Electronic Supplementary Material (ESI) for New Journal of Chemistry.

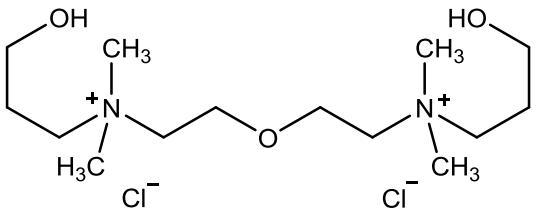
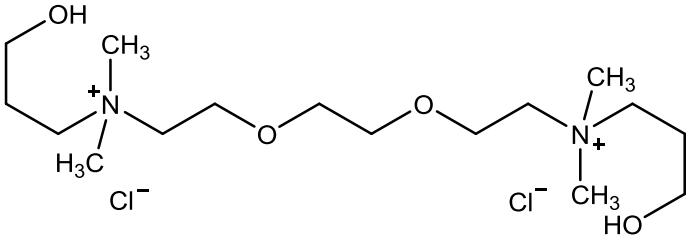
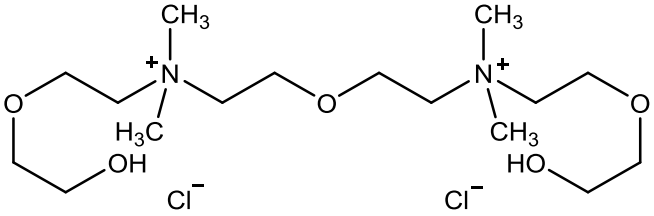
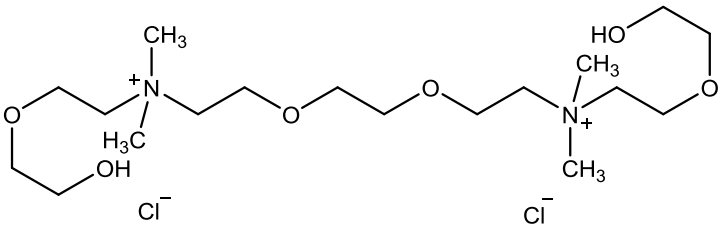
Electronic Supplementary Information

Synthesis and antioxidant properties of dicationic ionic liquids

Kamil Czerniak and Filip Walkiewicz

Department of Chemical Technology, Poznan University of Technology, 60-965 Poznan, Poland

Table S1. Prepared dicationic quaternary ammonium chlorides

Cation	Structure	Form at 25 °C	Mp (^{o}C)	Yield (%)
1		solid	166-167	95
2		solid	119-120	94
3		solid	79-81	97
4		liquid	-	93

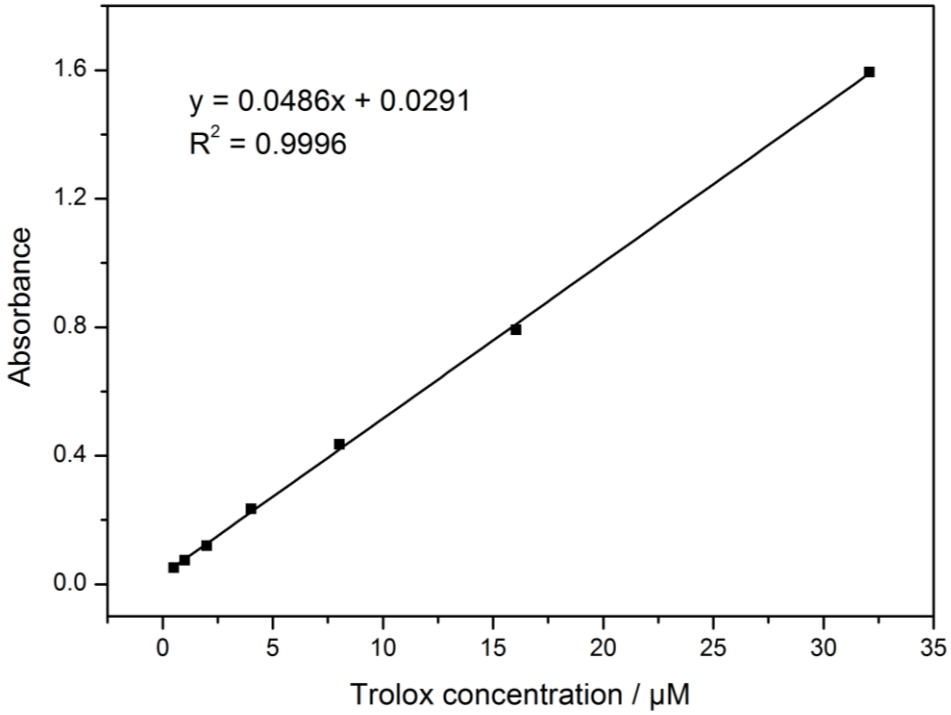


Fig. S1 Trolox calibration curve of FRAP assay.

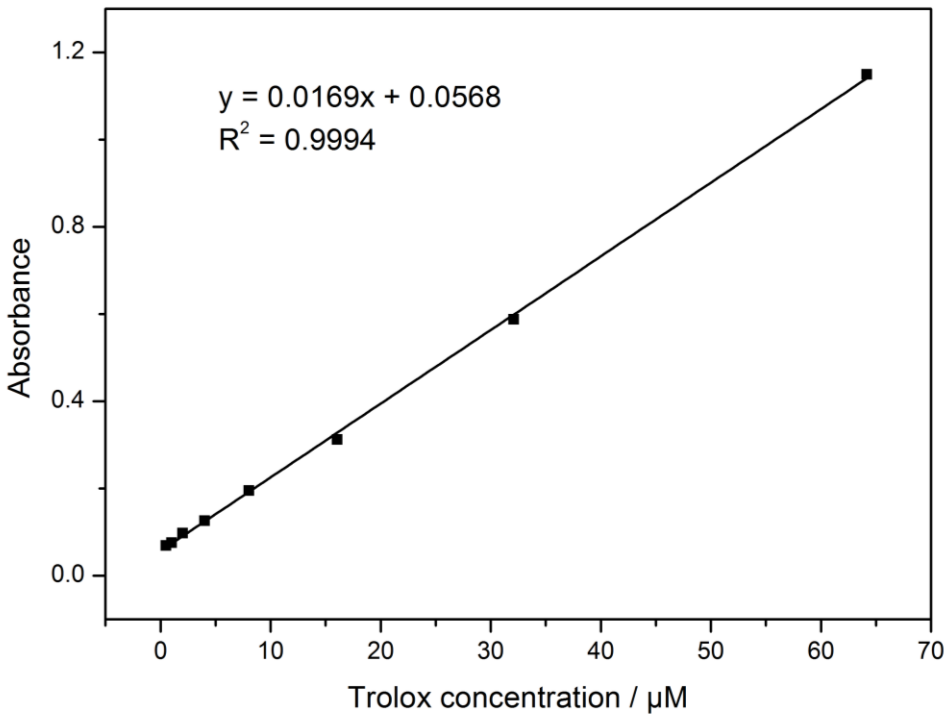


Fig. S2 Trolox calibration curve of CUPRAC assay.

Table S2 Antioxidant activity of ILs. The same letter in the column means no statistically significant differences.

Compounds	DPPH EC_{50} (μM)	ABTS EC_{50} (μM)	FRAP (μmol TE)	CUPRAC (μmol TE)	Linoleic acid peroxidation inhibition at 72 h (%)
1a	5.06 ± 0.15 a	5.06 ± 0.04 a	2.86 ± 0.07 ab	5.59 ± 0.13 a	48 ± 6 a
2a	5.45 ±0.20 ab	5.01 ± 0.09 a	2.74 ± 0.05 ac	5.11 ± 0.05 b	59 ± 2 b
3a	5.85 ±0.04 bc	5.44 ± 0.11 b	3.01 ± 0.12 b	5.16 ± 0.10 b	60 ± 2 b
4a	5.98 ±0.05 c	5.27 ± 0.10 c	2.68 ± 0.12 c	4.75 ± 0.12 c	60 ± 2 b
PCA	15.83 ±0.62 d	10.07 ± 0.15 e	1.39 ± 0.05 d	2.71 ± 0.09 d	48 ± 5 a
1b	4.19 ±0.13 e	3.41 ± 0.08 f	3.93 ± 0.12 e	4.76 ± 0.13 c	13 ± 4 c
2b	3.80 ±0.15 ef	3.48 ± 0.04 f	3.57 ± 0.11 f	4.73 ± 0.14 c	14 ± 6 c
3b	3.93 ±0.14 e	3.64 ± 0.01 g	3.63 ± 0.10 f	4.28 ± 0.14 e	21 ± 4 d
4b	3.55 ±0.10 f	3.49 ± 0.03 f	3.79 ± 0.09 e	4.24 ± 0.07 e	23 ± 2 d
GA	6.30 ±0.16 c	6.47 ± 0.11 i	2.18 ± 0.04 g	2.50 ± 0.06 d	18 ± 3 cd
Trolox	12.66 ±0.34 g	10.09 ± 0.09 e	-	-	82 ± 1 e

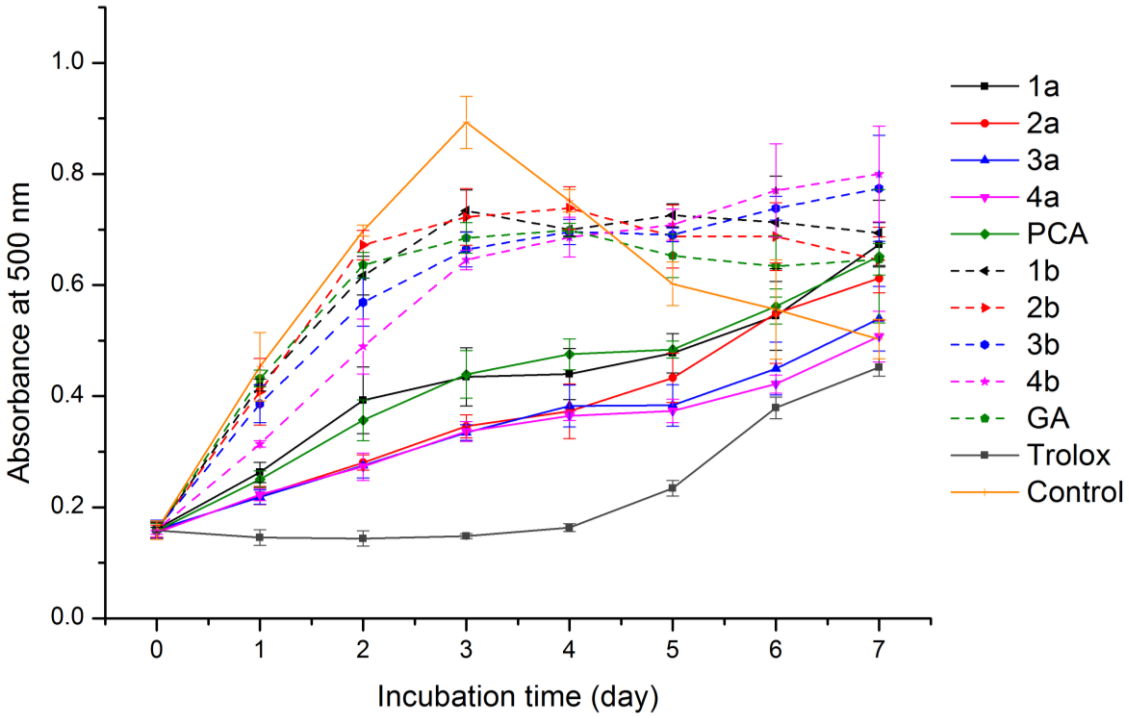


Fig. S3 Antioxidant activity of compounds, measured by the ferric thiocyanate method.

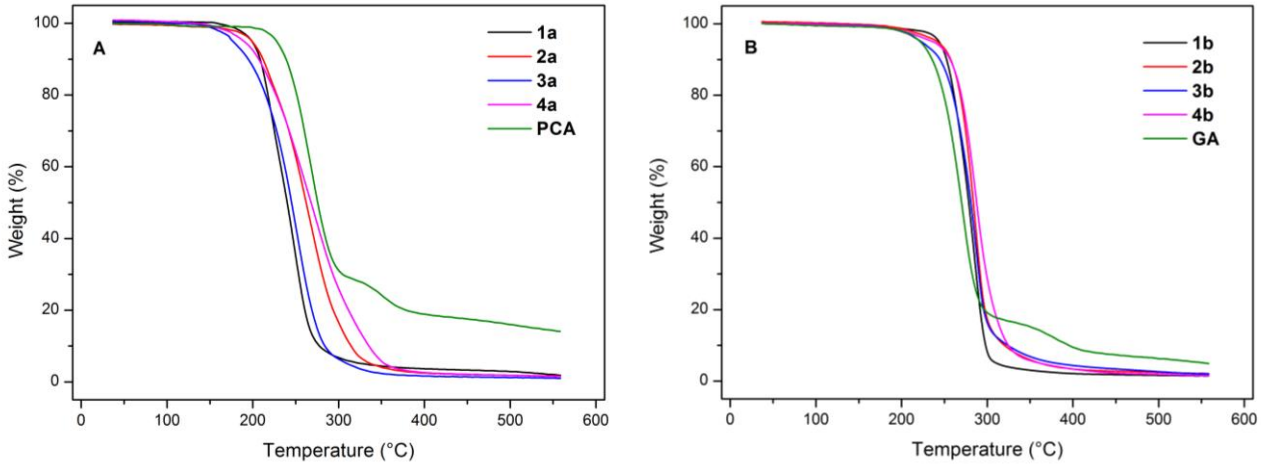


Fig. S4 TGA curves of DILs with PCA (A) and GA (B) anions.

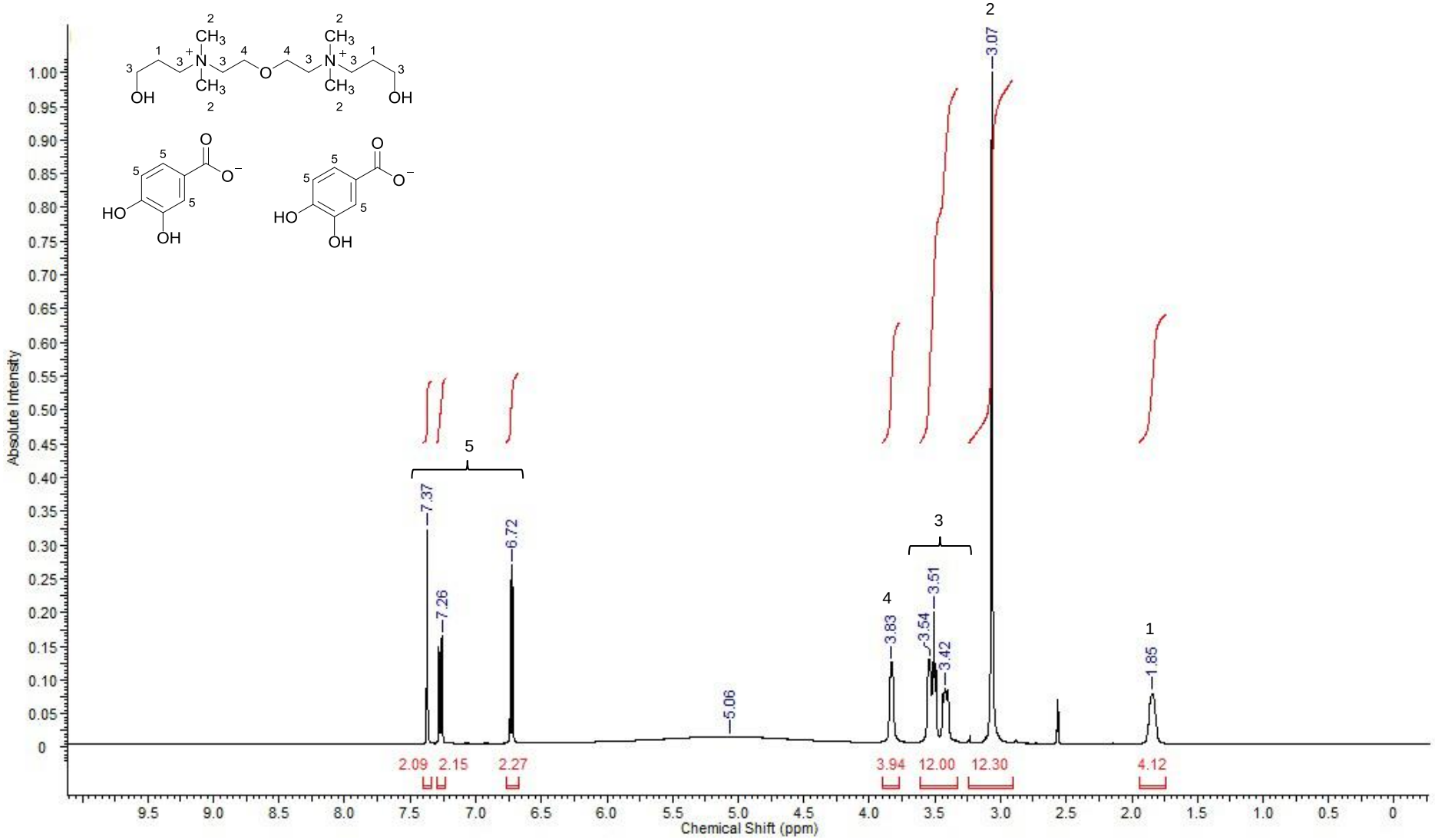


Fig. S5 ^{1}H spectrum of oxybis(ethylene)bis(1-dimethyl-3-hydroxypropylammonium) di**[**3,4-dihydroxybenzoate] (**1a).**

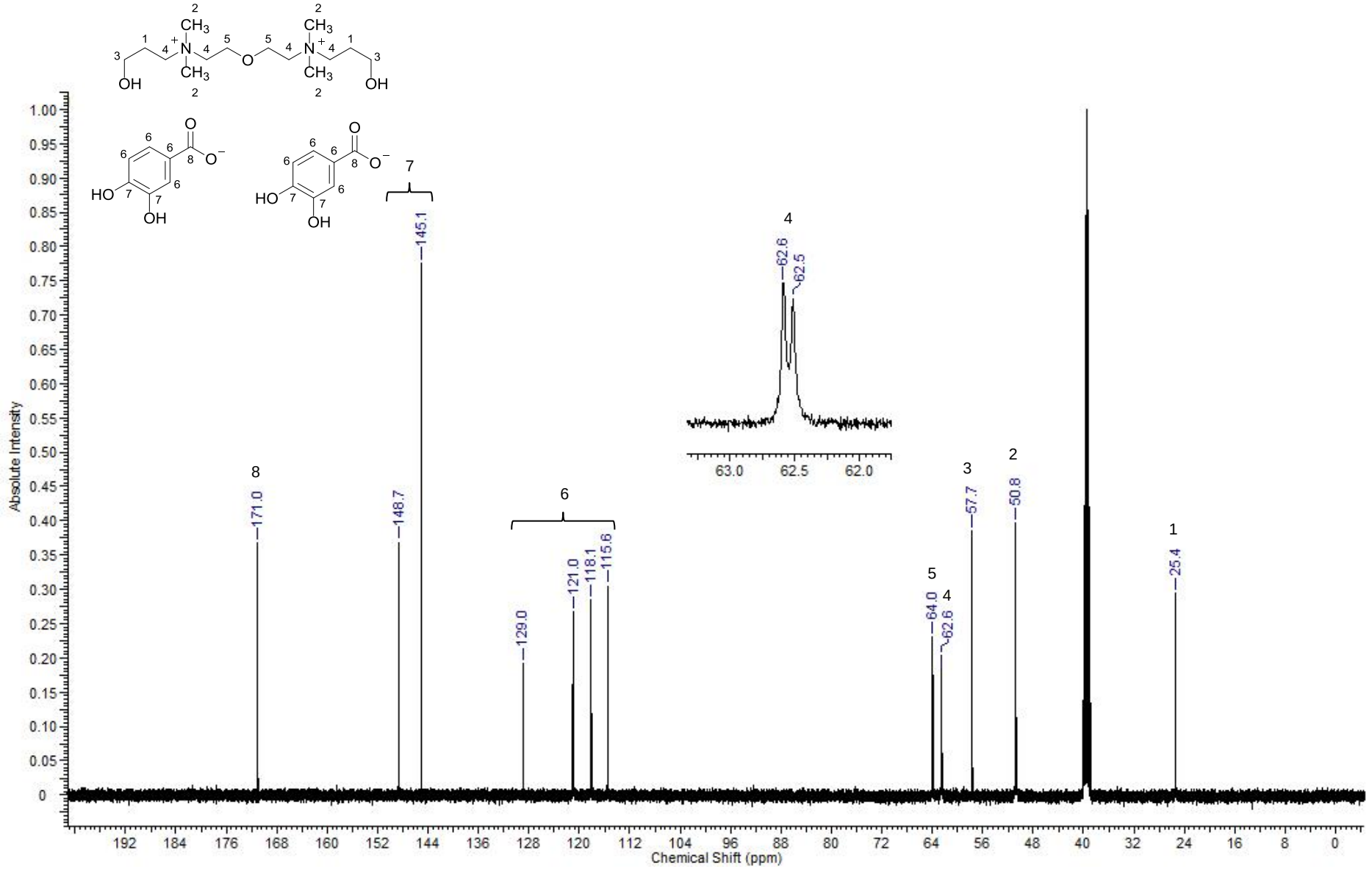


Fig. S6 ^{13}C spectrum of oxybis(ethylene)bis(1-dimethyl-3-hydroxypropylammonium) di**[**3,4-dihydroxybenzoate] (**1a**).

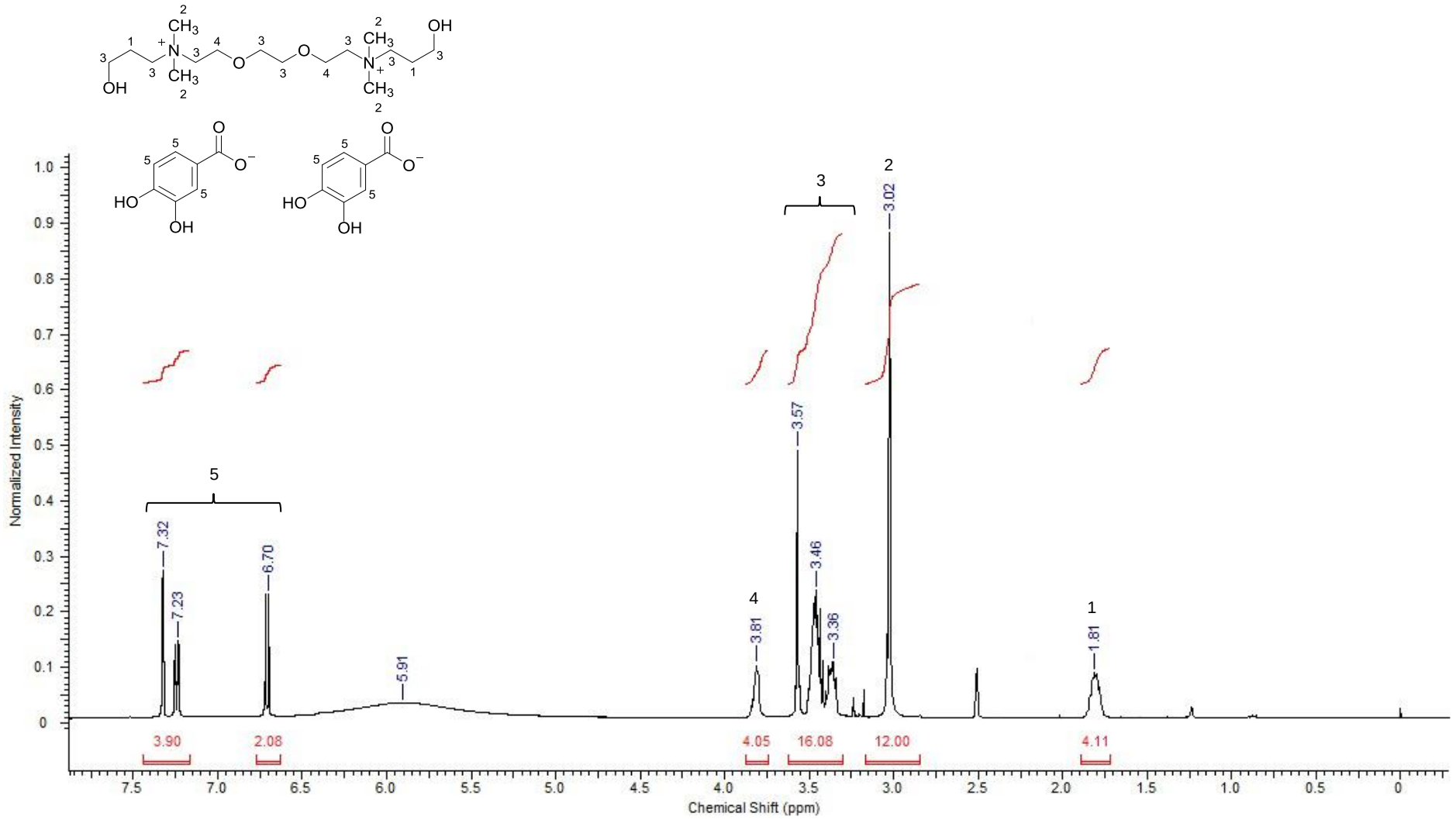


Fig. S7 ^{1}H spectrum of ethylenebis(oxyethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[3,4-dihydroxybenzoate] (**2a**).

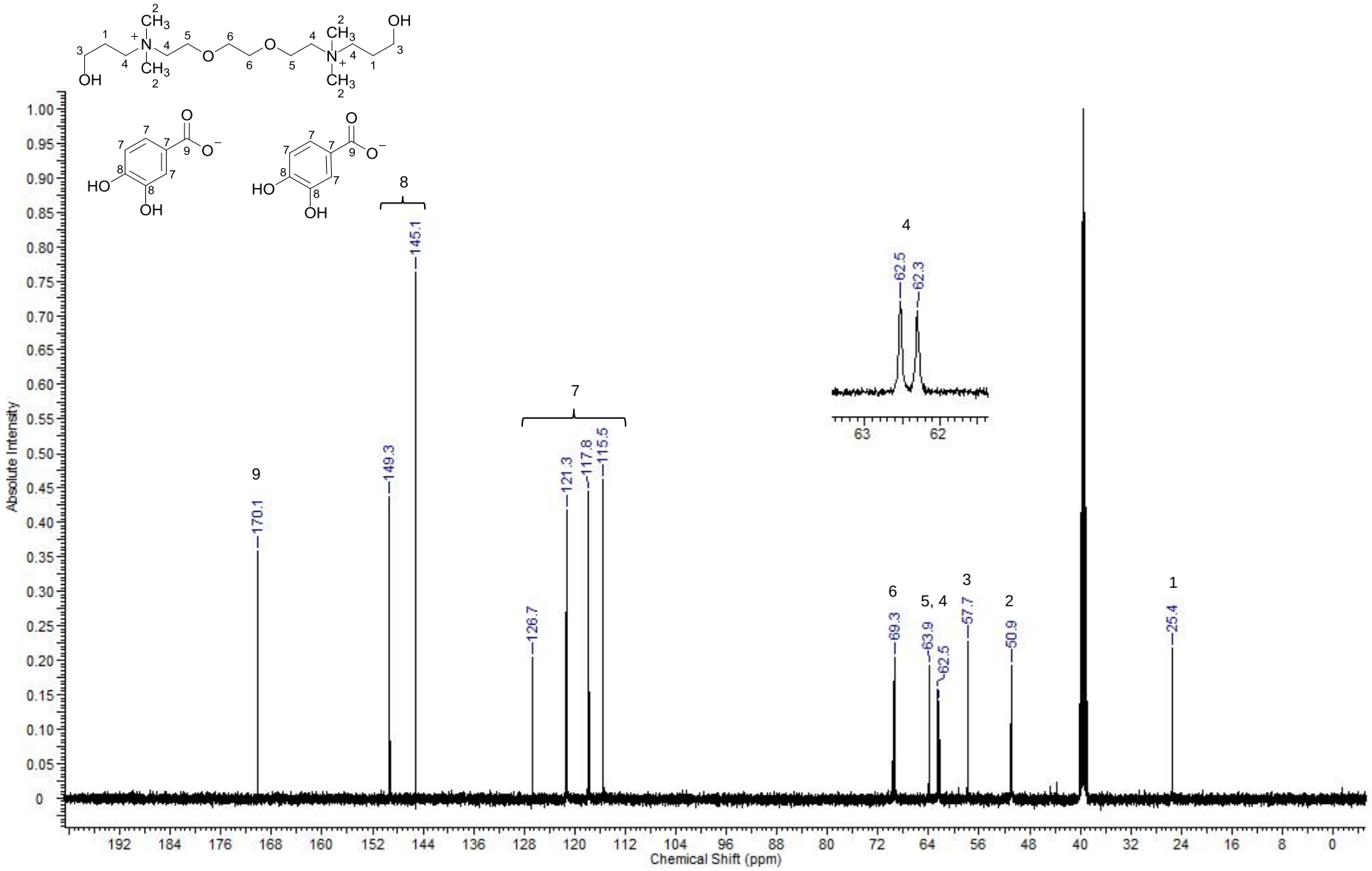


Fig. S8 ^{13}C spectrum of ethylenebis(oxyethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[3,4-dihydroxybenzoate] (**2a**).

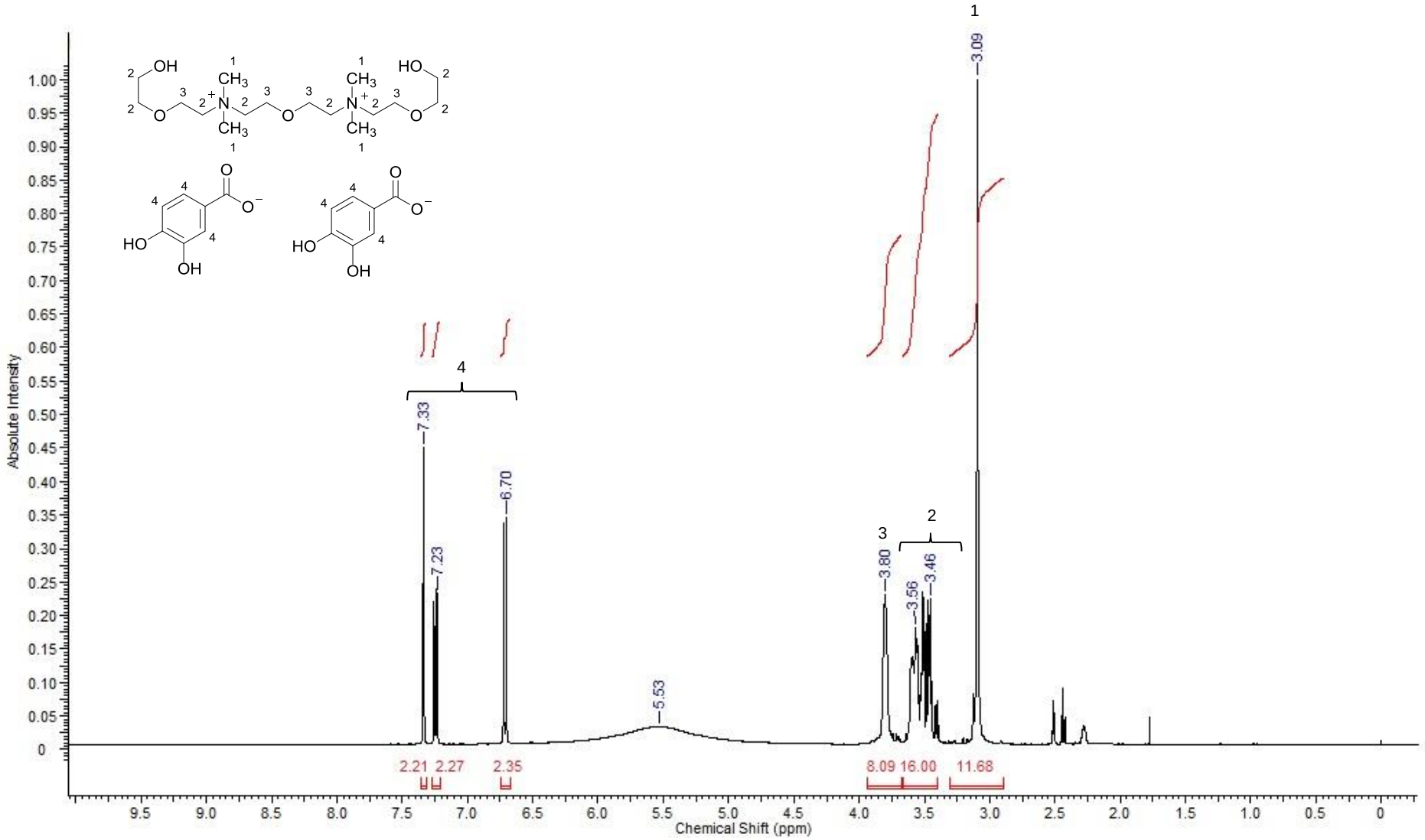


Fig. S9 ^{1}H spectrum of oxybis(ethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[3,4-dihydroxybenzoate] (**3a**).

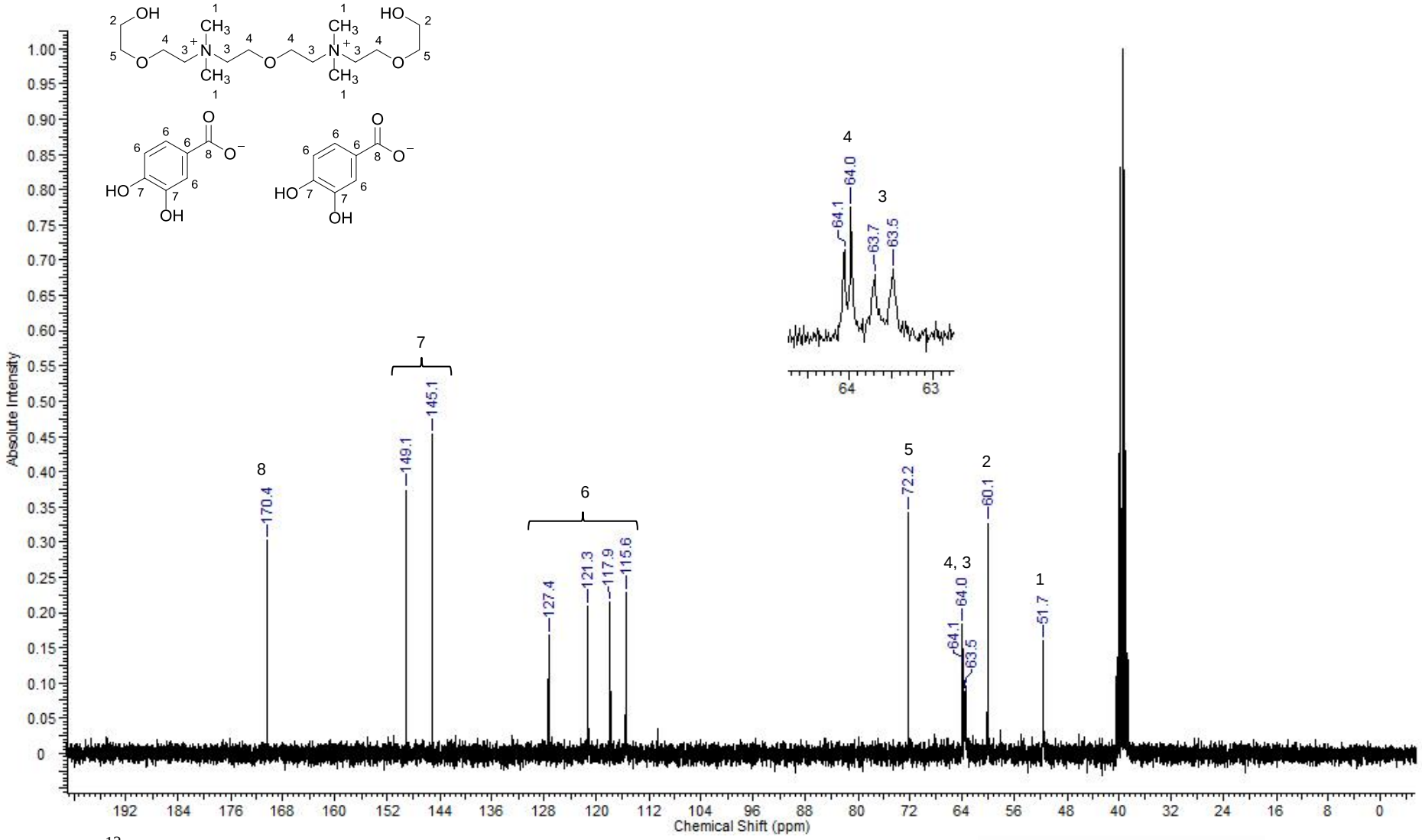


Fig. S10 ^{13}C spectrum of oxybis(ethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[3,4-dihydroxybenzoate] (**3a**).

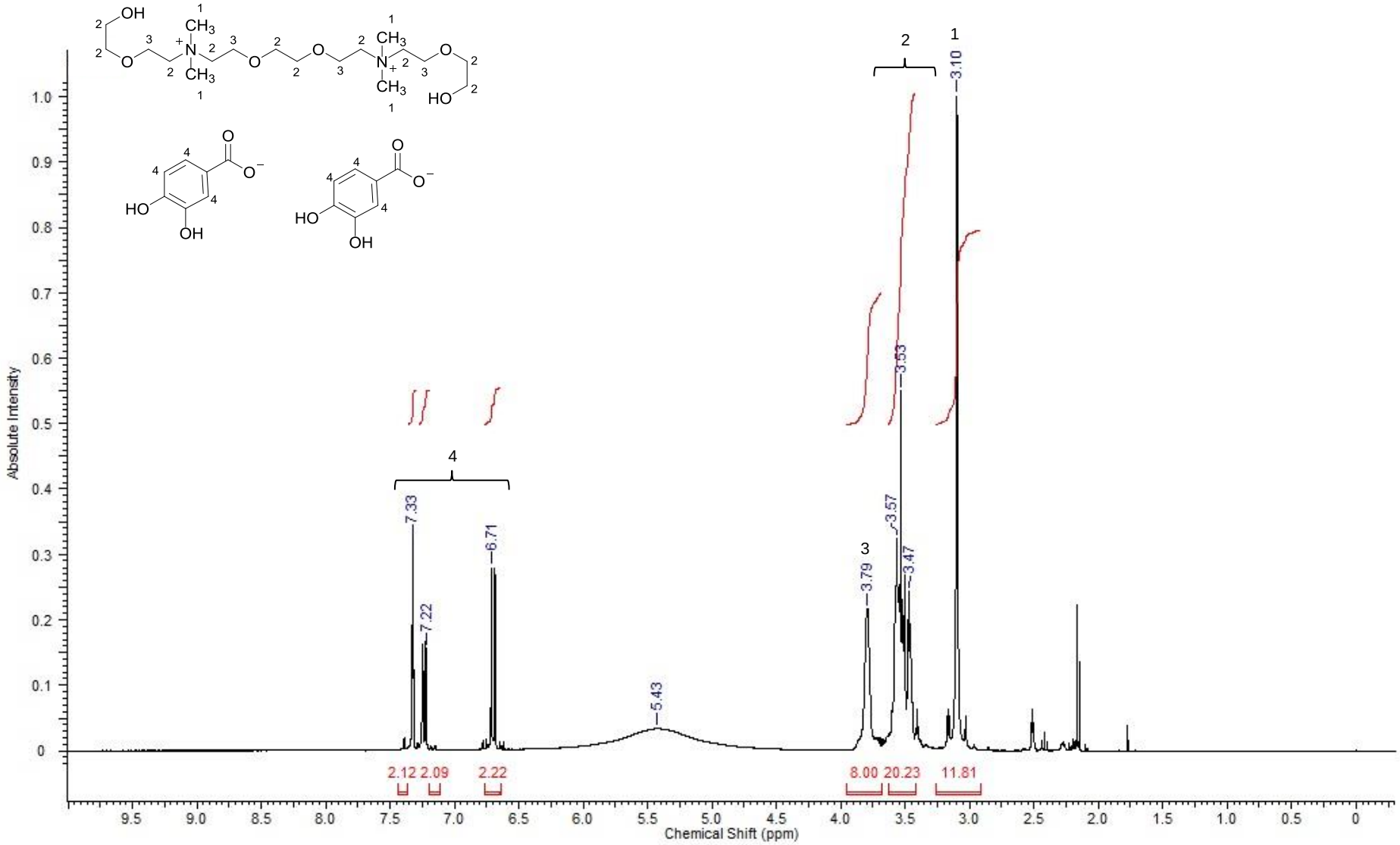


Fig. S11 ^{1}H spectrum of ethylenebis(oxyethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[3,4-dihydroxybenzoate] (**4a**).

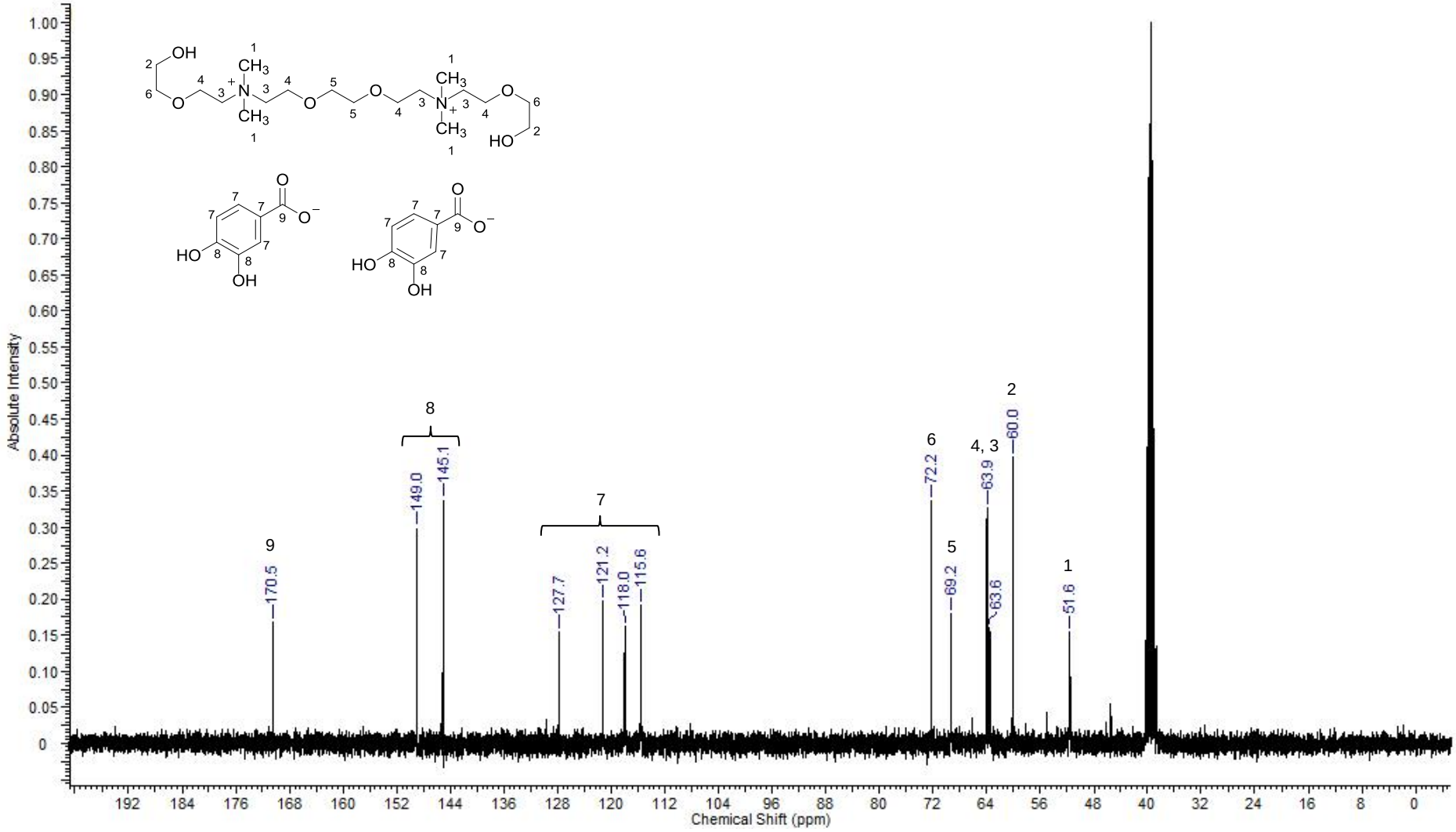


Fig. S12 ^{13}C spectrum of ethylenebis(oxyethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[3,4-dihydroxybenzoate] (**4a**).

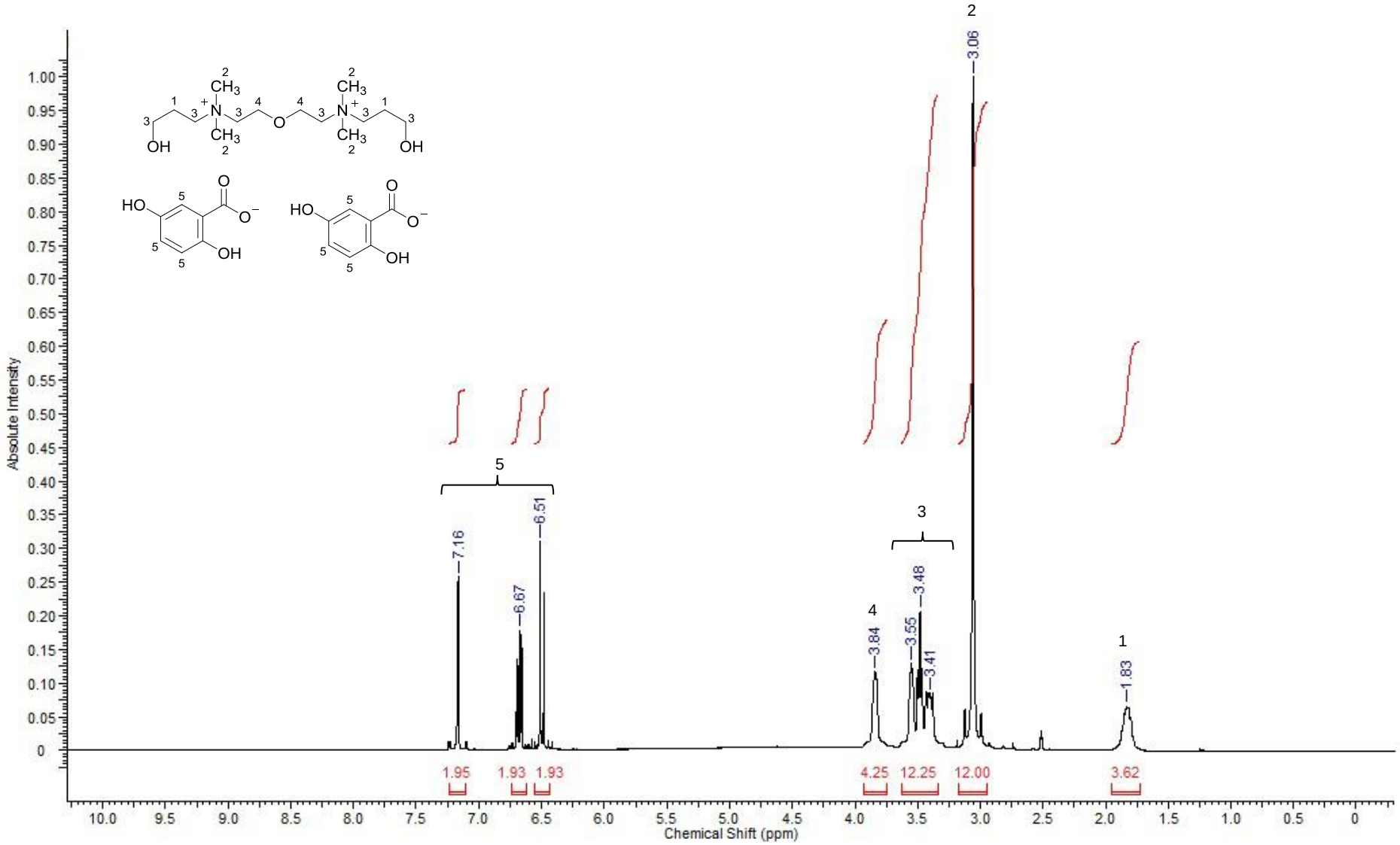


Fig. S13 ^{1}H spectrum of oxybis(ethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[2,5-dihydroxybenzoate] (**1b**).

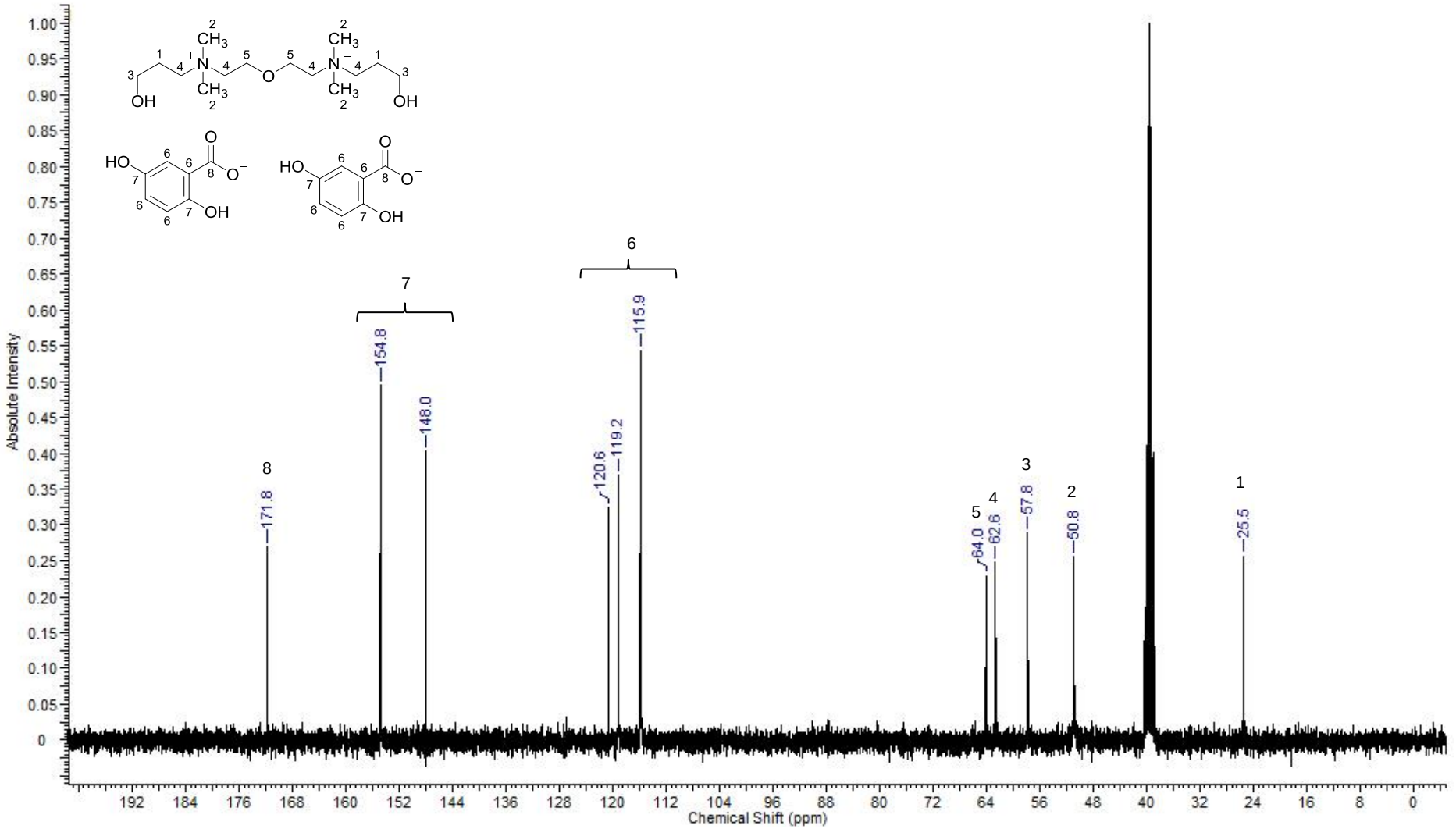


Fig. S14 ^{13}C spectrum of oxybis(ethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[2,5-dihydroxybenzoate] (**1b**).

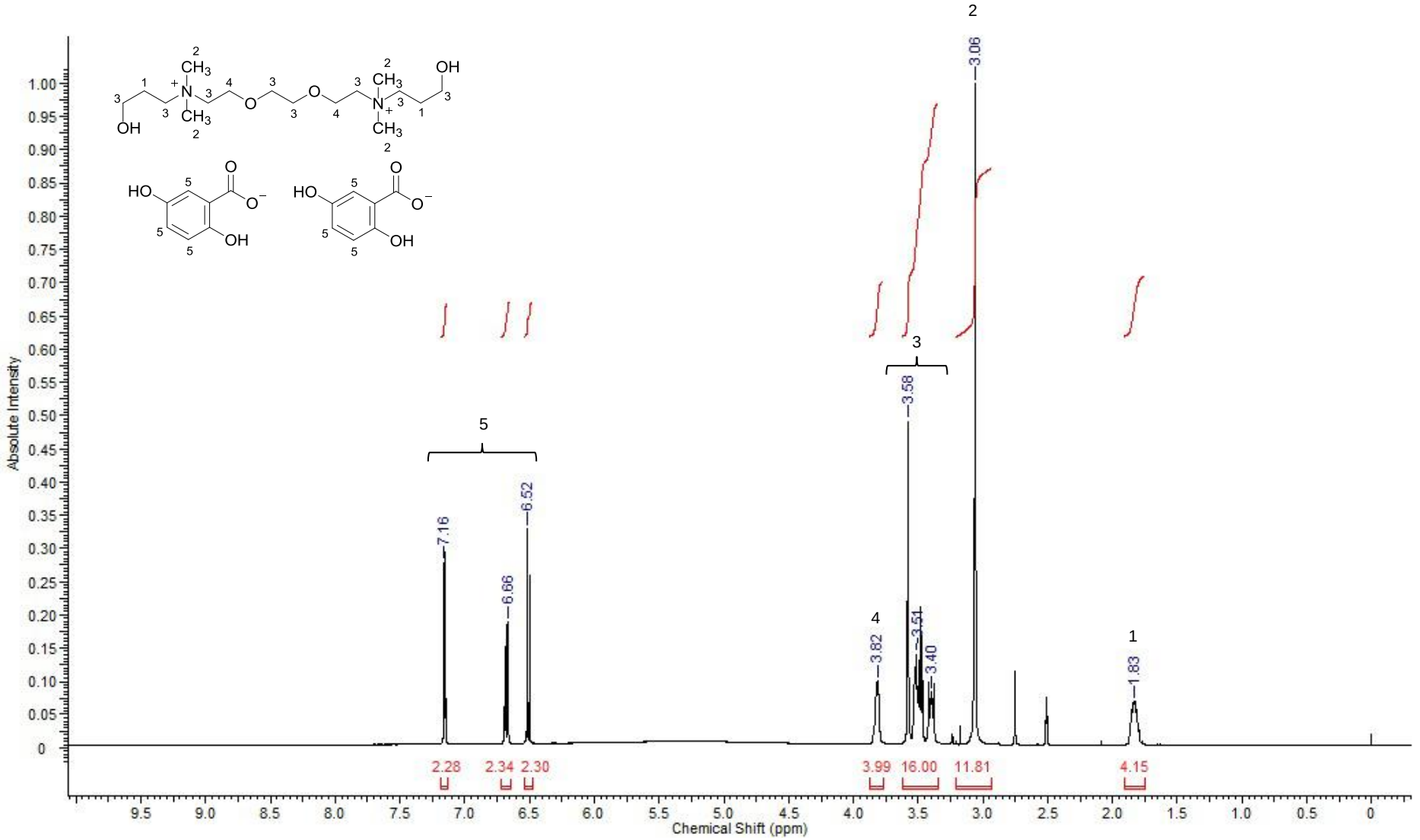


Fig. S15 ^{1}H spectrum of ethylenebis(oxyethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[2,5-dihydroxybenzoate] (**2b**).

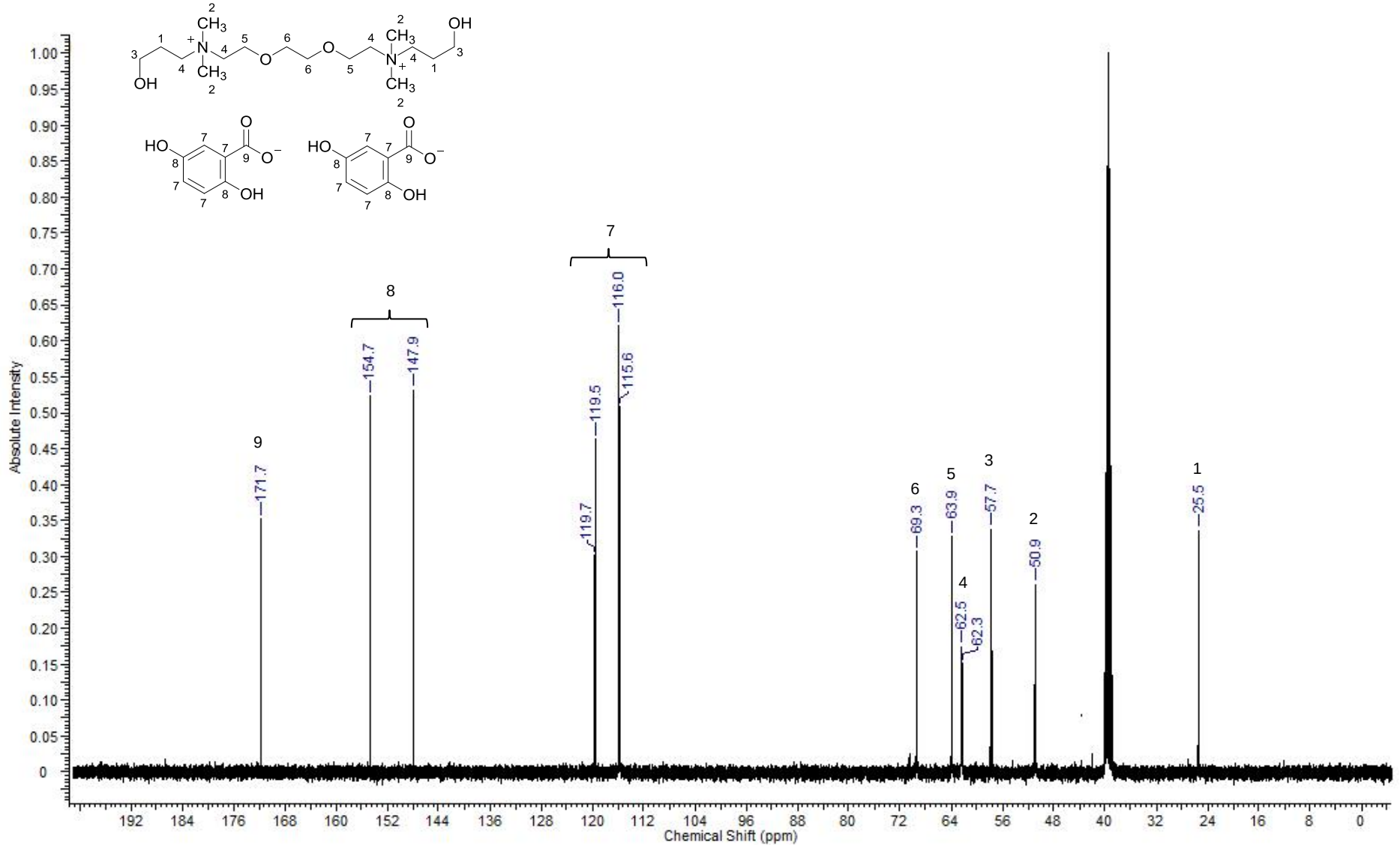


Fig. S16 ^{13}C spectrum of ethylenebis(oxyethylene)bis(1-dimethyl-3-hydroxypropylammonium) di[2,5-dihydroxybenzoate] (**2b**).

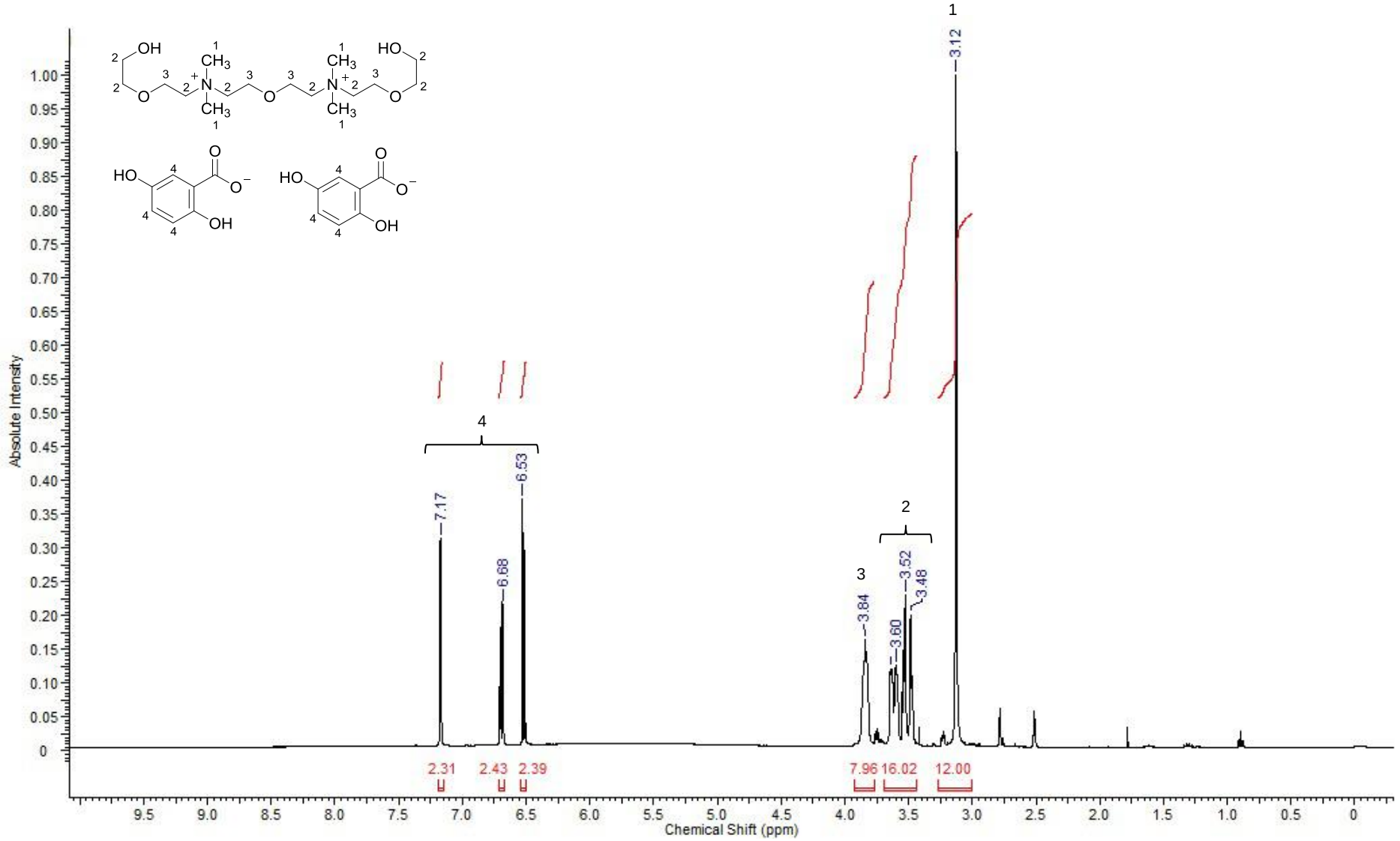


Fig. S17 ^{1}H spectrum of oxybis(ethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[2,5-dihydroxybenzoate] (**3b**).

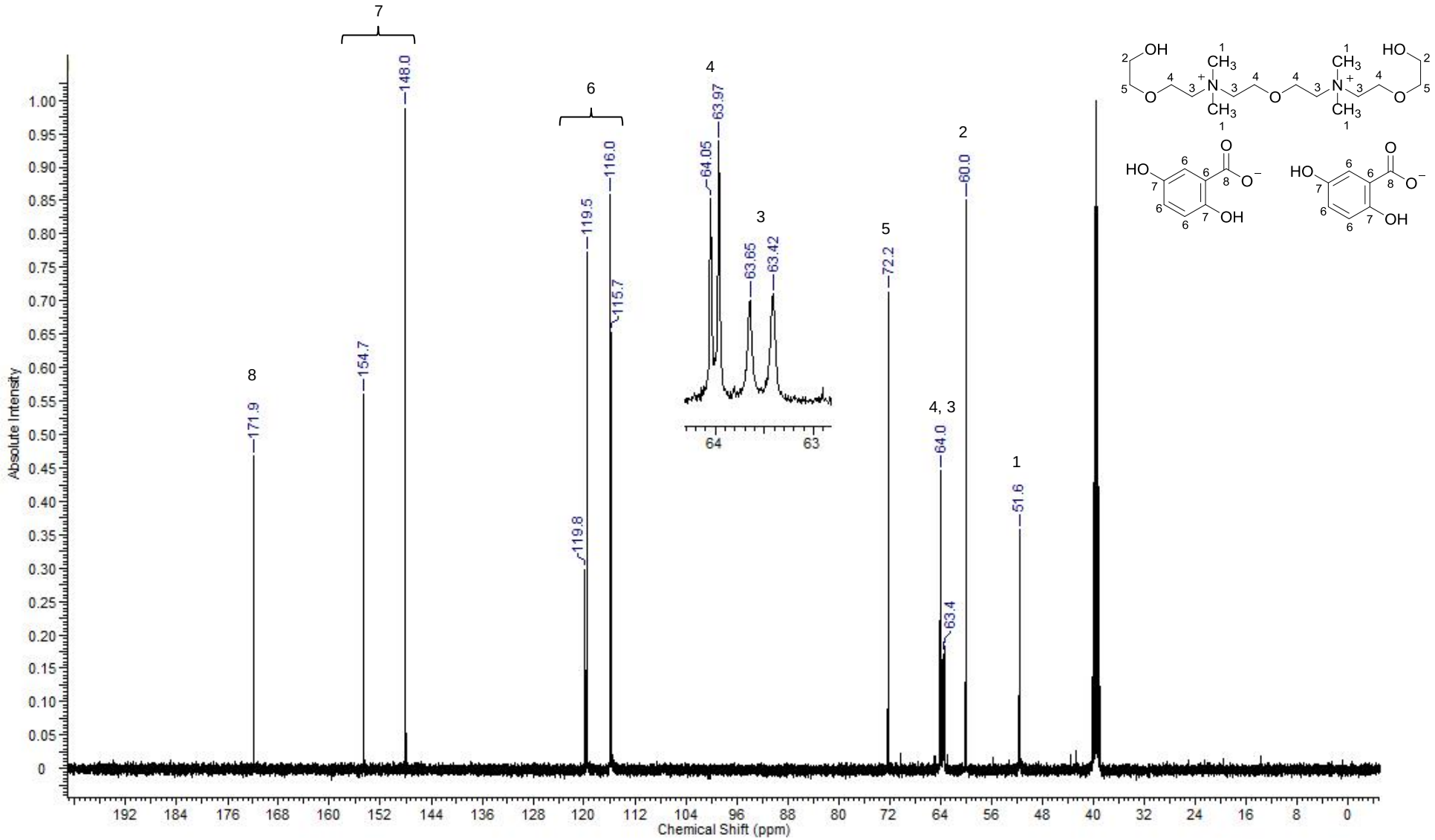


Fig. S18 ^{13}C spectrum of oxybis(ethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[2,5-dihydroxybenzoate] (**3b**).

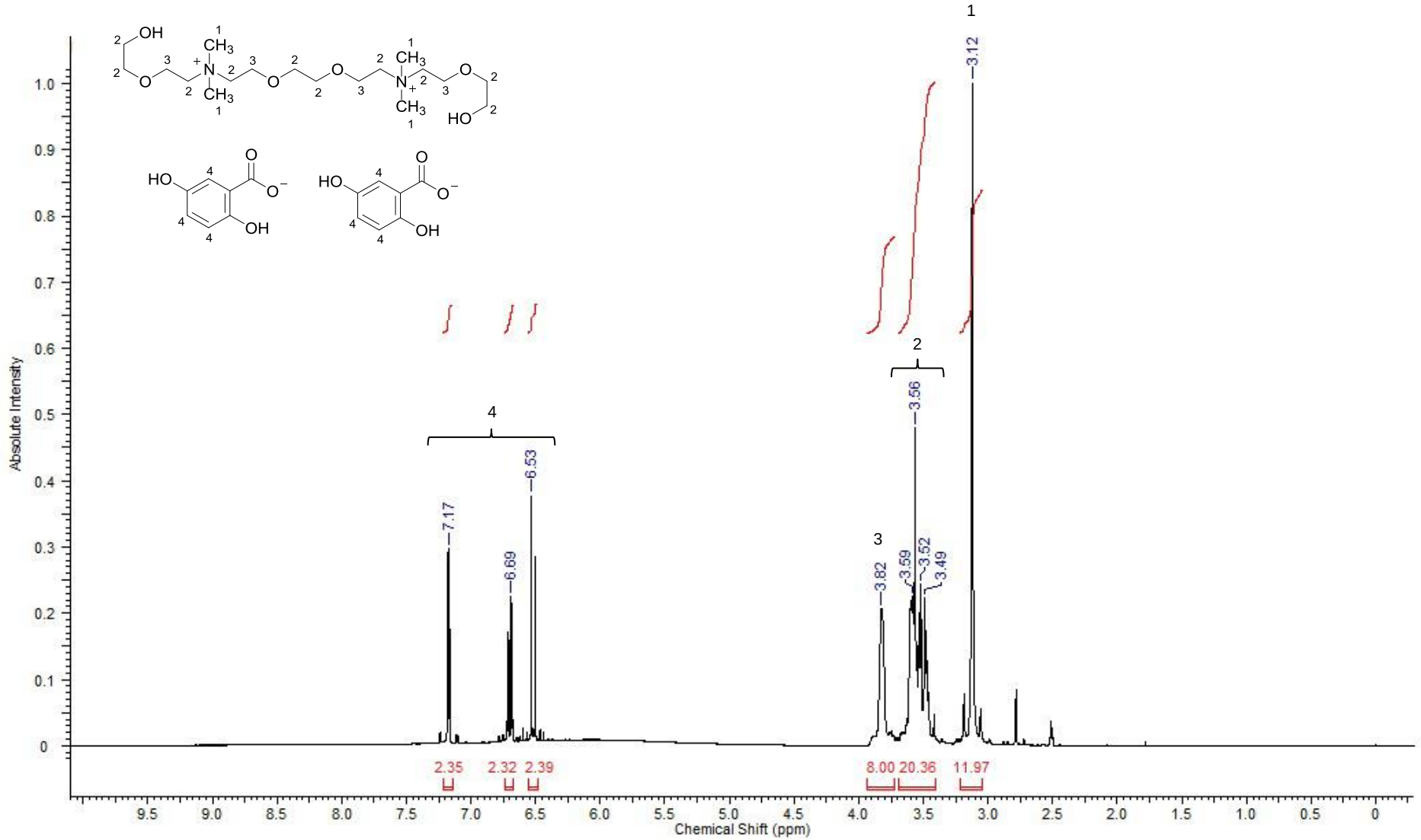


Fig. S19 ^{1}H spectrum of ethylenebis(oxyethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[2,5-dihydroxybenzoate] (**4b**).

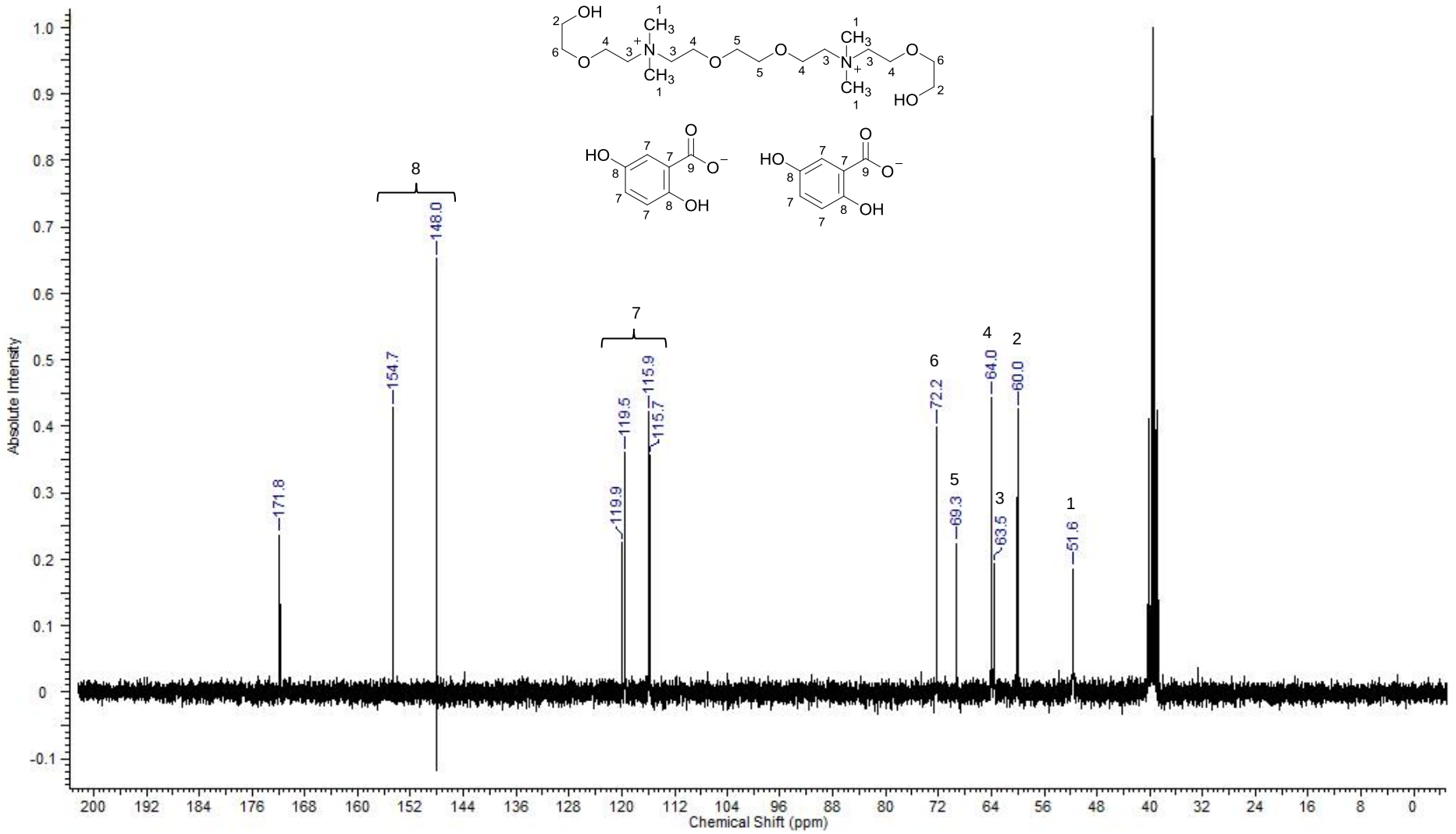


Fig. S20 ^{13}C spectrum of ethylenebis(oxyethylene)bis[2-[2-(dimethyl)ethoxy]hydroxyethylammonium] di[2,5-dihydroxybenzoate] (**4b**).