Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Simple primary β-amino alcohols as organocatalysts for the asymmetric Michael addition of β-keto esters to nitroalkenes

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1. General information:

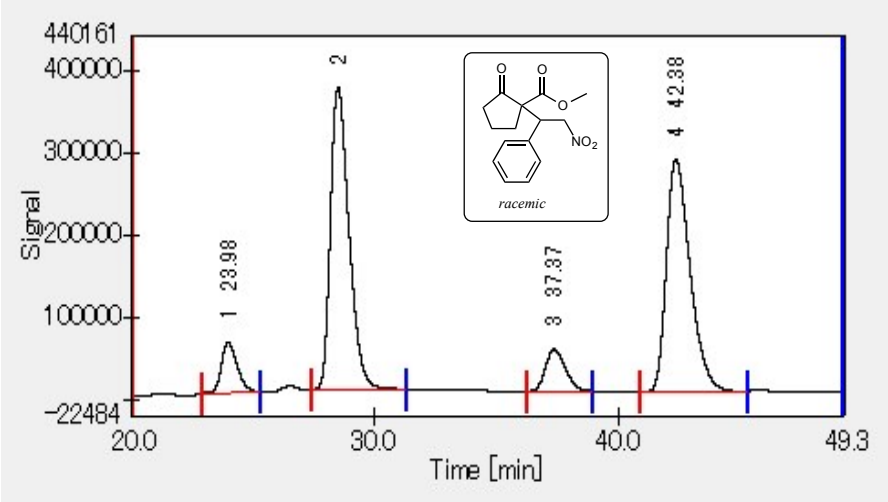
All reagents and dry solvents were purchased from commercial vendors and used directly without further purification. All reactions were placed in dried sample vials inserted with magnetic beads. Thin-layer chromatography (TLC) was performed on Merck silica gel 60 F254 plates and the analytes were identified under UV light. Infrared (IR) spectra were measured with a JASCO FT/IR-4100 spectrophotometer. Flash column chromatography was performed using silica gel pore size 60N (40-100 μm). ^{1}H and ^{13}C NMR spectroscopic data were recorded using a JEOL JNM-ECA500 instrument with tetramethyl silane as the internal standard. HPLC data were collected using the TOSOH instrument equipped with (UV-8020, DP-8020, and SD-8022) detectors using Daicel Chiralcel OD-H column. Optical rotations were measured with a JASCO-DIP-370 digital polarimeter. MS were taken on a JEOL-JMS-700V spectrometers.

2. General procedure for catalytic asymmetric Michael addition of β-keto ester 2a with nitroolefin 3a using catalyst 1a.

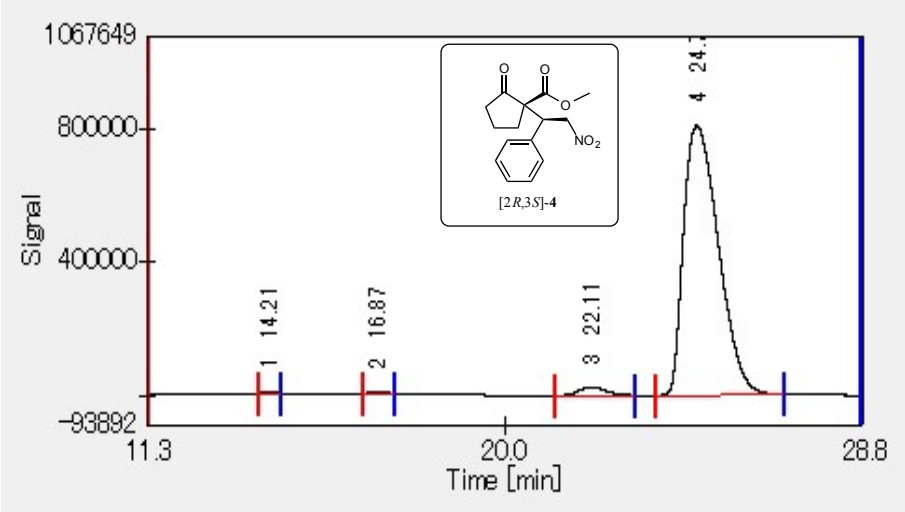
To a solution of catalyst **1a** (10 mol%) in dry toluene (2 mL) with Molecular sieves 4A was added β-keto esters,ketones **2a,2b-g** (0.4 mmol) at RT under inert atmosphere and the solution was stirred at same temperature. After 1 h, the reaction was cooled to -30 ^{o}C and the nitrostyrene **3a,6a-i** (0.2 mmol) was added. The reaction was allowed to stir at -30 ^{o}C for 48h. After the completion of the reaction, the solvent was removed under reduced pressure and the residue was purified by flash chromatography on silica gel (*n*-hexane/AcOEt = 10/1) to give the corresponding chiral Michael adduct.

HPLC spectra of Michael Adducts

[2*R*,3*S*]-Methyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**4**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 16.8 (minor enantiomer), t_R = 24.7(major enantiomer), 99% ee

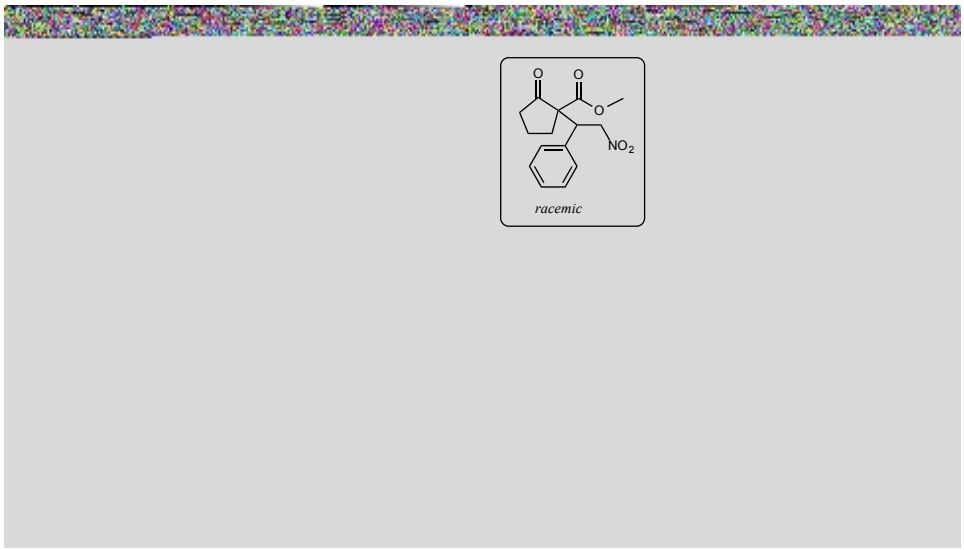


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	23.98	2765739	6.2547	61195	6254	1.273	3.443
2	28.5	19470276	44.032	367697	6516.5	1.388	5.989
3	37.37	2923812	6.6122	50532	9317	1.255	2.963
4	42.38	19058633	43.1011	283498	8548.8	1.405	*****
		44218460	100	762922			

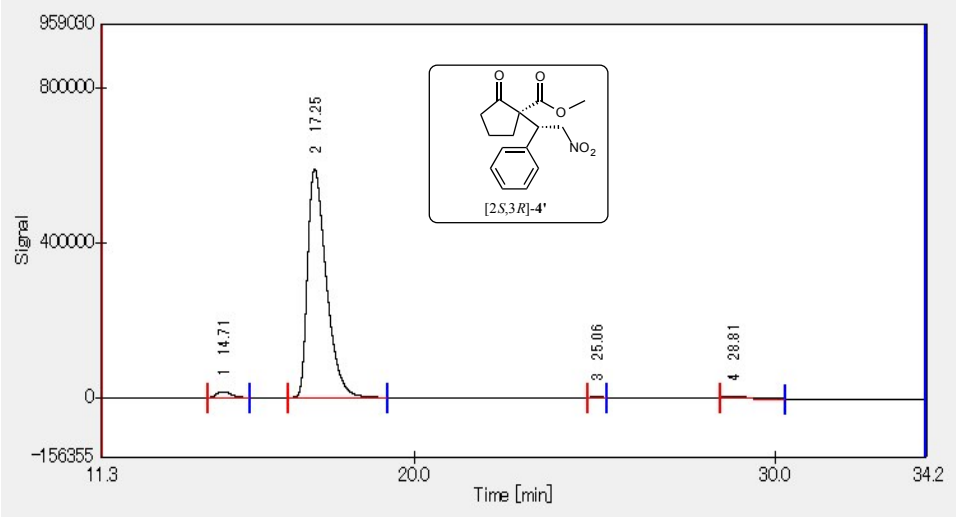


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.21	82262.6	0.1671	4109	14270.9	1.262	4.626
2	16.87	205922.4	0.4182	7496	10061	1.24	5.603
3	22.11	1090582	2.2147	23612	5452.6	1.213	1.903
4	24.71	47864972	97.2001	804797	4129.1	1.538	*****
		49243739	100	840014			

[2*S*,3*R*]-Methyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**4'**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 28.8 (minor enantiomer), t_R = 17.2 (major enantiomer), 99% ee

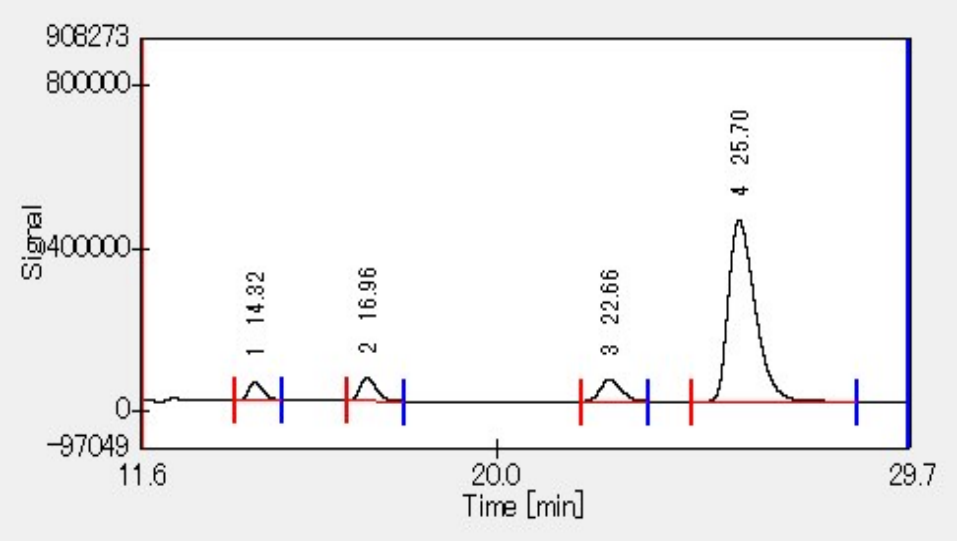


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	23.98	2765739	6.2547	61195	6254	1.273	3.443
2	28.5	19470276	44.032	367697	6516.5	1.388	5.989
3	37.37	2923812	6.6122	50532	9317	1.255	2.963
4	42.38	19058633	43.1011	283498	8548.8	1.405	*****
		44218460	100	762922			



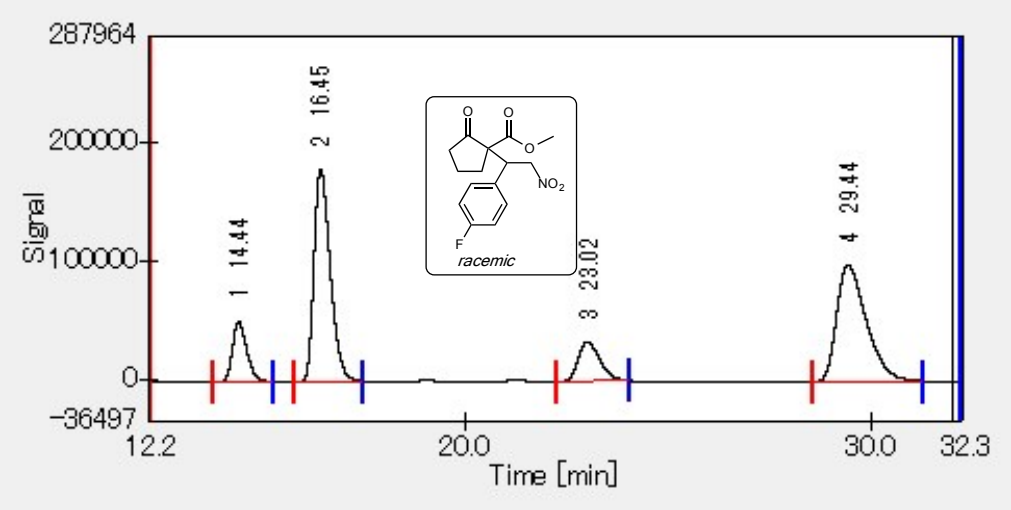
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.71	479086.8	2.197	16245	5244.9	1.357	2.841
2	17.25	21218823	97.3041	589696	5003.8	1.594	10.685
3	25.06	15665	0.0718	760	42465.4	1.066	5.356
4	28.81	93130.6	0.4271	2887	15864.7	1.528	*****
		21806705	100	609588			

HPLC Chromatogram of gram scale synthesis product [2*R*,3*S*]-Methyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate : CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90:10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 16.9 (minor enantiomer), t_R = 25.7(major enantiomer), 86% ee

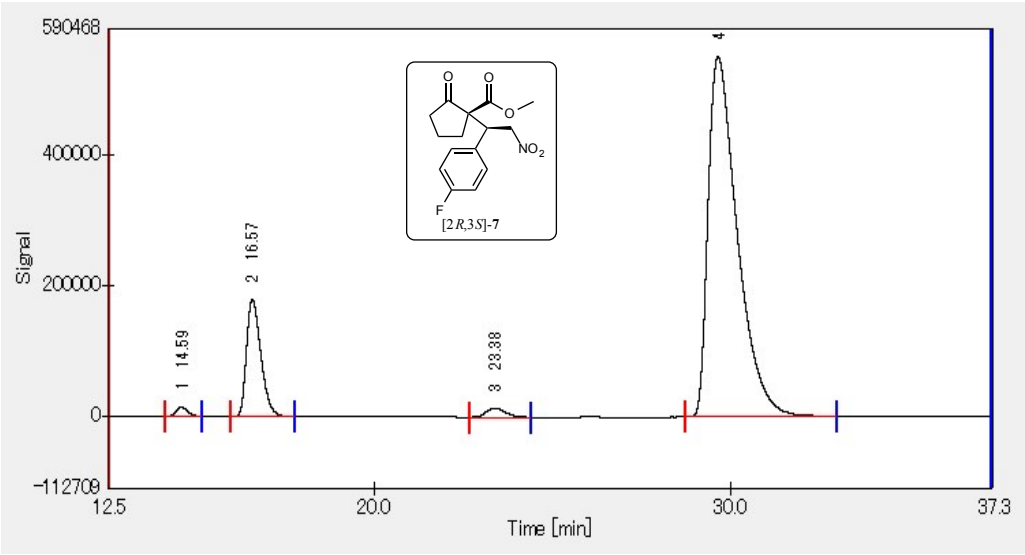


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.32	1094095	4.5945	45840	7696	1.31	3.888
2	16.96	1517027	6.3706	57592	9206.9	1.21	6.918
3	22.66	1843791	7.7428	52775	9281.1	1.213	2.891
4	25.7	19358150	81.2921	443086	7824.6	1.472	*****
		23813063	100	599293			

[2*R*,3S]-Methyl-1-(1-(4-Fluorophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**7**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 16.5 (minor enantiomer), t_R = 29.6 (major enantiomer), 72% ee

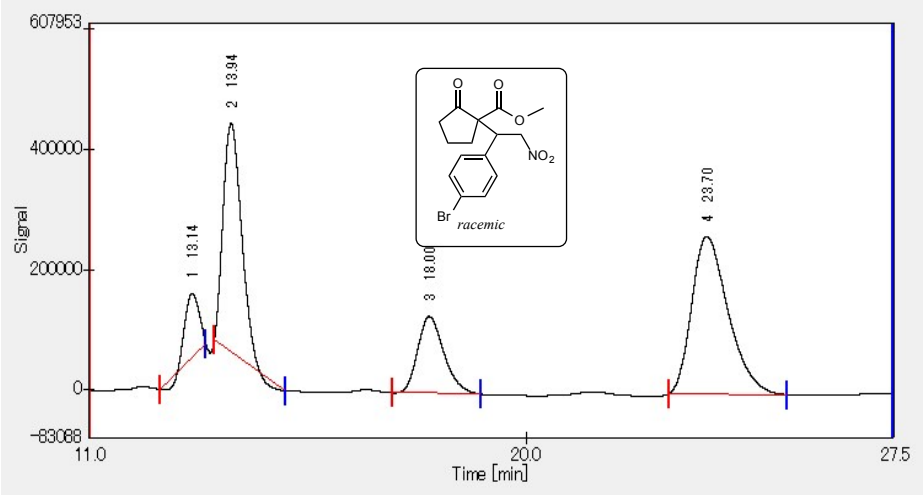


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.44	1246632	10.0951	50728	7558.1	1.316	2.864
2	16.45	4979133	40.3204	179481	7819.7	1.379	7.466
3	23.02	1228837	9.951	32914	8244.6	1.326	5.407
4	29.44	4894301	39.6335	97842	7489.4	1.496	*****
		12348904	100	360965			

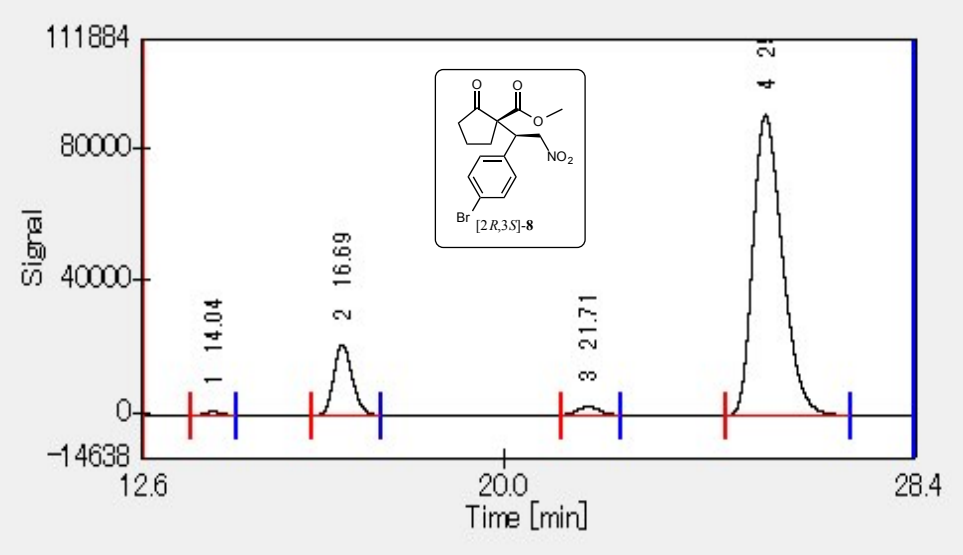


No	Rt (min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.59	352651.9	0.9439	14541	7860.1	1.174	2.804
2	16.57	5067579	13.5638	179912	7680.6	1.41	7.578
3	23.38	525448.2	1.4064	13623	8082.6	1.202	4.813
4	29.64	31415507	84.0859	551899	5764.5	1.839	*****
		37361186	100	759975			

[2*R*,3S]-Methyl-1-(1-(4-Bromophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**8**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 16.6 (minor enantiomer), t_R = 25.3 (major enantiomer), 74% ee

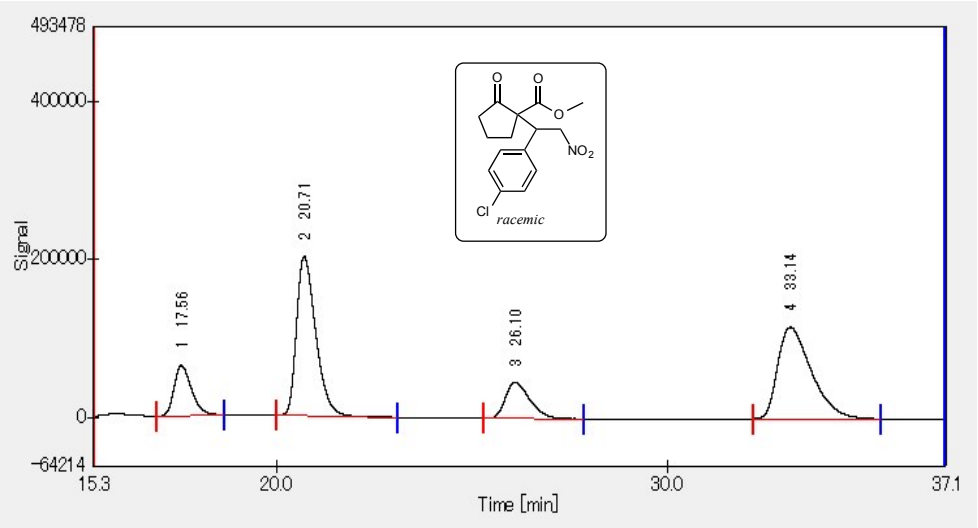


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	13.14	1892470	6.2964	105446	11043.9	0.984	1.341
2	13.94	9764638	32.488	381110	6297.8	1.279	4.692
3	18	4817231	16.0274	128241	4909.5	1.264	4.65
4	23.7	13581839	45.1882	262383	4449.5	1.364	*****
		30056177	100	877180			

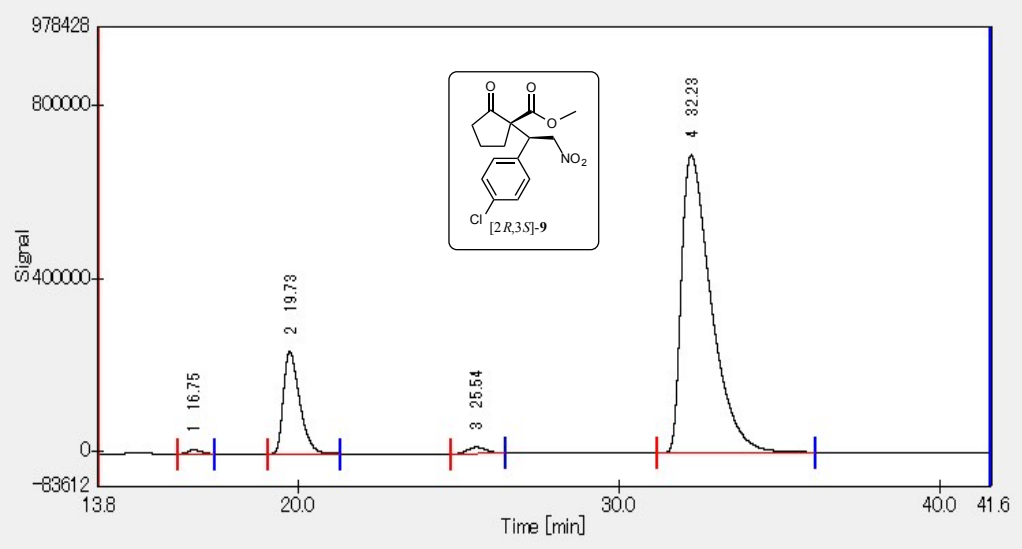


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.04	19025.4	0.4265	954	11792.6	1.289	4.338
2	16.69	560647.4	12.5697	21297	8898.6	1.174	6.312
3	21.71	82713.5	1.8544	2518	9701.3	1.084	3.609
4	25.33	3797921	85.1493	90698	8115.5	1.325	*****
		4460308	100	115467			

[2*R*,3S]-Methyl-1-(1-(4-Chlorophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**9**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 19.7 (minor enantiomer), t_R = 32.2 (major enantiomer), 68% ee

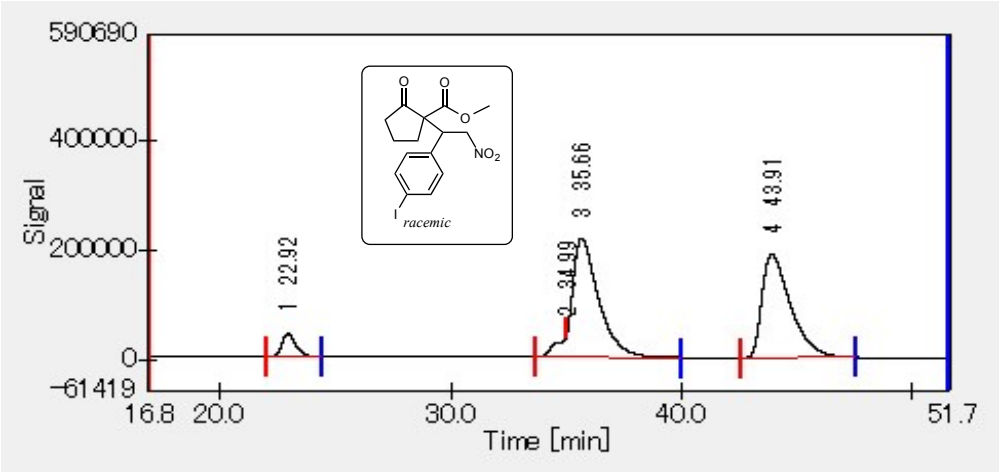


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	17.56	1942347	11.0496	63273	7153.2	1.341	3.606
2	20.71	6791334	38.6344	201151	8233	1.413	5.229
3	26.1	1952753	11.1088	45866	8223.8	1.362	5.077
4	33.14	6892050	39.2073	115835	6680.9	1.554	*****
		17578483	100	426125			

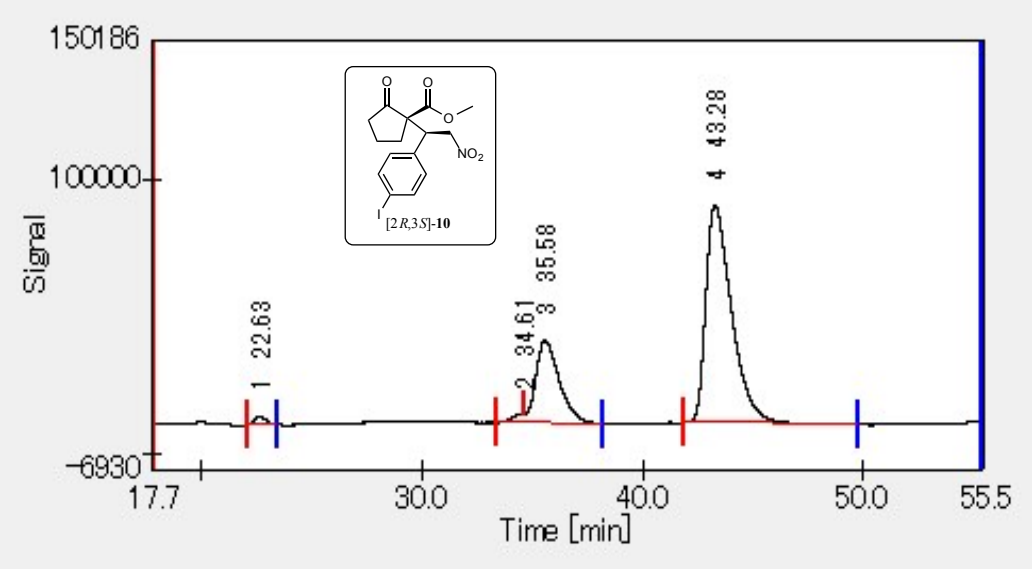


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	16.75	269309.2	0.5048	9339	7513.2	1.193	3.463
2	19.73	8335138	15.6245	236360	6871	1.475	5.607
3	25.54	613934	1.1508	14769	8351.4	1.184	4.66
4	32.23	44128110	82.7198	686606	5388.2	1.953	*****
		53346491	100	947074			

[2*R*,3S]-Methyl-1-(1-(4-Iodophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**10**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 35.5 (minor enantiomer), t_R = 43.2 (major enantiomer), 49% ee

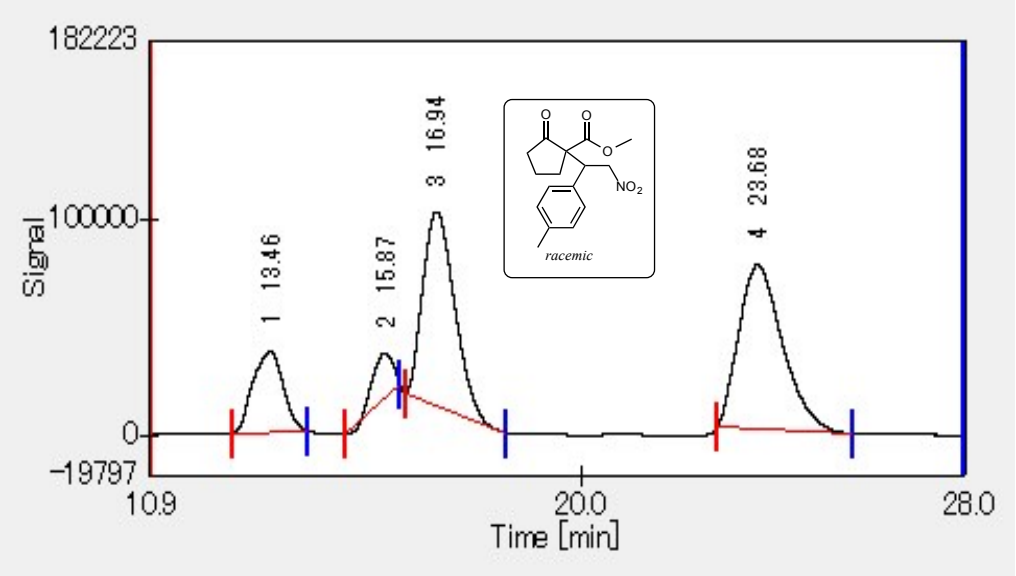


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	22.92	1756104	4.8602	41644	6403	1.338	*****
2	34.99	1216632	3.3672	35975	24213.3	*****	0.45
3	35.66	16887465	46.7383	217594	4774.5	*****	3.786
4	43.91	16271784	45.0343	188524	5498.6	1.809	*****
		36131985	100	483737			

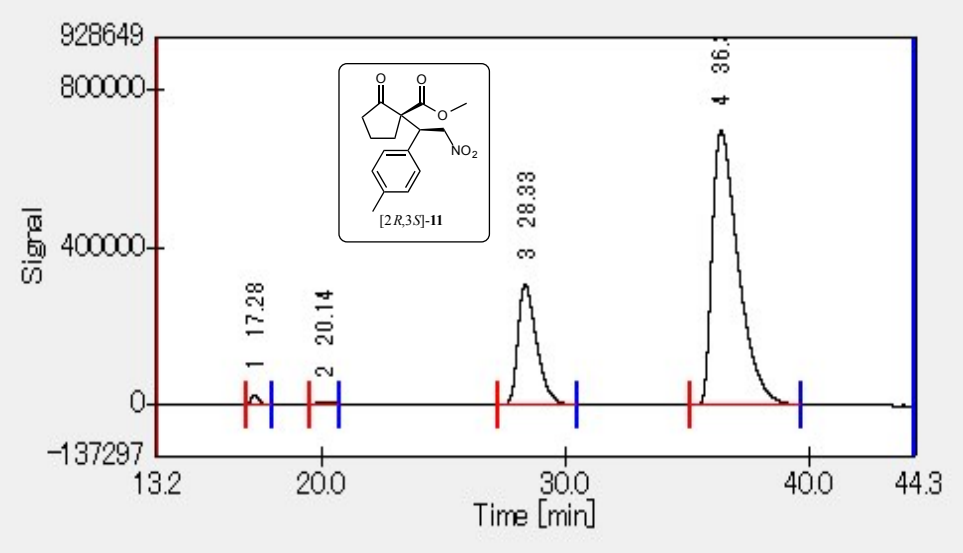


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	22.63	108322.8	1.206	2916	8394.6	1.208	*****
2	34.61	111258.5	1.2387	3012	19857.7	*****	0.654
3	35.58	2246368	25.0105	30244	5189.5	*****	3.719
4	43.28	6515745	72.5447	79904	6086.9	1.673	*****
		8981695	100	116076			

[2*R*,3S]-Methyl-1-(1-(4-Methylphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**11**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 28.3 (minor enantiomer), t_R = 36.3 (major enantiomer), 52 % ee



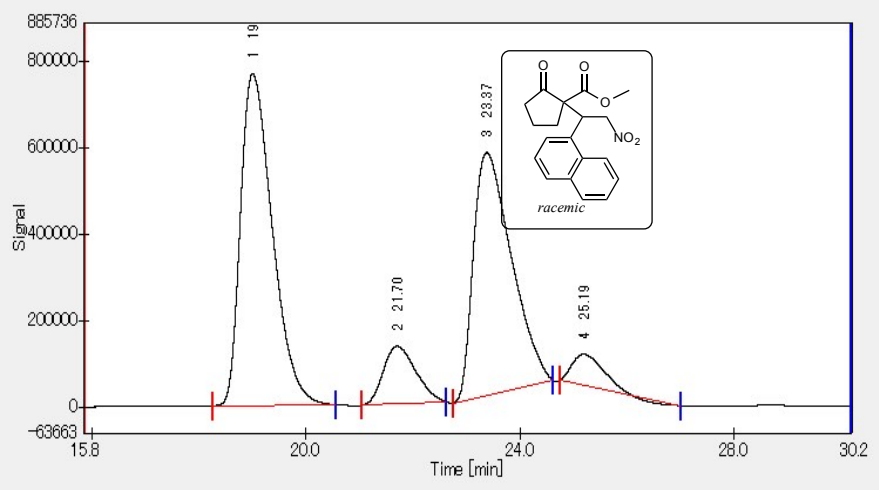
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	13.46	1633491	14.5624	37195	2303.3	1.017	2.612
2	15.87	605907.4	5.4016	21319	7640.1	0.827	1.102
3	16.94	4132802	36.8434	89820	3075.7	1.316	4.562
4	23.68	4844997	43.1926	76085	2998.3	1.361	*****
		11217197	100	224419			



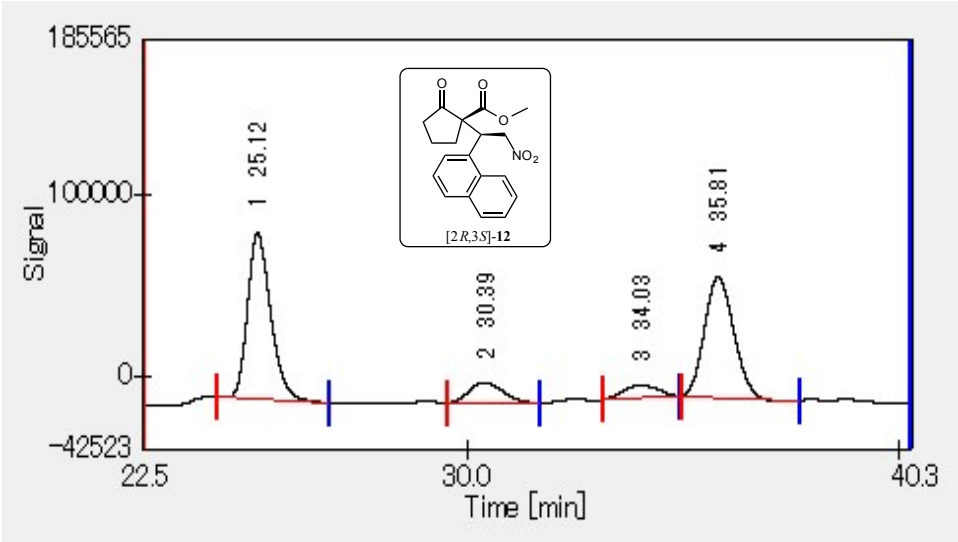
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	17.28	517220	0.7439	23882	14242.4	1.155	3.625
2	20.14	279653.6	0.4022	7148	6504.7	1.038	6.648
3	28.33	16587484	23.8585	308470	5973.9	1.497	4.568
4	36.36	52140177	74.9954	697658	5040.8	1.854	*****

69524535	100	1037158	

[2*R*,3*S*]-Methyl-1-(2-nitro-1-(naphthalen-2-yl)ethyl)-2-oxocyclopentanecarboxylate(**12**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 30.3 (minor enantiomer), t_R = 35.8 (major enantiomer), 67 % ee

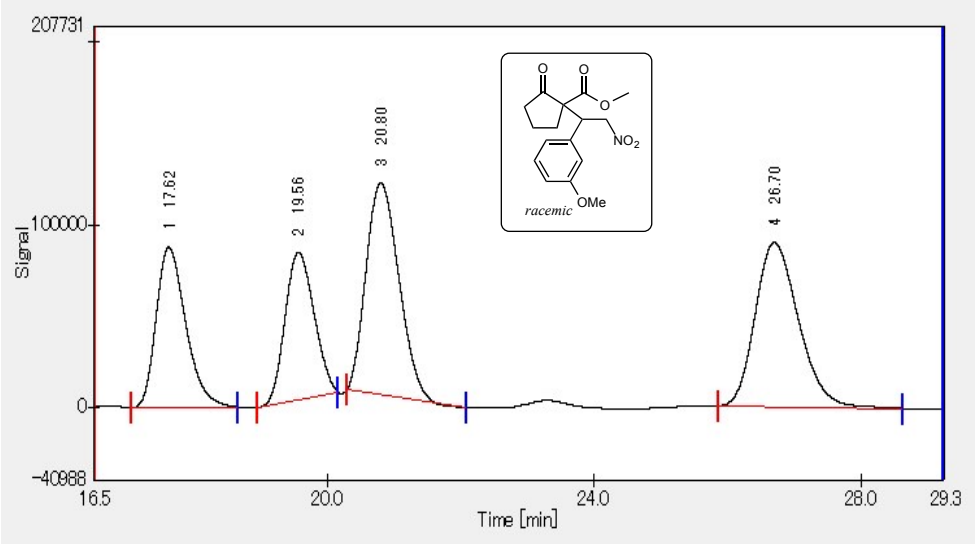


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	19	31711815	46.7832	767858	4739.1	1.505	2.409
2	21.7	5641961	8.3234	133684	5827.4	1.256	1.349
3	23.37	27648872	40.7893	561550	4874.1	1.652	1.49
4	25.19	2782019	4.1042	71822	8462.3	1.508	*****
		67784668	100	1534914			

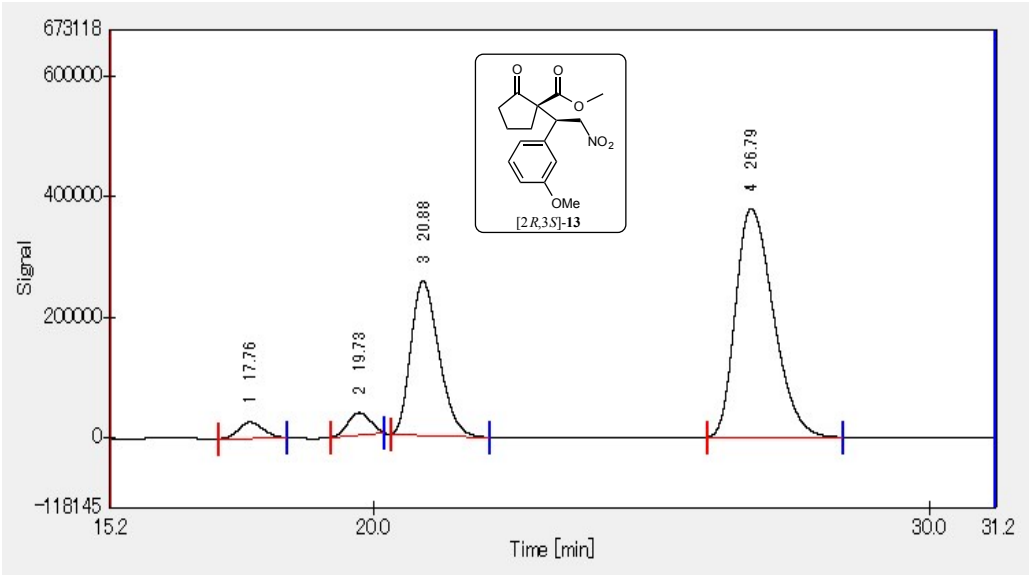


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	25.12	3442701	45.5924	92187	9877.1	1.281	4.326
2	30.39	609428.4	8.0708	11429	7274.6	1.161	2.533
3	34.03	392227.6	5.1944	6896	8801	0.977	1.311
4	35.81	3106677	41.1424	66706	12825.8	1.125	*****
		7551034	100	177218			

[2*R*,3*S*]-Methyl-1-(1-(3-Methoxyphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**13**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 20.8 (minor enantiomer), t_R = 26.7 (major enantiomer), 34% ee



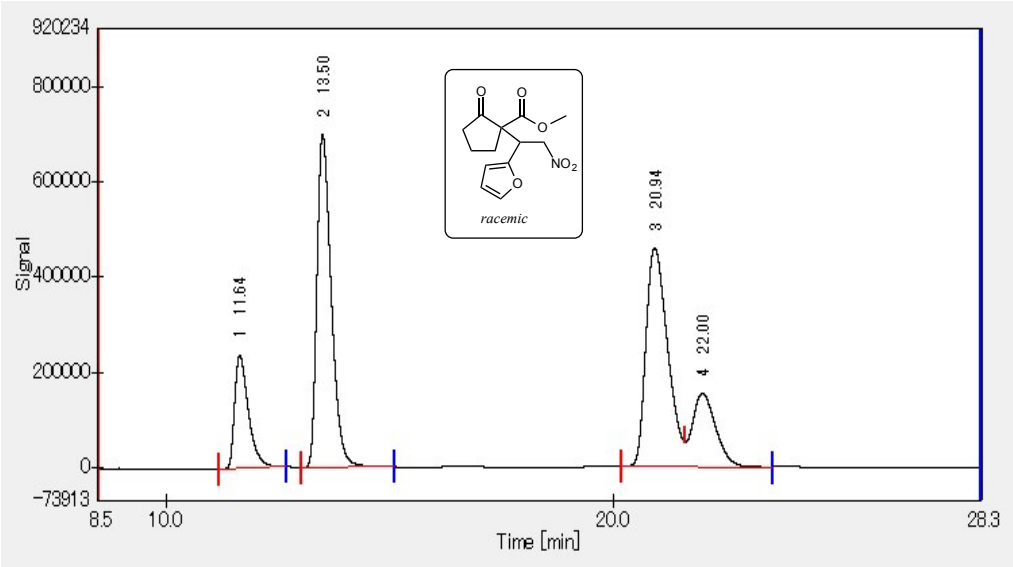
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	17.62	2714844	20.6168	87919	7107.5	1.34	2.372
2	19.56	2433957	18.4837	80623	9505	1.118	1.442
3	20.8	3964487	30.1067	115886	8313.7	1.209	5.584
4	26.7	4054855	30.7929	89916	7899.9	1.227	*****
		13168143	100	374344			



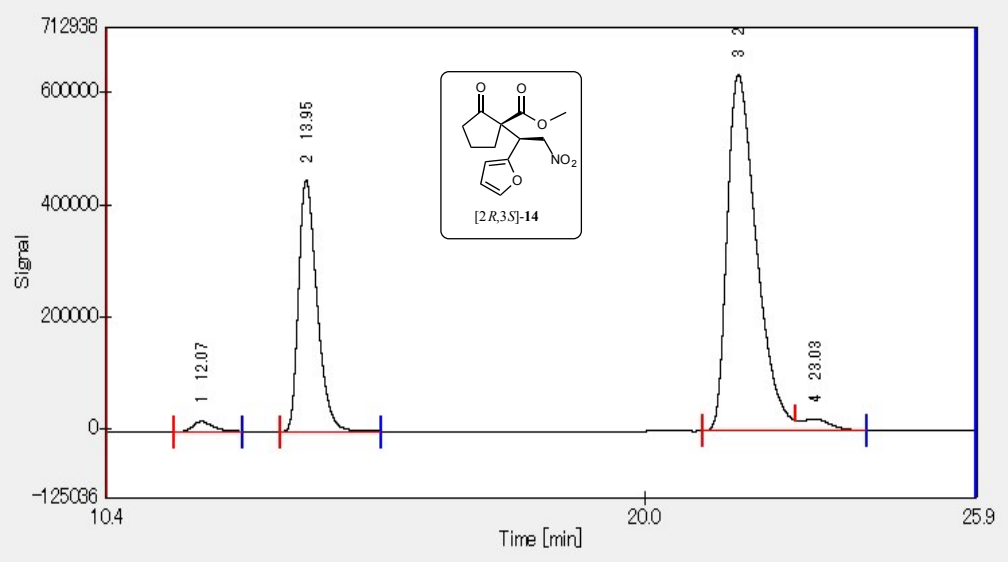
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	17.76	813434	2.8216	26624	7424.2	1.178	2.505
2	19.73	1060455	3.6785	37179	11208.7	1.01	1.36
3	20.88	8973821	31.1281	254775	7798.8	1.28	5.353
4	26.79	17980985	62.3718	379079	7220.2	1.344	*****

28828696	100	697657	

[2*R*,3*S*]-Methyl-1-((1-furan-2-yl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**14**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 13.9 (minor enantiomer), t_R = 23.0(major enantiomer), 37% ee

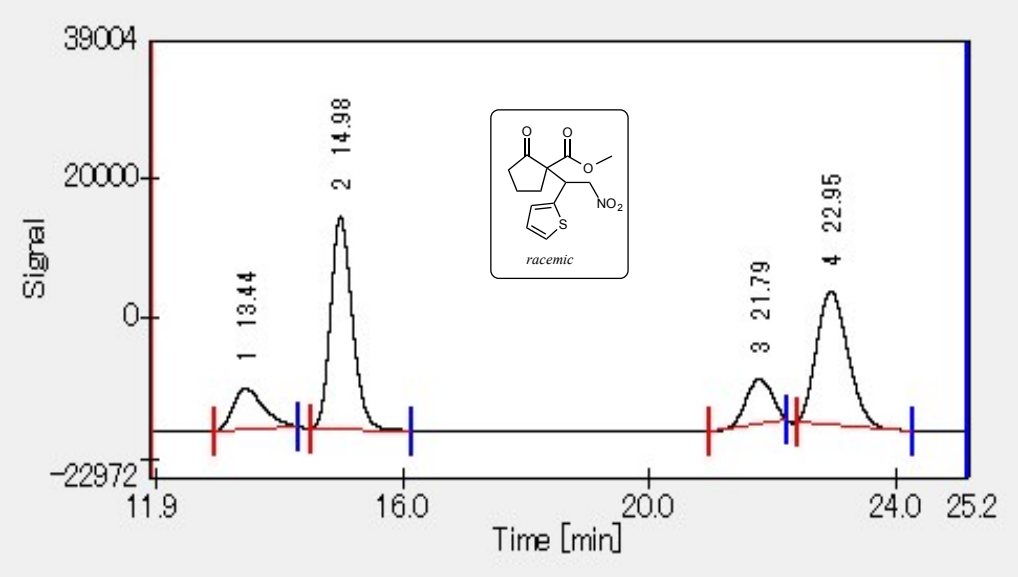


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	11.64	5084223	12.1031	238523	6309	1.65	3.143
2	13.5	15694597	37.3615	701659	8175.7	1.423	9.64
3	20.94	15614717	37.1713	461296	8653.4	*****	1.142
4	22	5613920	13.3641	154344	8277.6	*****	*****
		42007457	100	1555822			

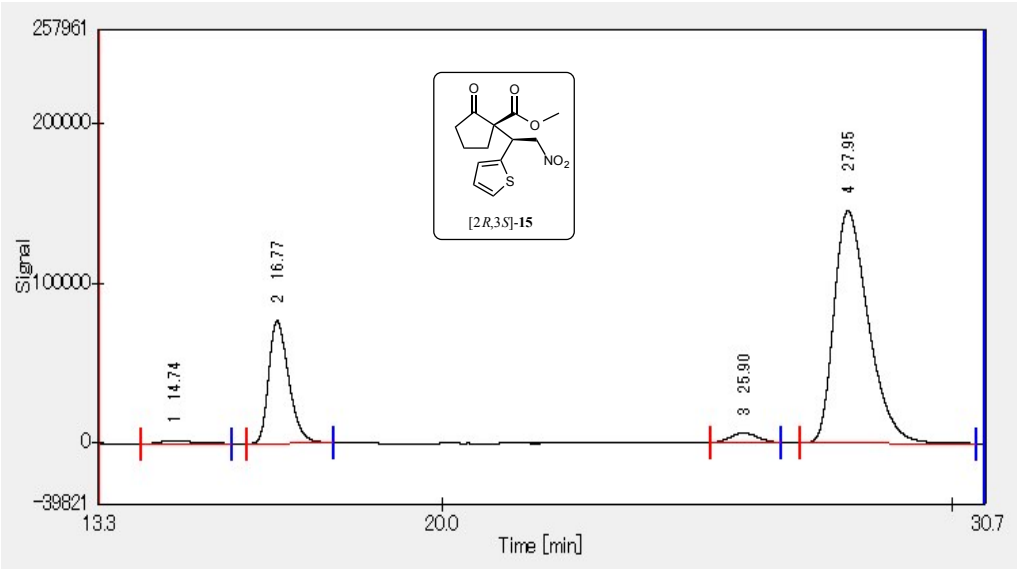


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	12.07	432185.6	1.2511	17678	5014.2	1.458	2.894
2	13.95	10264096	29.7125	448301	8219.4	1.392	9.638
3	21.67	23073222	66.7924	634108	8025	1.572	1.379
4	23.03	775186.3	2.244	20730	8576.9	*****	*****
		34544689	100	1120817			

[2*R*,3*S*]-Methyl-1-((1-thien-2-yl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**15**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 16.7 (minor enantiomer), t_R = 27.9 (major enantiomer), 53% ee



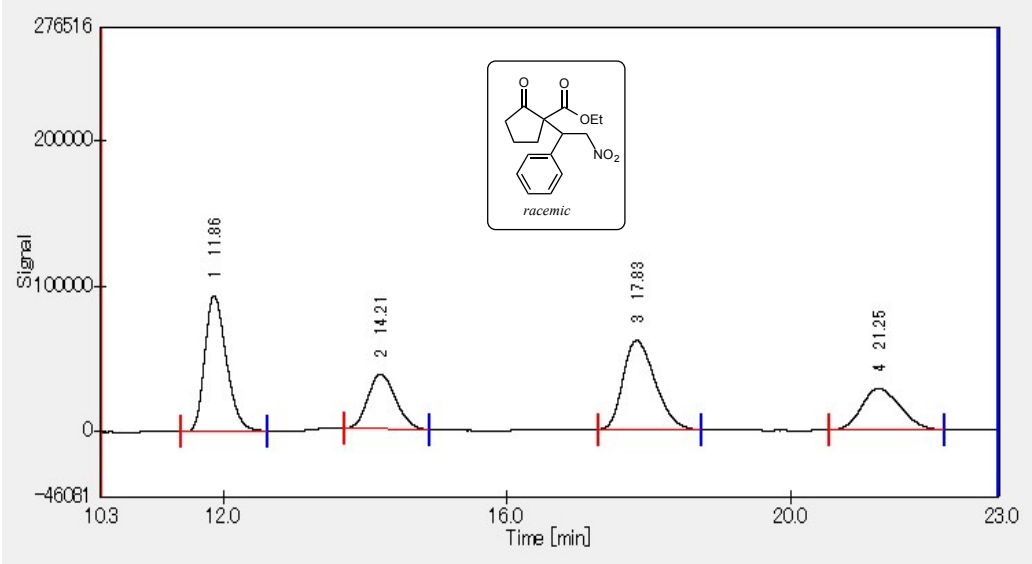
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	13.44	203046.2	11.4111	5826	3086.1	1.424	1.904
2	14.98	729645.1	41.0057	29961	8394.4	1.204	9.61
3	21.79	186393.6	10.4752	6405	13021.4	0.966	1.355
4	22.95	660291.8	37.108	18825	9561.7	1.197	*****
		1779377	100	61017			



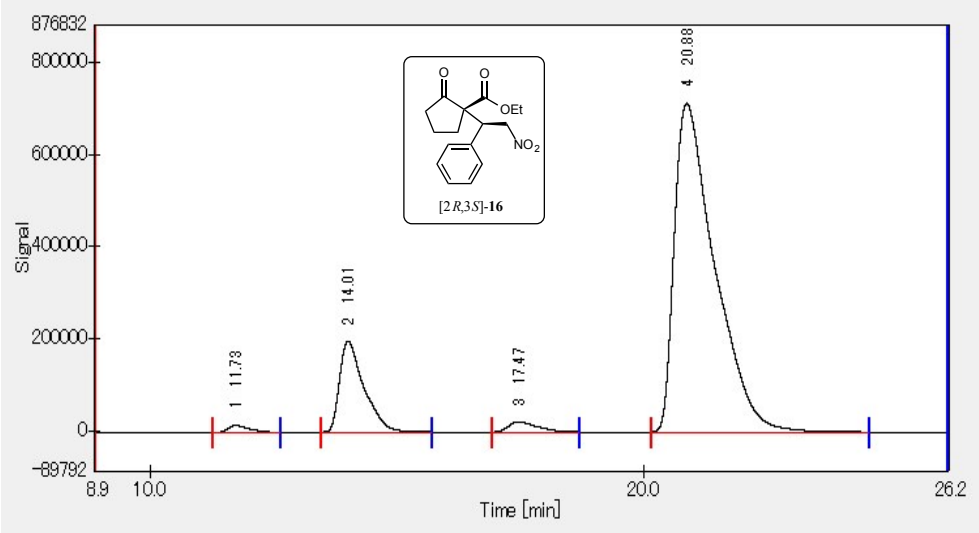
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	14.74	90496.7	0.9753	1954	2109.7	1.465	2.013
2	16.77	2095720	22.5868	77008	8350.3	1.354	10.542
3	25.9	224811.7	2.4229	6009	10770	1.1	1.812
4	27.95	6867507	74.015	145617	7729.5	1.414	*****

9278535	100	230588	

[2*R*,3*S*]-Ethyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate(**16**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 90: 10, flow rate 1.0 mL/min, λ= 213 nm) t_R = 14.0 (minor enantiomer), t_R = 20.8 (major enantiomer), 72% ee



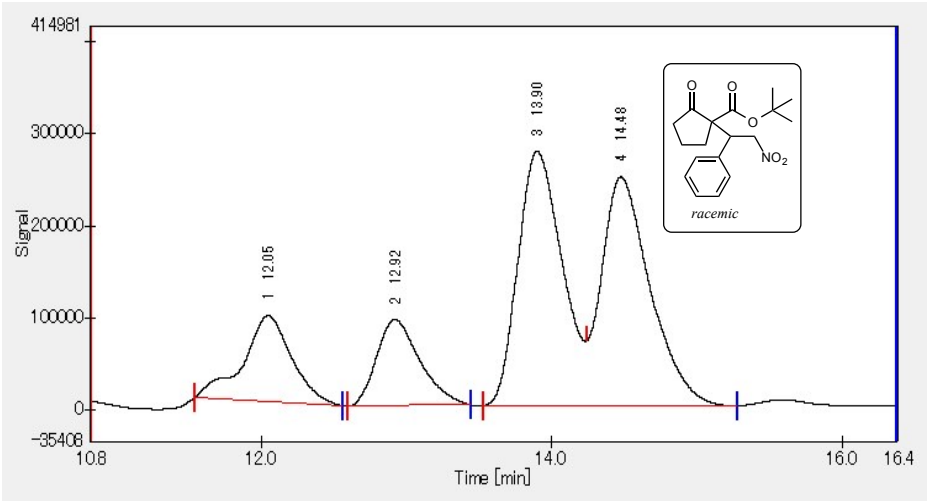
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	11.86	1974531	32.832	93486	6963.9	1.286	3.618
2	14.21	1027587	17.0865	37636	6053.5	1.166	4.595
3	17.83	1931206	32.1116	61168	7145.6	1.31	3.693
4	21.25	1080715	17.9699	28617	7099.1	1.177	*****
		6014040	100	220907			



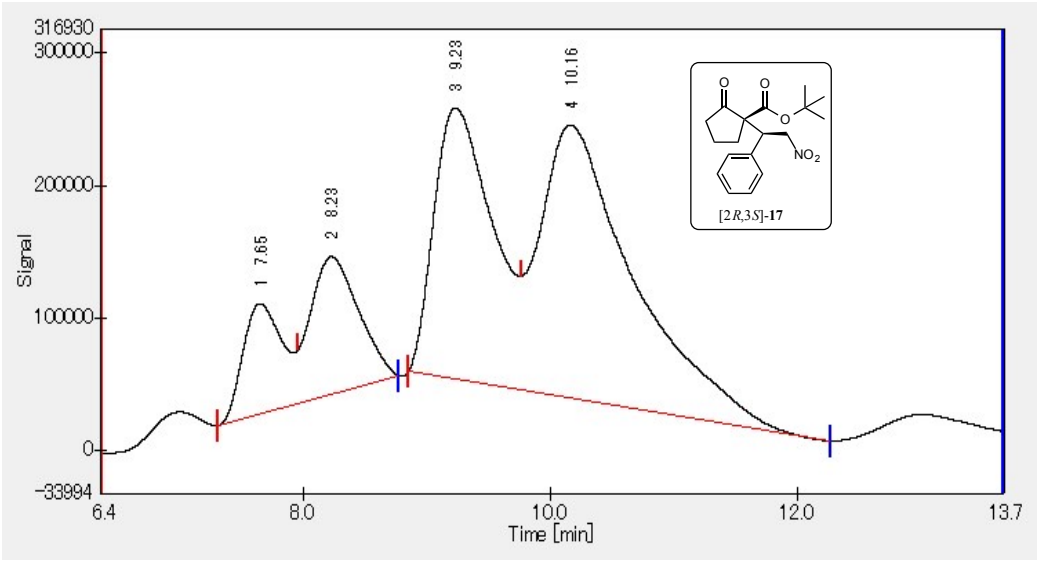
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	11.73	421351.2	0.8669	14668	3290.1	1.627	2.548
2	14.01	6771008	13.931	196901	3345.8	1.706	3.304

3	17.47	896684.8	1.8449	22450	3855.5	1.588	2.517
4	20.88	40515000	83.3573	711832	2789.1	1.995	*****
		48604044	100	945851			

[2*R*,3*S*]-*tert*-butyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**17**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 95:5, flow rate 1.0 mL/min, λ= 207 nm) t_R = 9.2 (minor enantiomer), t_R = 10.1(major enantiomer), 23% ee



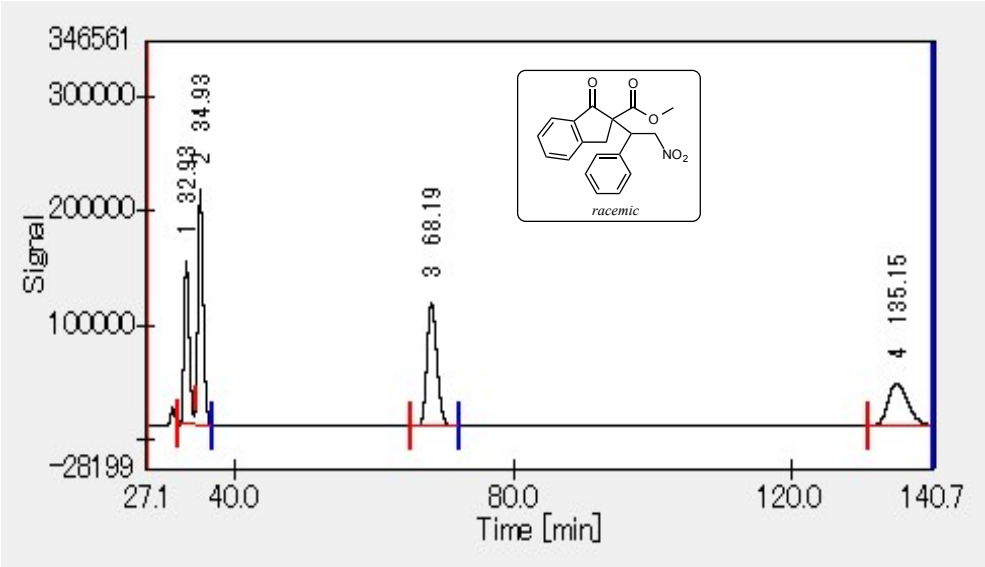
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	12.05	2153670	13.701	92843	4082.6	0.934	1.31
2	12.92	1921381	12.2233	93374	7956.3	1.336	*****
3	13.9	5870080	37.3438	275644	9631.9	*****	0.978
4	14.48	5773895	36.7319	247828	8733.4	*****	*****
		15719025	100	709689			



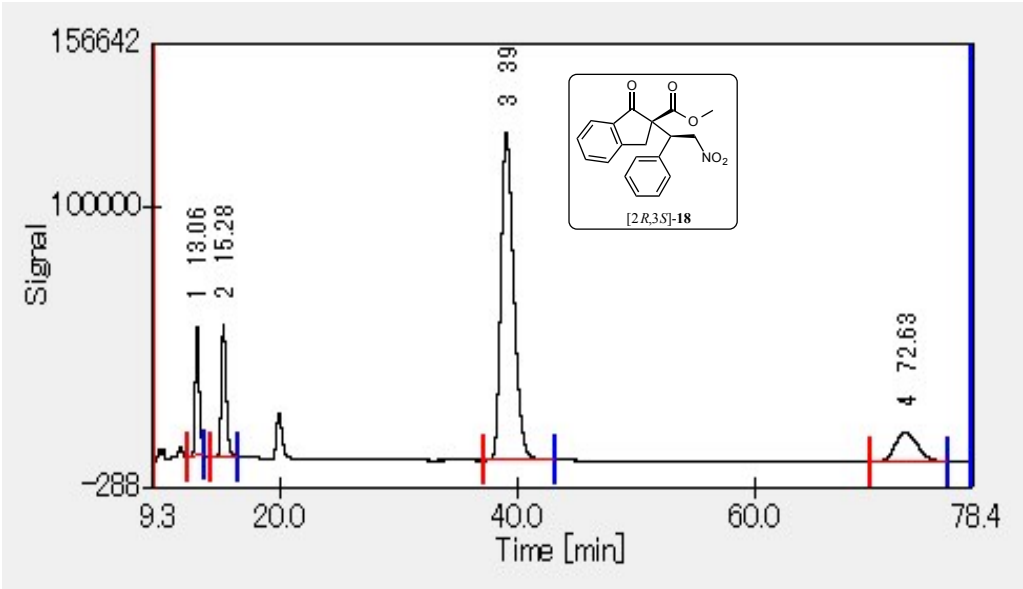
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	7.65	1871335	8.3464	83328	2627	*****	0.874
2	8.23	2818888	12.5726	103881	2080.6	*****	1.235
3	9.23	6871050	30.6457	204833	1711.3	*****	0.817
4	10.16	10859678	48.4354	206378	843.8	*****	*****

22420951	100	598420	

[2*R*,3*S*]-Methyl-2,3-dihydro-2-(2-nitro-1-phenylethyl)-1-oxo-1H-indene-2-carboxylate(**18**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 80: 20, flow rate 0.8 mL/min, λ= 210 nm) t_R = 15.2 (minor enantiomer), t_R = 39.0 (major enantiomer), 75% ee



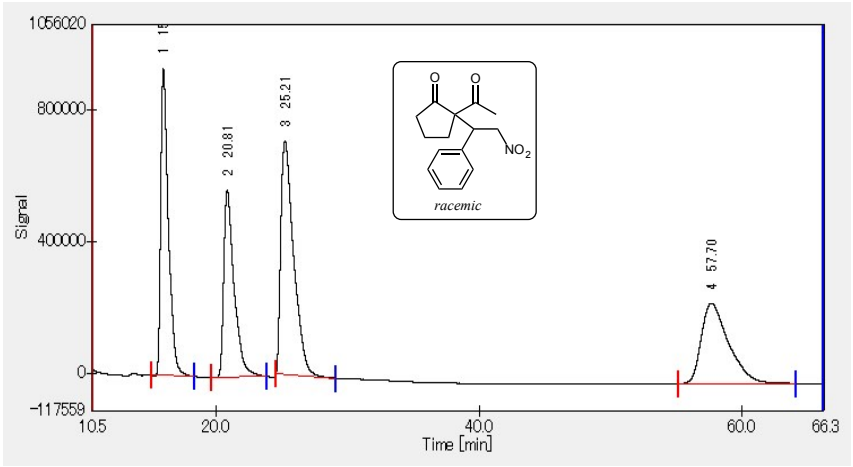
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	32.93	7446887	20.457	142244	8947.4	1.38	1.437
2	34.93	10866637	29.8512	206418	9960.2	*****	16.442
3	68.19	10817255	29.7156	108750	10529.9	1.201	16.935
4	135.15	7271850	19.9762	37174	10604.6	1.222	*****
		36402630	100	494586			



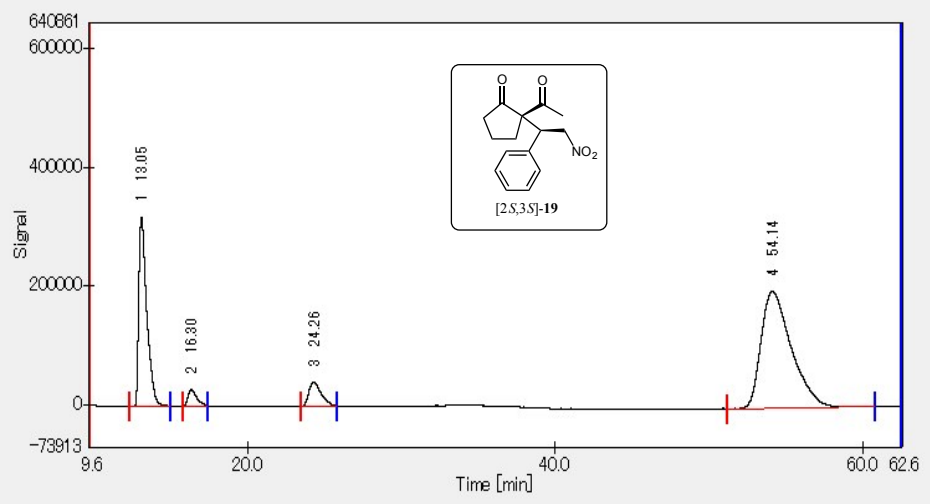
No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	13.06	1083178	8.634	45707	6550	1.245	3.143
2	15.28	1333363	10.6283	46375	6338.4	1.273	17.049

3	39.07	8697945	69.3316	115498	5965.5	1.326	11.848
4	72.63	1430948	11.4061	10555	6363.8	1.156	*****
		12545434	100	218135			

[2*S*,3*S*]- 2-Acetyl-2-(2-nitro-1-phenylethyl)-cyclopentanone (**19**): CHIRALCEL OD-H (*n*-hexane: 2-propanol = 80:20, flow rate 1.0 mL/min, λ= 220 nm) t_R = 13.0 (minor enantiomer), t_R = 54.1(major enantiomer), 40 % ee

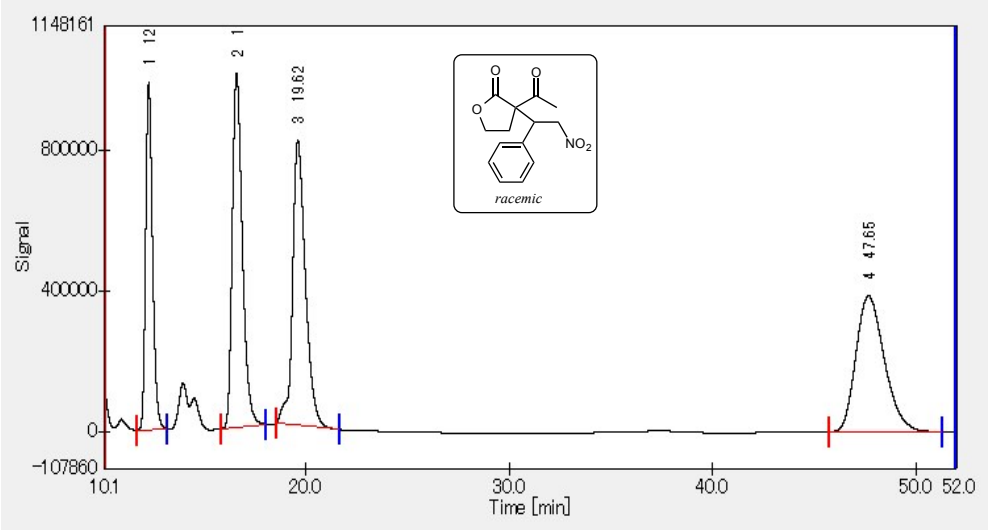


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	15.94	37863055	24.7832	931248	3141.8	1.71	3.626
2	20.81	31331428	20.5079	568927	2901.8	1.878	2.569
3	25.21	48384968	31.6703	709162	2861	1.935	11.029
4	57.7	35197714	23.0386	243615	3320.1	1.582	*****
		1.53E+08	100	2452952			

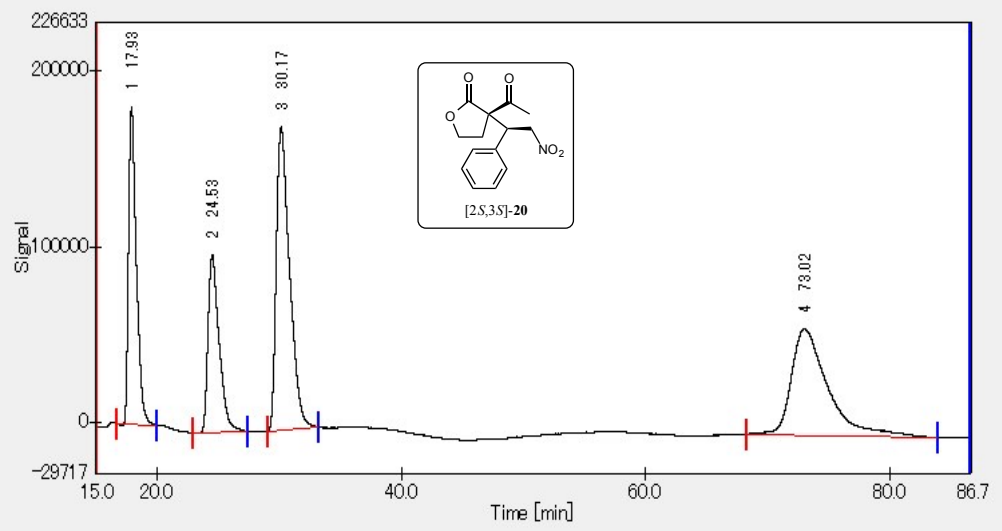


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	13.05	11714248	27.7101	319768	2592.4	1.892	2.95
2	16.3	1177365	2.7851	28337	3074.2	1.512	5.734
3	24.26	2350633	5.5604	41198	3674.3	1.494	11.058
4	54.14	27032013	63.9444	195949	3240.5	1.545	*****
		42274259	100	585252			

[2*S*,3*S*]- 3-Acetyl-3-(2-nitro-1-phenylethyl)-dihydrofuran-2-one (**20**): CHIRALCEL OD-H (*n*-hexane: EtOH = 80 : 20, flow rate 1.0 mL/min, λ= 210 nm) t_R = 24.5 (minor enantiomer), t_R = 73.0 (major enantiomer), 32% ee



No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	12.29	23119588	17.7374	985390	5987.6	1.268	5.525
2	16.61	34539476	26.4988	1003295	5122.9	1.341	2.879
3	19.62	35174010	26.9856	805374	4577	1.104	14.814
4	47.65	37510517	28.7782	385266	5275.7	1.257	*****
		1.30E+08	100	3179325			

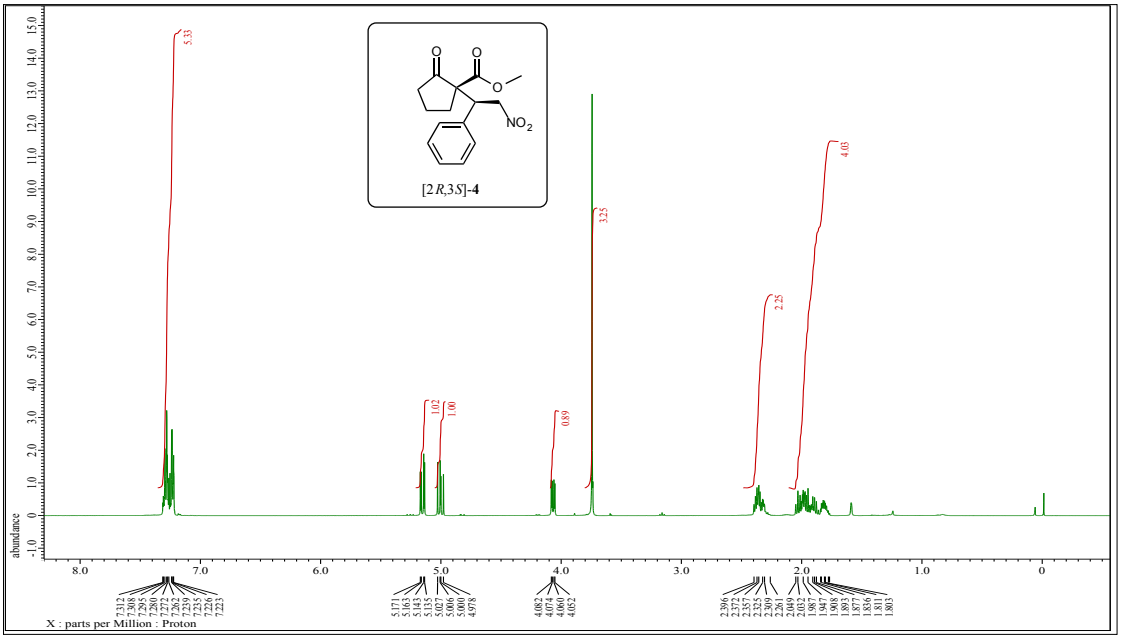


No	Rt(min)	Area	Area%	Height	NTP	Symmetry	Resolution
1	17.93	7983606	20.026	179807	3463.6	1.537	4.474
2	24.53	6385963	16.0185	101193	3214.4	1.593	2.971

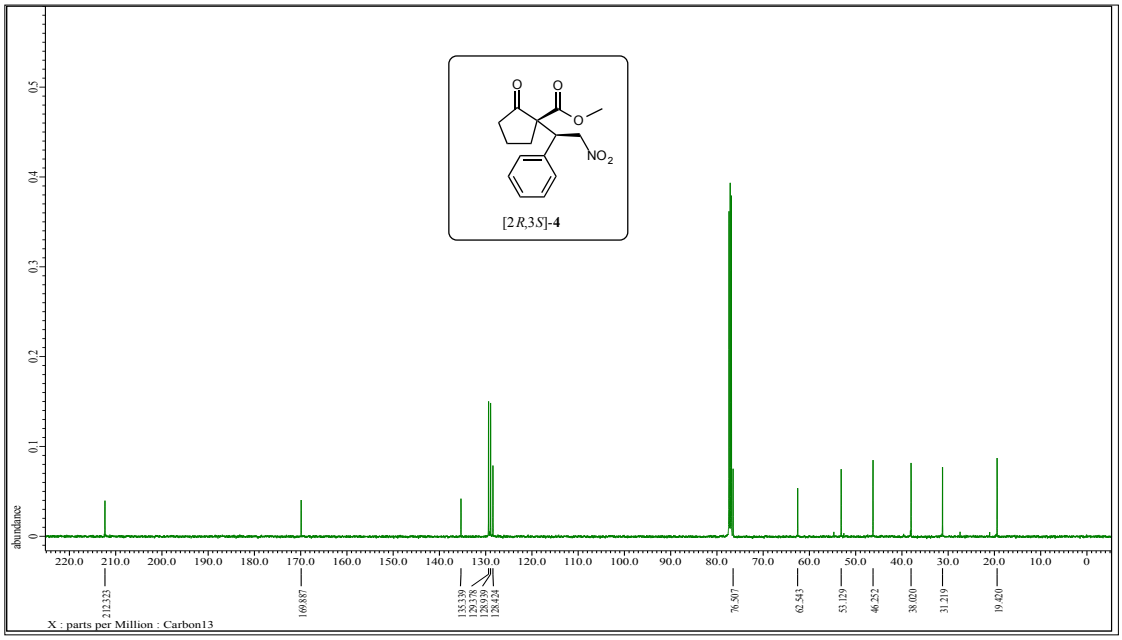
3	30.17	13004074	32.6193	171845	3402.7	1.618	11.364
4	73.02	12492587	31.3363	60388	2848.4	1.904	*****
		39866230	100	513233			

NMR spectra of Michael Adducts

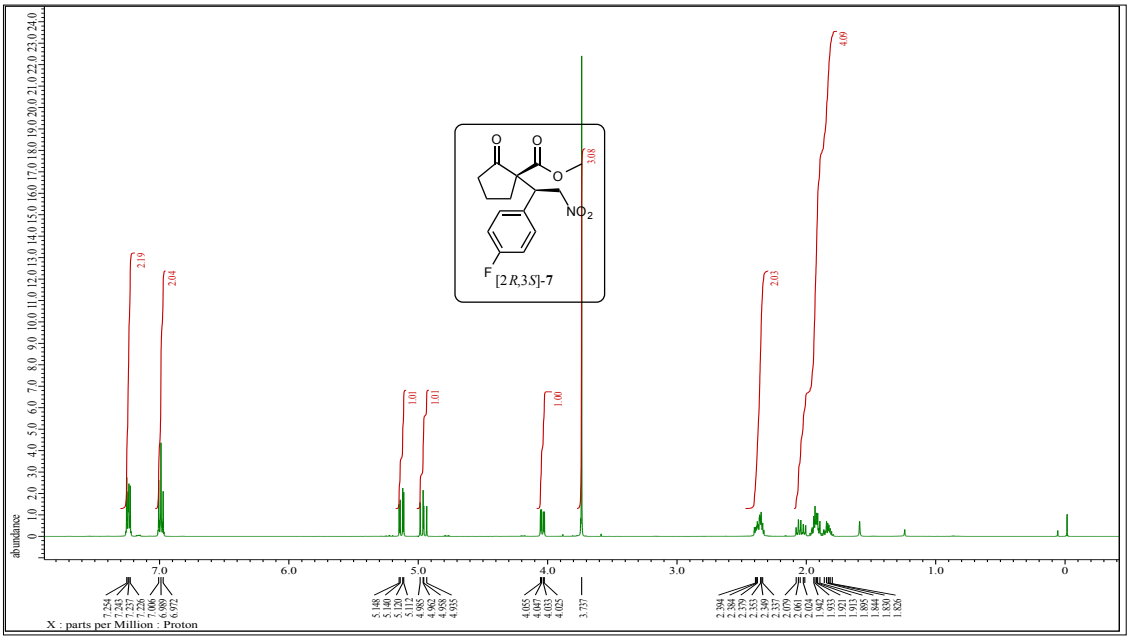
^{1}H-NMR spectra of [2*R*,3*S*]-Methyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**4**)



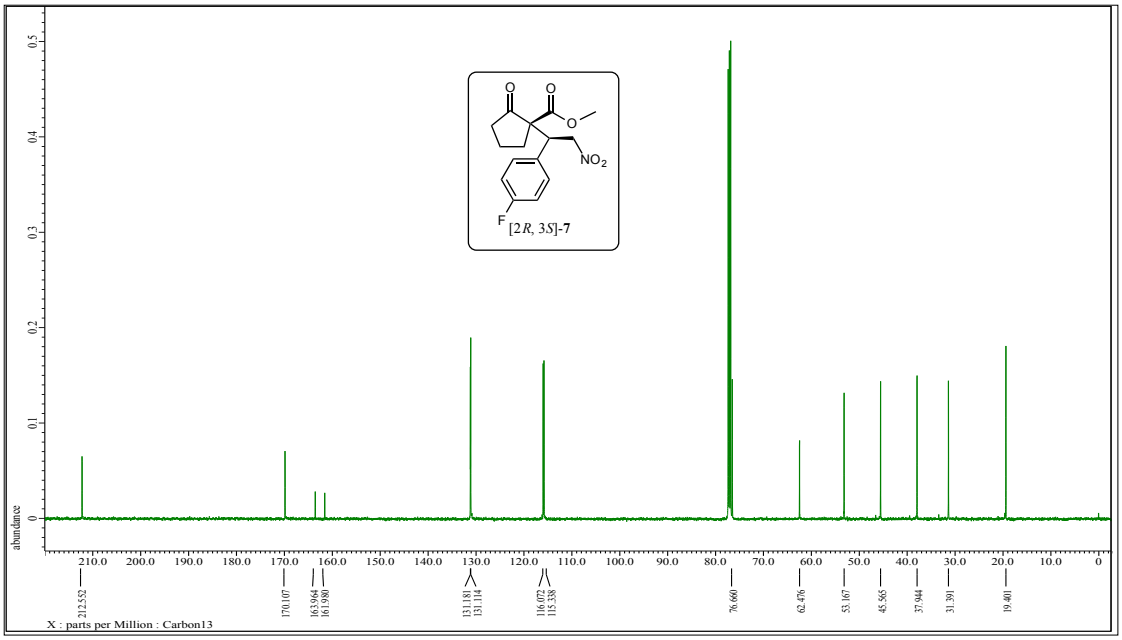
^{13}C-NMR spectra of [2*R*,3*S*]-Methyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**4**)



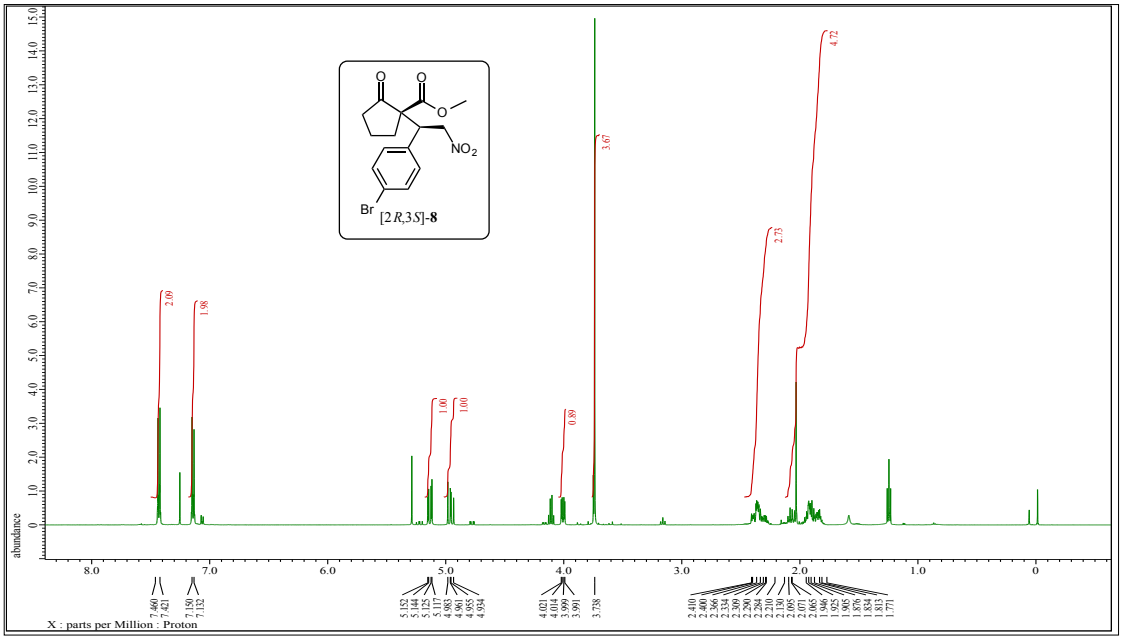
^{1}H-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Fluorophenyl)-2-nitroethyl)-2-oxocyclopentane carboxylate (**7**)



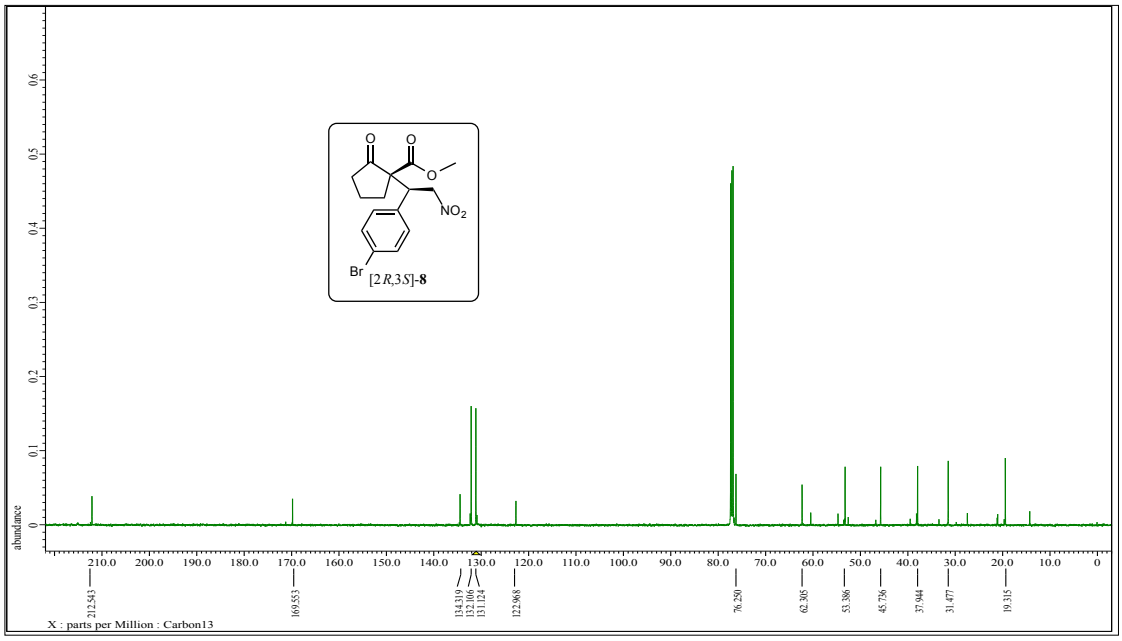
^{13}C-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Fluorophenyl)-2-nitroethyl)-2-oxocyclopentane carboxylate (**7**)



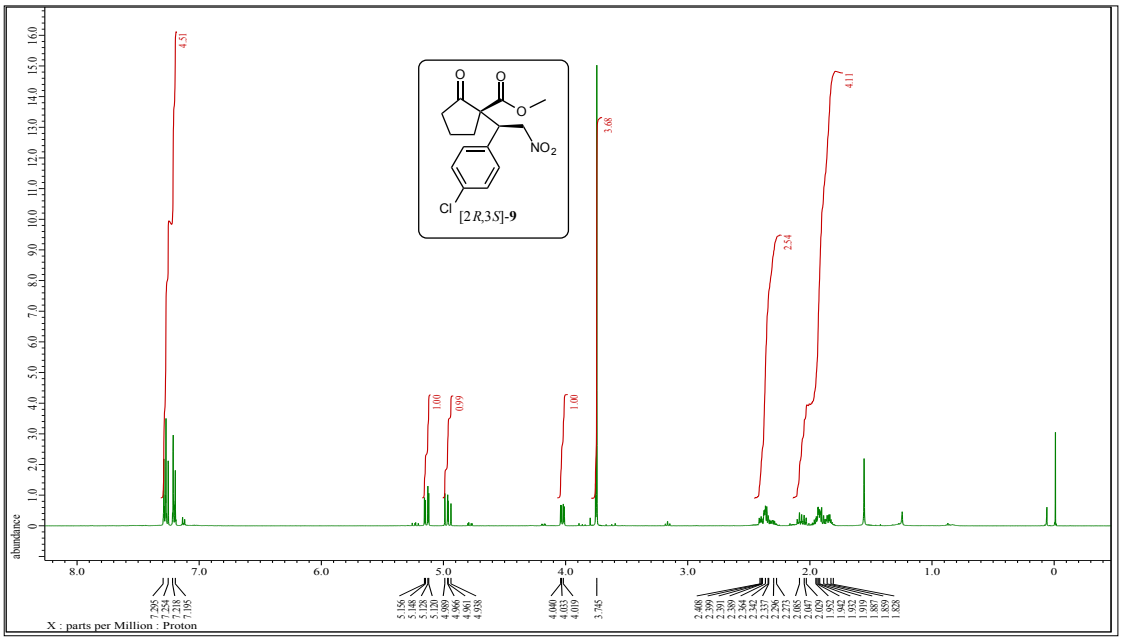
[1]H-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Bromophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**8**)



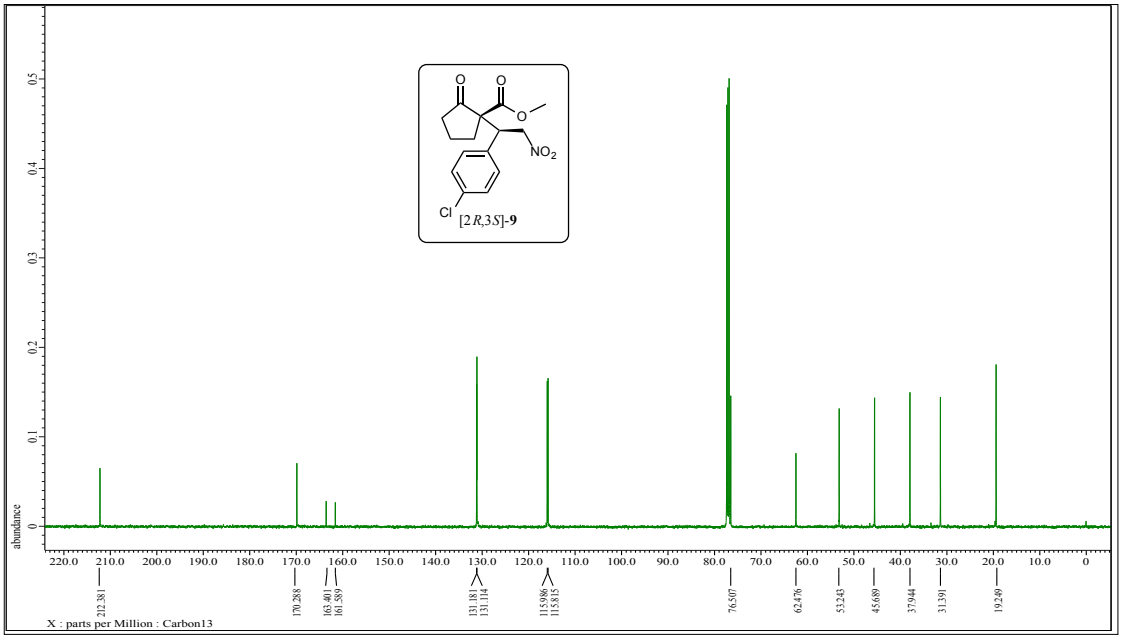
[1]C-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Bromophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**8**)



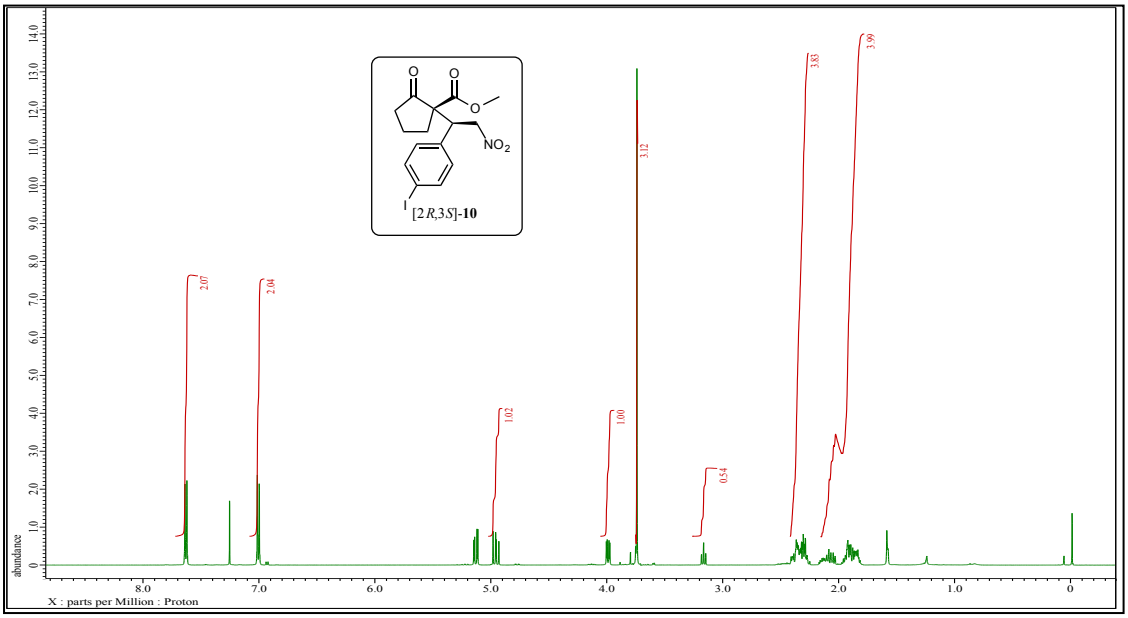
[1]H-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Chlorophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**9**)



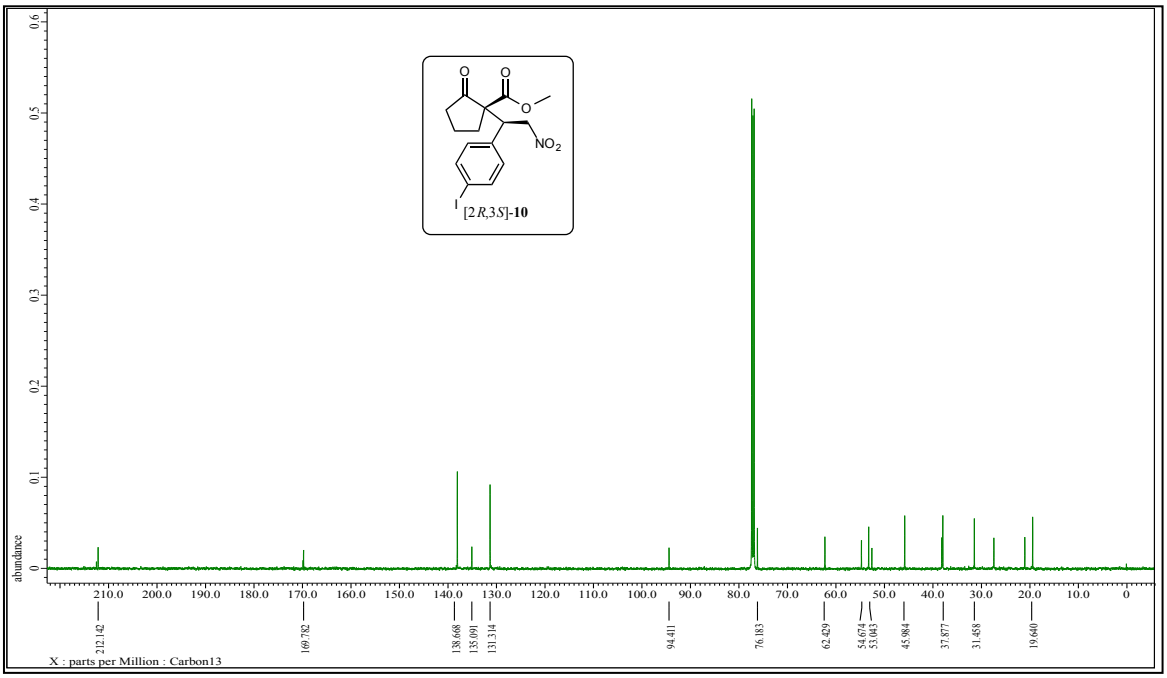
[13]C-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Chlorophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**9**)



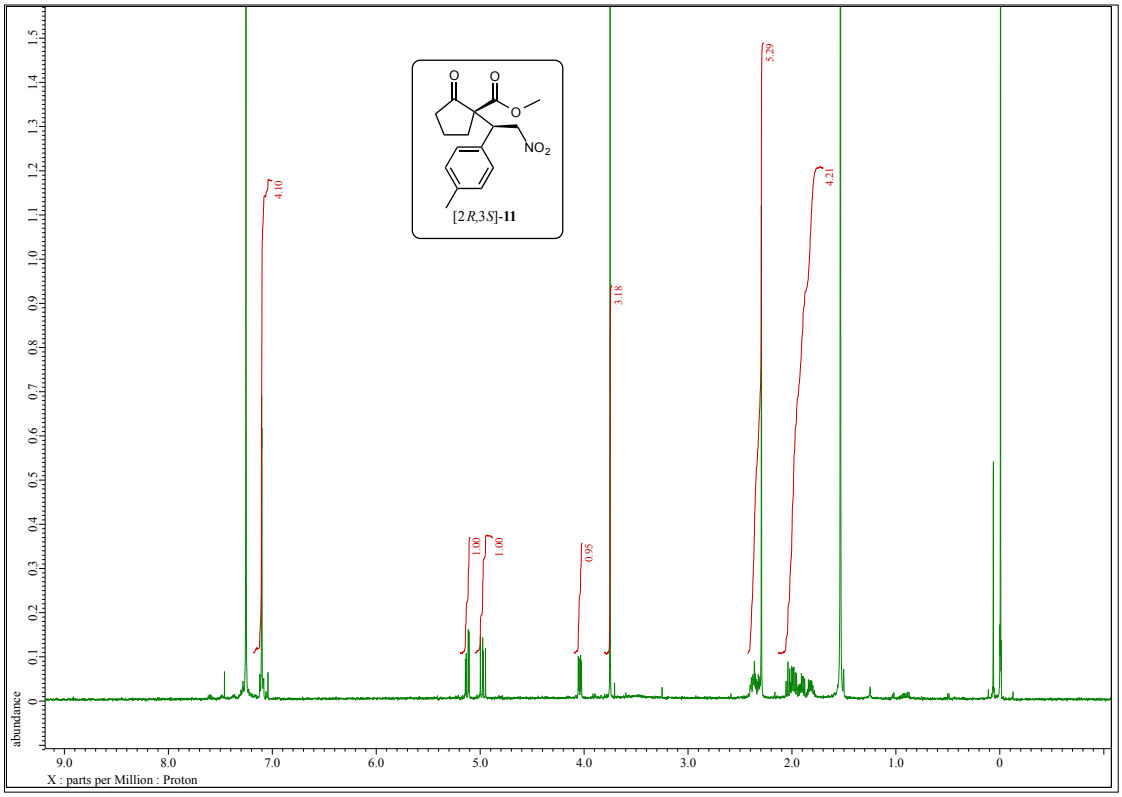
^{1}H-NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Iodophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**10**)



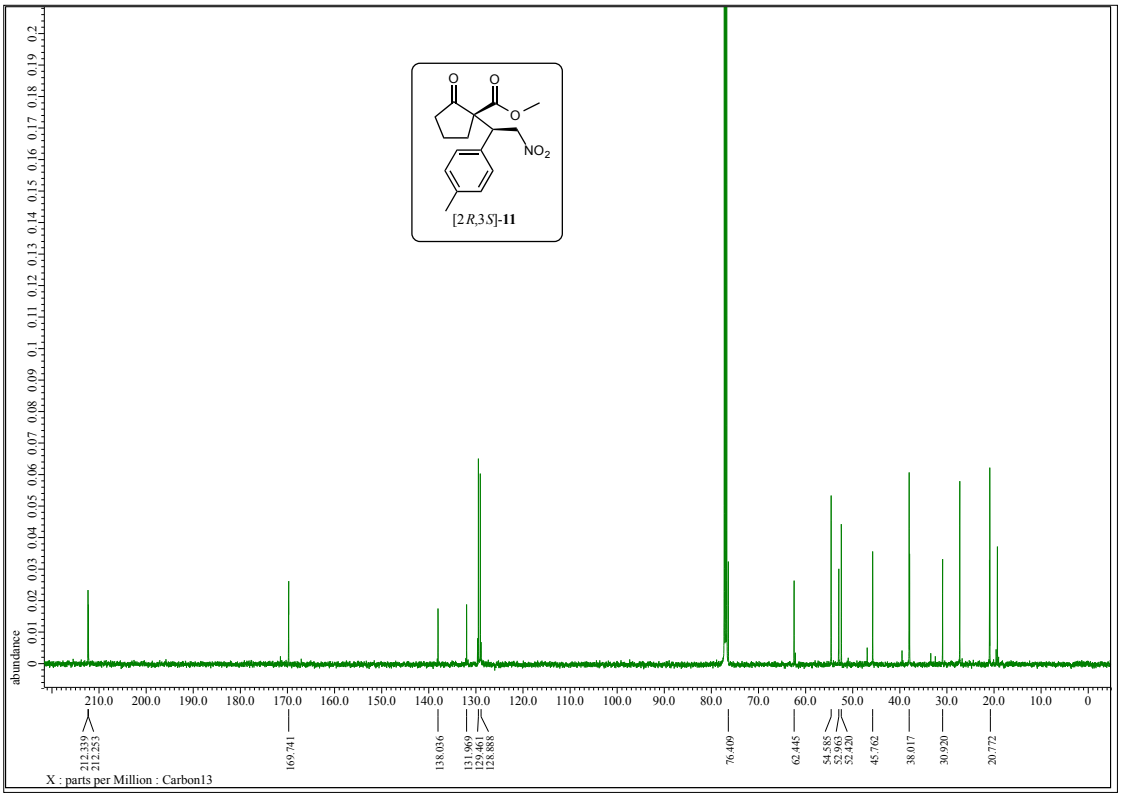
^{13}C -NMR spectra of [2*R*,3S]-Methyl-1-(1-(4-Iodophenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate(**10**)



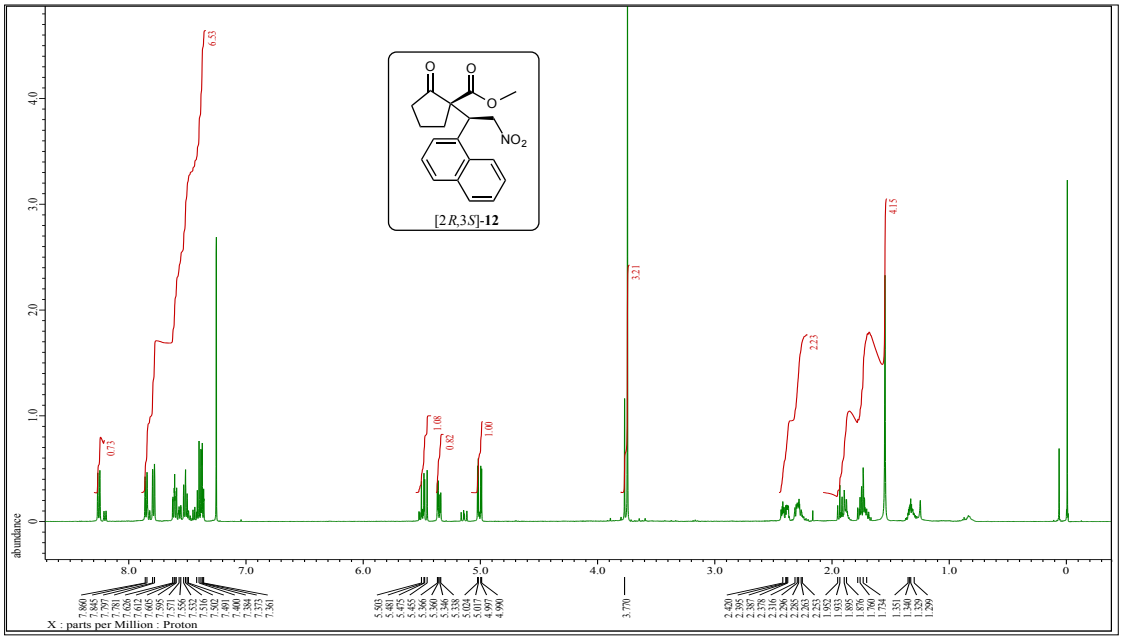
^{1}H-NMR spectra of [2*R*, 3S]-Methyl-1-(1-(4-Methylphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**11**)



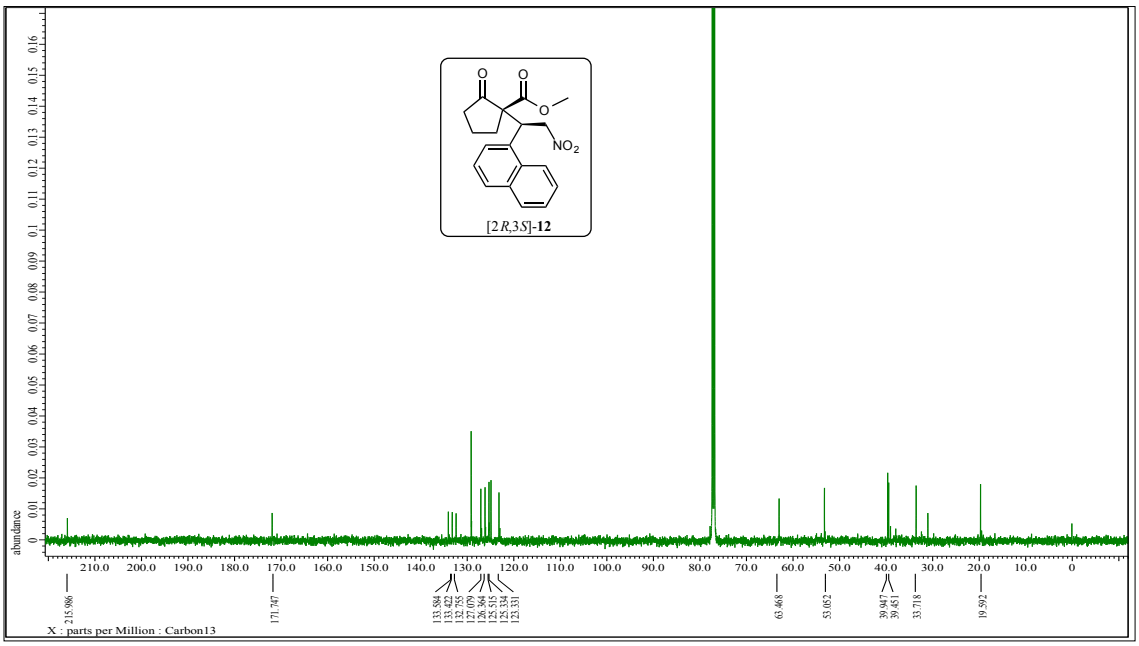
^{13}C-NMR spectra of [2*R*, 3S]-Methyl-1-(1-(4-Methylphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**11**)



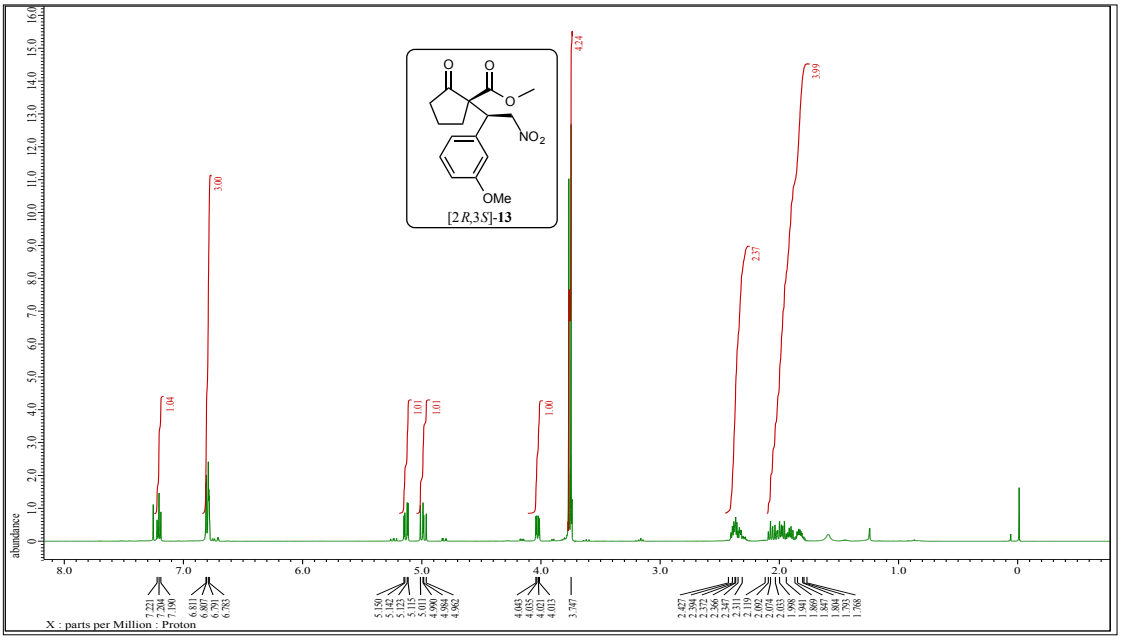
^{1}H-NMR spectra of [2*R*,3*S*]-Methyl-1-(2-nitro-1-(naphthalen-2-yl)ethyl)-2-oxocyclopentanecarboxylate(**12**)



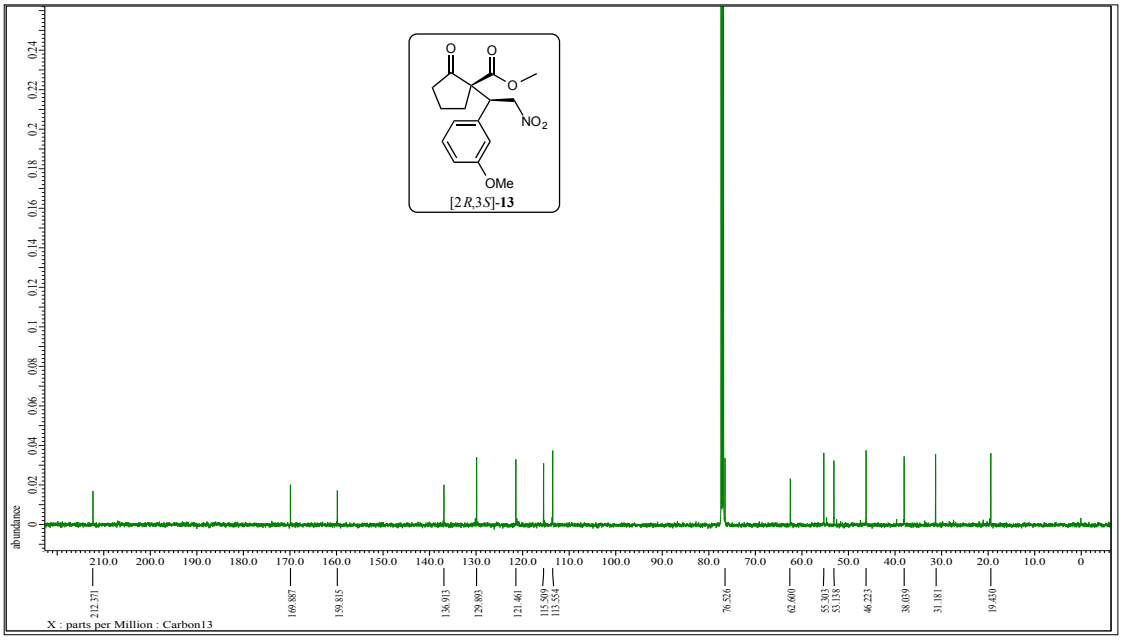
^{13}C-NMR spectra of [2*R*,3*S*]-Methyl-1-(2-nitro-1-(naphthalen-2-yl)ethyl)-2-oxocyclopentanecarboxylate(**12**)



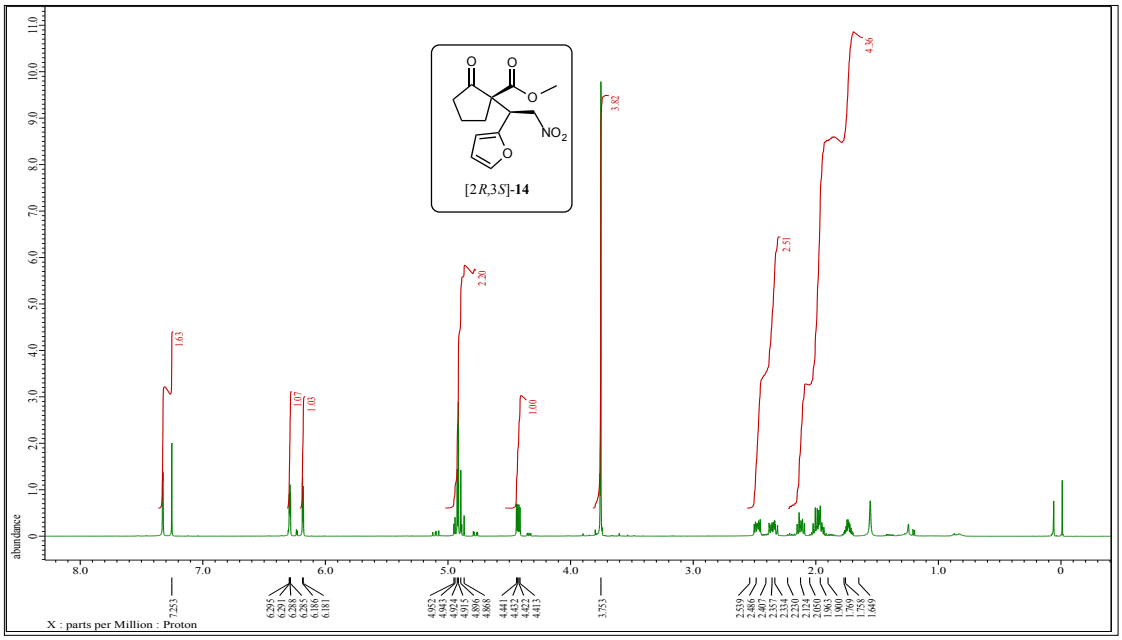
^{1}H-NMR spectra of [2*R*,3*S*]-Methyl-1-(1-(3-Methoxyphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**13**)



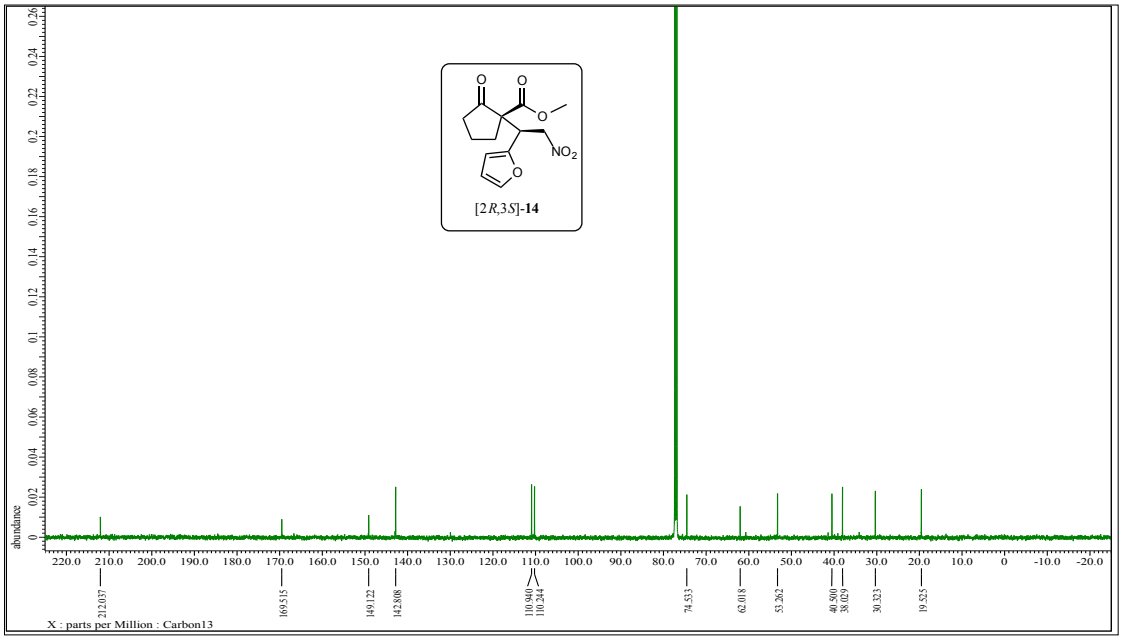
^{13}C-NMR spectra of [2*R*,3*S*]-Methyl-1-(1-(3-Methoxyphenyl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**13**)



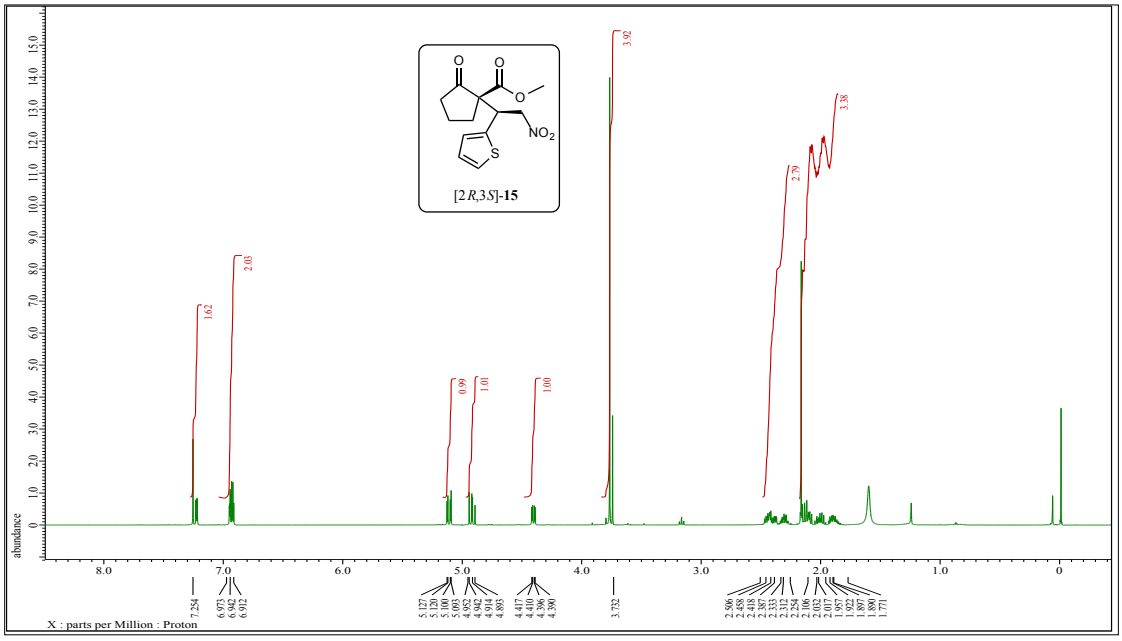
^{1}H-NMR spectra of [2*R*,3*S*]-Methyl-1-((1-furan-2-yl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**14**)



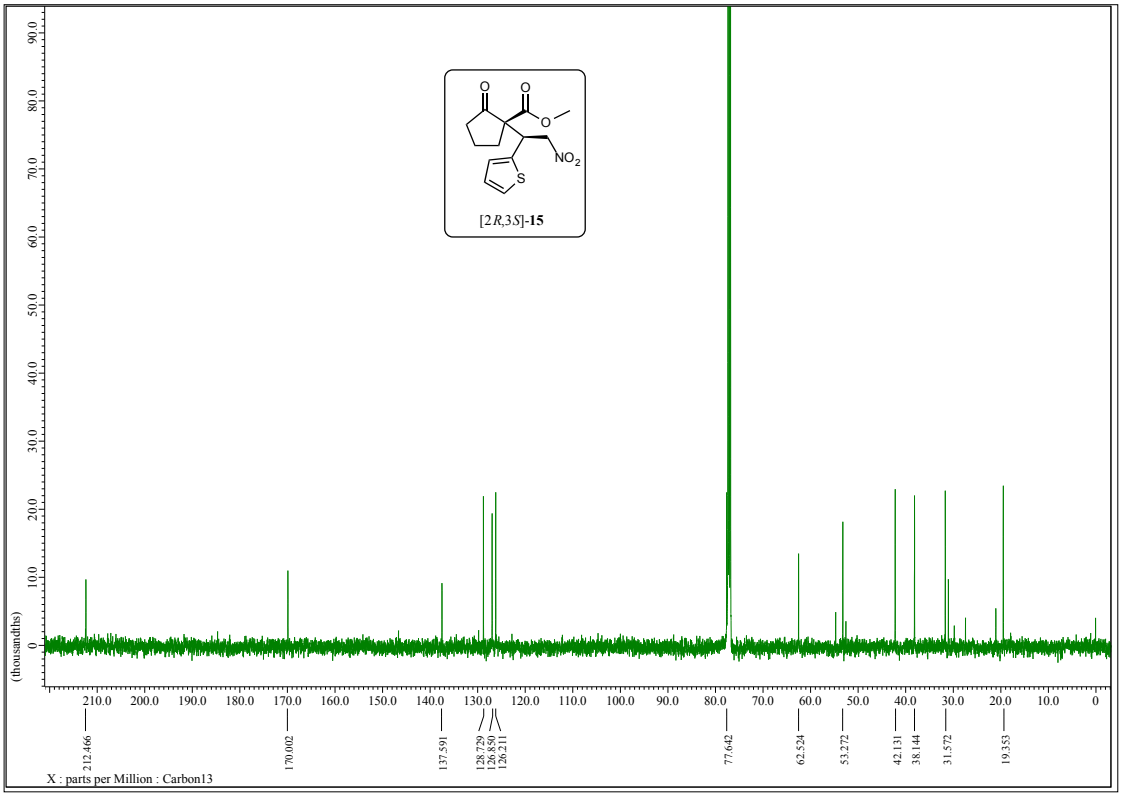
^{13}C-NMR spectra of [2*R*,3*S*]-Methyl-1-((1-furan-2-yl)-2-nitroethyl)-2-oxocyclopentanecarboxylate (**14**)



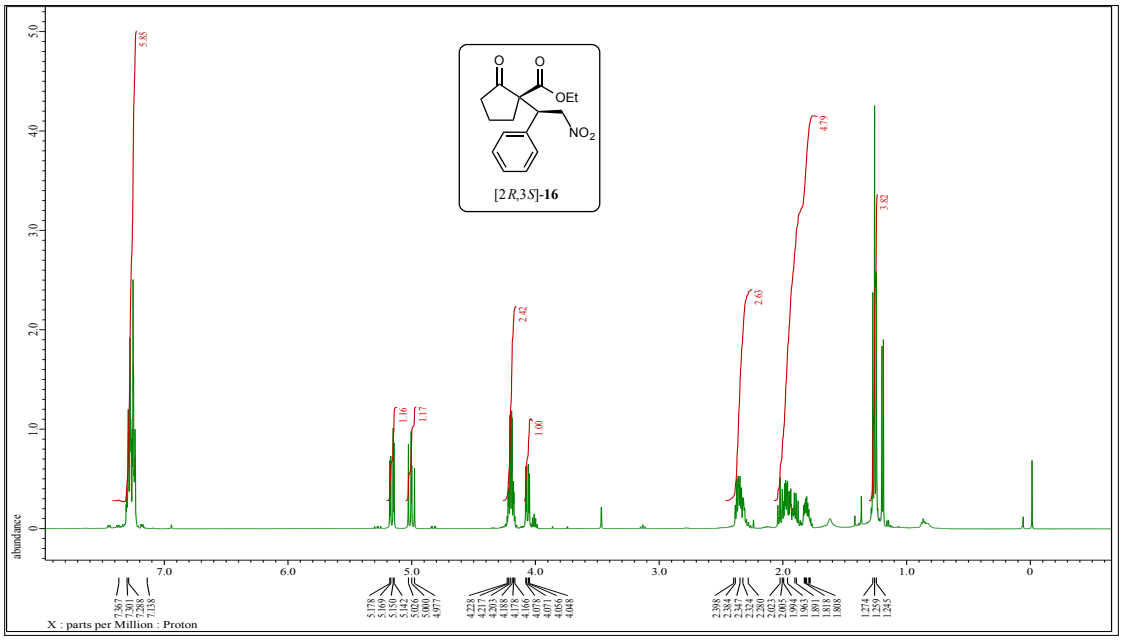
^{1}H-NMR spectra of [2*R*,3*S*]- Methyl-1-(1-(thienyl-2-yl)- 2-nitroethyl)-2-oxocyclopentanecarboxylate (**15**)



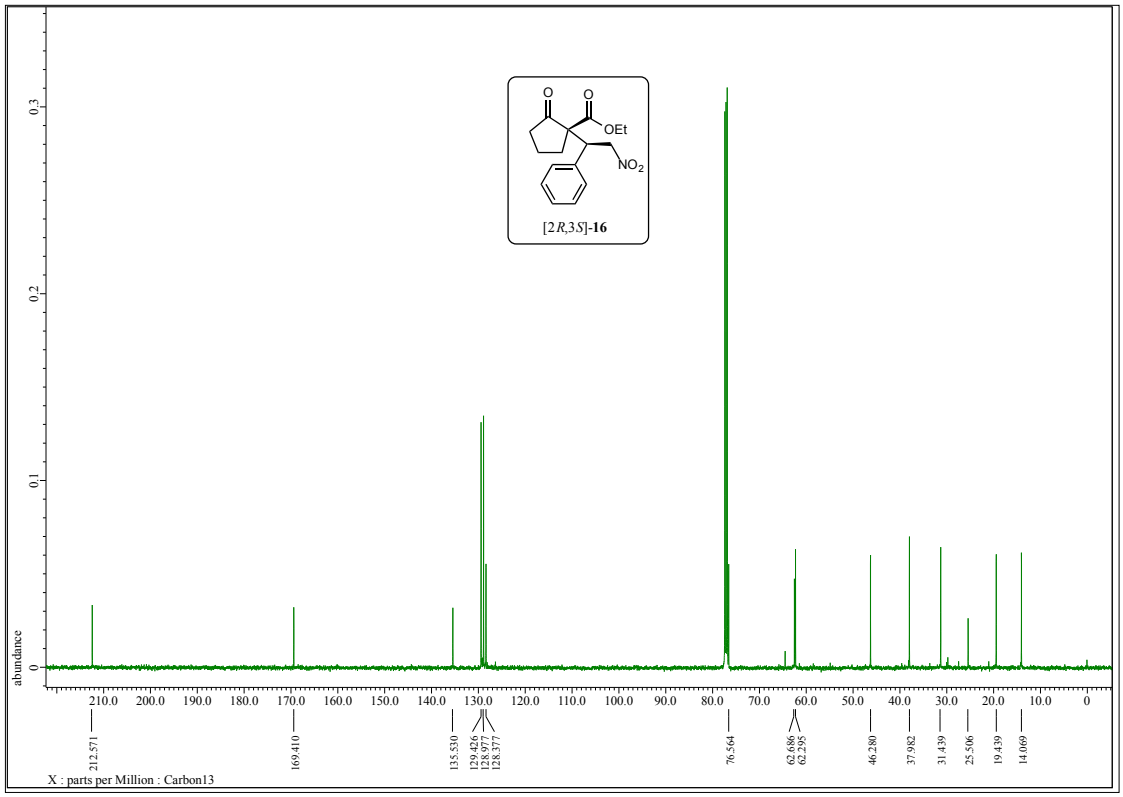
^{13}C-NMR spectra of [2*R*,3*S*]- Methyl-1-(1-(thienyl-2-yl)- 2-nitroethyl)-2-oxocyclopentanecarboxylate (**15**)



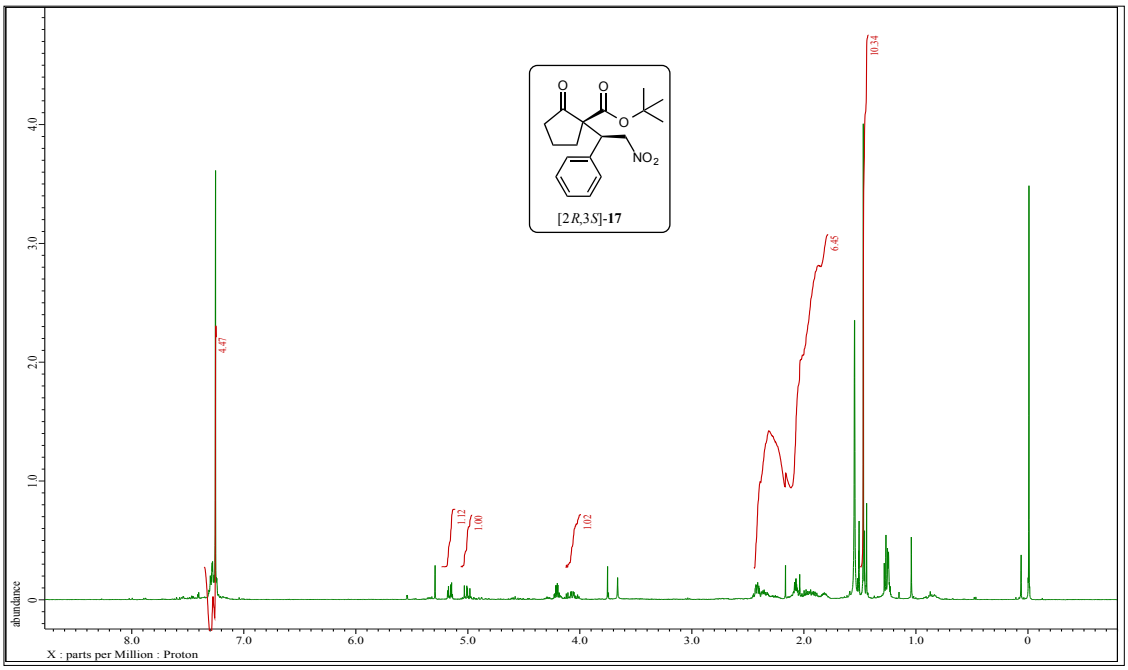
^{1}H-NMR spectra of [2*R*,3*S*]-Ethyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate(**16**)



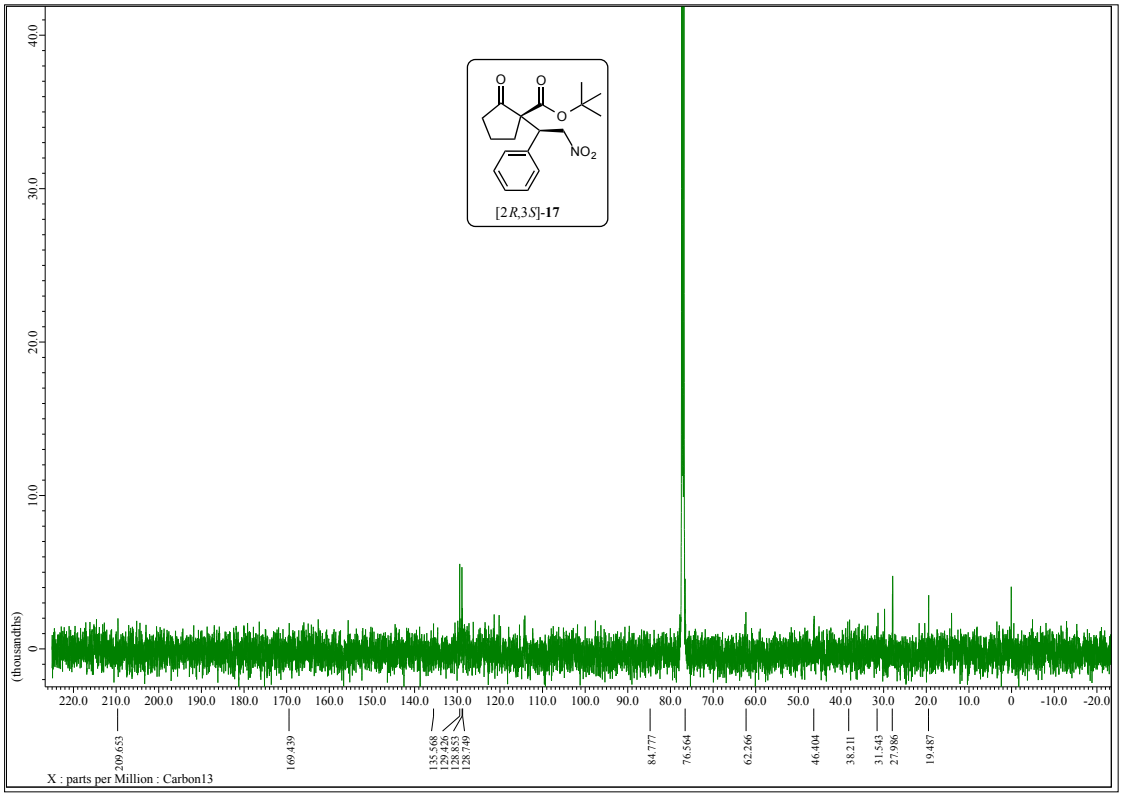
^{13}C-NMR spectra of [2*R*,3*S*]-Ethyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate(**16**)



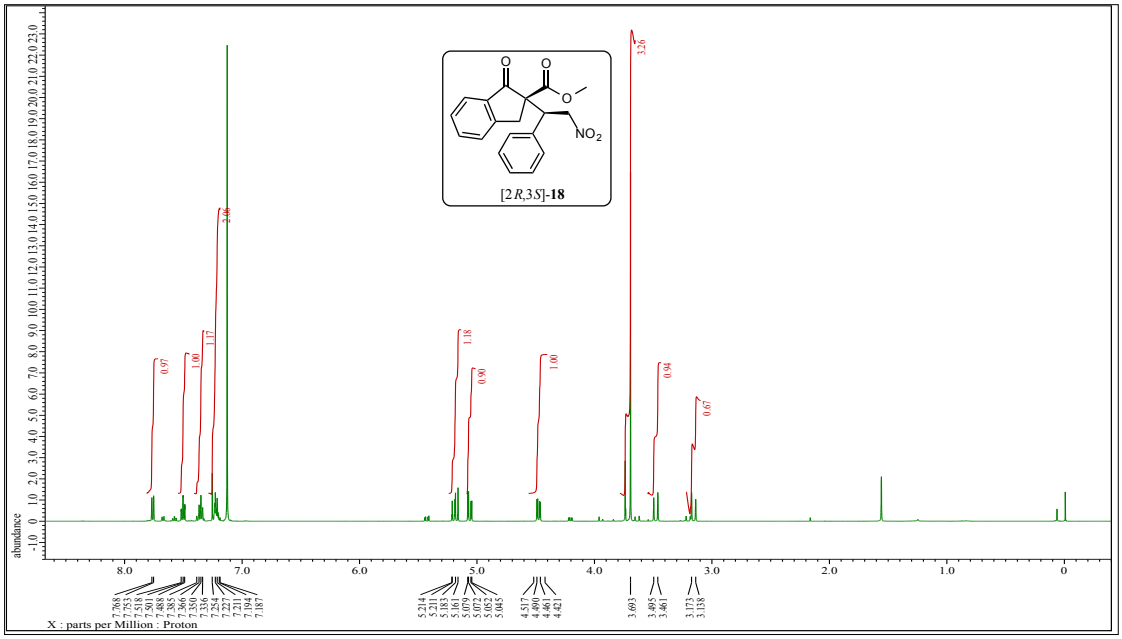
[1]H-NMR spectra of [2*R*,3*S*]-*tert*-butyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**17**)



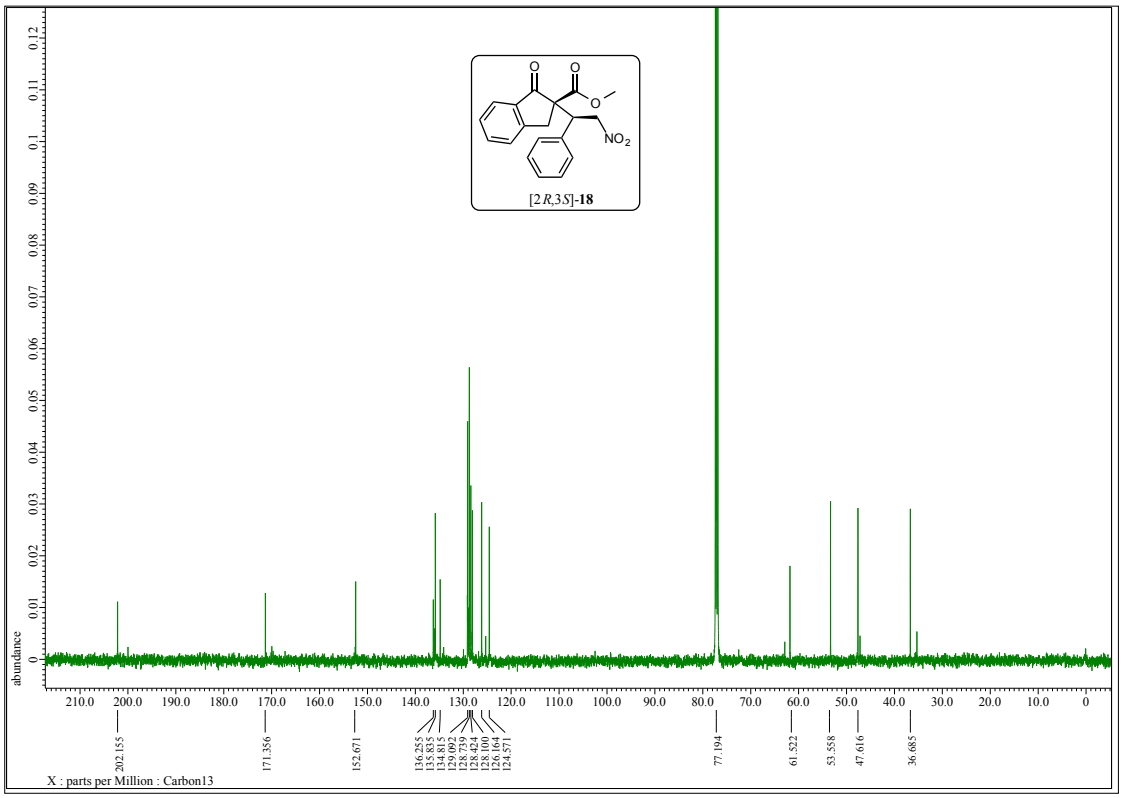
[13]C-NMR spectra of [2*R*,3*S*]-*tert*-butyl-1-(2-nitro-1-phenylethyl)-2-oxocyclopentanecarboxylate (**17**)



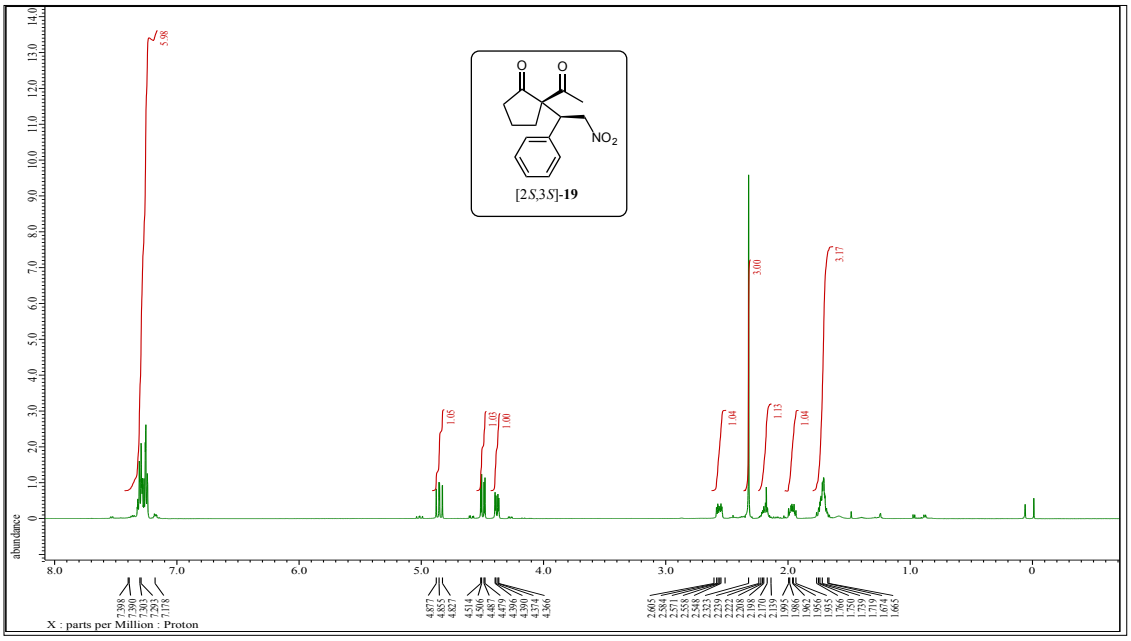
^{1}H-NMR spectra of [2*R*,3*S*]-Methyl-2,3-dihydro-2-(2-nitro-1-phenylethyl)-1-oxo-1H-indene-2-carboxylate-(**18**)



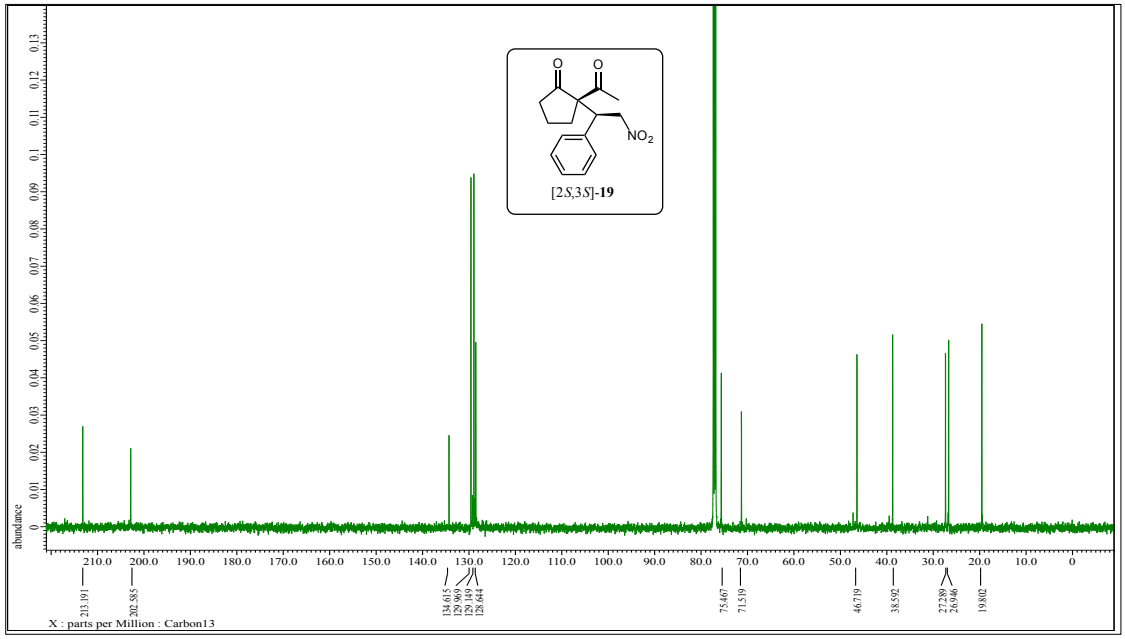
^{13}C-NMR spectra of [2*R*,3*S*]-Methyl-2,3-dihydro-2-(2-nitro-1-phenylethyl)-1-oxo-1H-indene-2-carboxylate-(**18**)



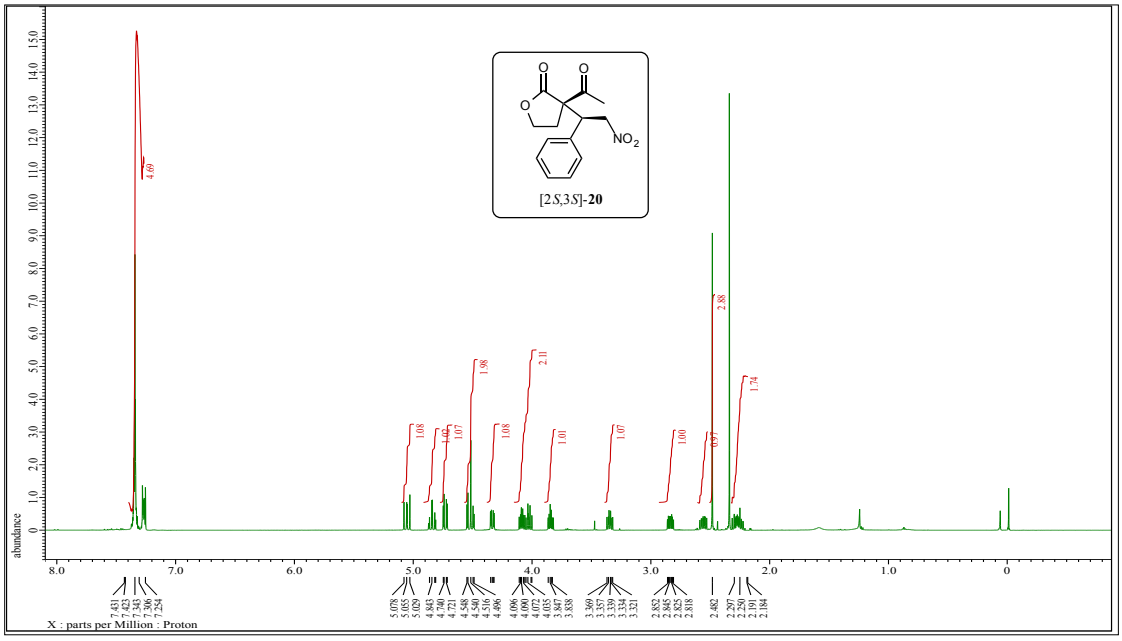
^{1}H-NMR spectra of [2*S*,3*S*]- 2-Acetyl-2-(2-nitro-1-phenylethyl)-cyclopentanone (**19**)



^{13}C-NMR spectra of [2*S*,3*S*]- 2-Acetyl-2-(2-nitro-1-phenylethyl)-cyclopentanone (**19**)



^{1}H-NMR spectra of [2*S*,3*S*]- 3-Acetyl-3-(2-nitro-1-phenylethyl)-dihydrofuran-2-one (**20**)



^{13}C-NMR spectra of [2*S*,3*S*]- 3-Acetyl-3-(2-nitro-1-phenylethyl)-dihydrofuran-2-one (**20**)