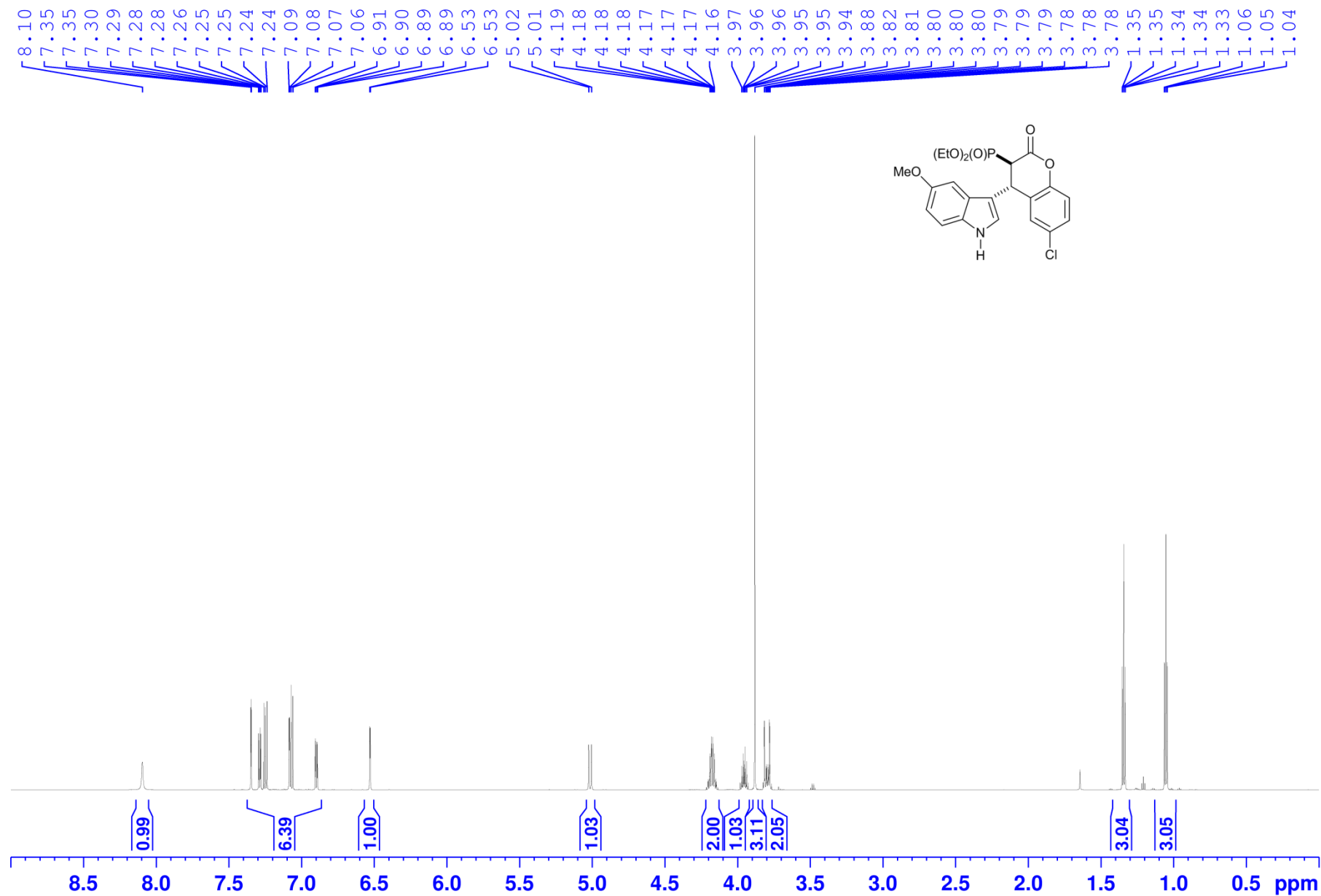
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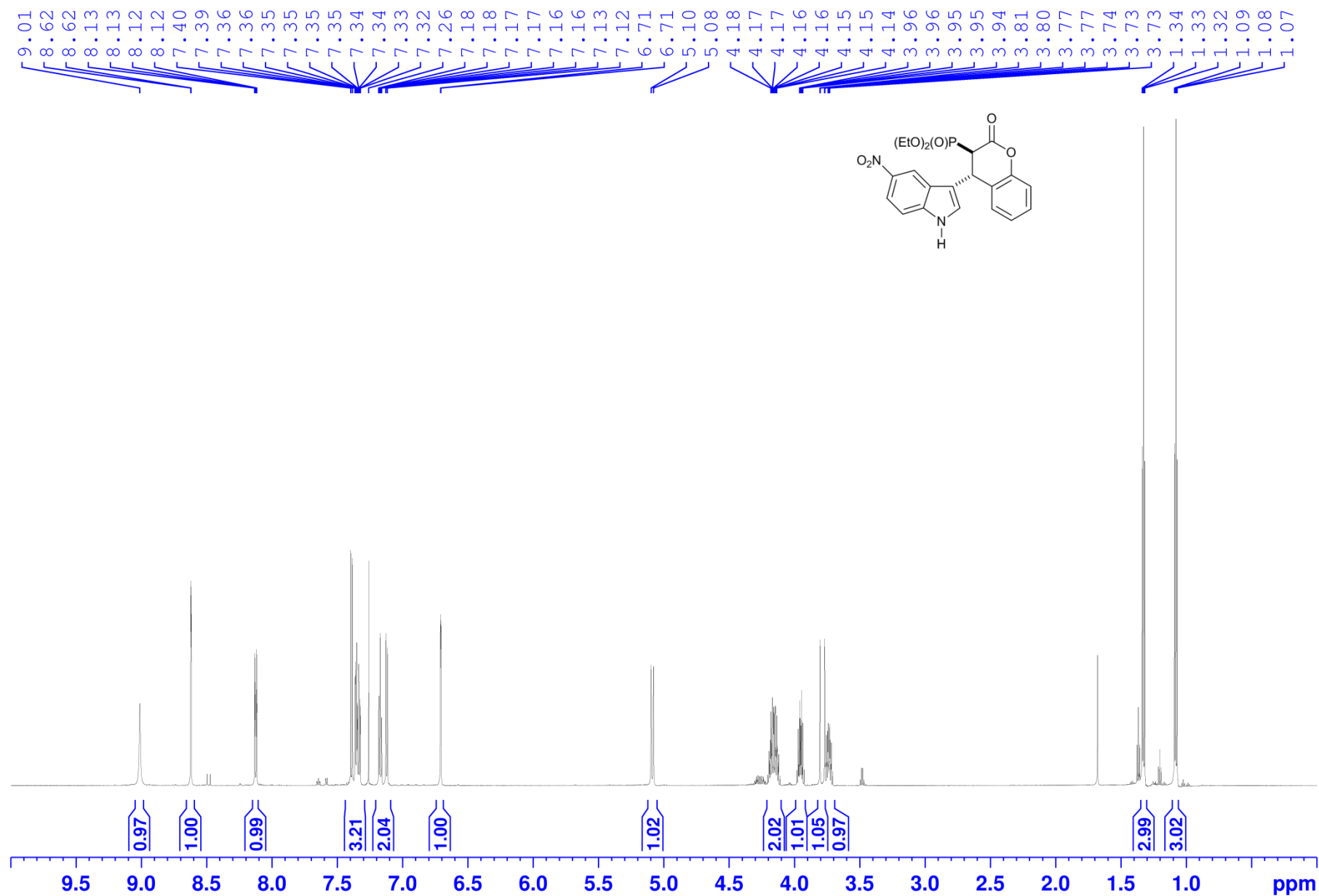
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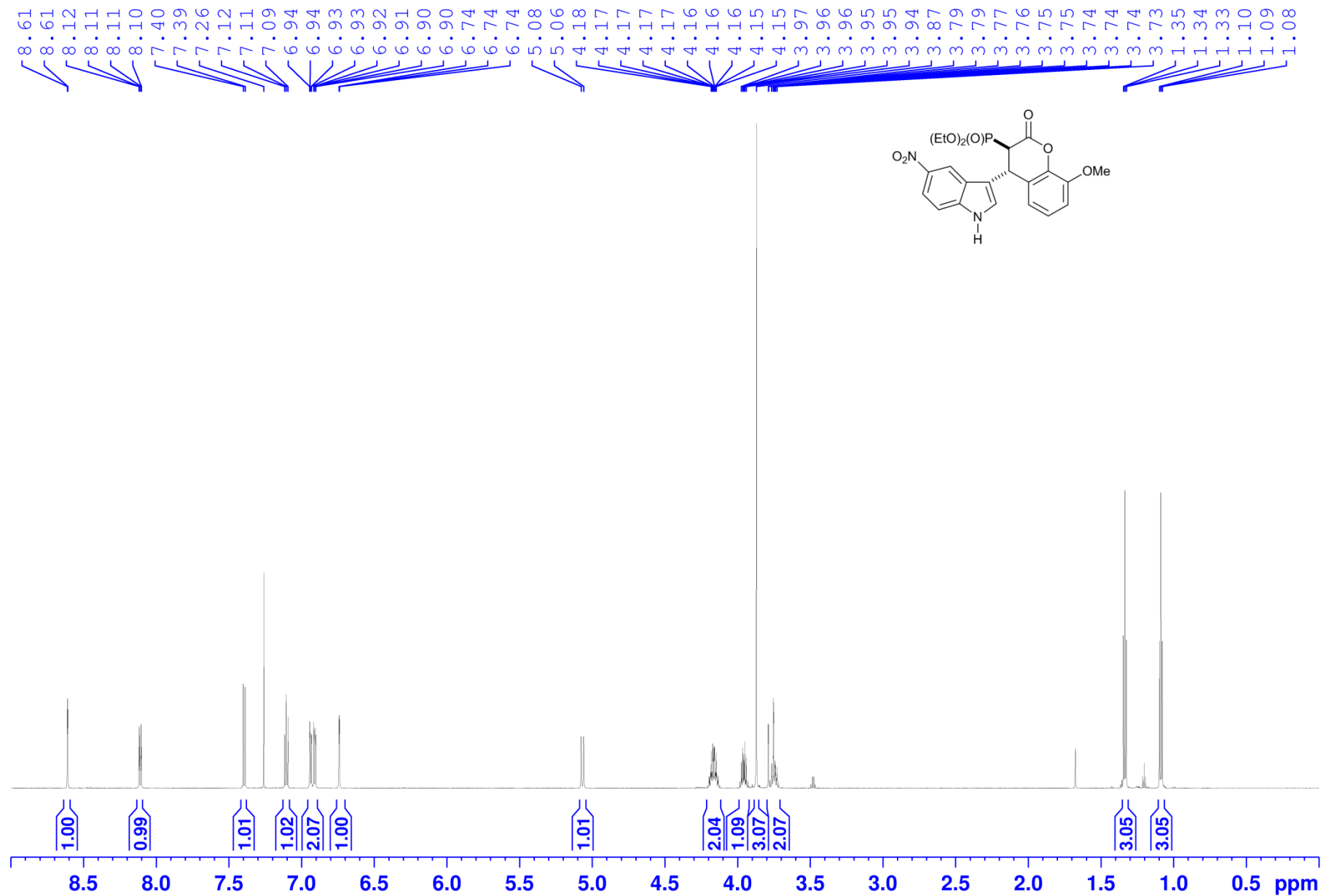
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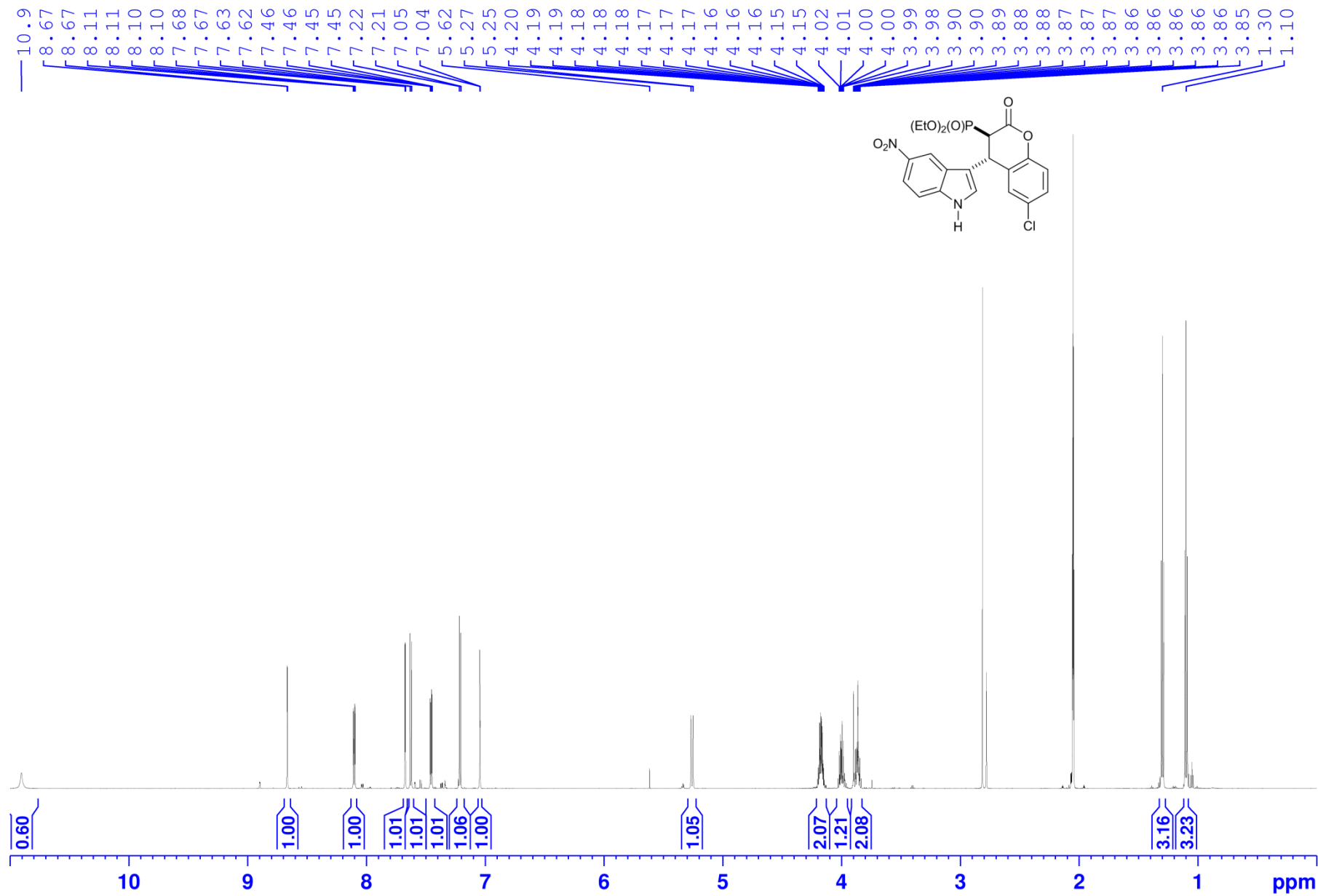
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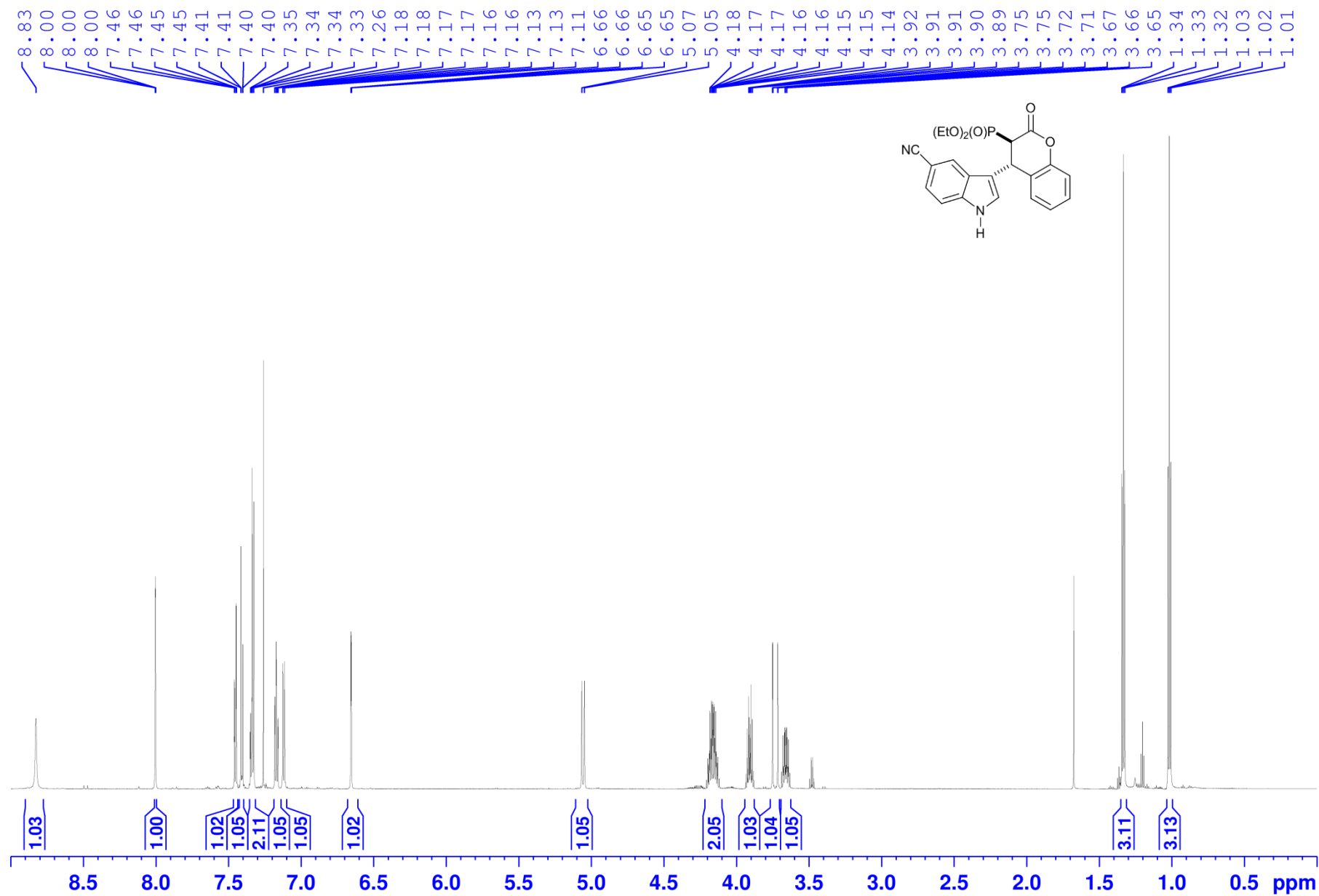
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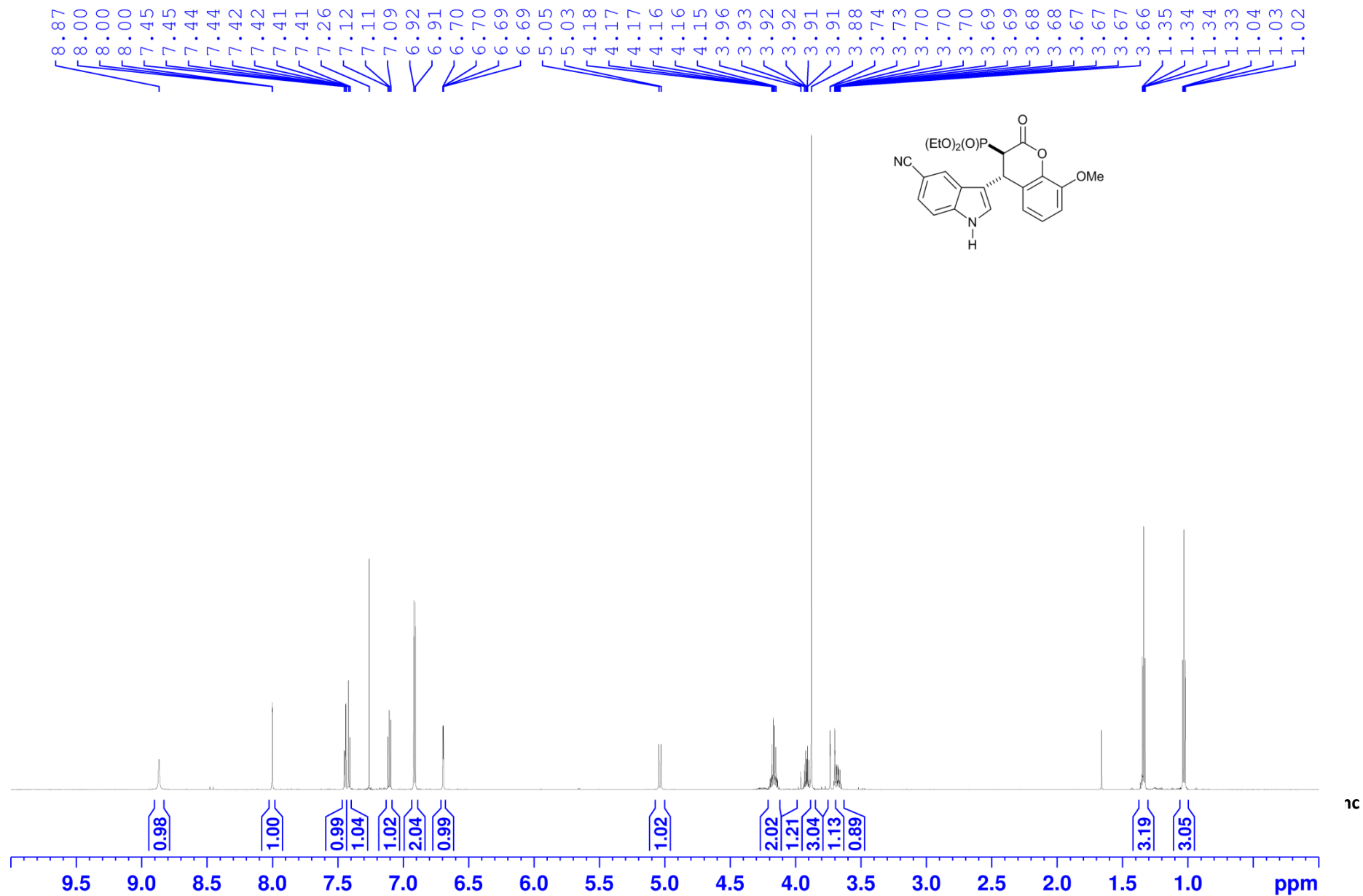
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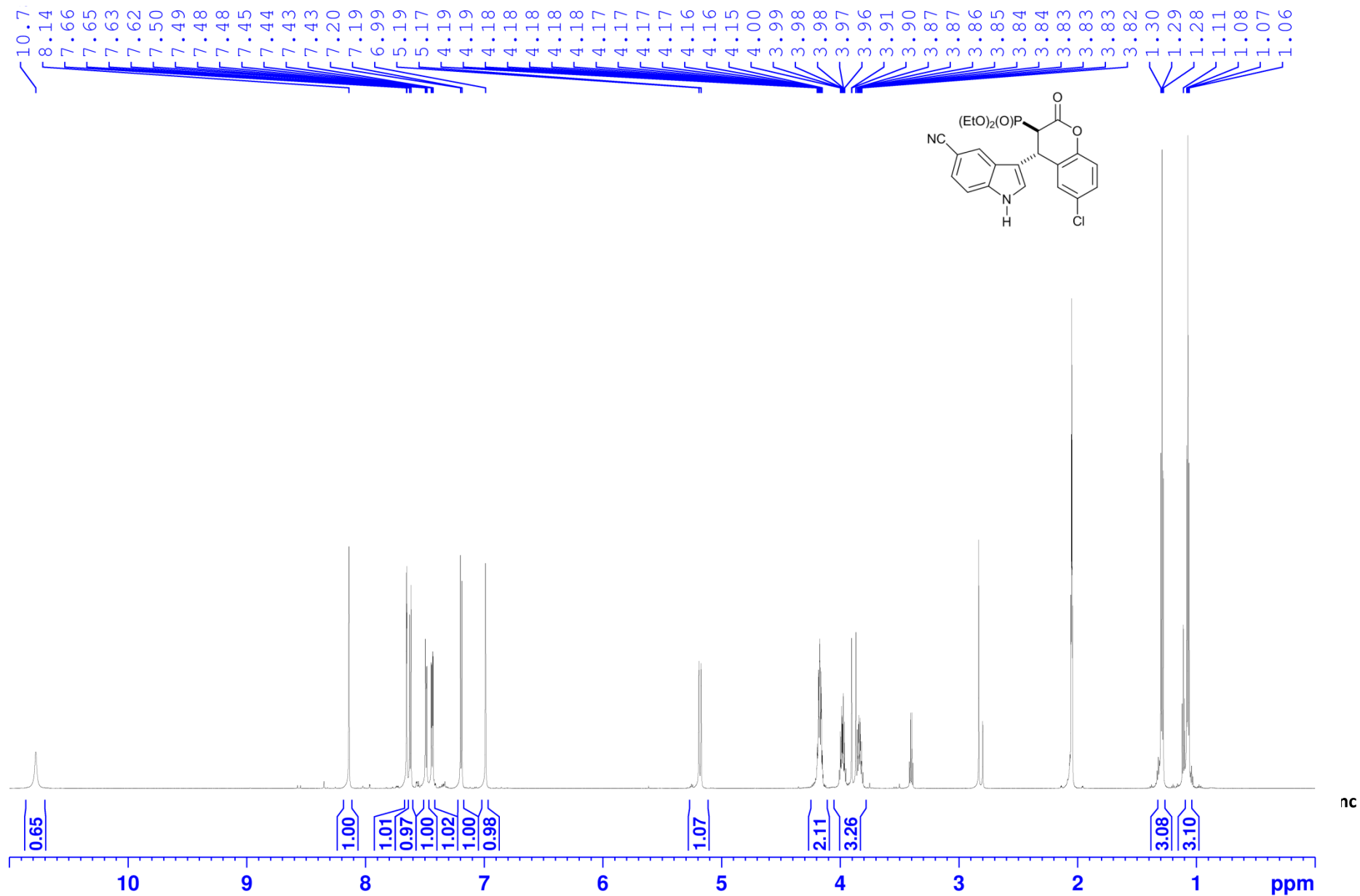
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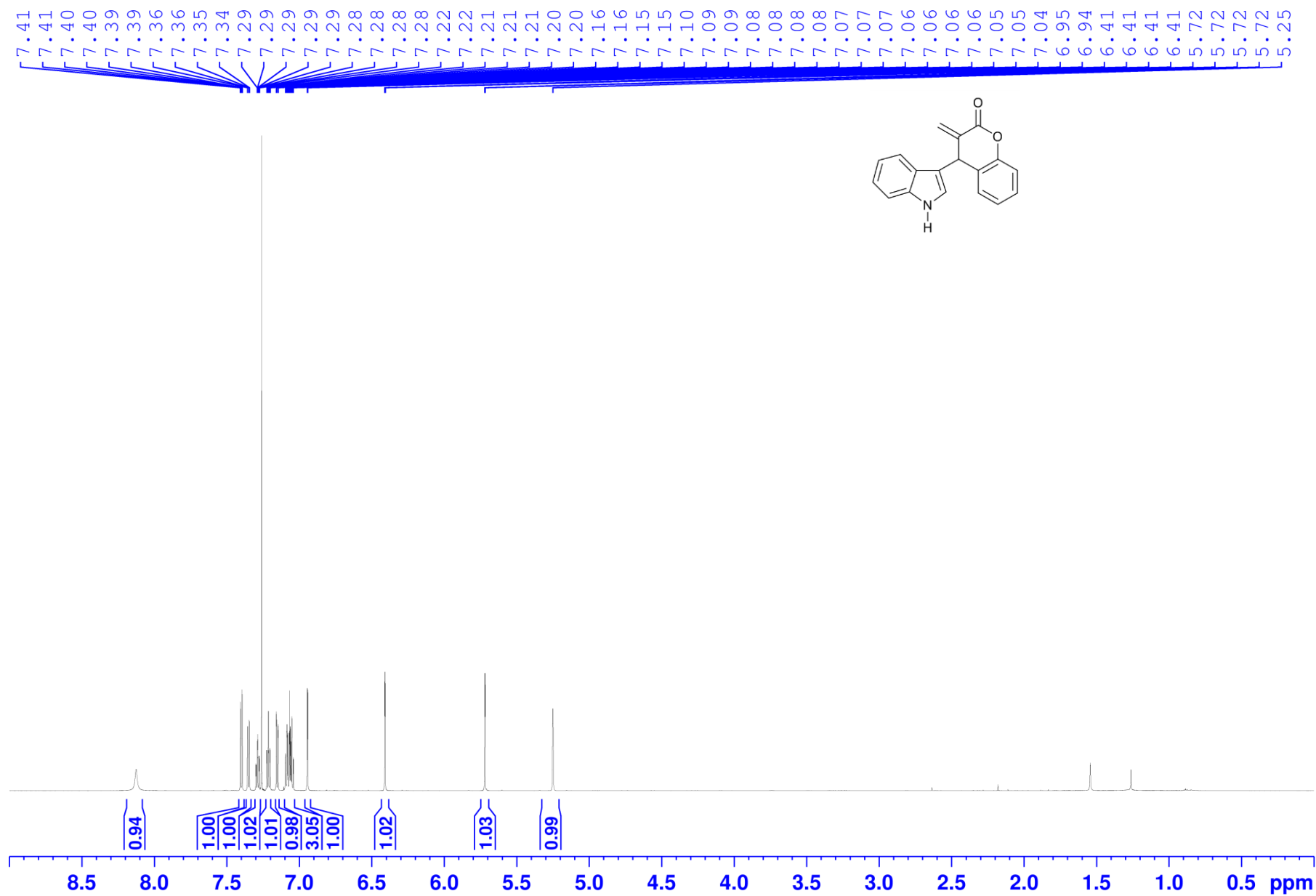
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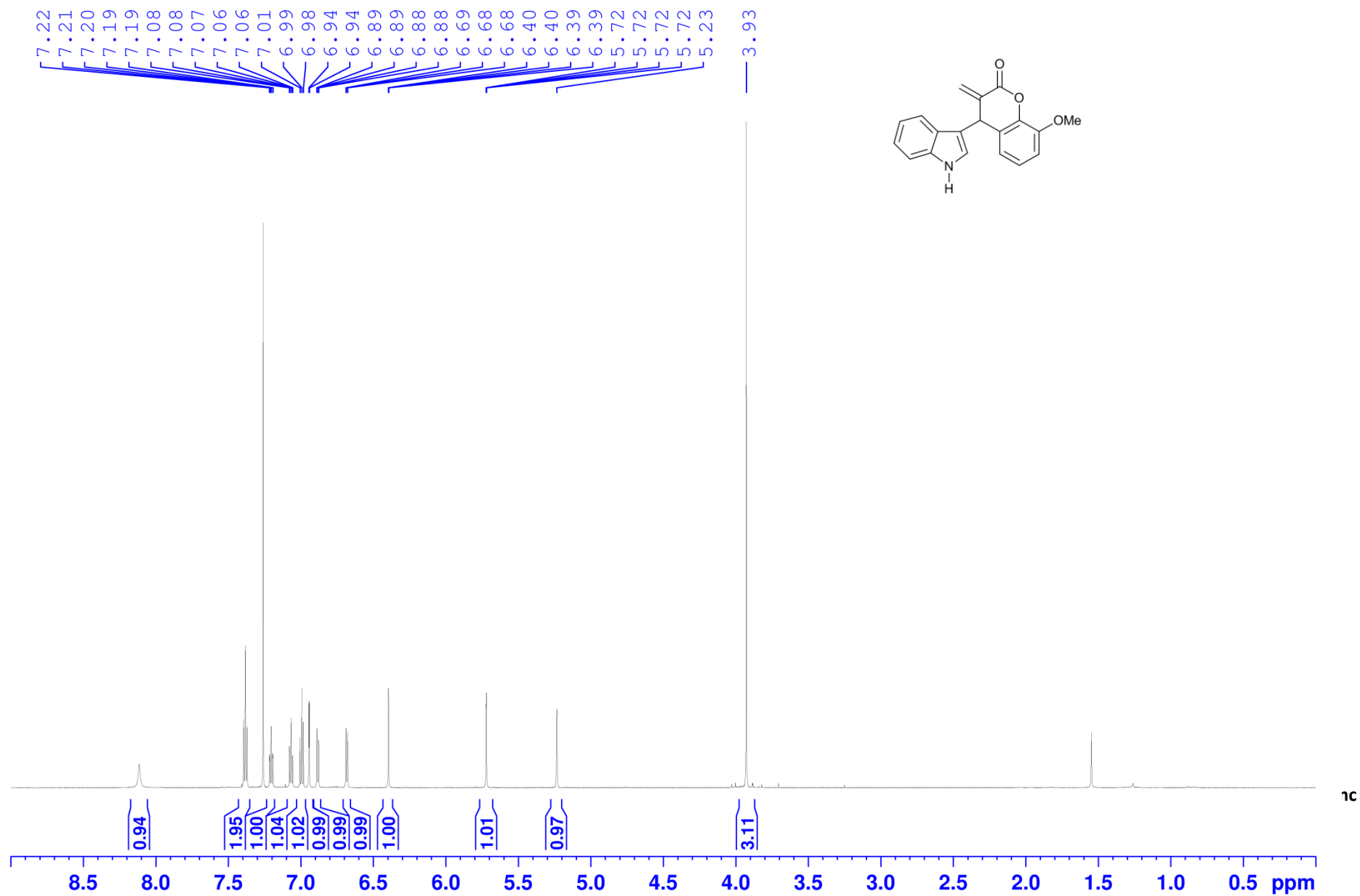
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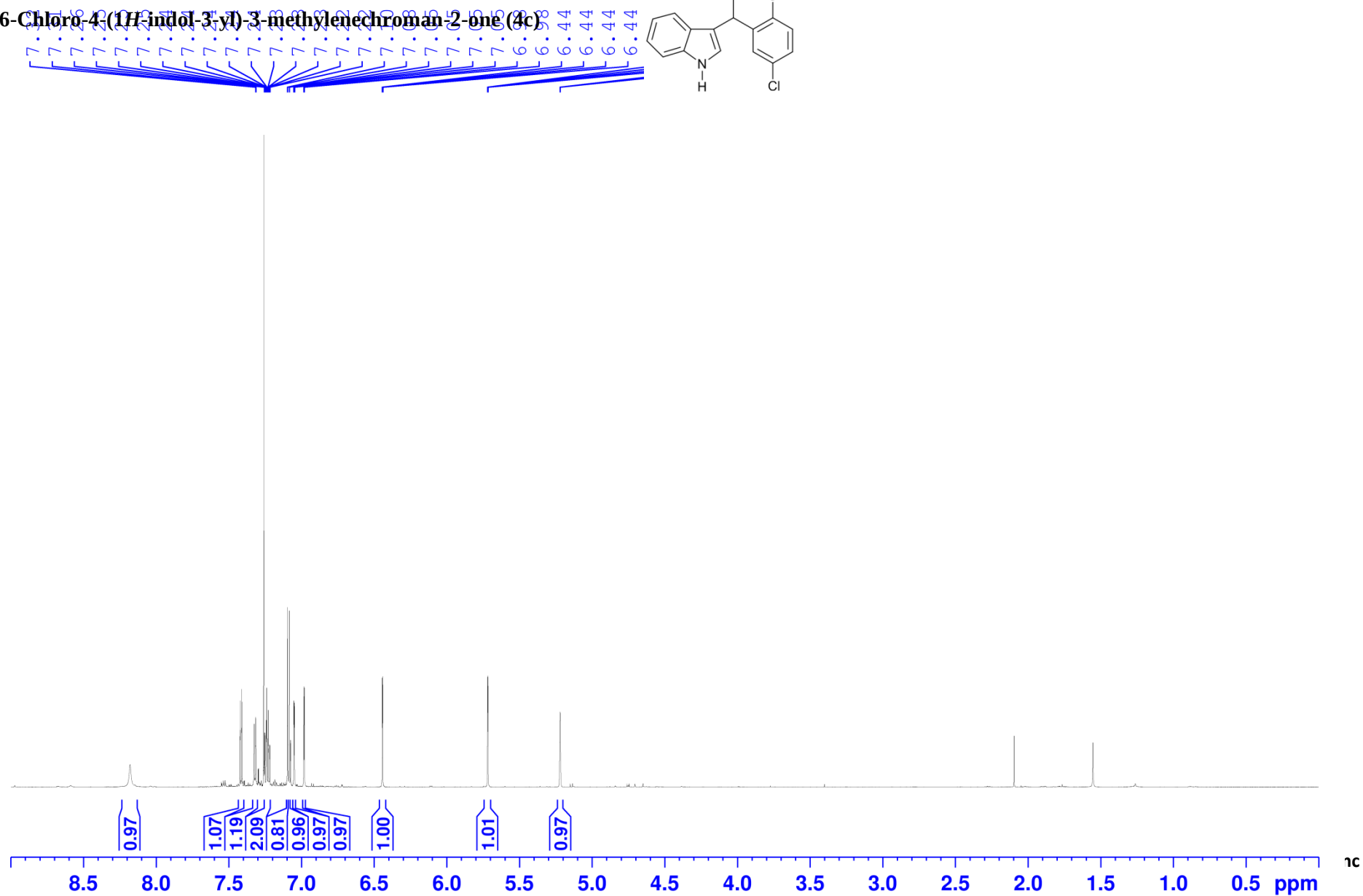
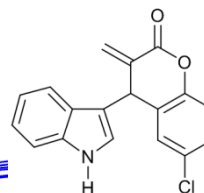
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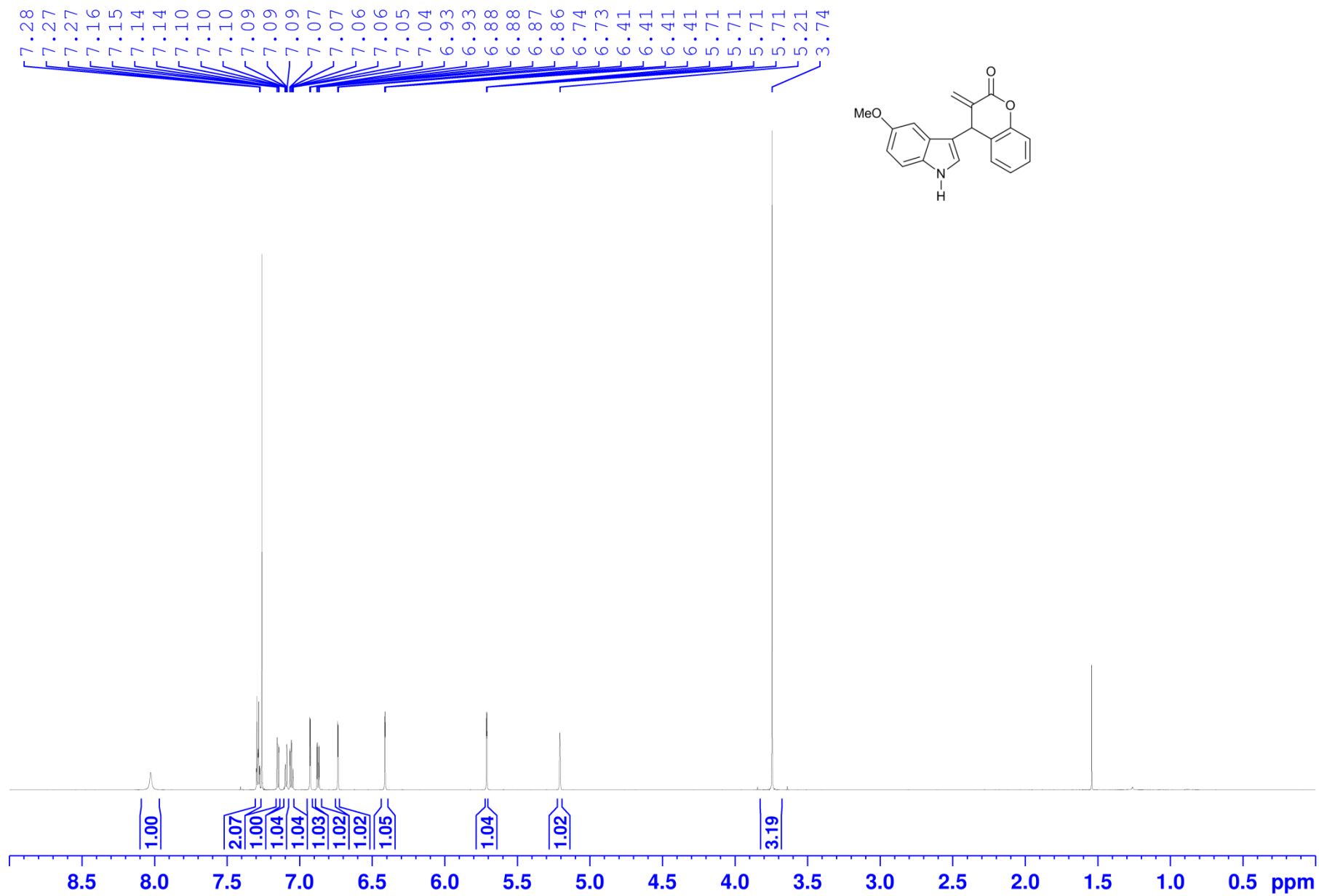
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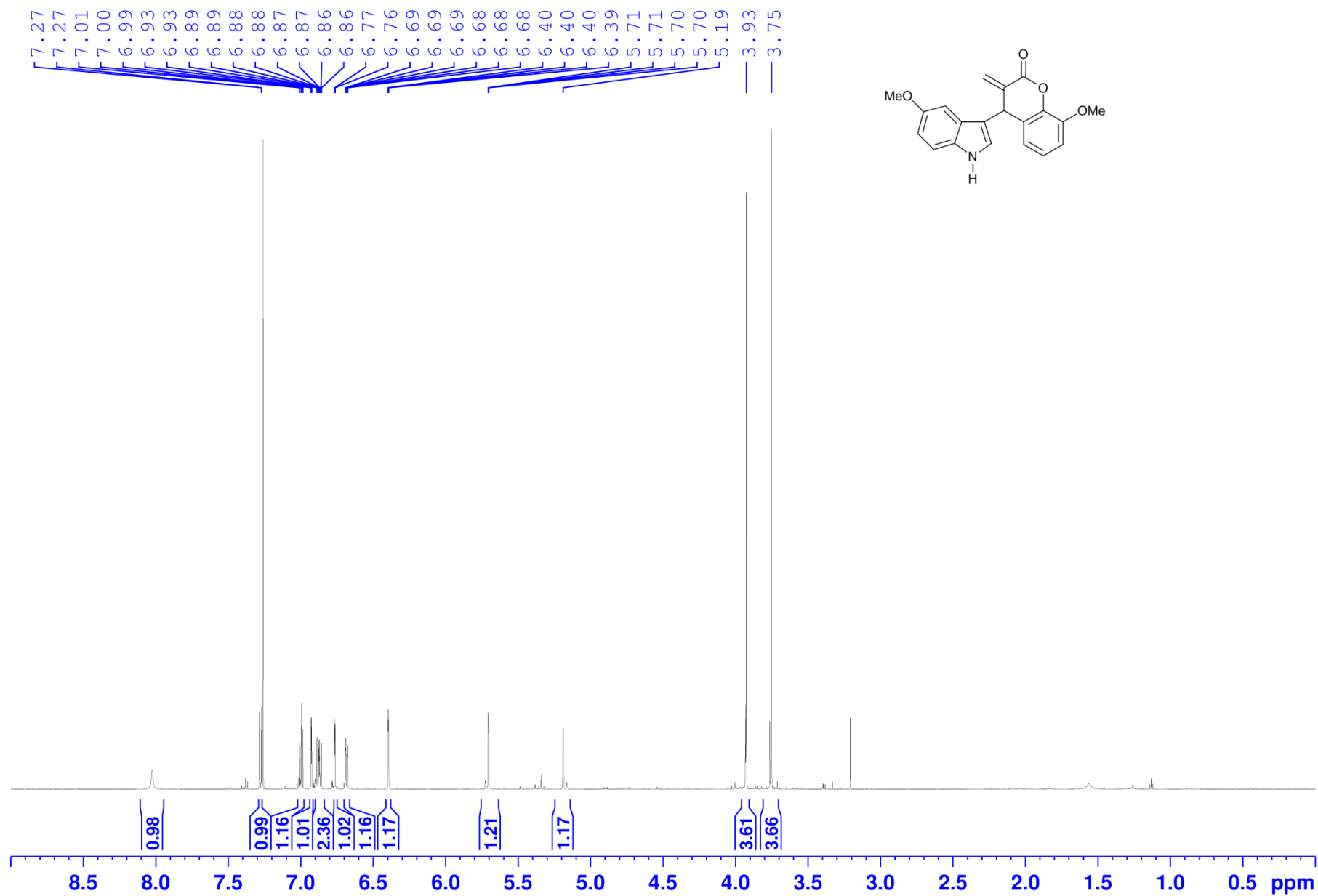
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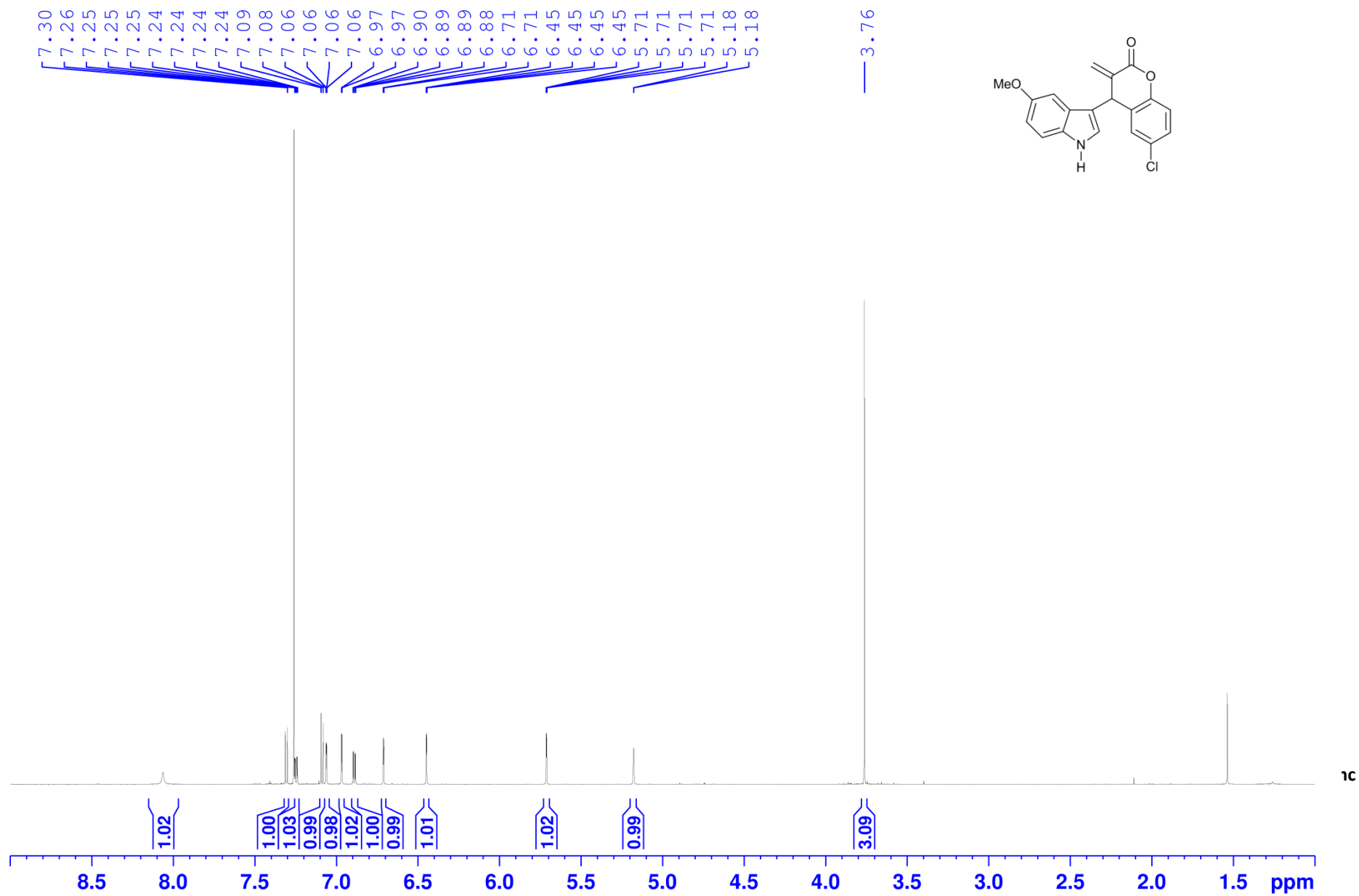
4-(1*H*-Indol-3-yl)-3-methylenechroman-2-one (4a)

4-(1*H*-Indol-3-yl)-8-methoxy-3-methylenechroman-2-one (4b)

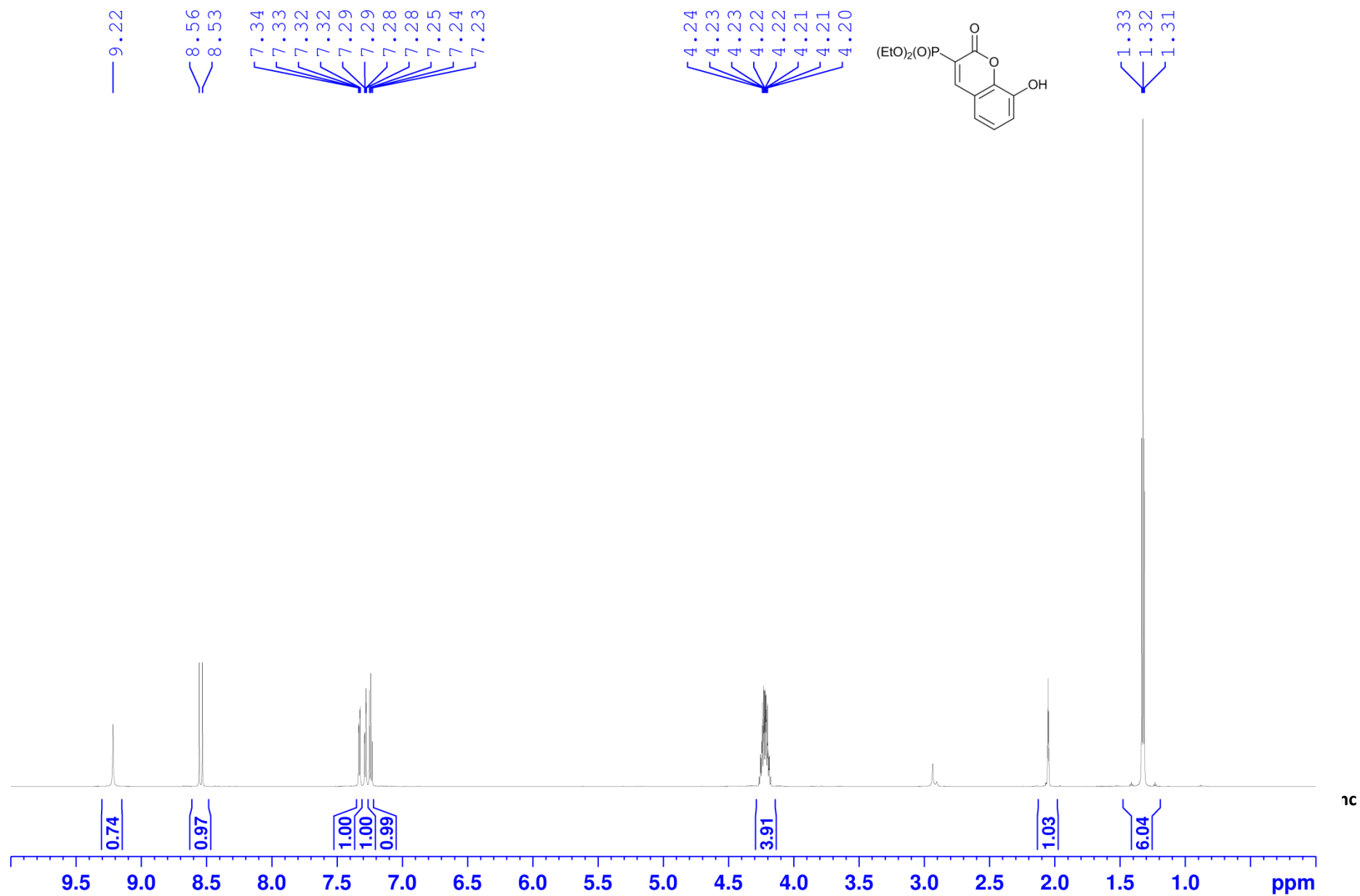
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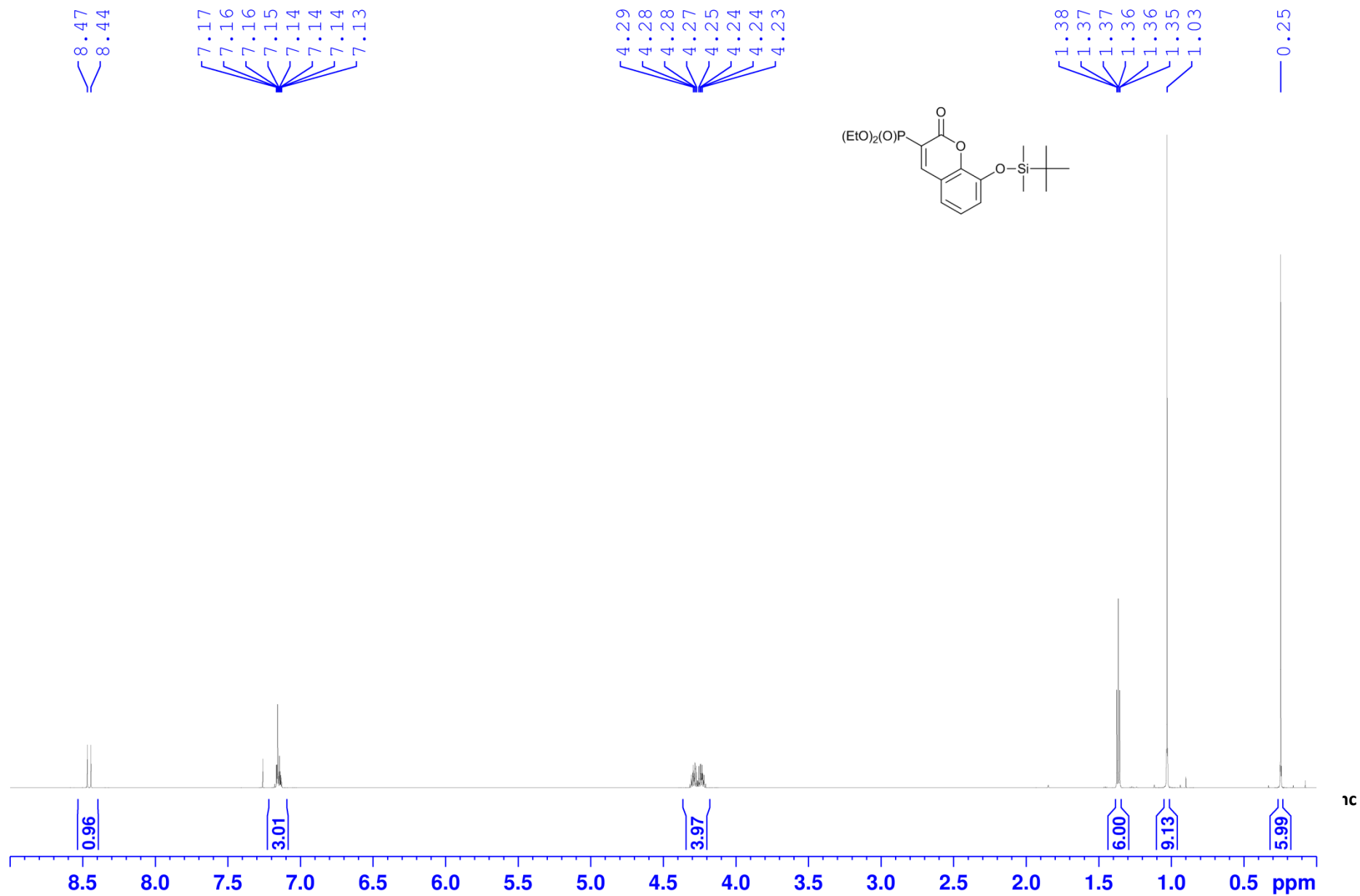
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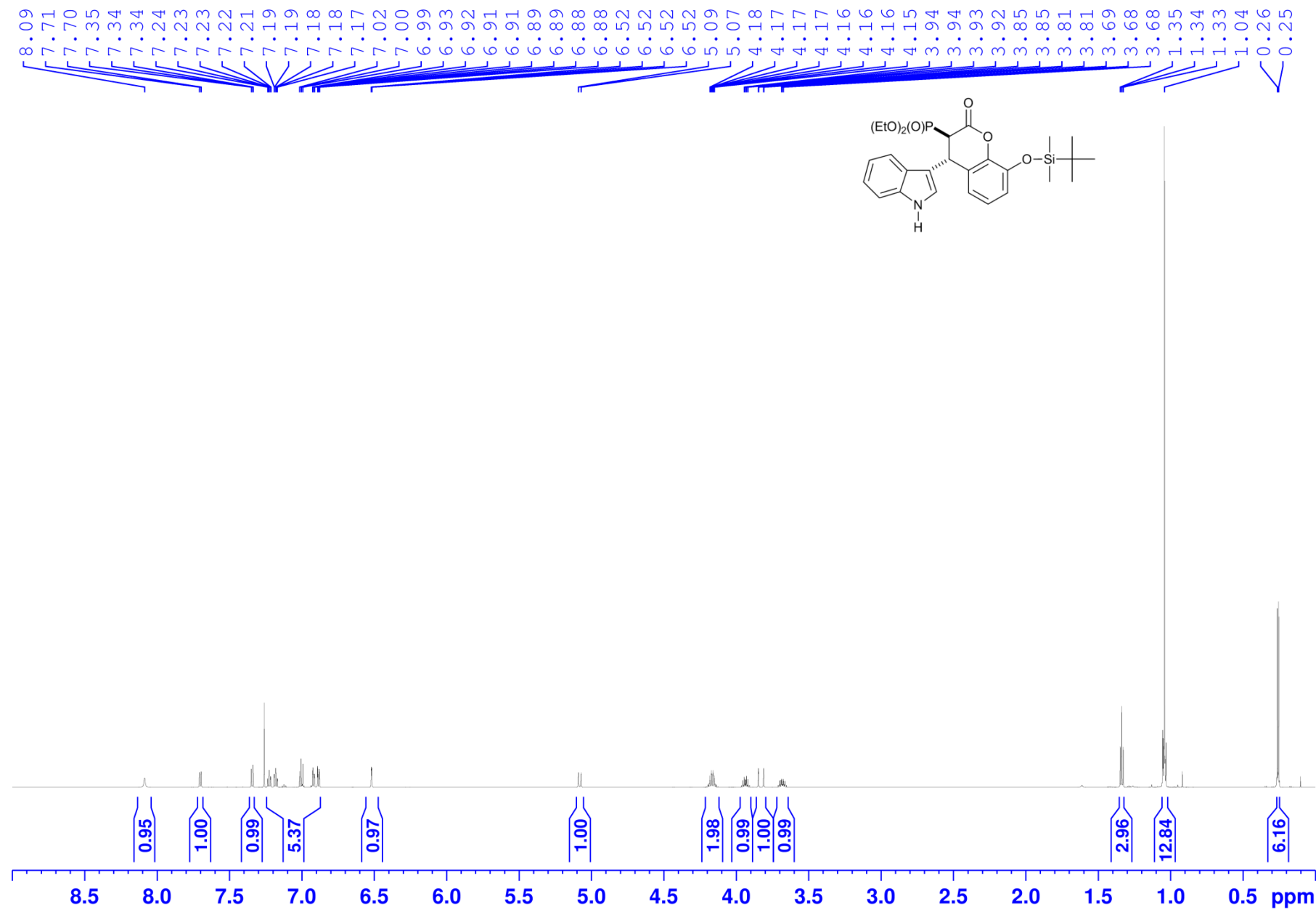
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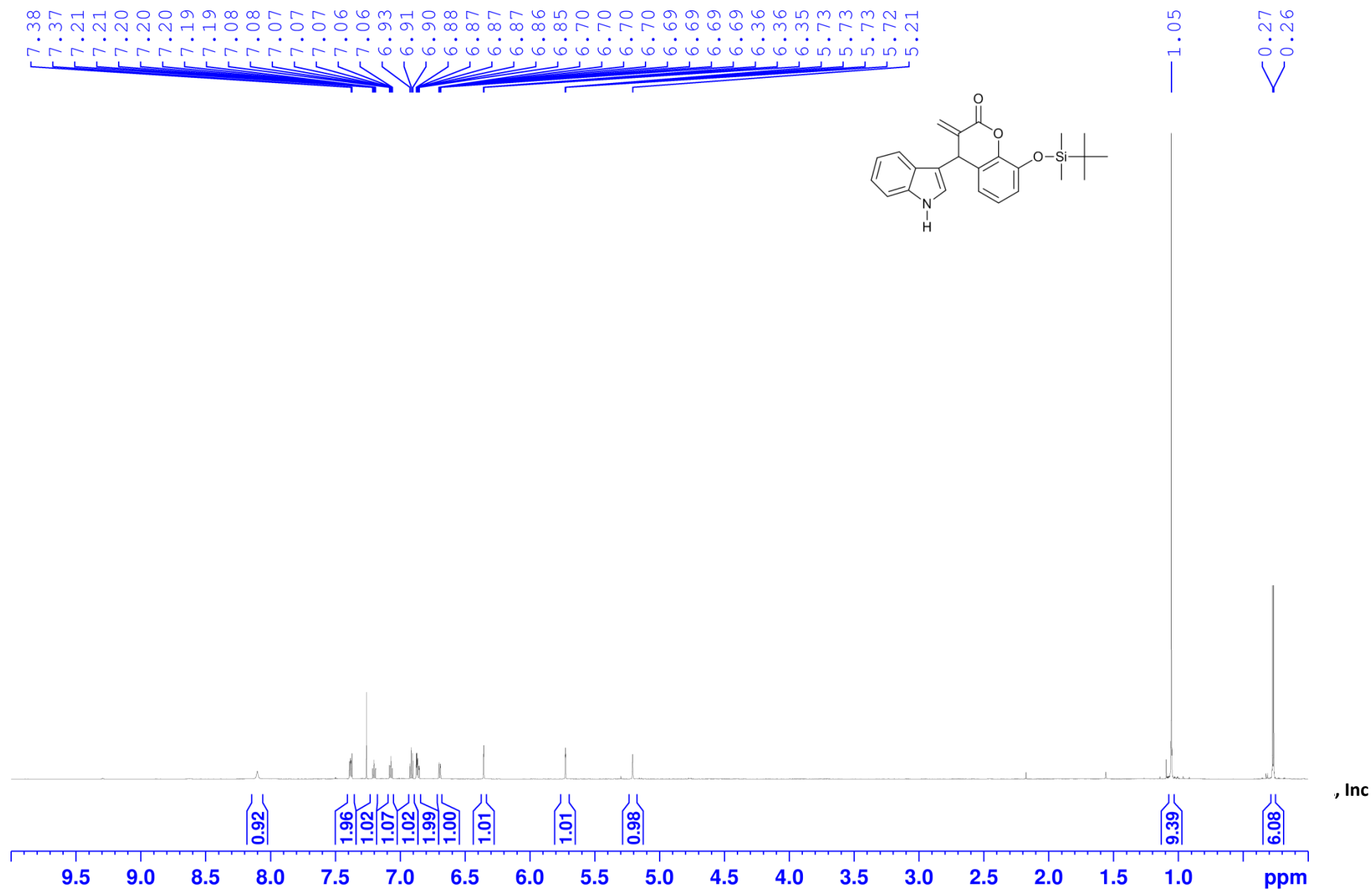
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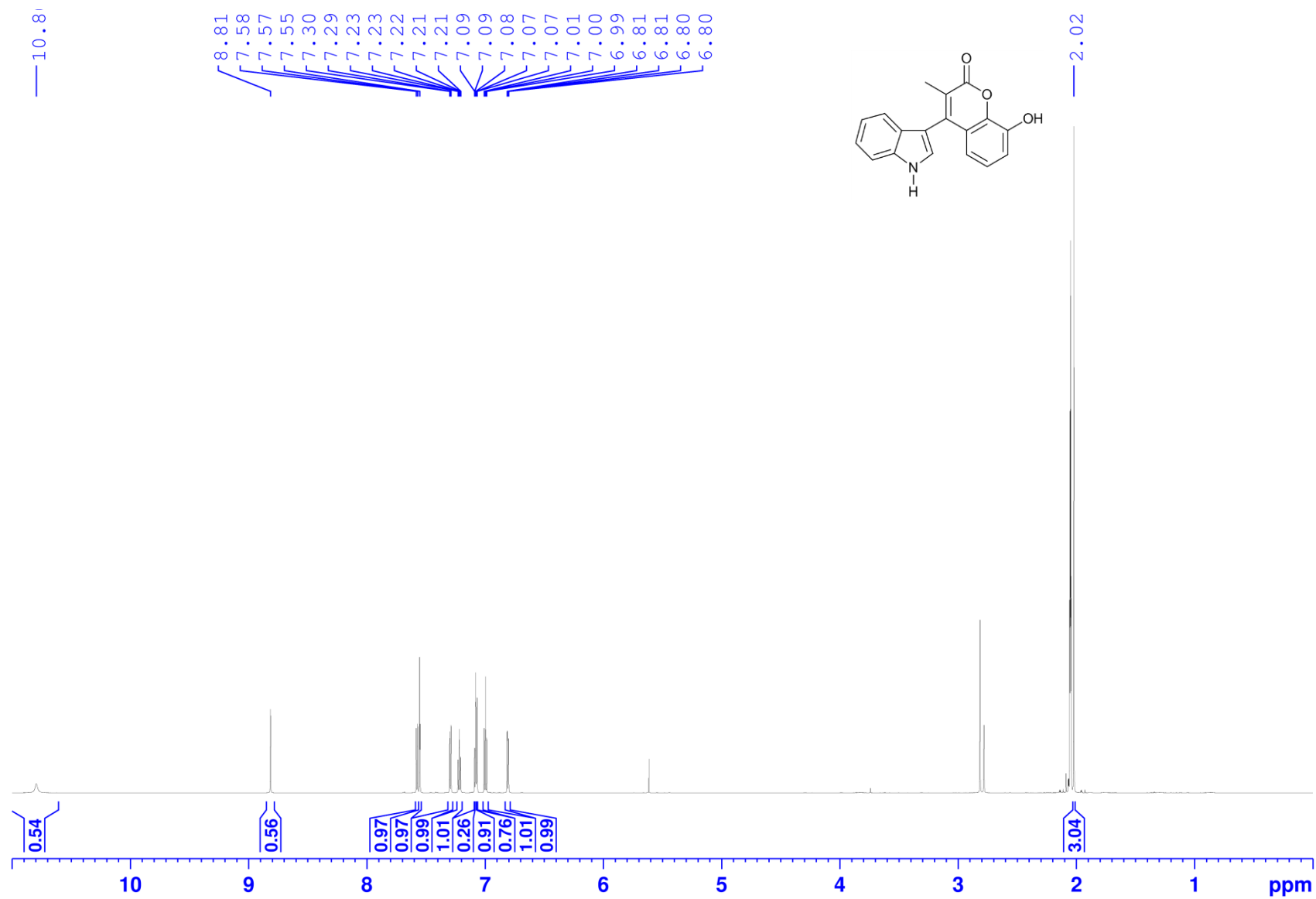


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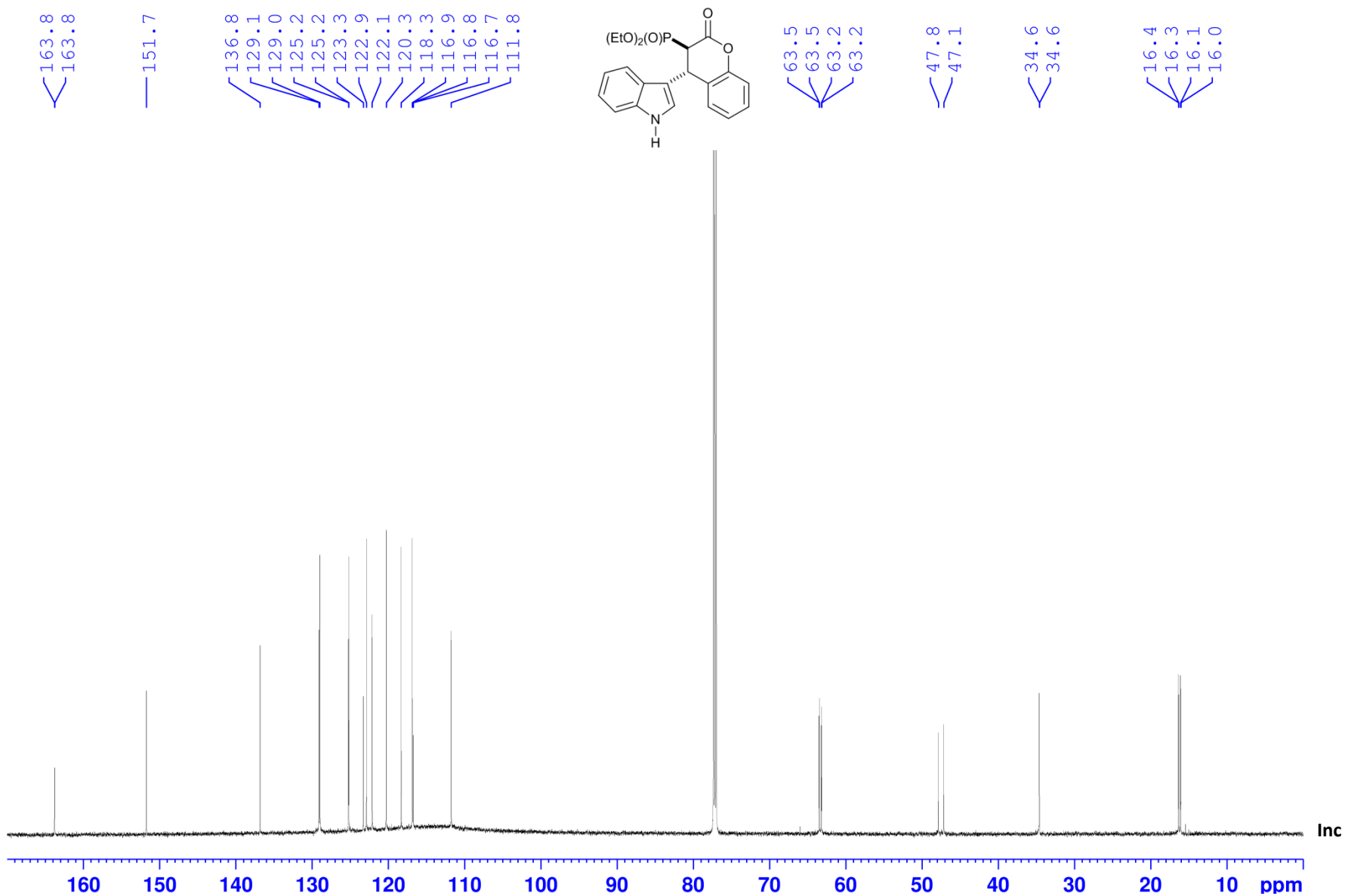
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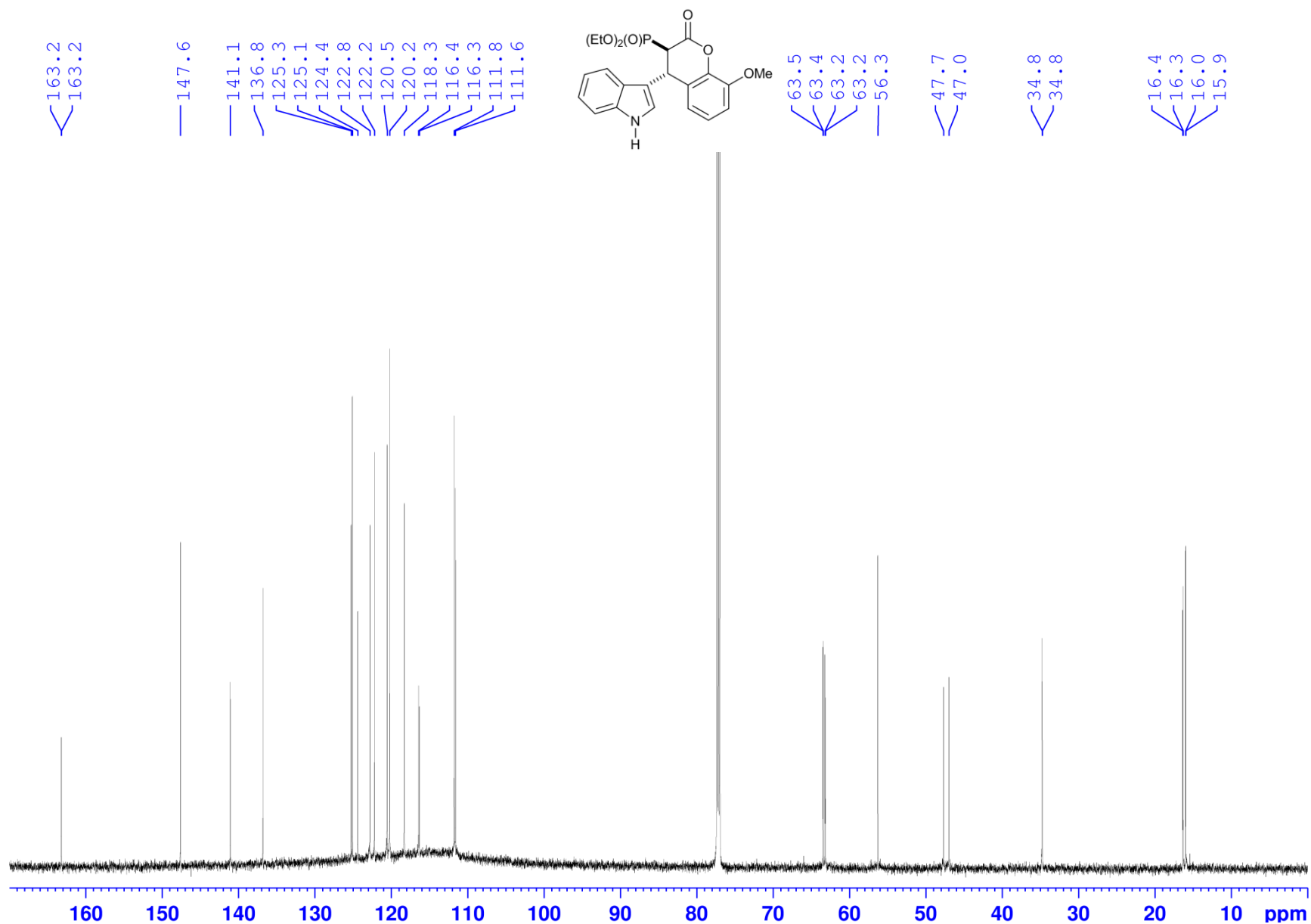
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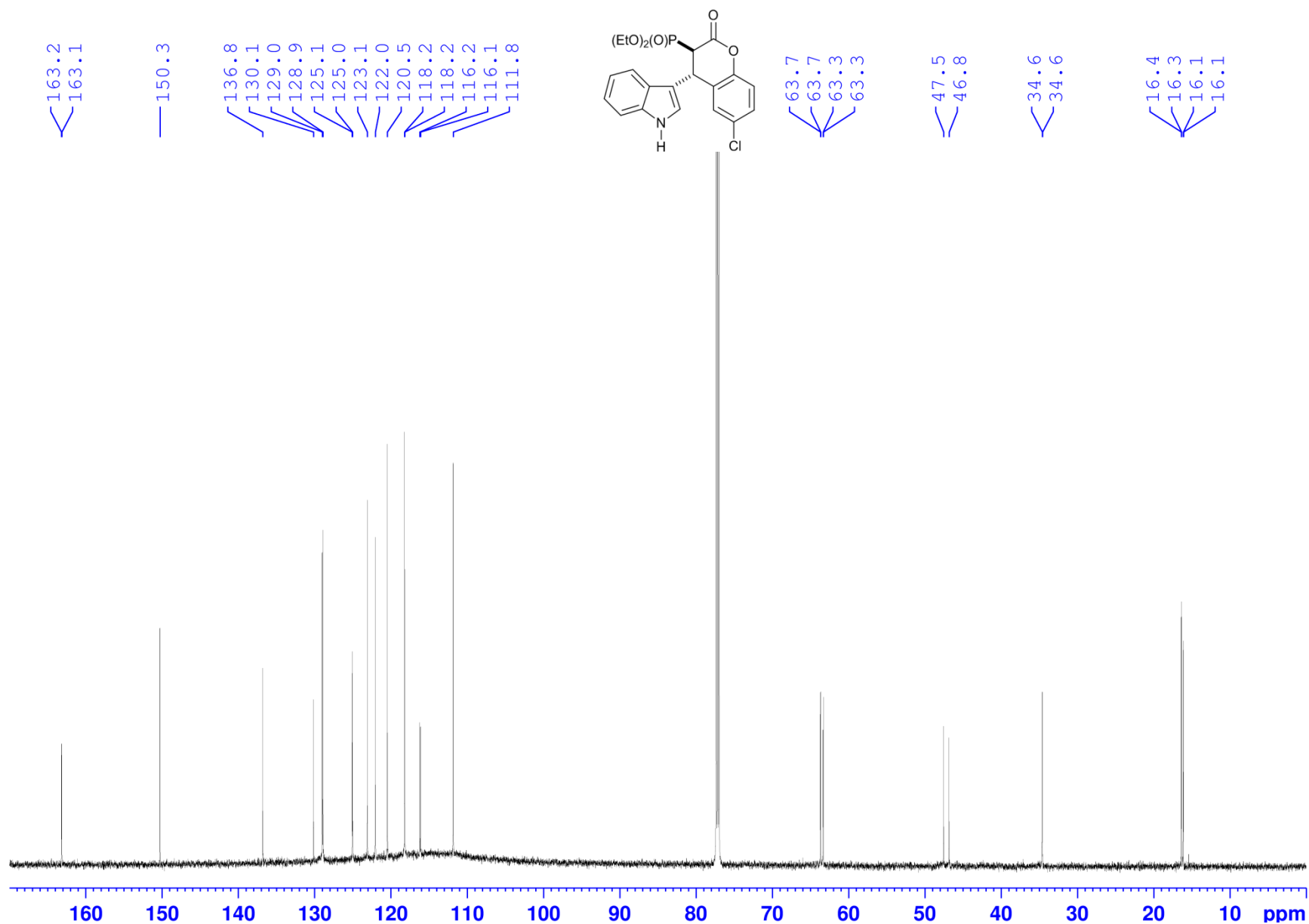
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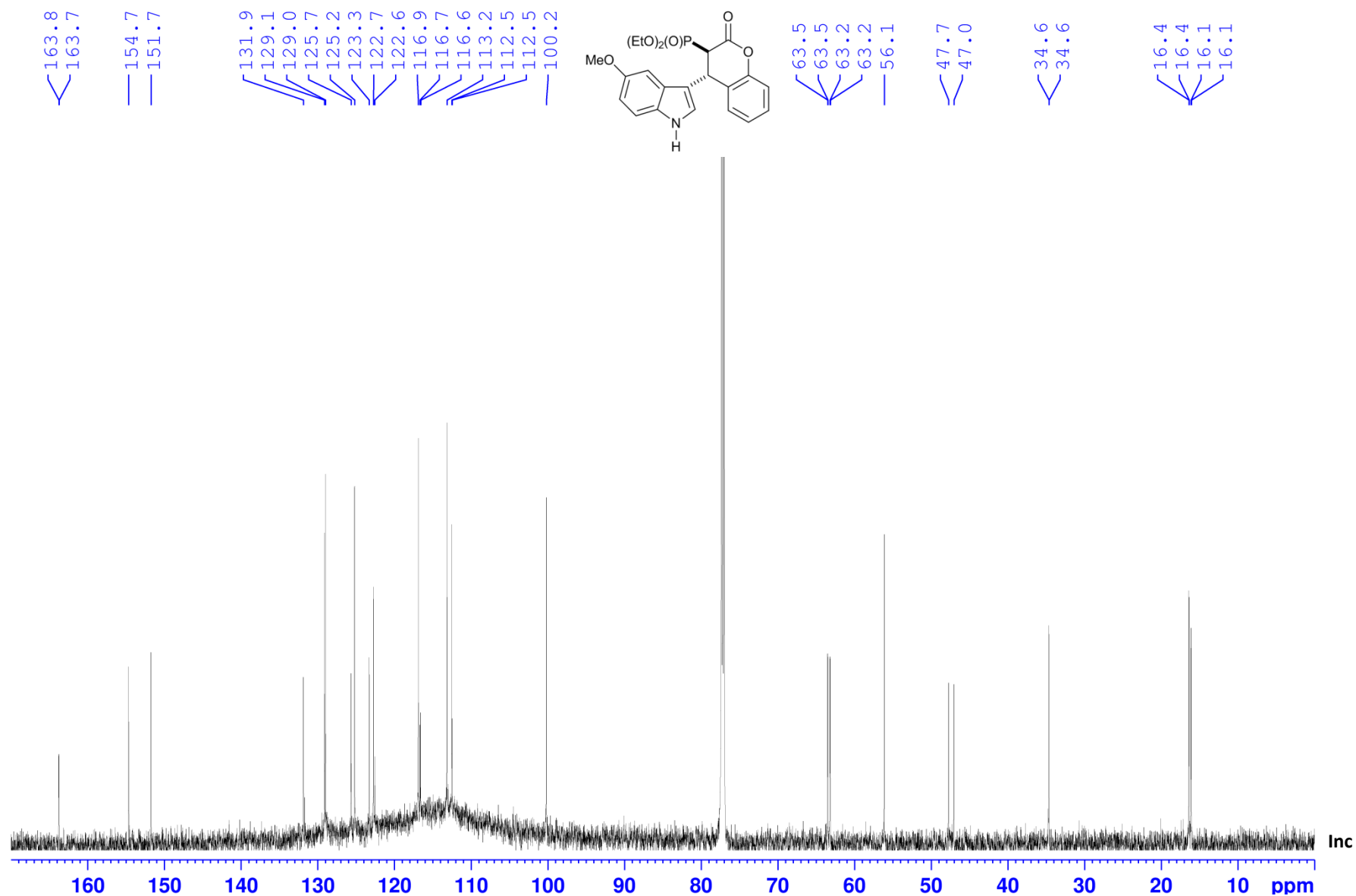
8-Hydroxy-4-(1*H*-indol-3-yl)-3-methyl-2*H*-chromen-2-one (11)

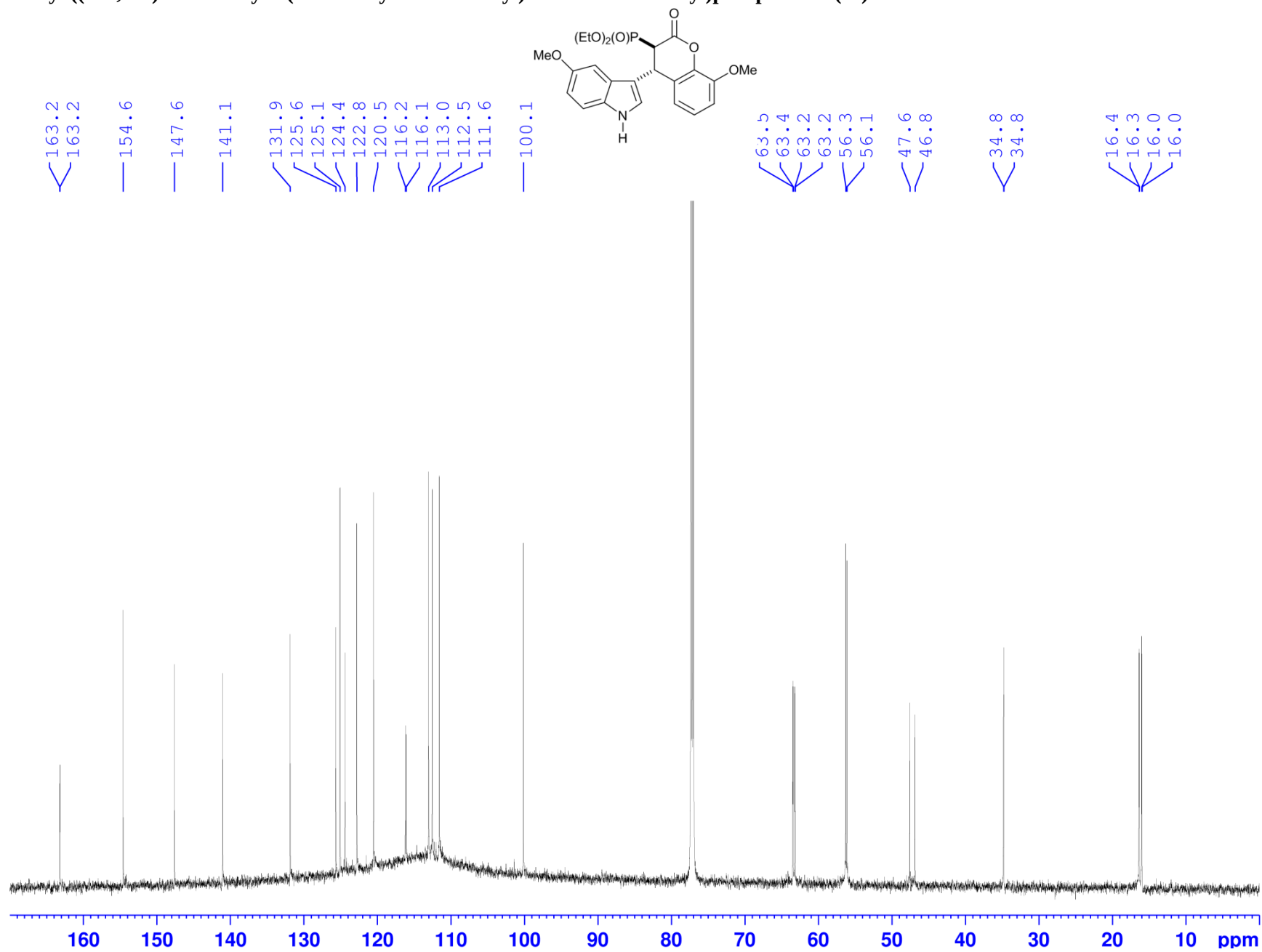
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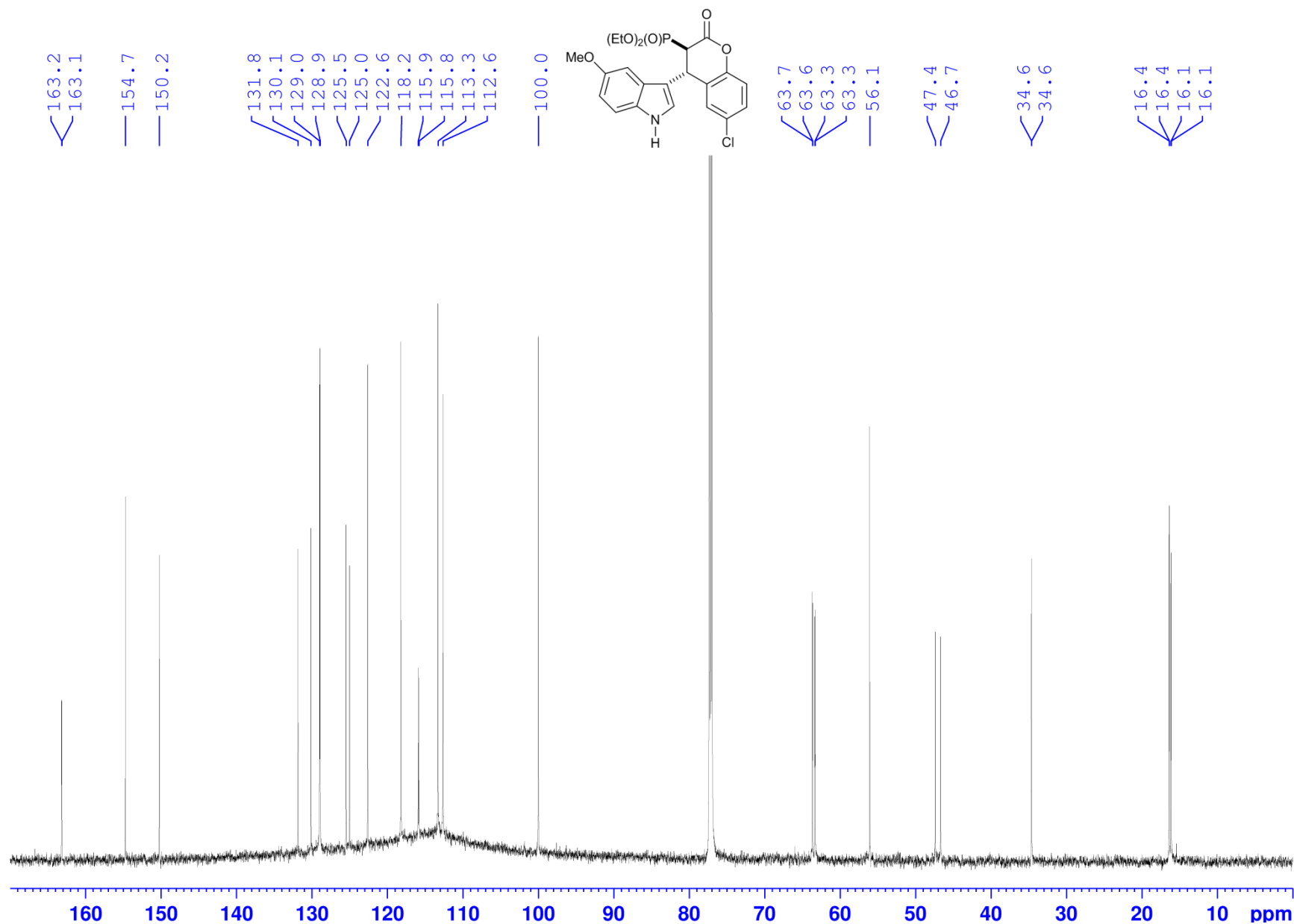
Diethyl ((3*R**,4*S**)-4-(1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (3a)

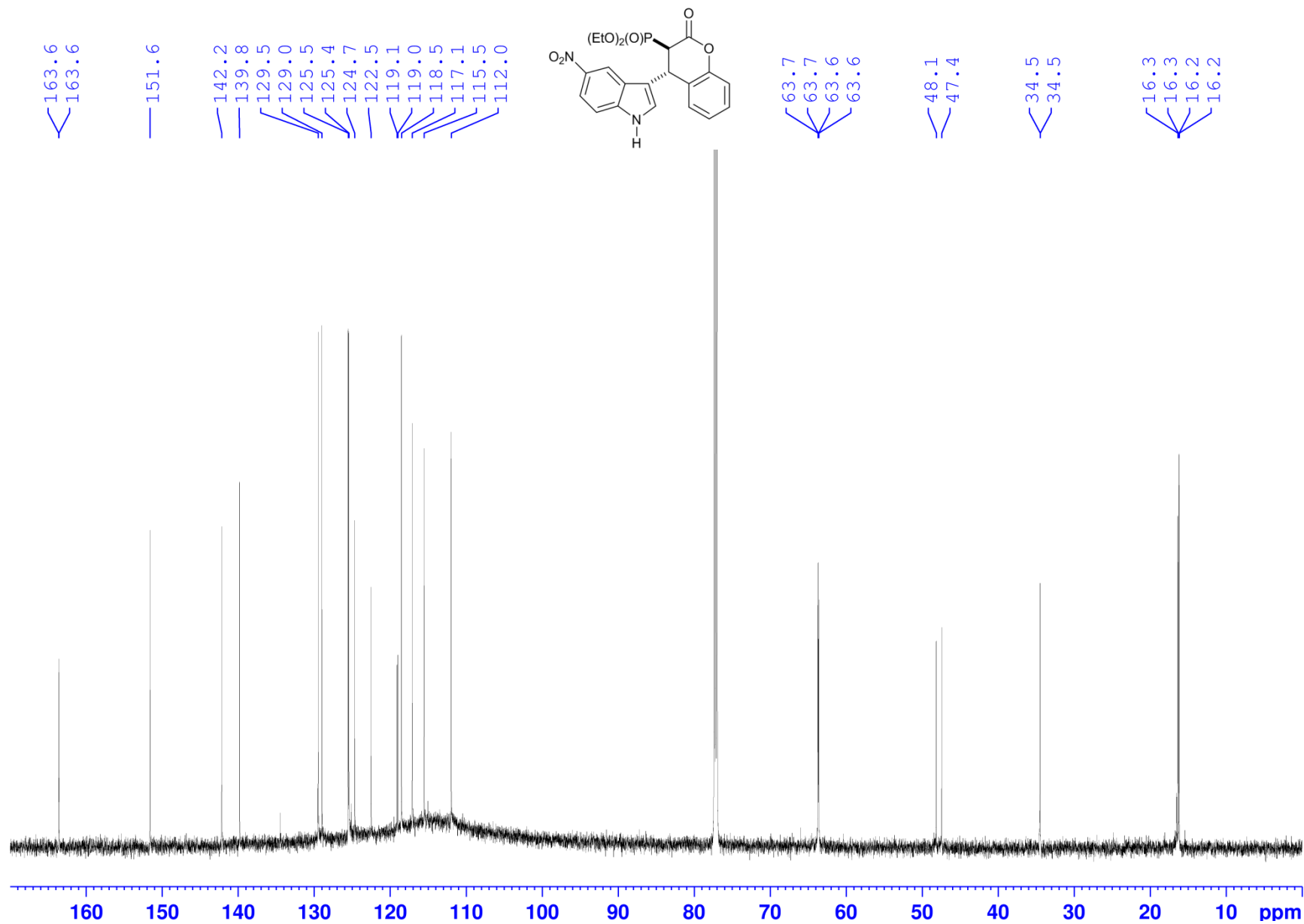
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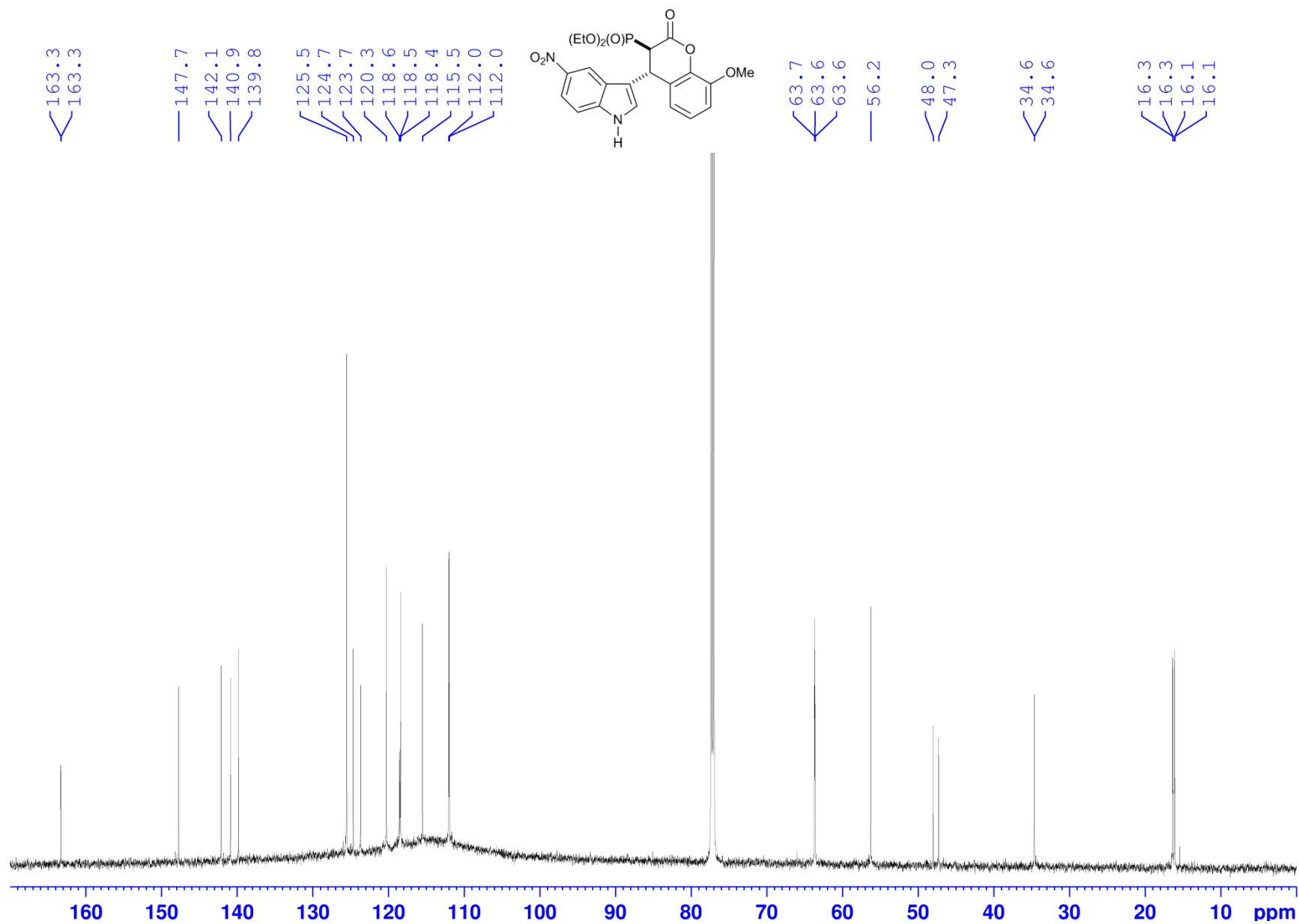
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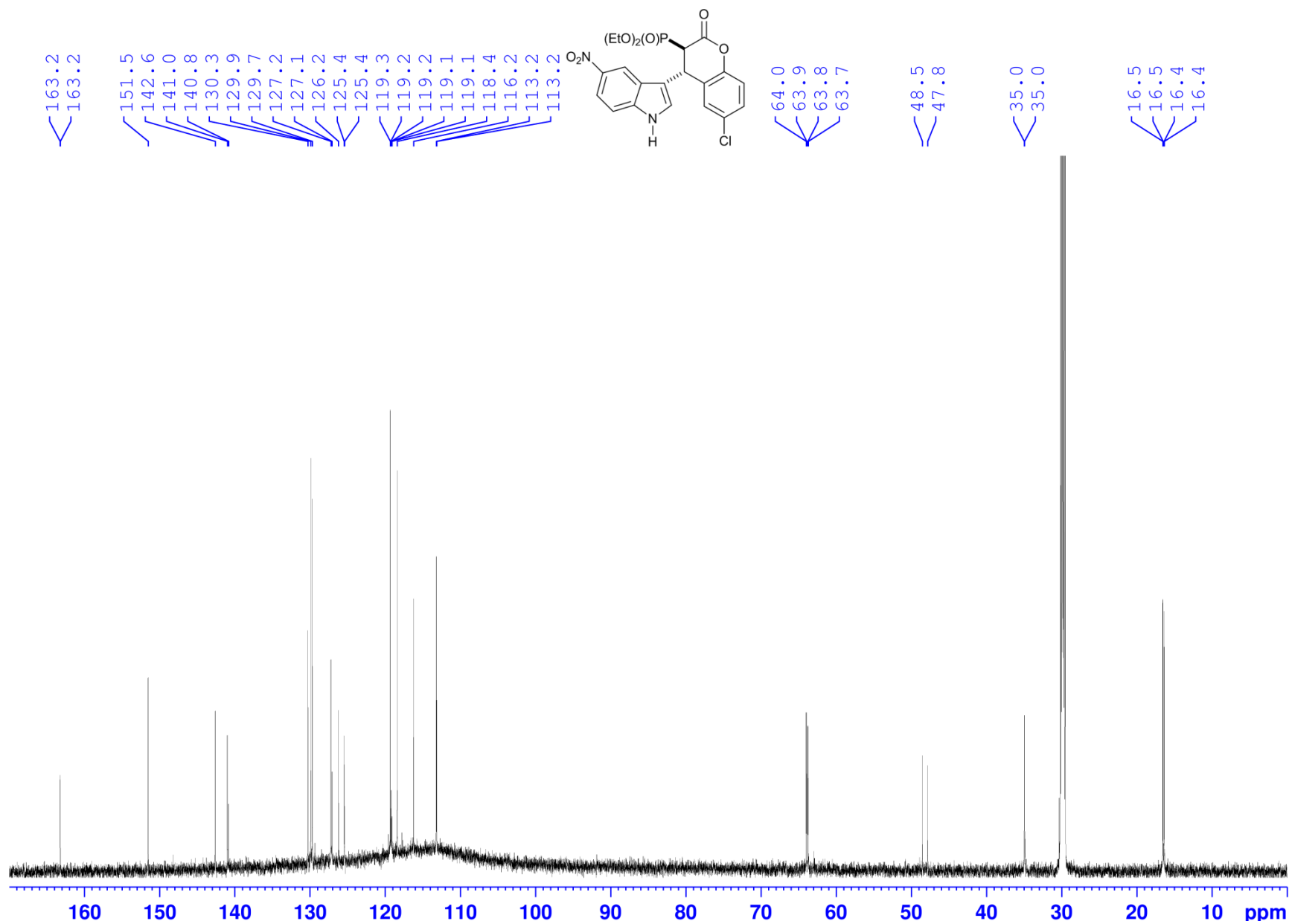
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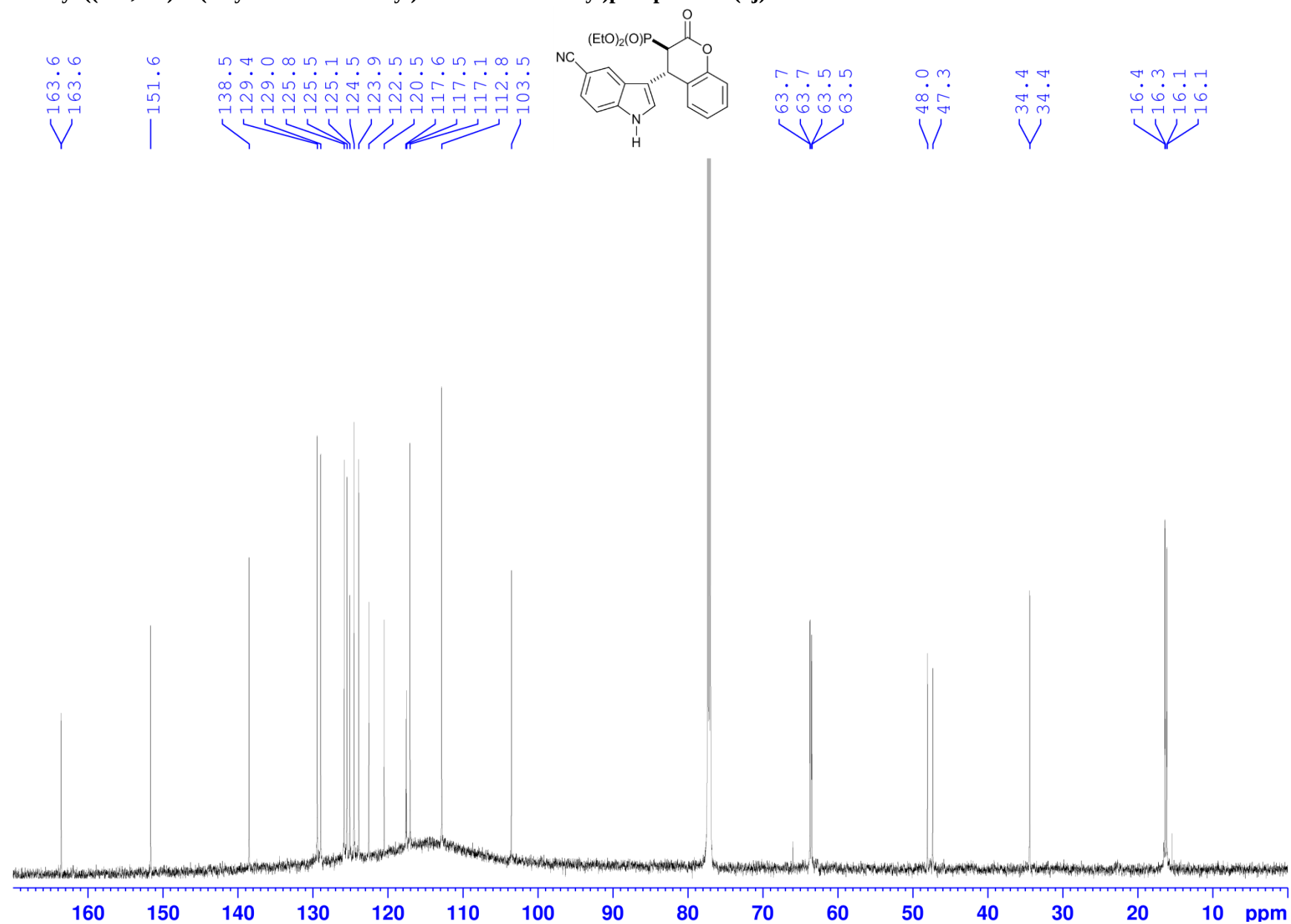
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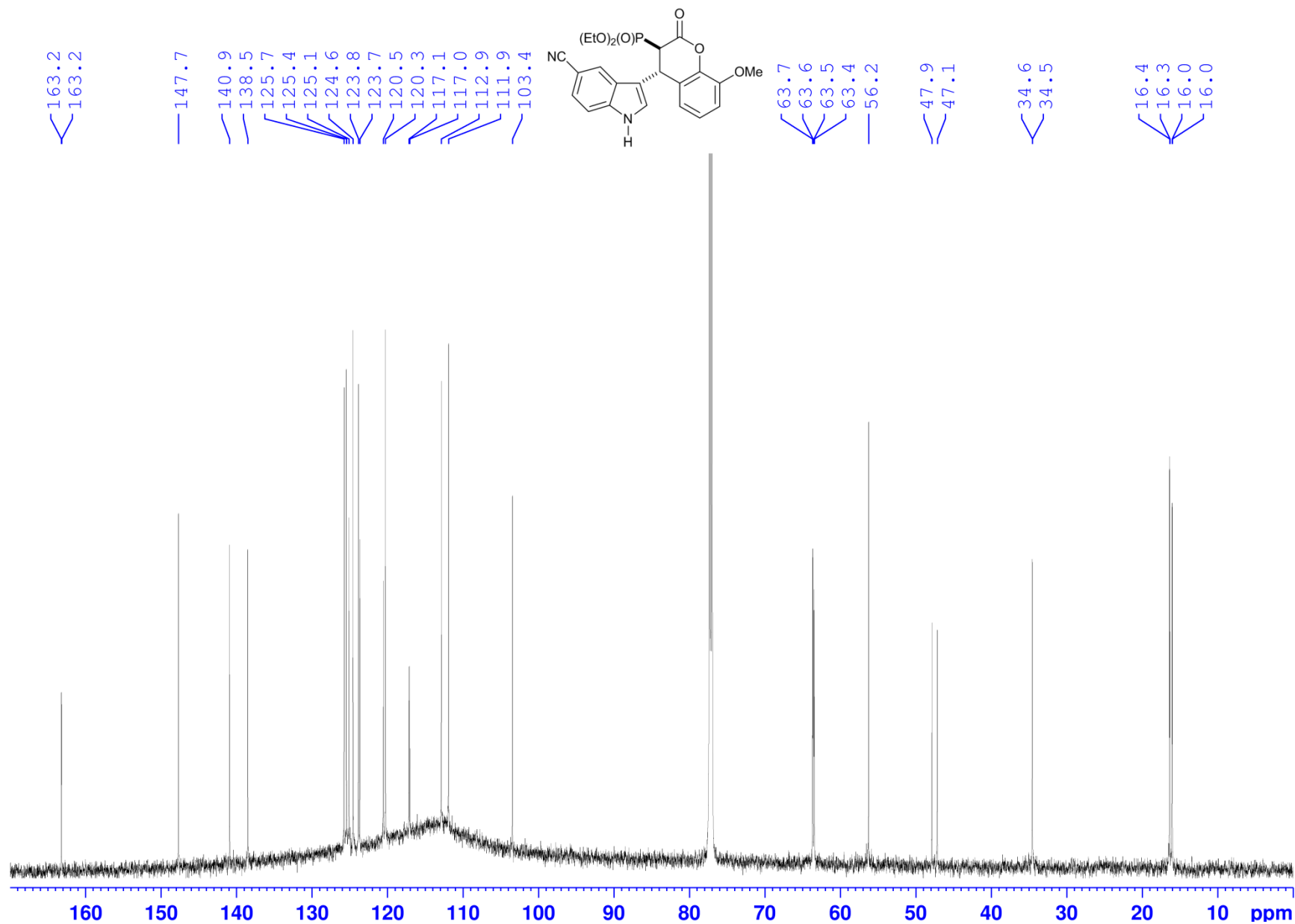
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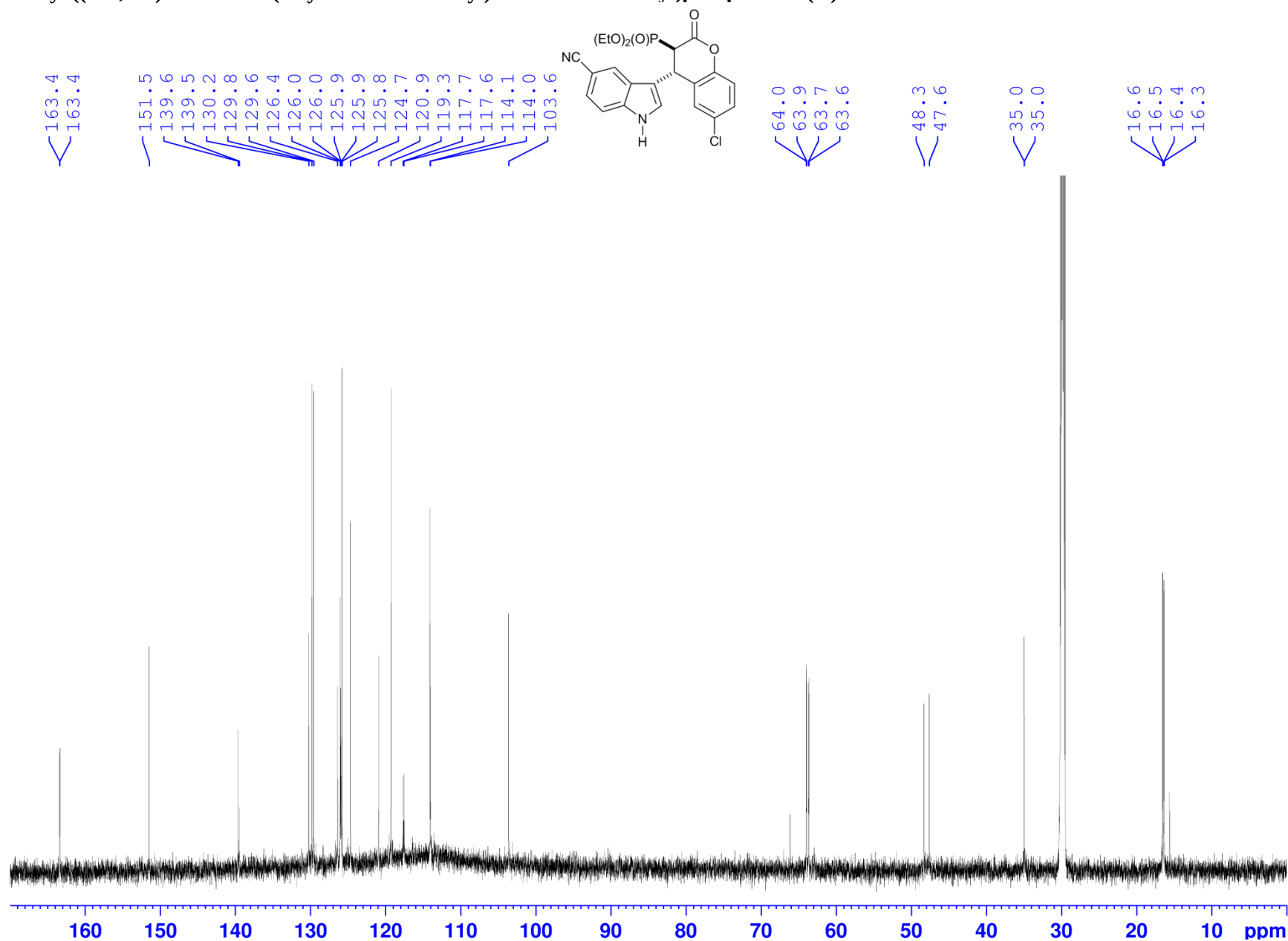
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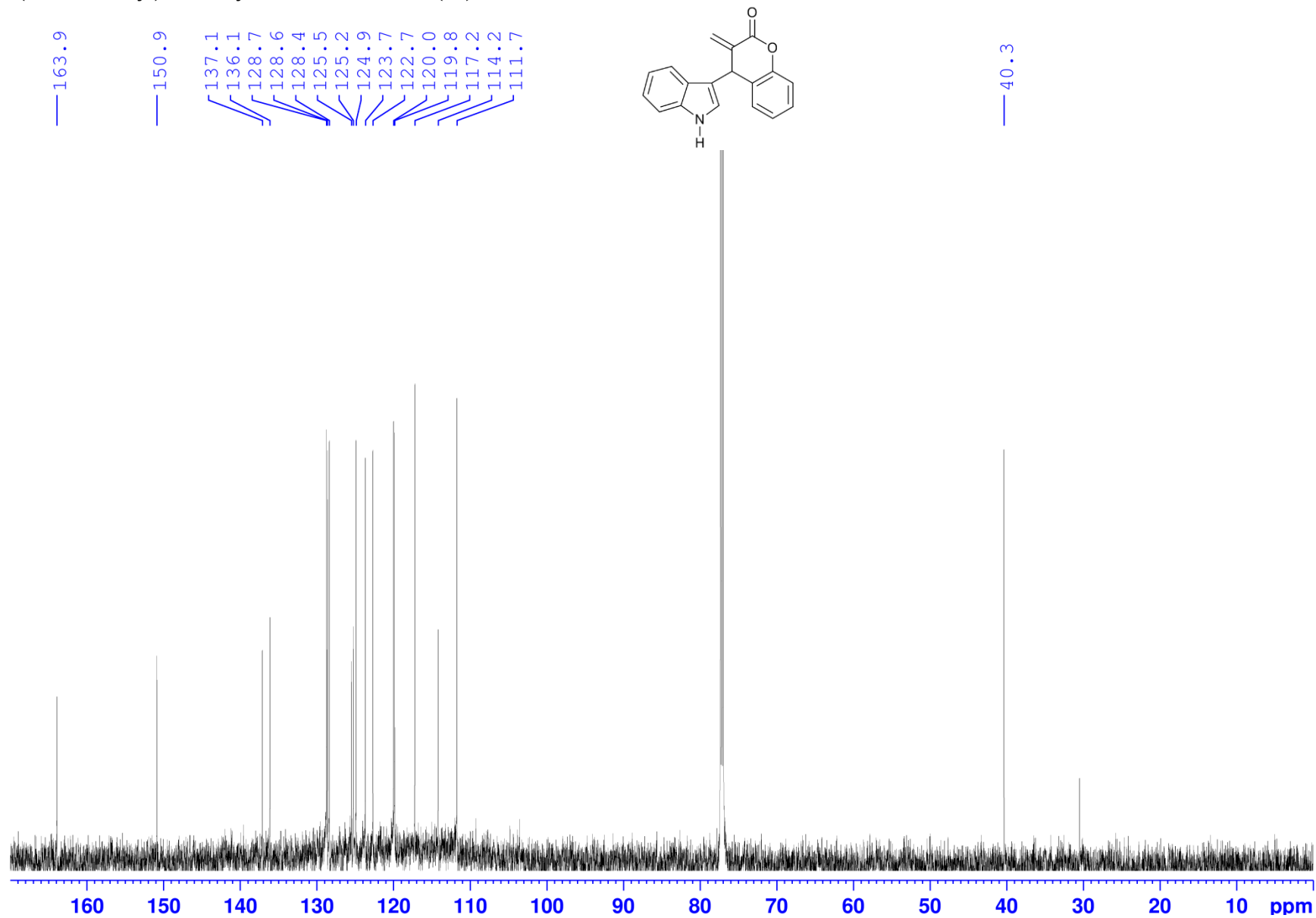
Diethyl ((3*R**,4*S**)-8-methoxy-4-(5-nitro-1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (3h)

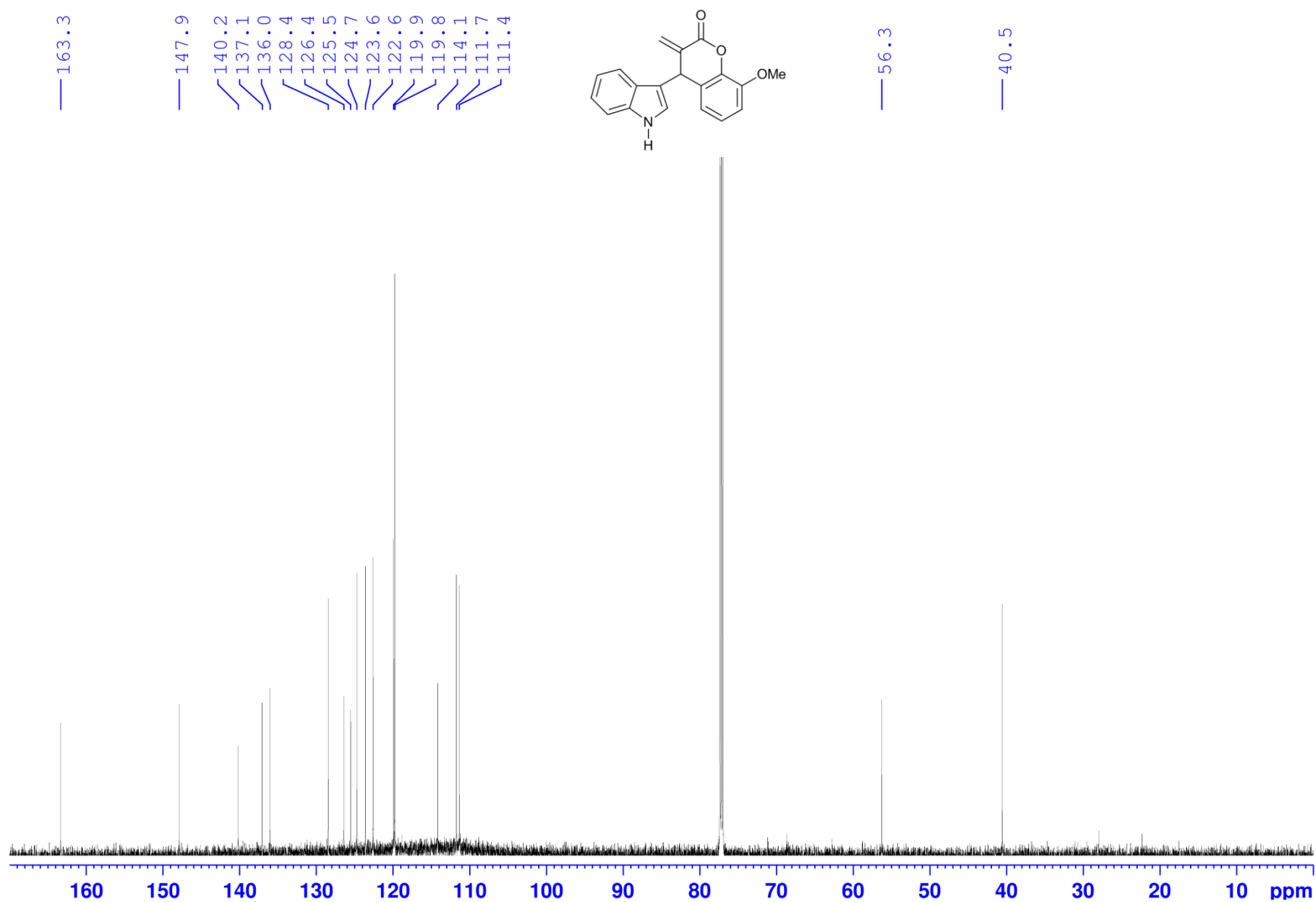
Diethyl ((3*R**,4*S**)-6-chloro-4-(5-nitro-1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (3i)

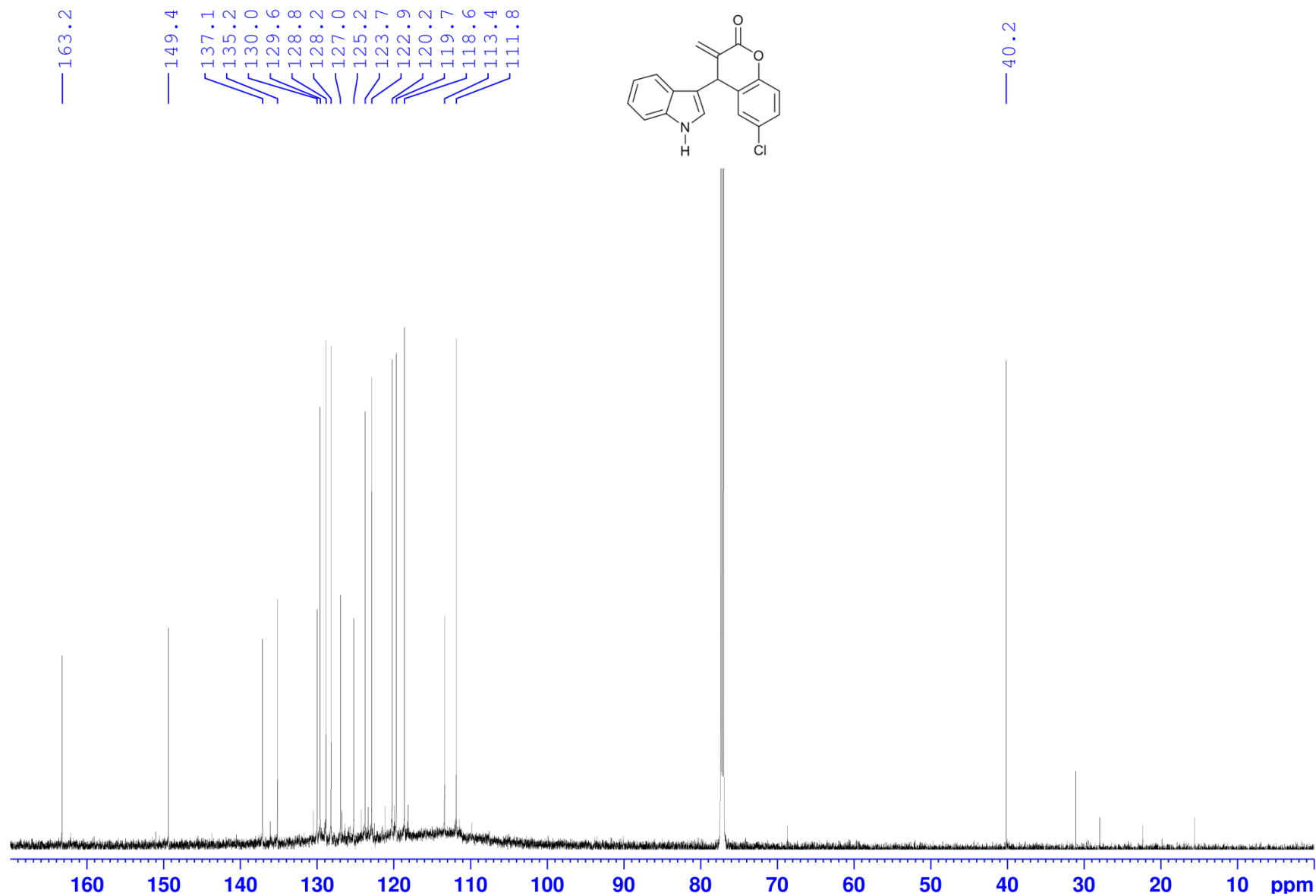
Diethyl ((3*R**,4*S**)-4-(5-cyano-1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (3j)

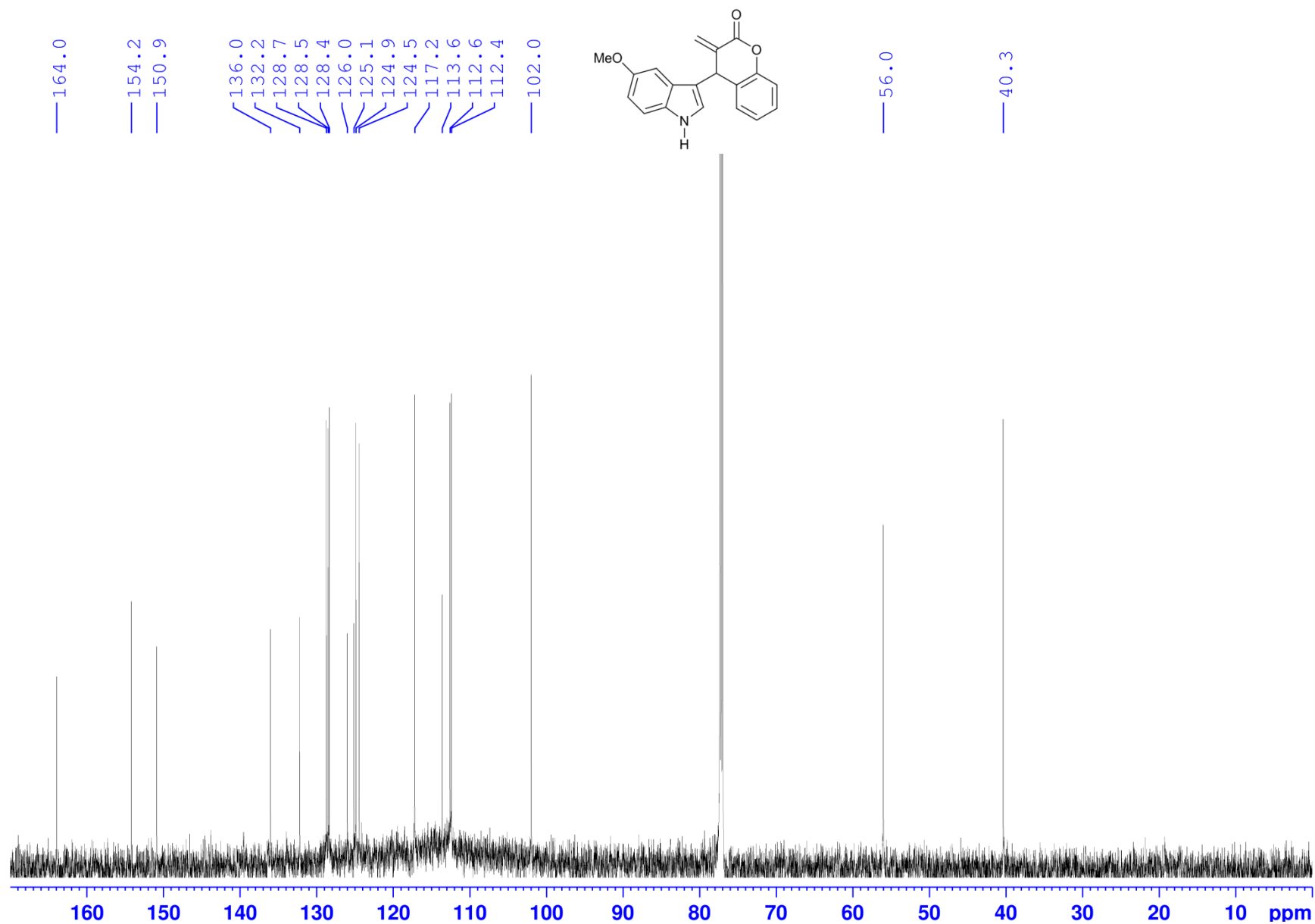
Diethyl ((3*R**,4*S**)-4-(5-cyano-1*H*-indol-3-yl)-8-methoxy-2-oxochroman-3-yl)phosphonate (3k)

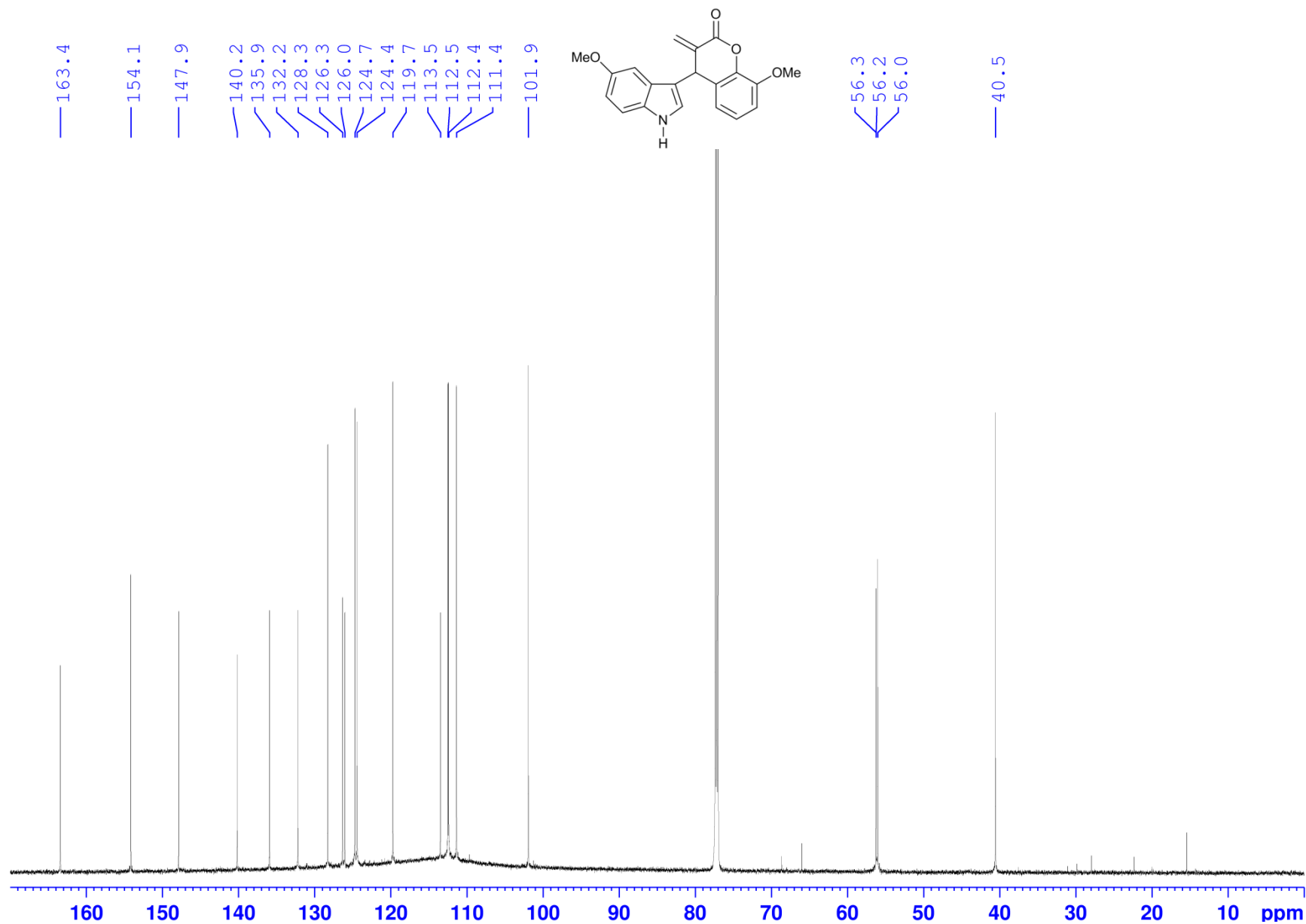
Diethyl ((3*R**,4*S**)-6-chloro-4-(5-cyano-1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (3l)

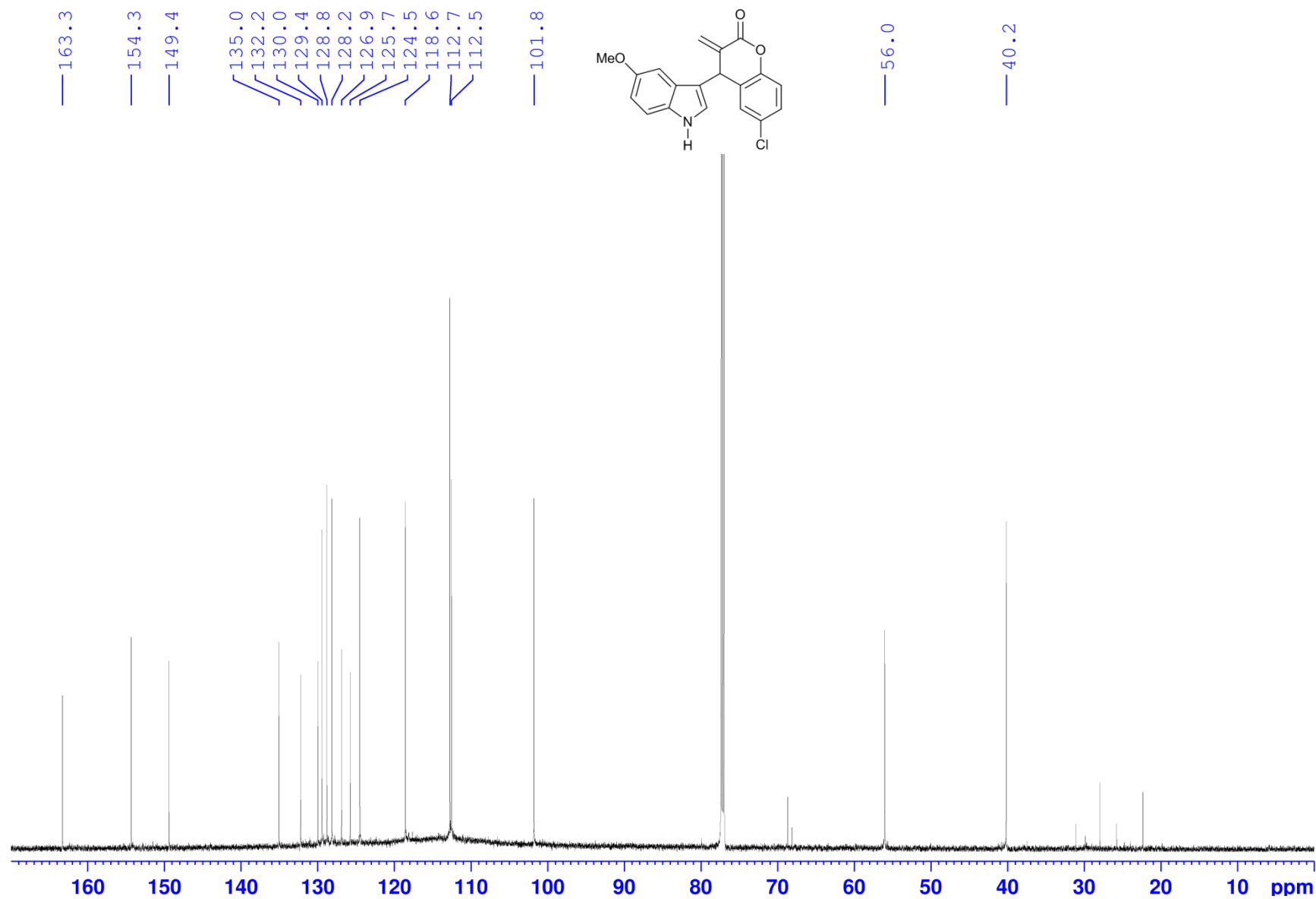
4-(1*H*-Indol-3-yl)-3-methylenechroman-2-one (4a)

4-(1*H*-Indol-3-yl)-8-methoxy-3-methylenechroman-2-one (4b)

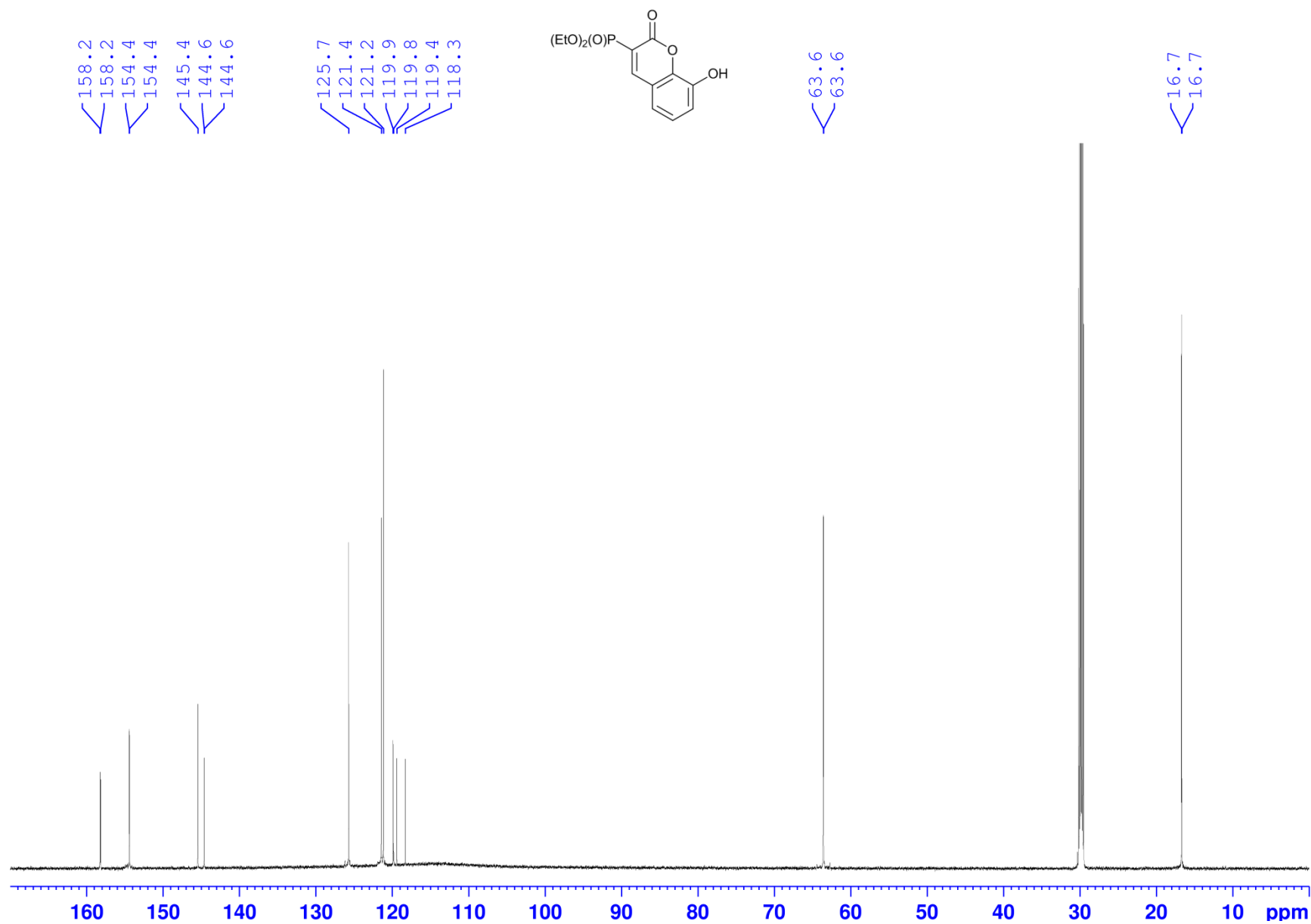
6-Chloro-4-(1*H*-indol-3-yl)-3-methylenechroman-2-one (4c)

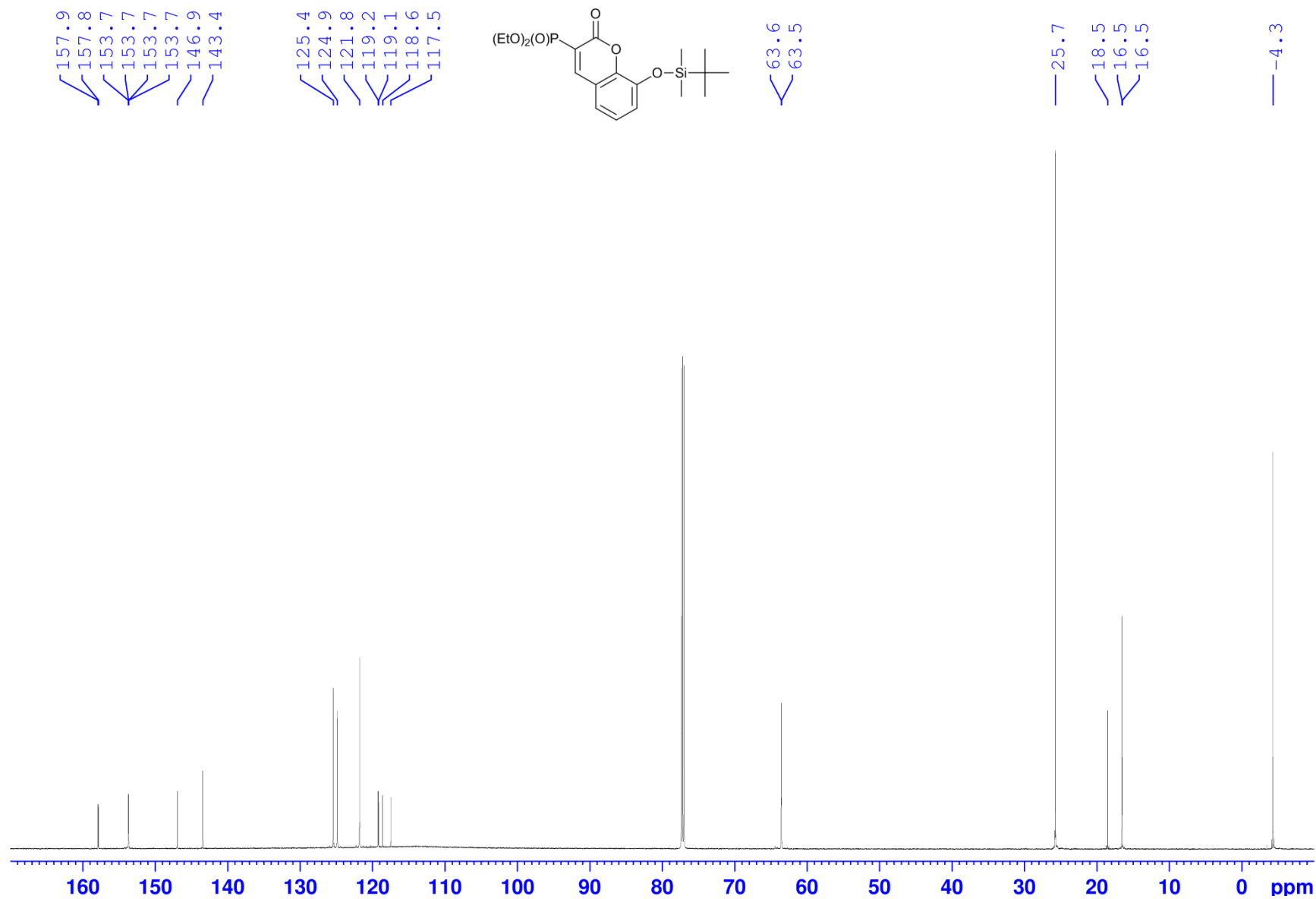
4-(5-Methoxy-1*H*-indol-3-yl)-3-methylenechroman-2-one (4d)

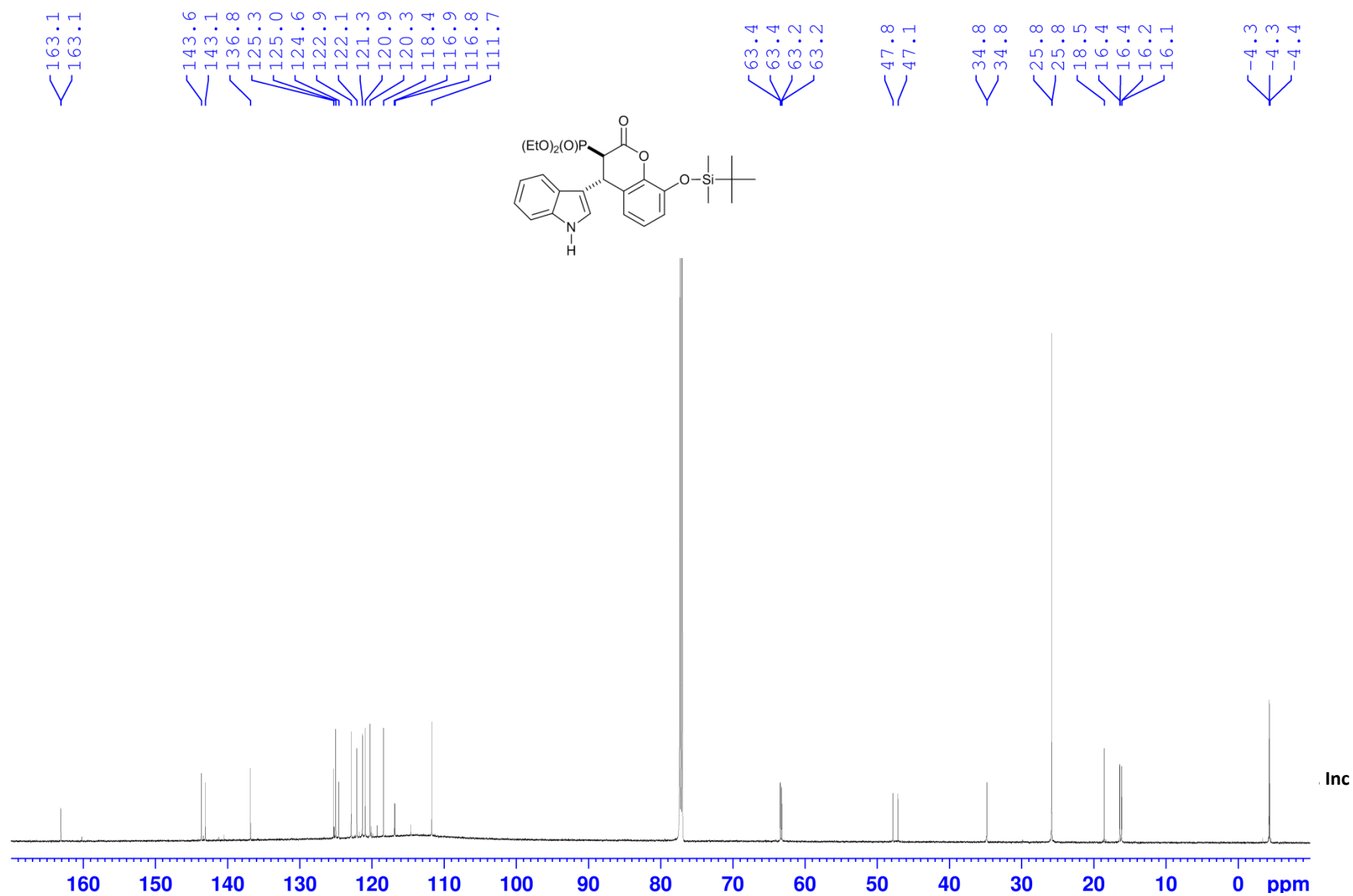
8-Methoxy-4-(5-methoxy-1H-indol-3-yl)-3-methylenechroman-2-one (4e)

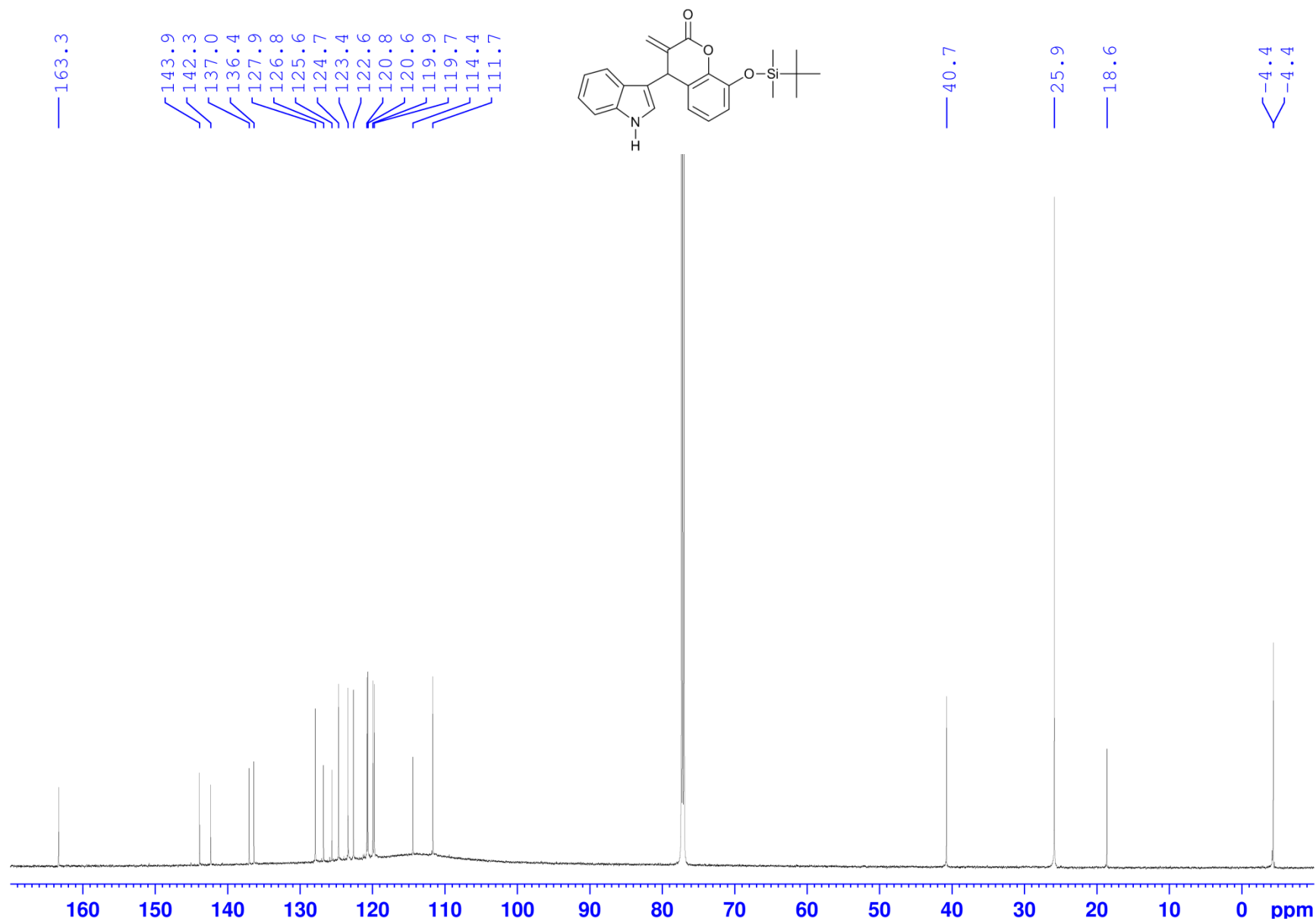
6-Chloro-4-(5-methoxy-1*H*-indol-3-yl)-3-methylenechroman-2-one (4f)

Diethyl (8-hydroxy-2-oxo-2H-chromen-3-yl)phosphonate (7)



Diethyl (8-((*tert*-butyldimethylsilyl)oxy)-2-oxo-2*H*-chromen-3-yl)phosphonate (8)

Diethyl ((3*R**,4*S**)-8-((*tert*-butyldimethylsilyl)oxy)-4-(1*H*-indol-3-yl)-2-oxochroman-3-yl)phosphonate (9)

8-((*tert*-Butyldimethylsilyl)oxy)-4-(1*H*-indol-3-yl)-3-methylenechroman-2-one (10)

8-Hydroxy-4-(1*H*-indol-3-yl)-3-methyl-2*H*-chromen-2-one (11)