

# **Enantioselective synthesis of chiral heterocycles containing both chroman and pyrazolone derivatives catalysed by a chiral squaramide**

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Beijing 100081, People's Republic of China*

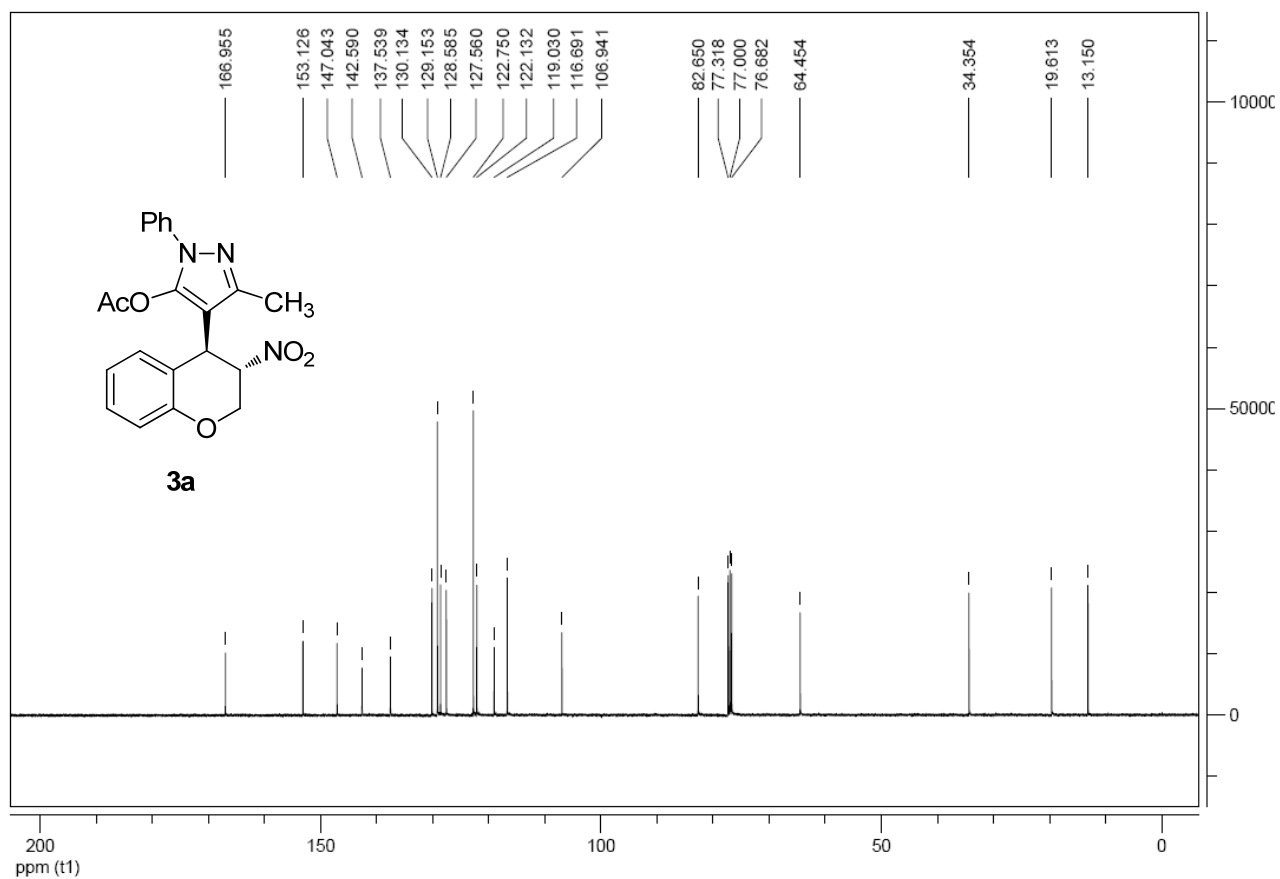
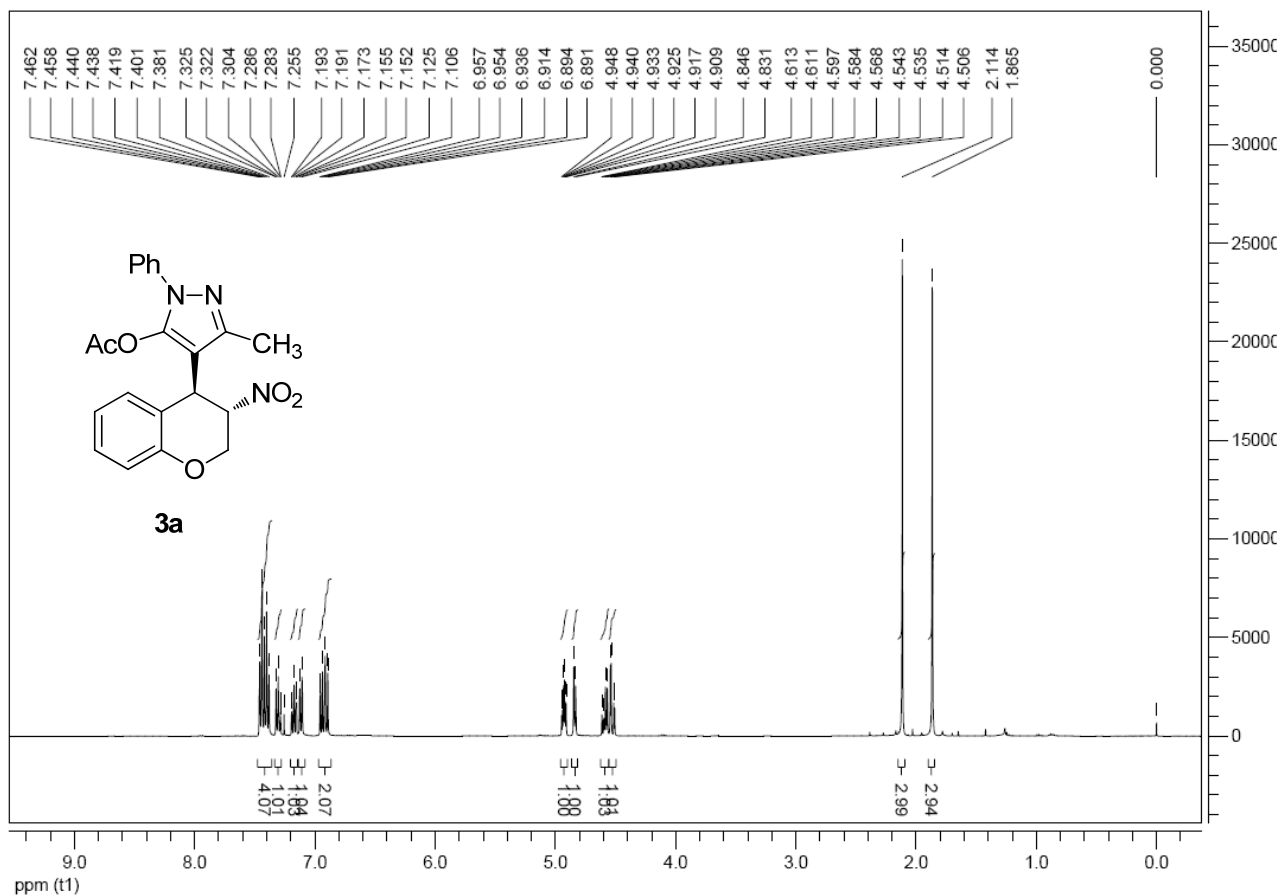
[dudm@bit.edu.cn](mailto:dudm@bit.edu.cn)

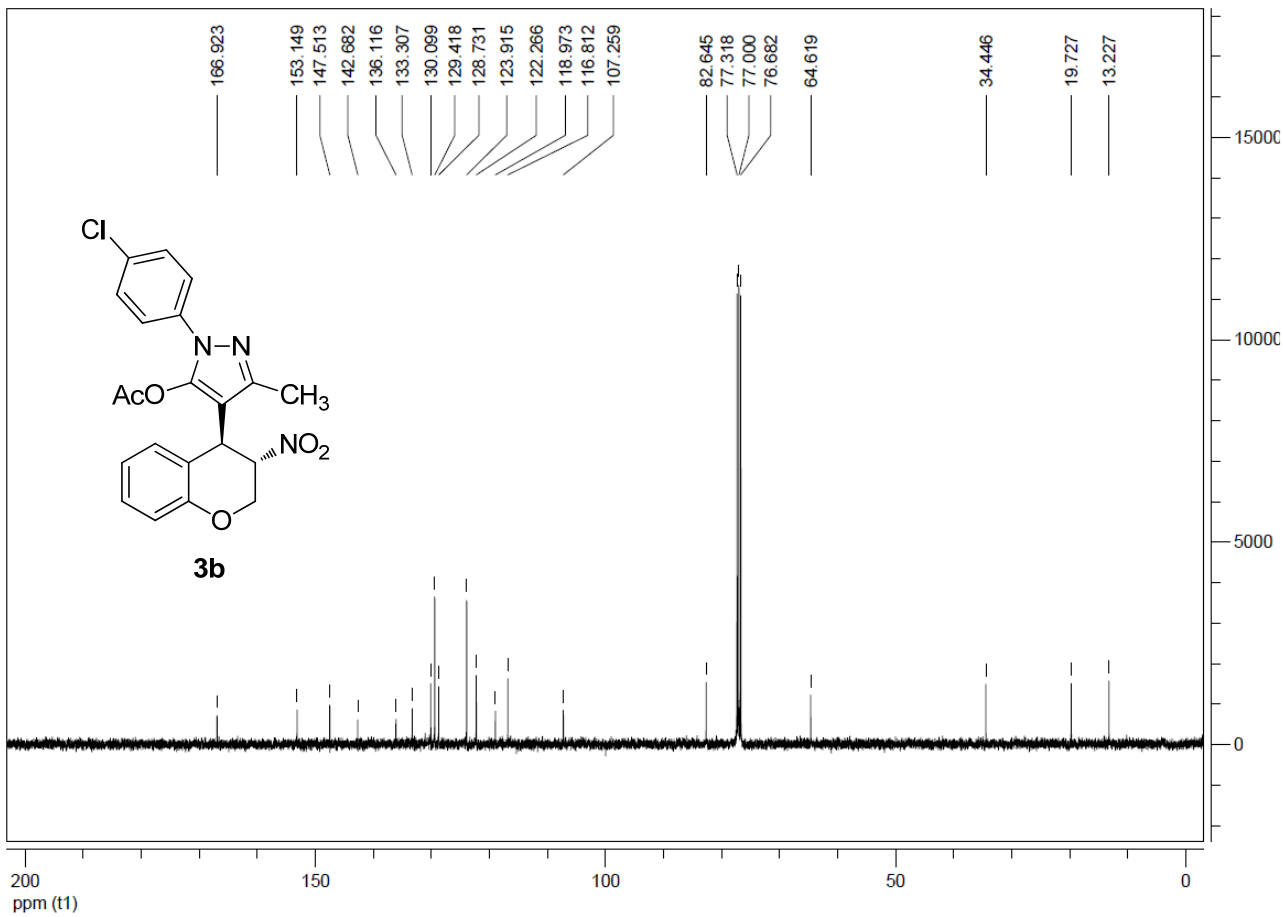
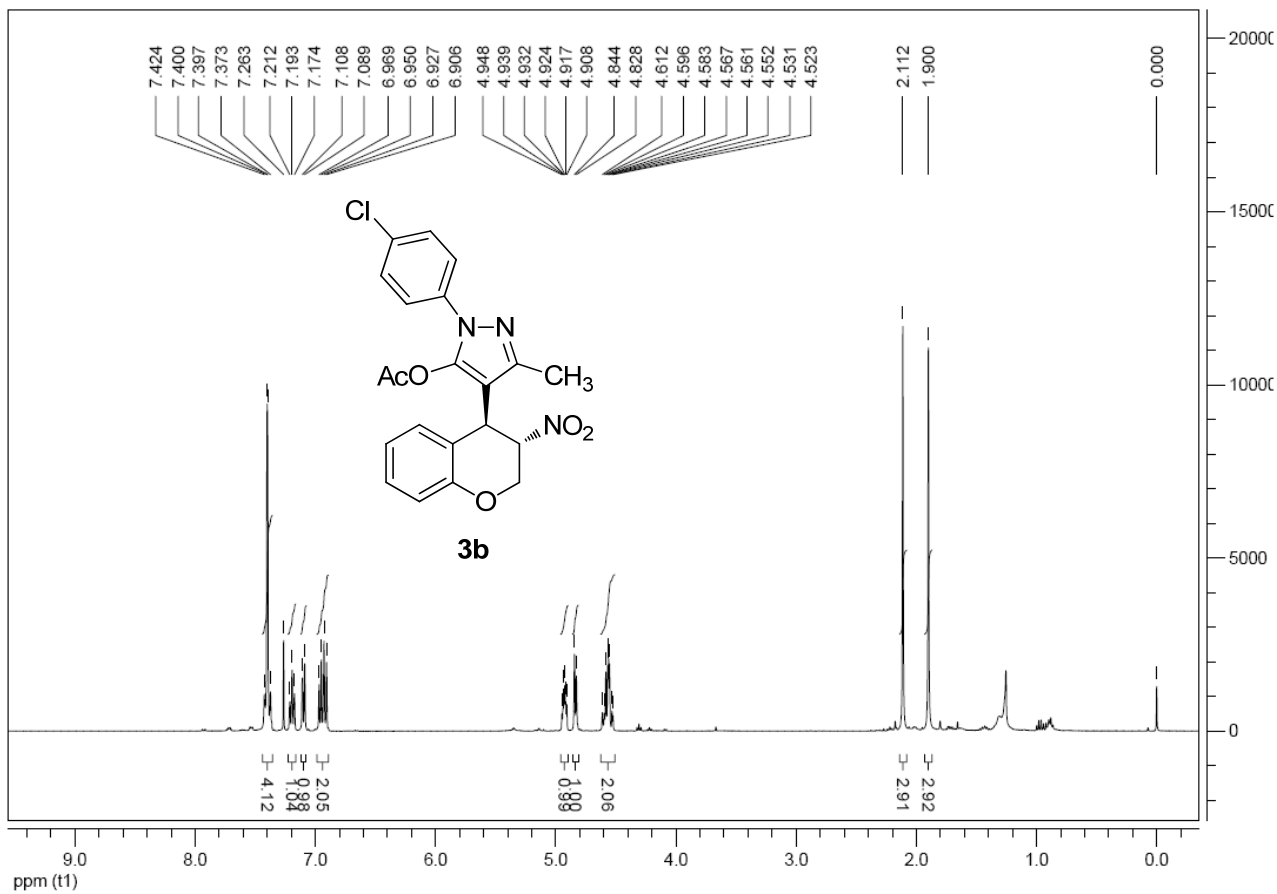
## ***Supporting Information***

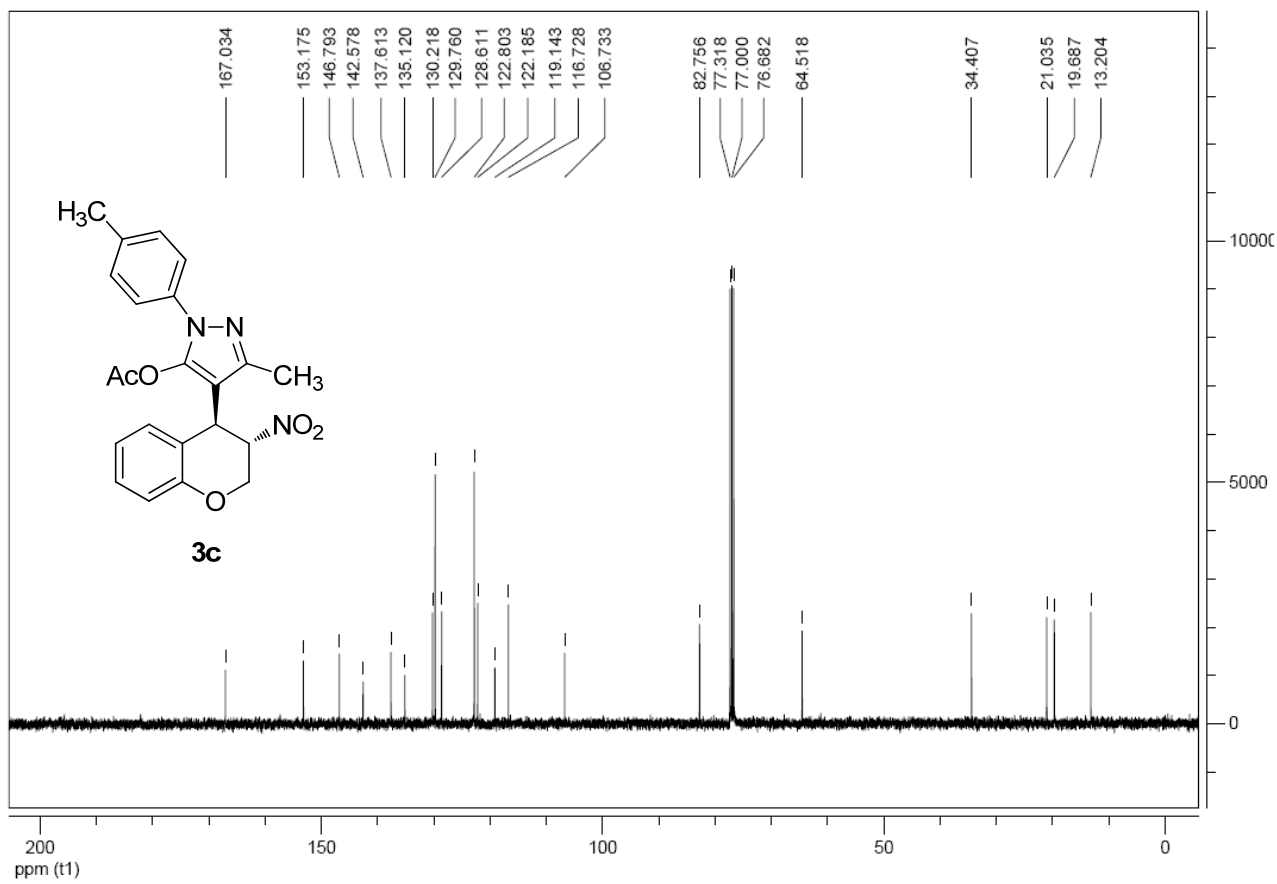
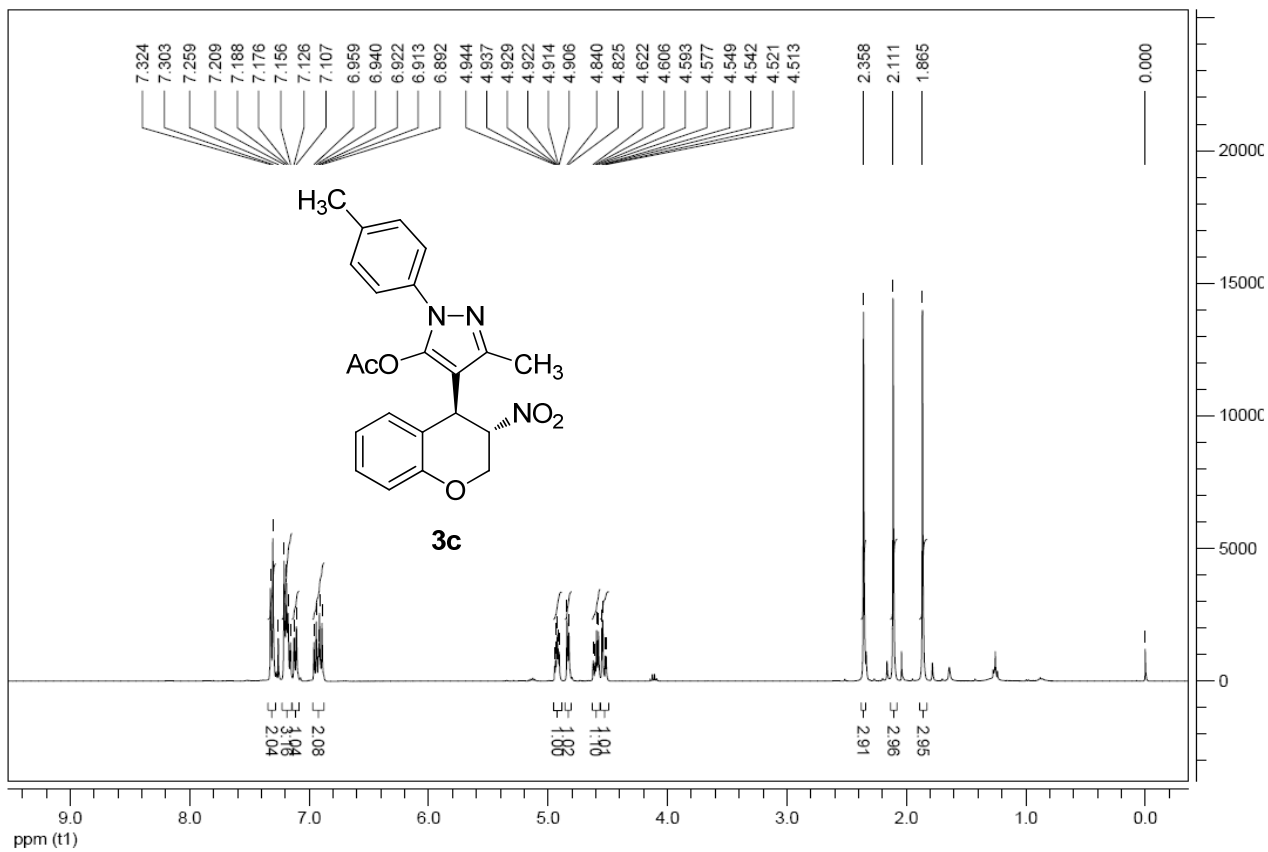
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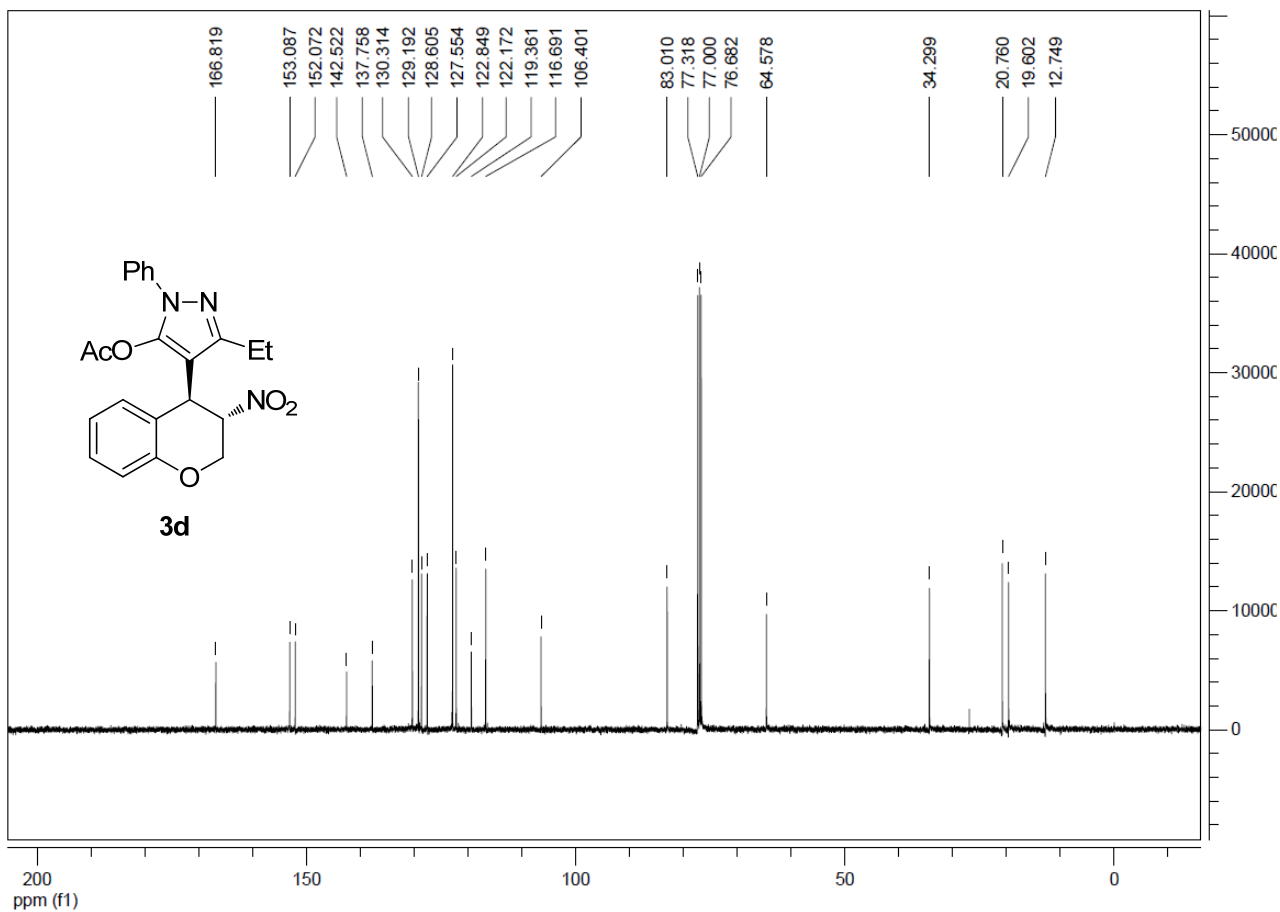
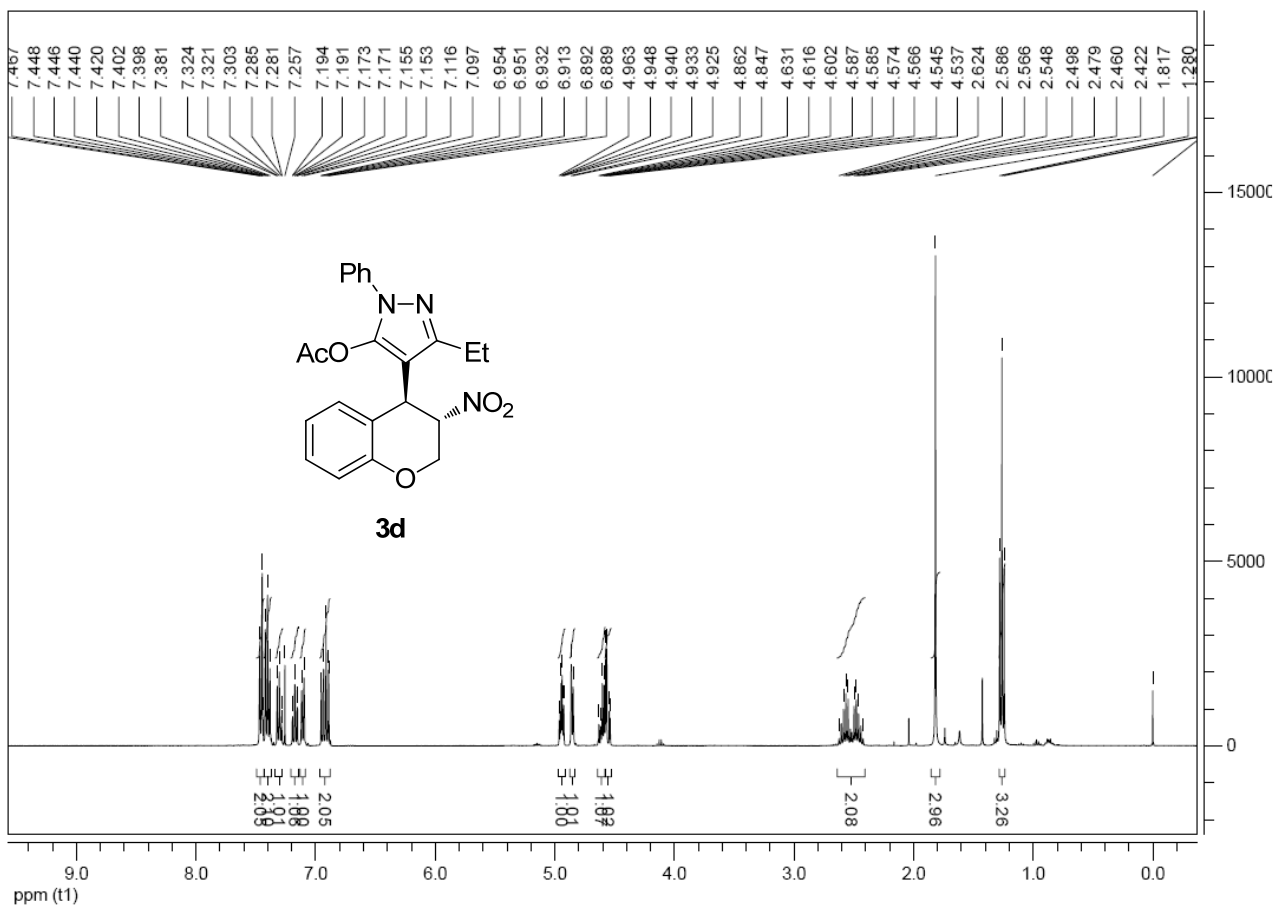
Copies of $^1\text{H}$ and $^{13}\text{C}$ NMR spectra of new products.....	S1
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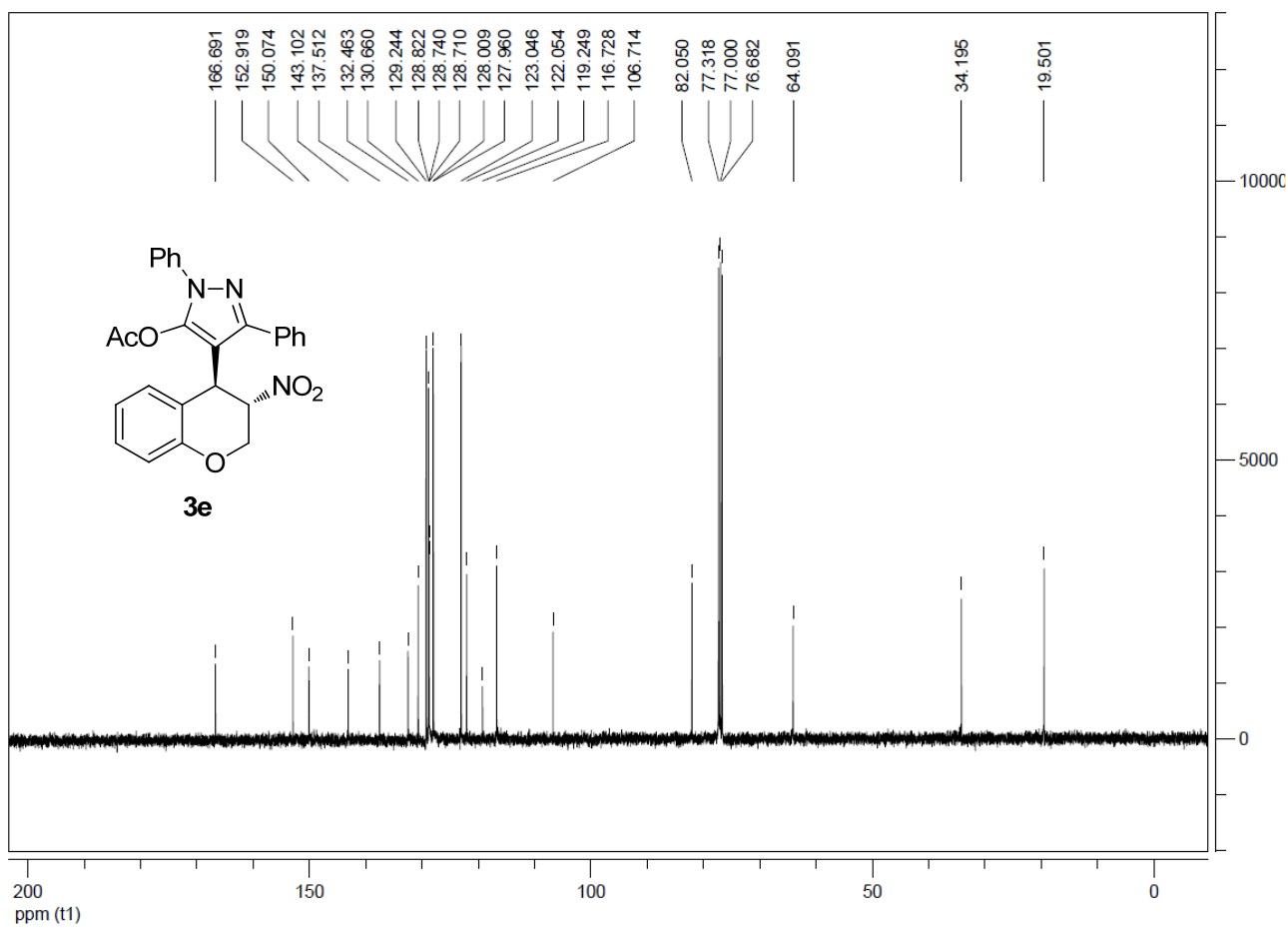
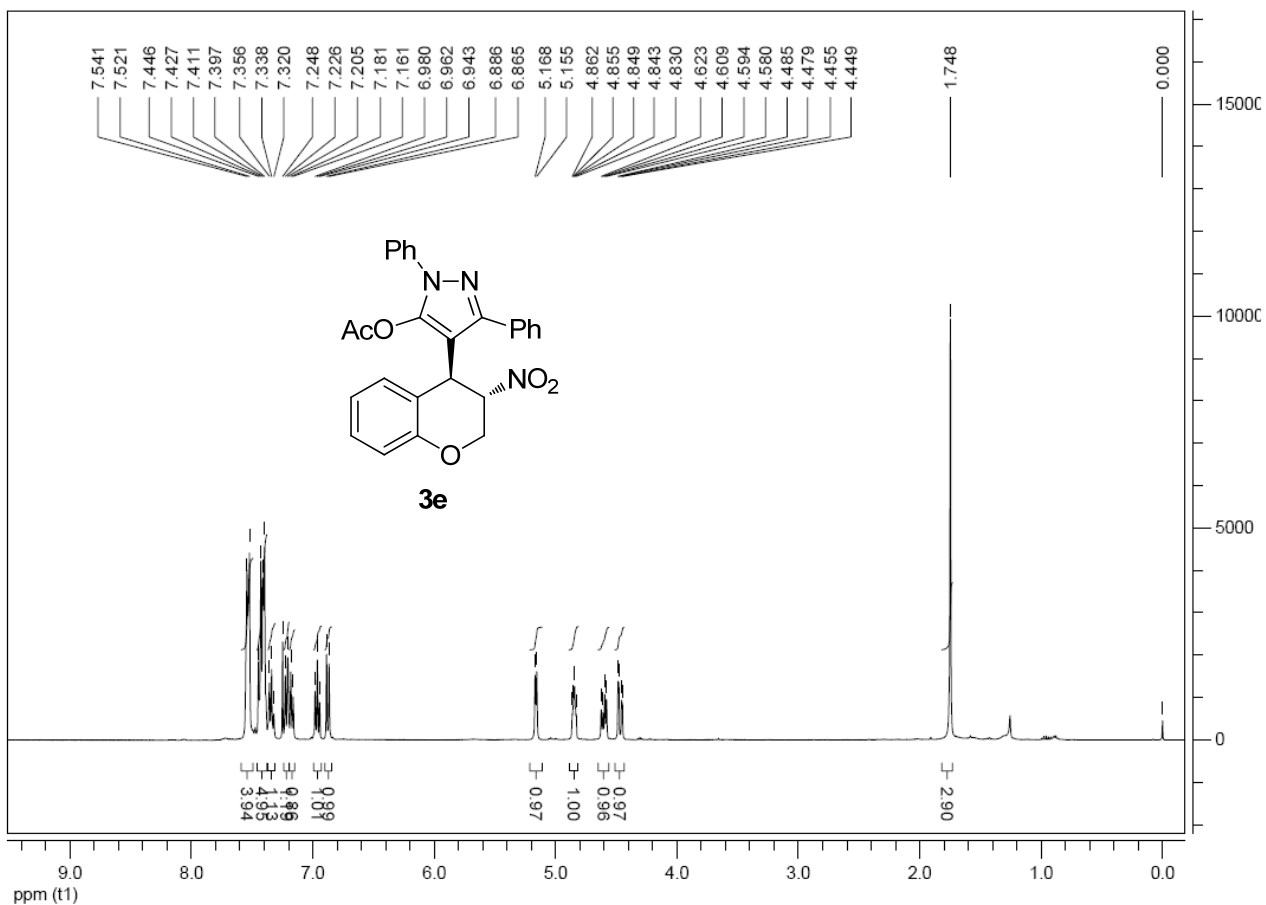
Copies of  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra of new products

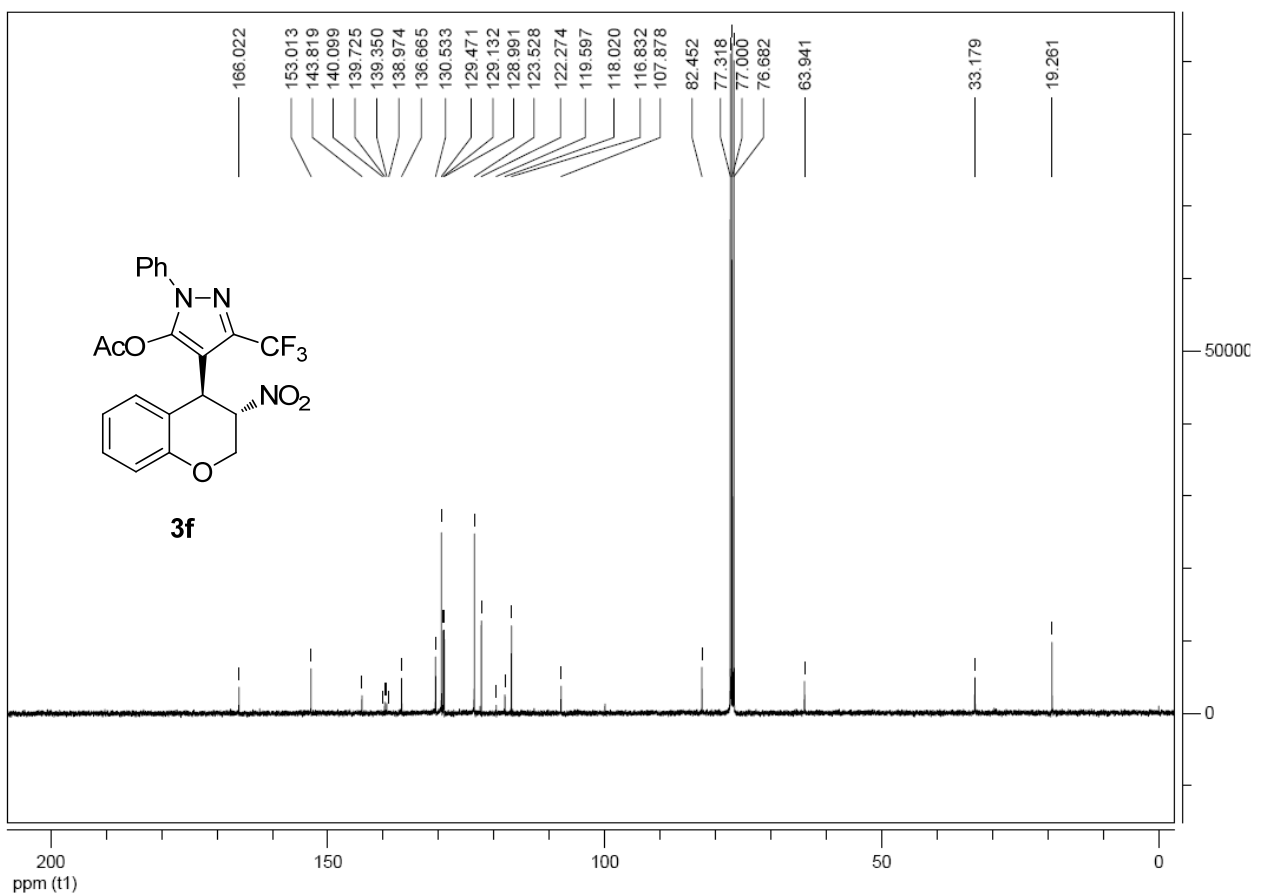
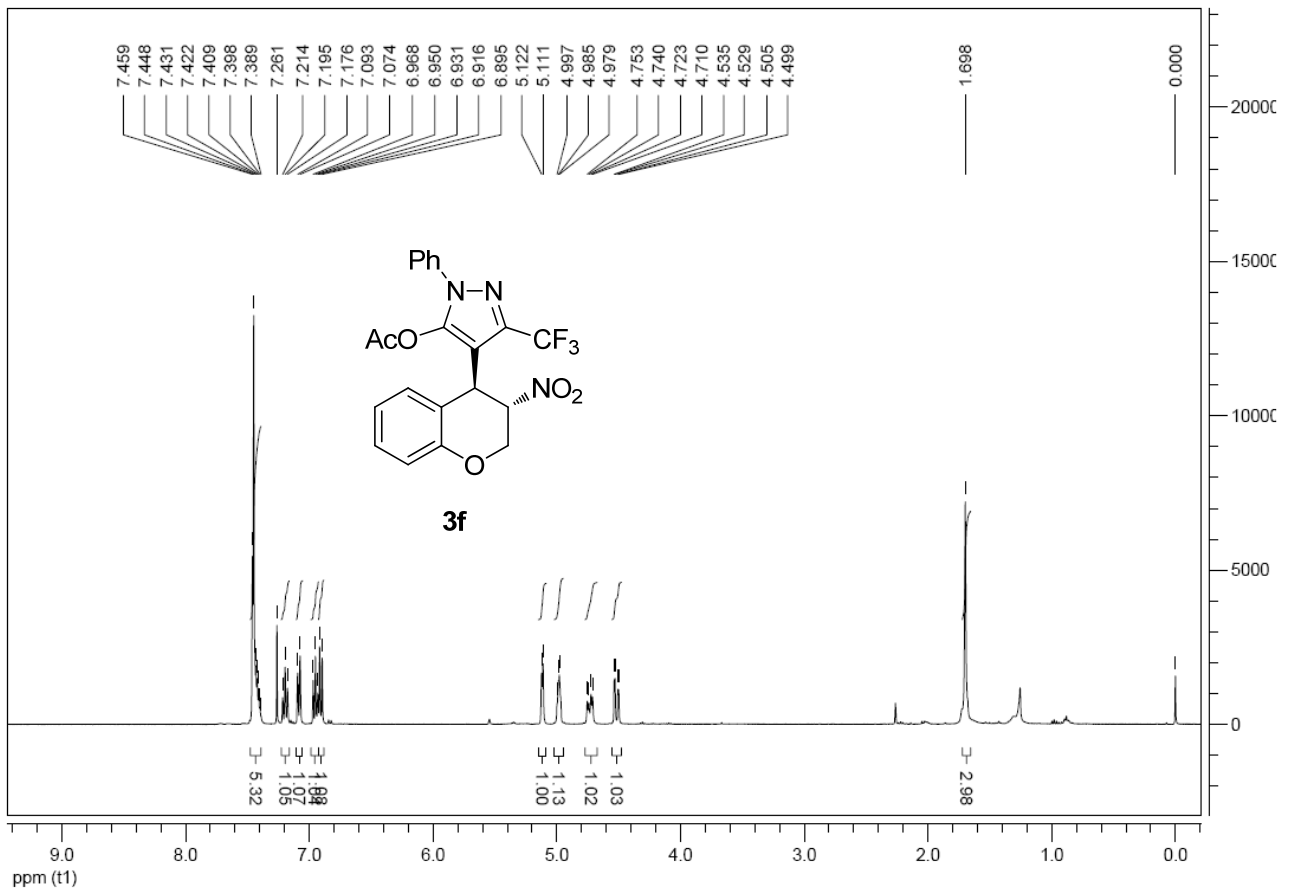


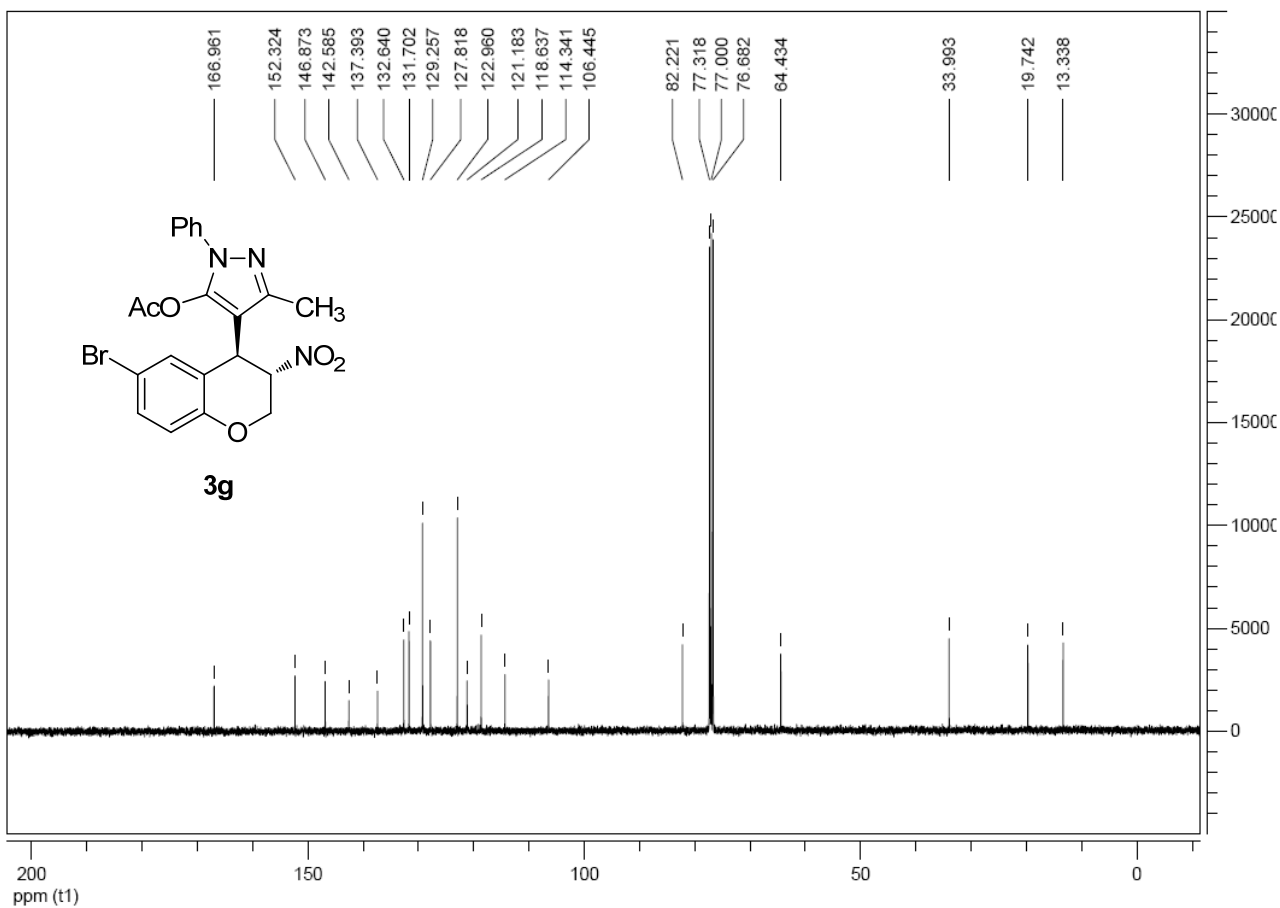
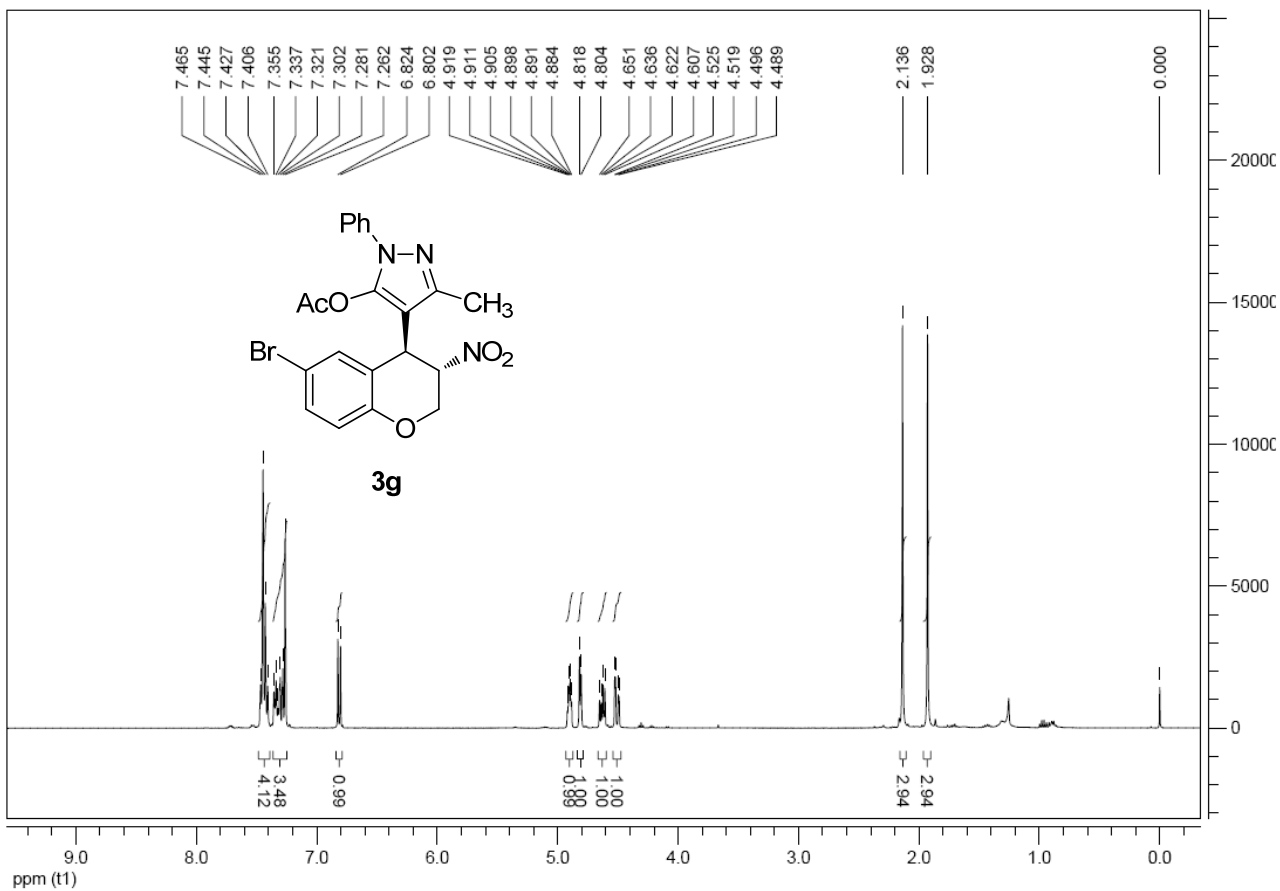




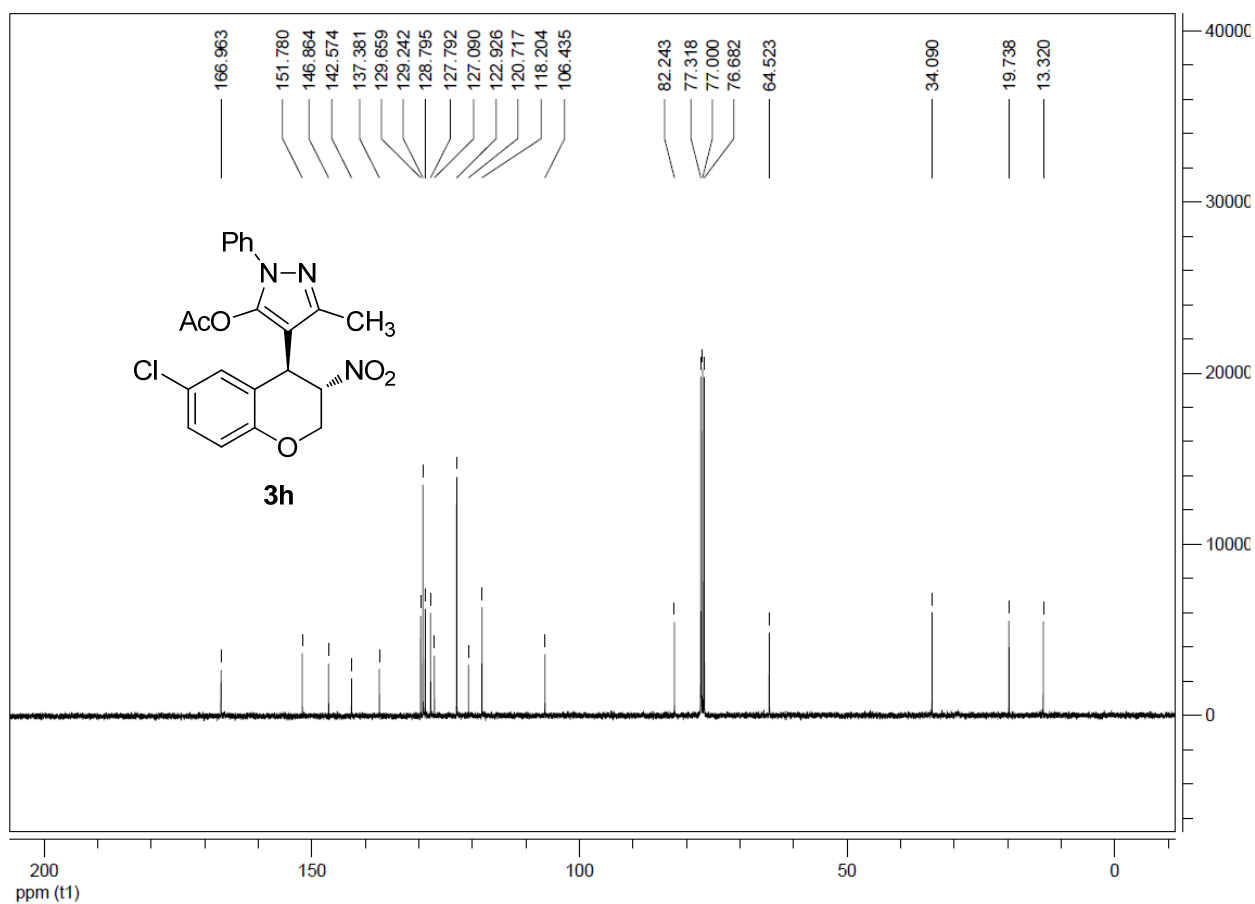
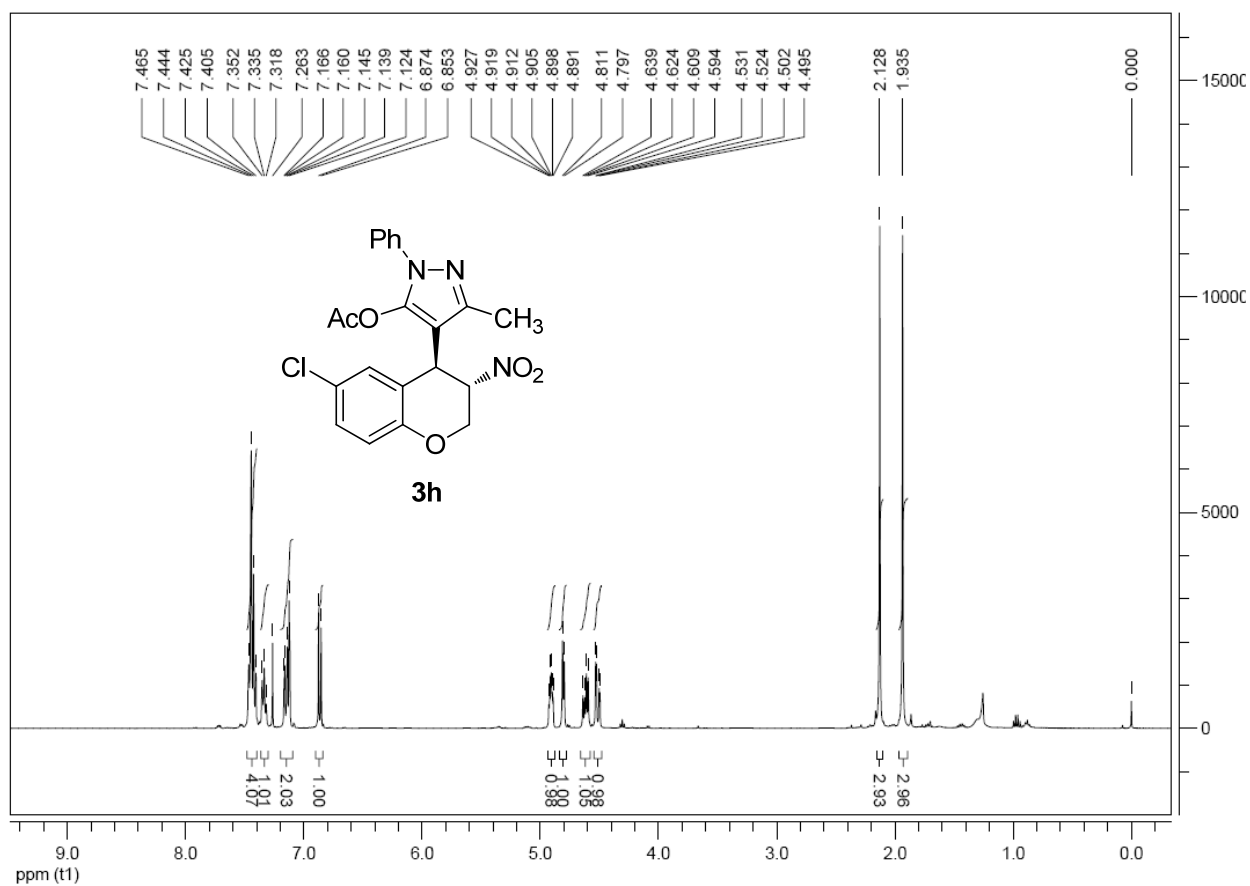


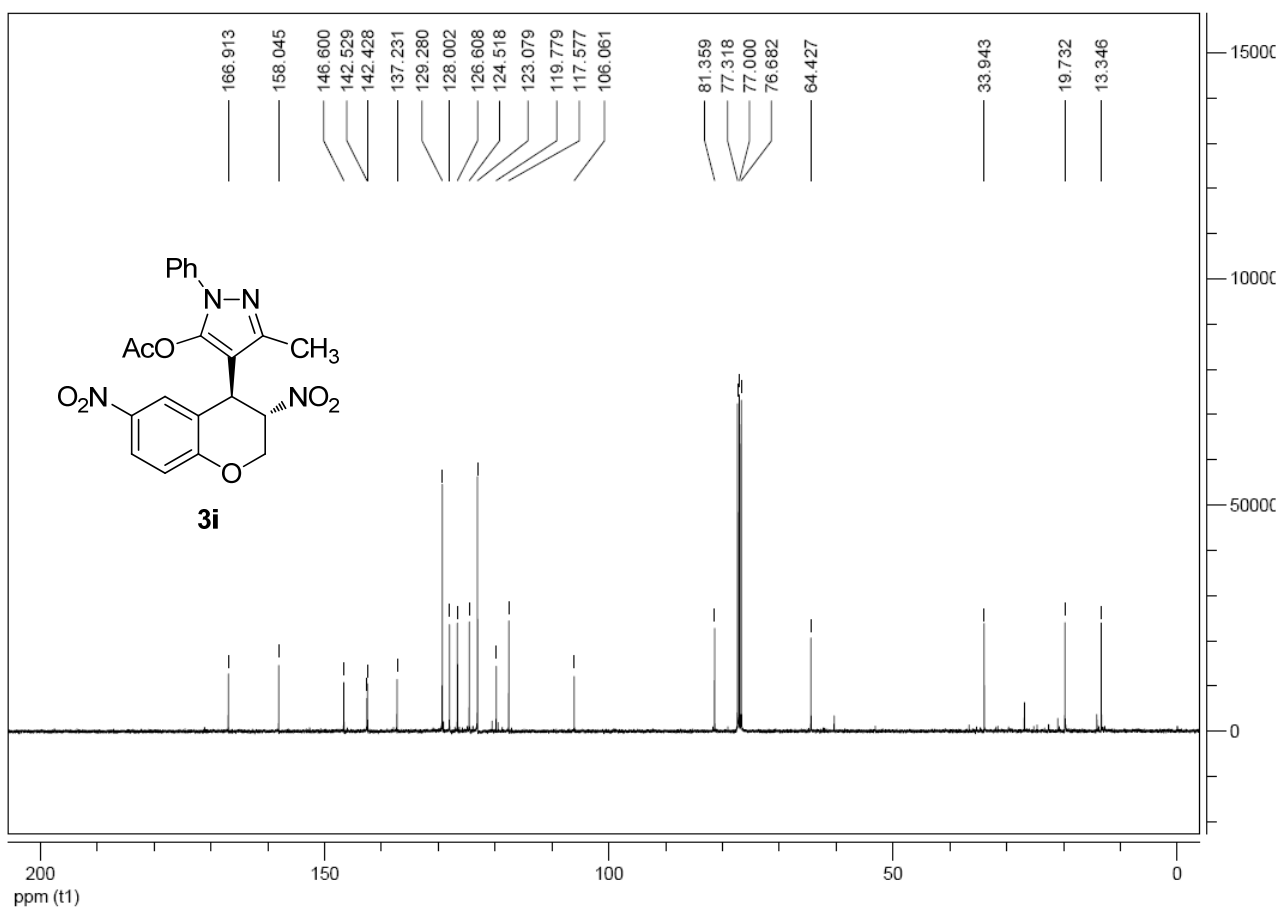
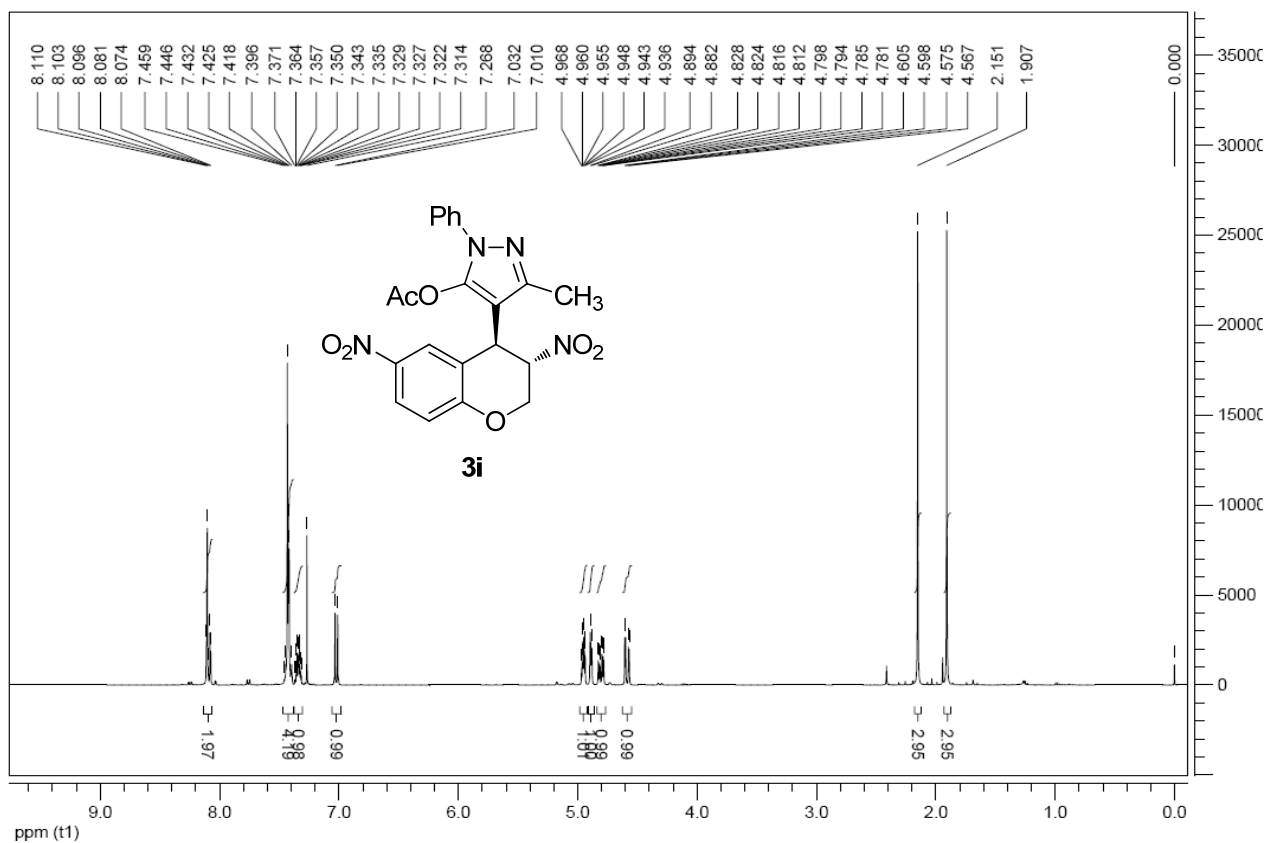


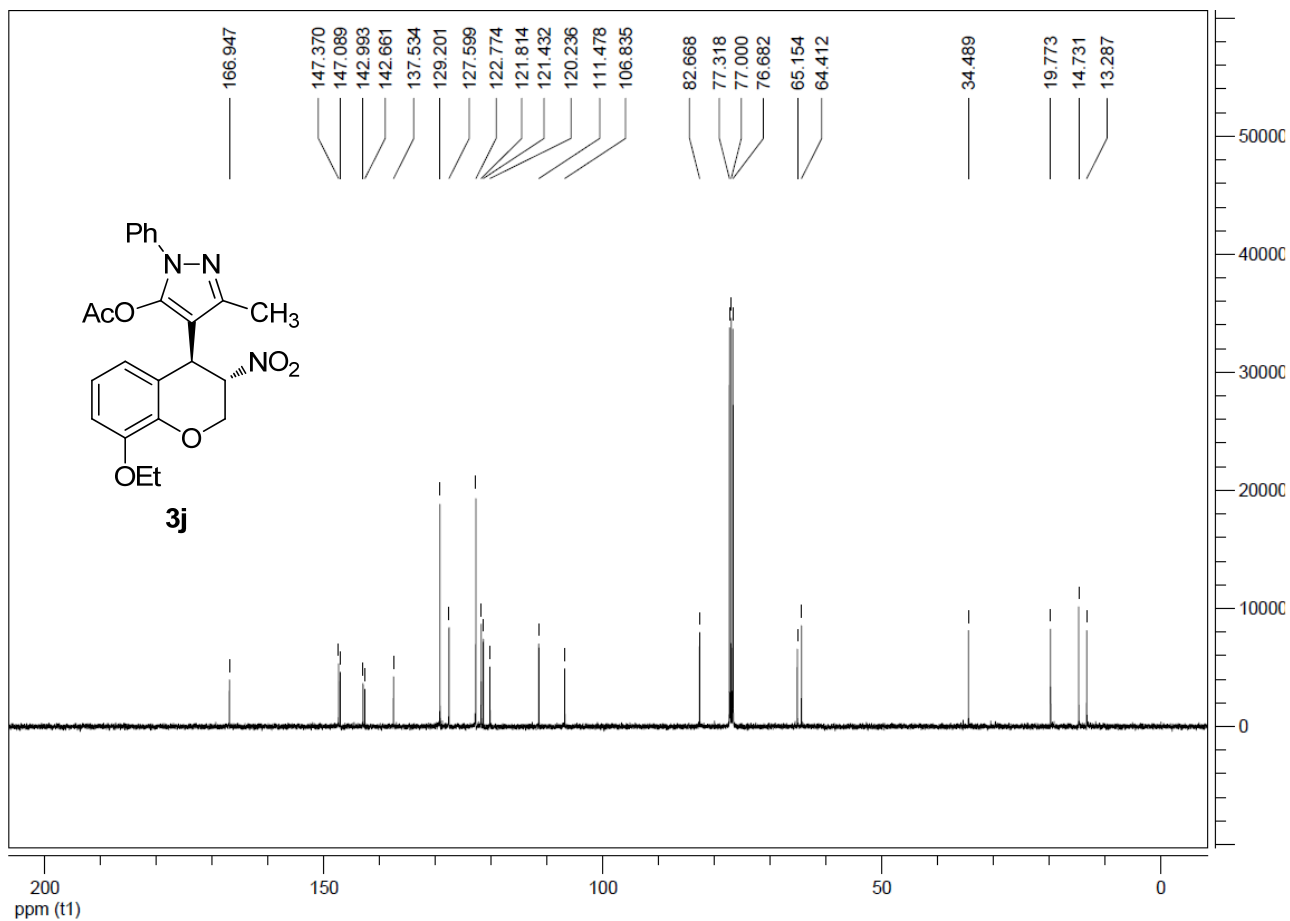
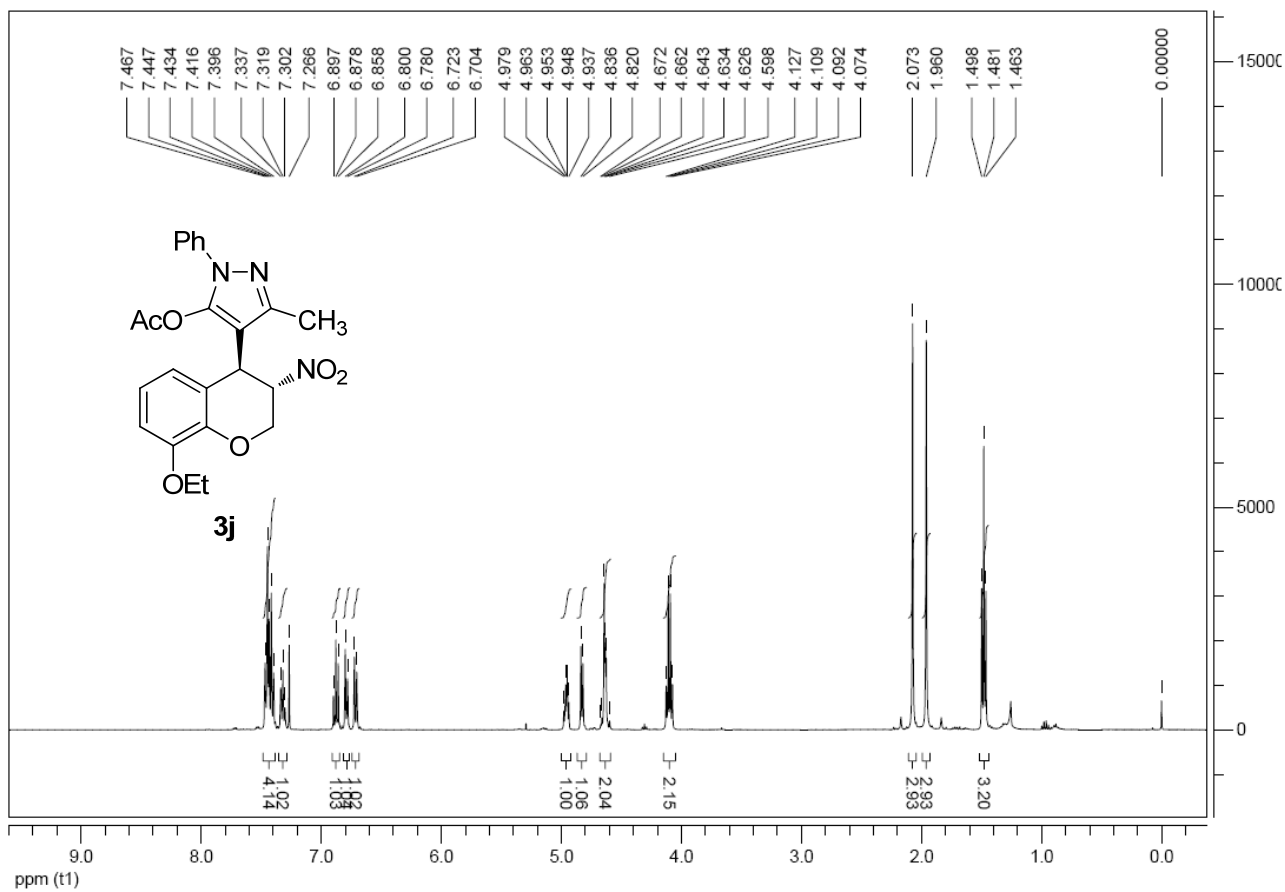


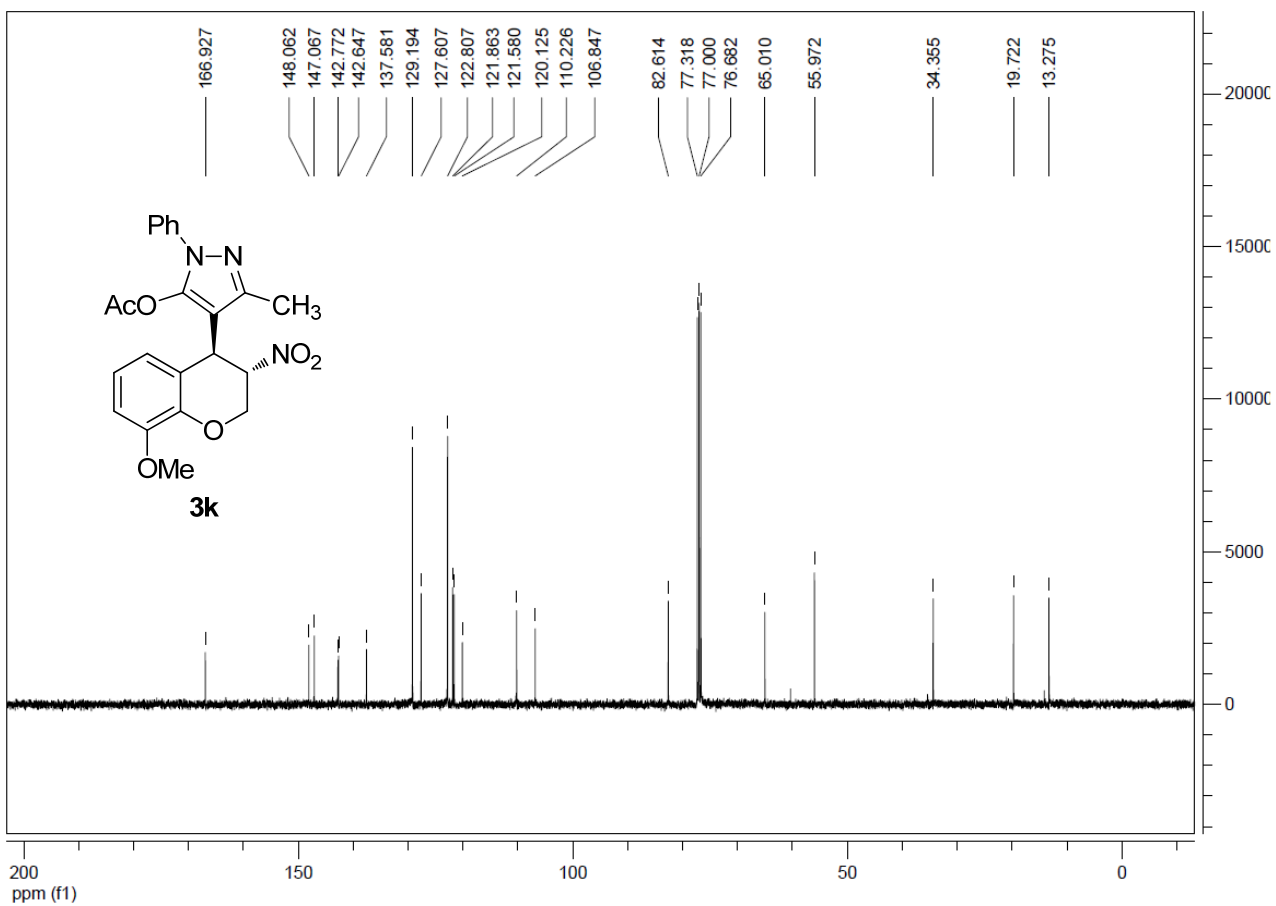
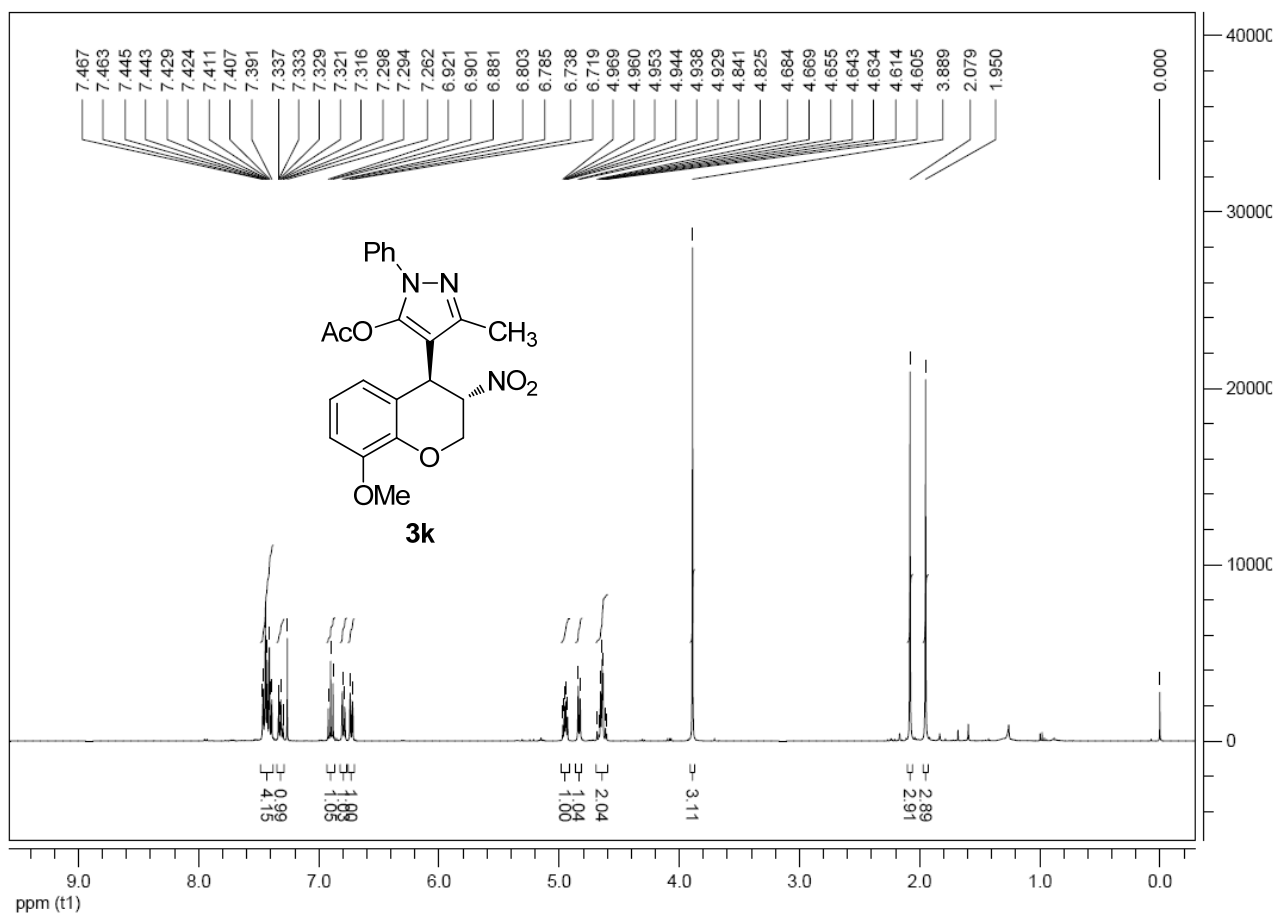


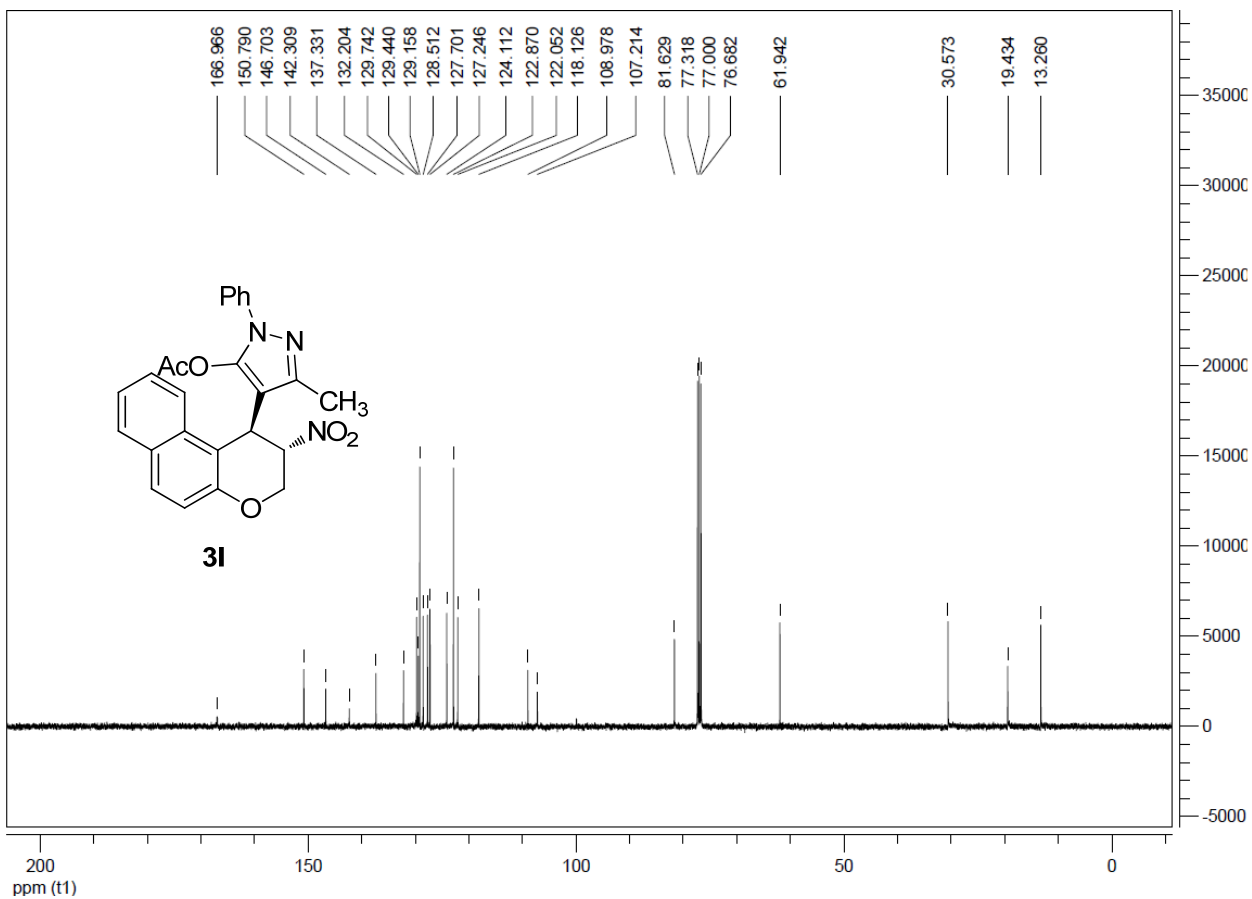
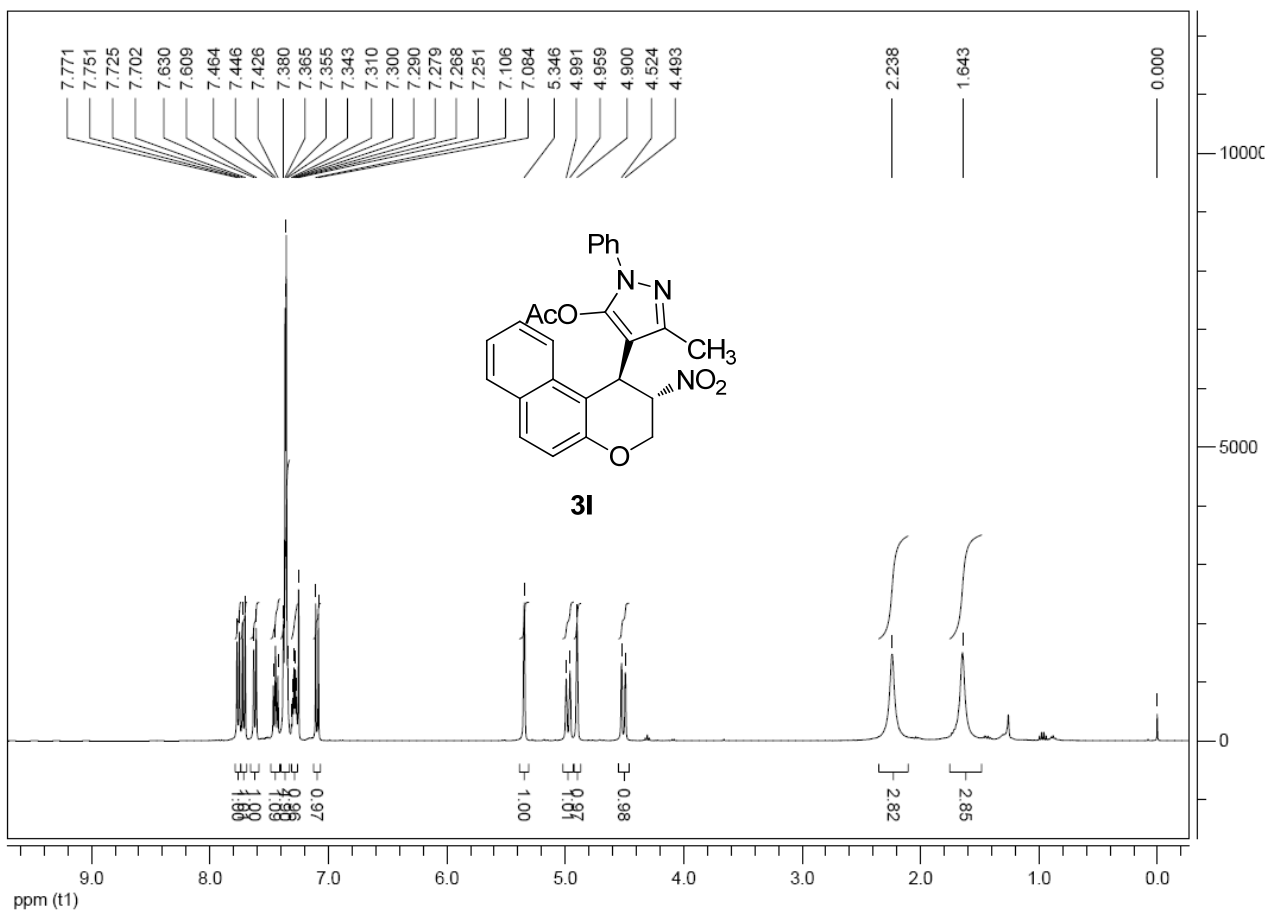


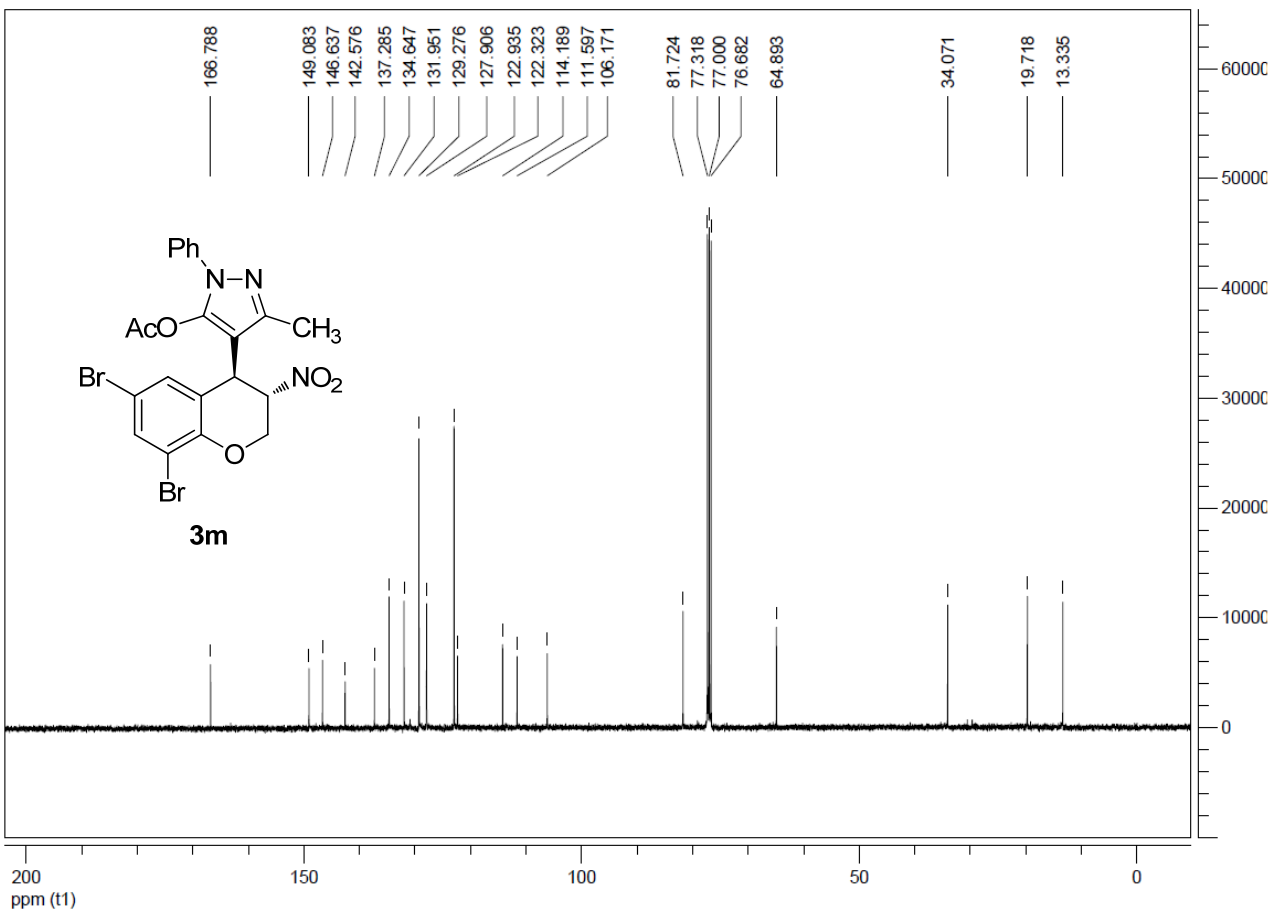
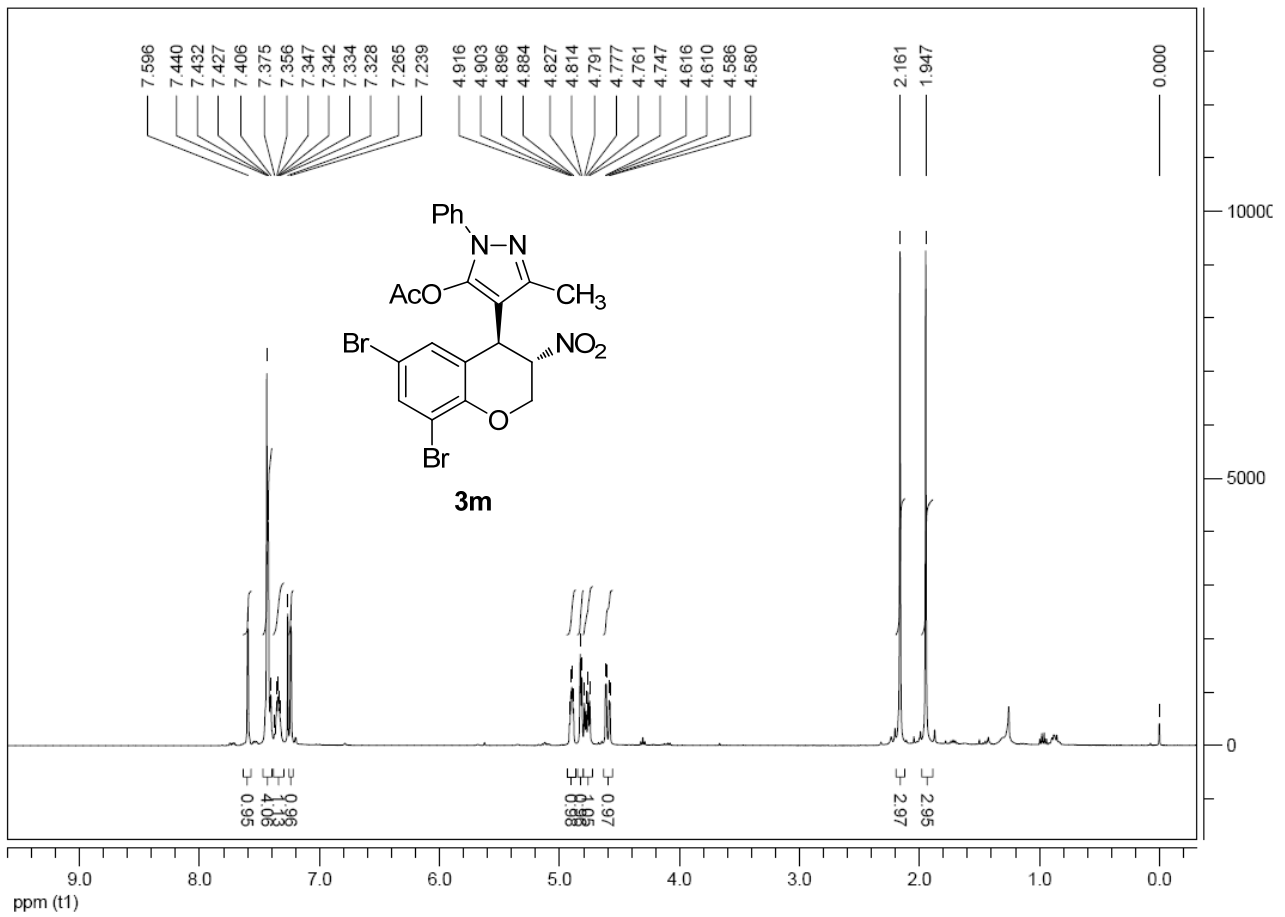


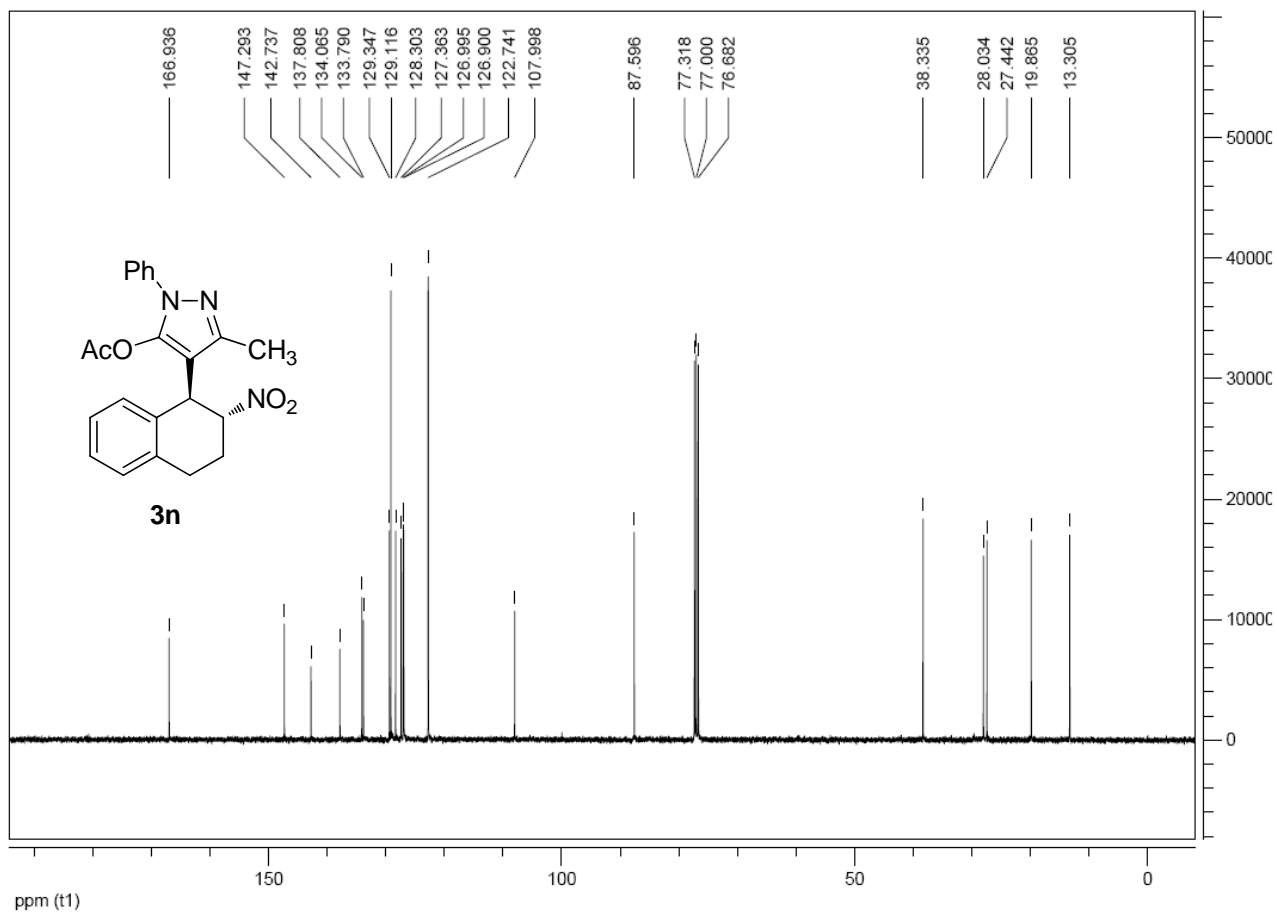
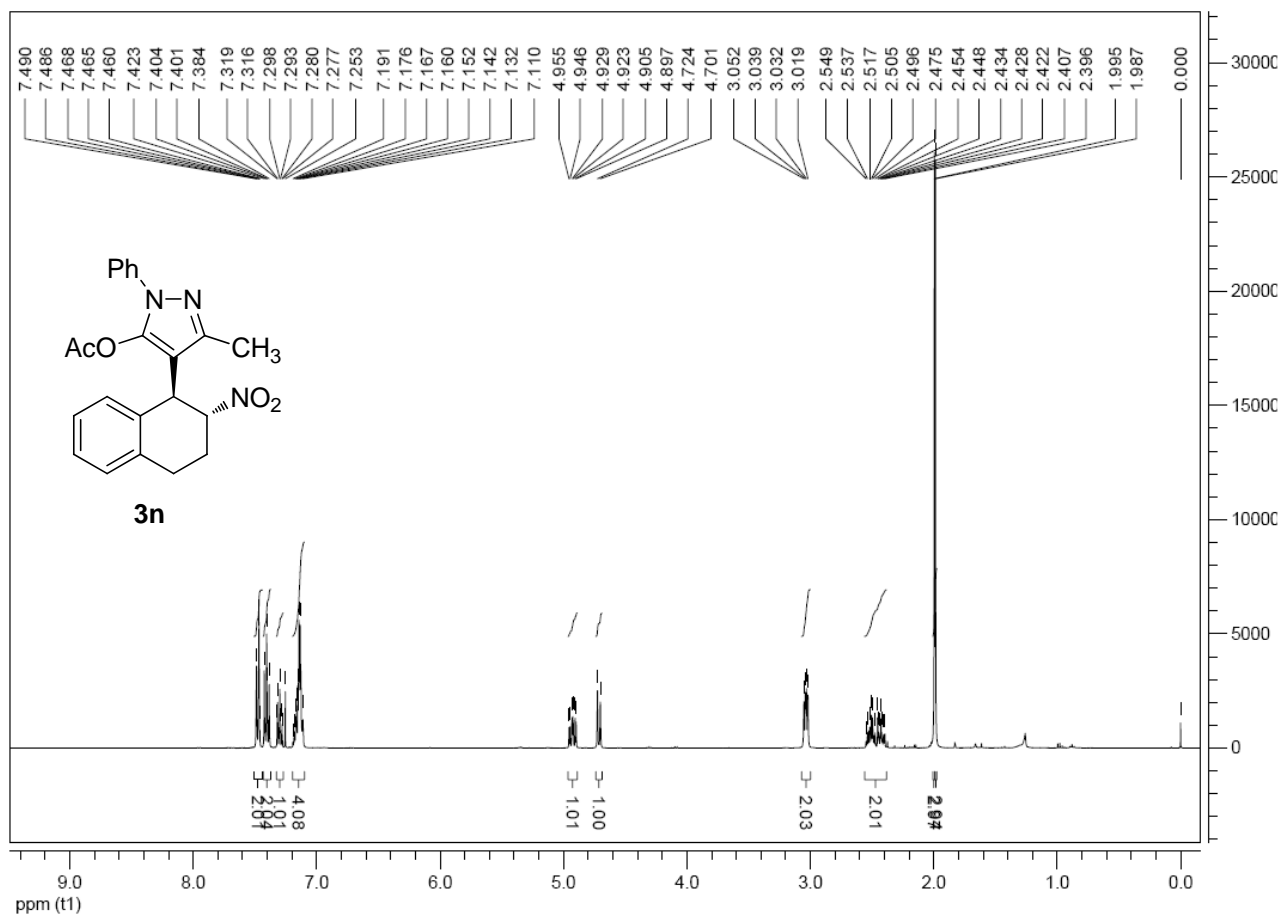


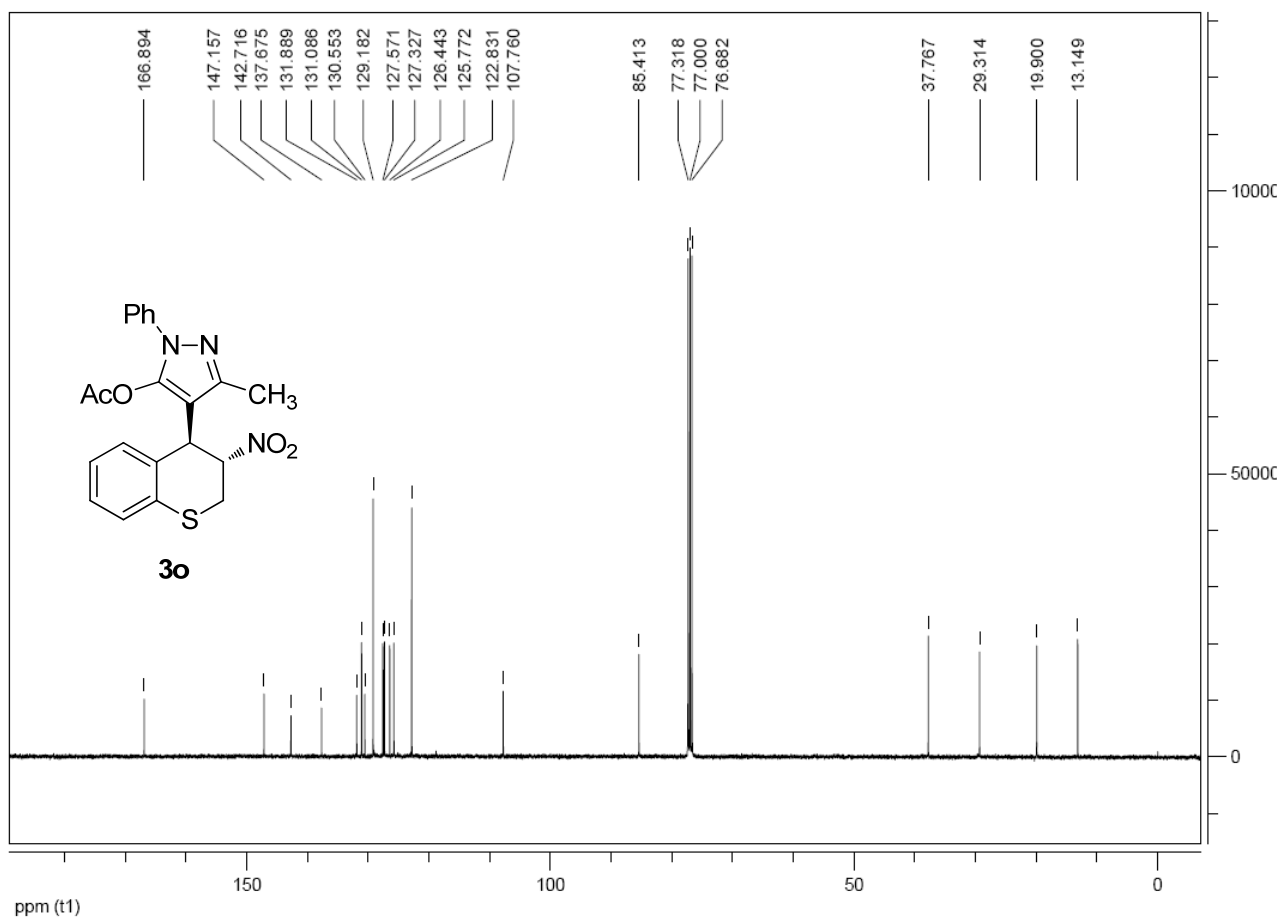
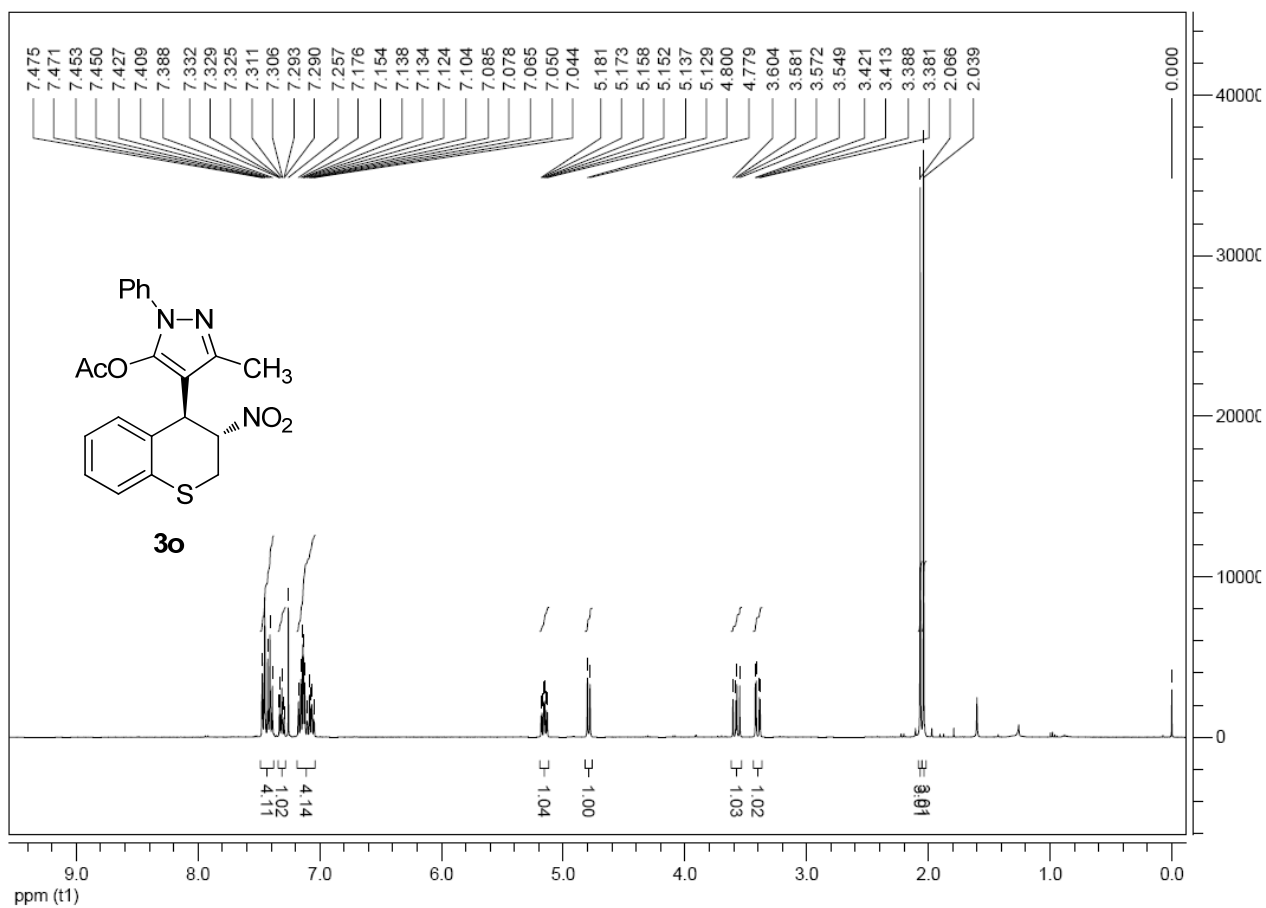




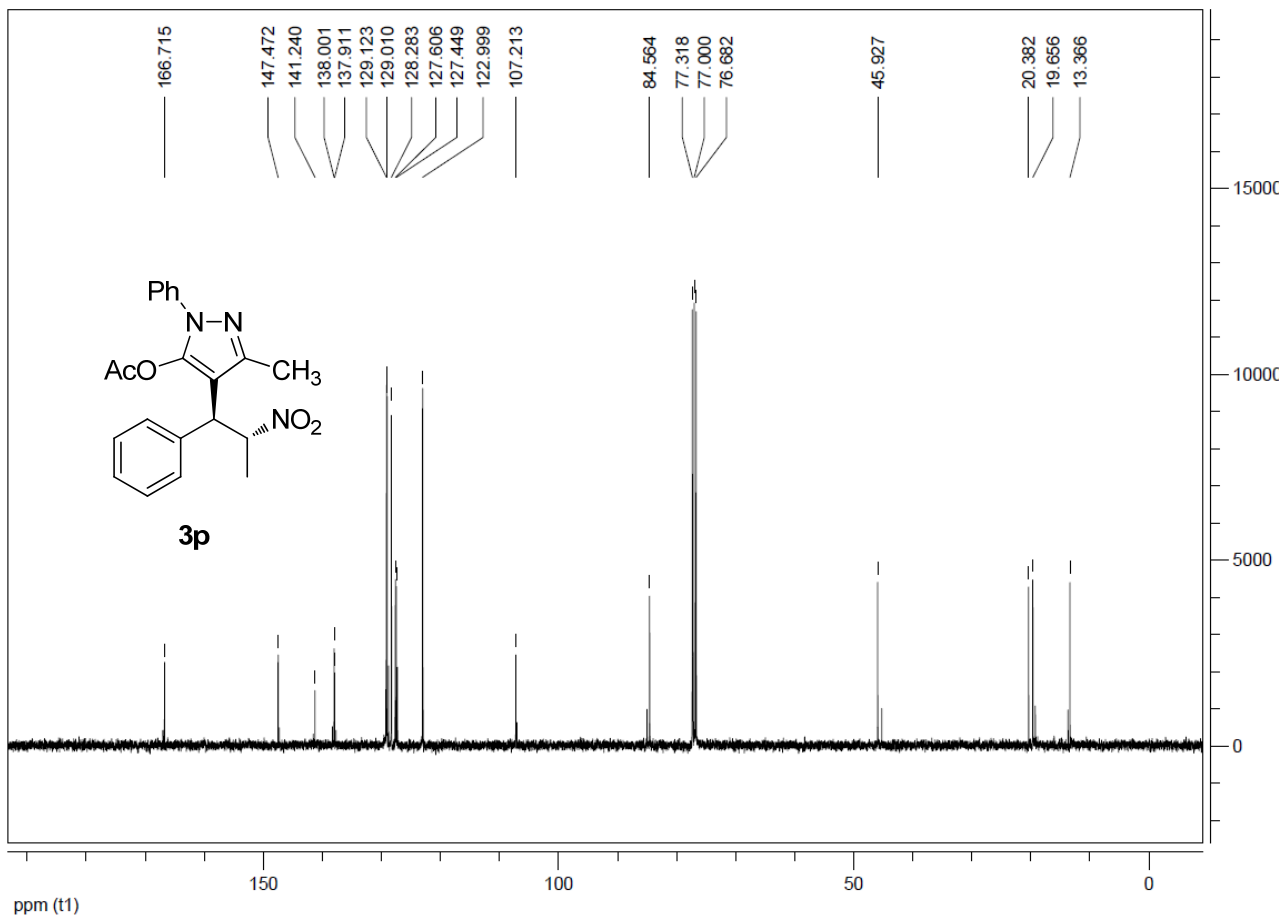
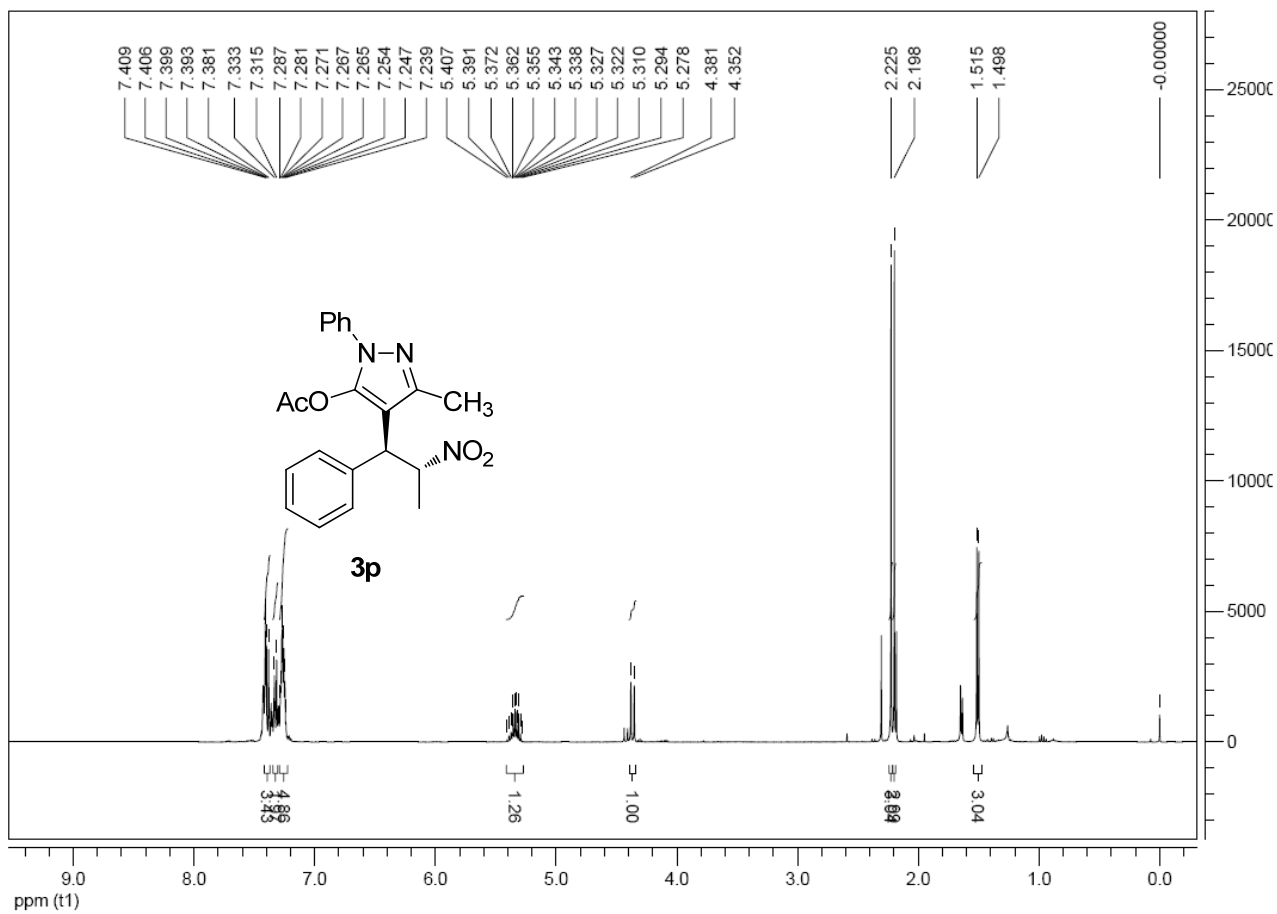




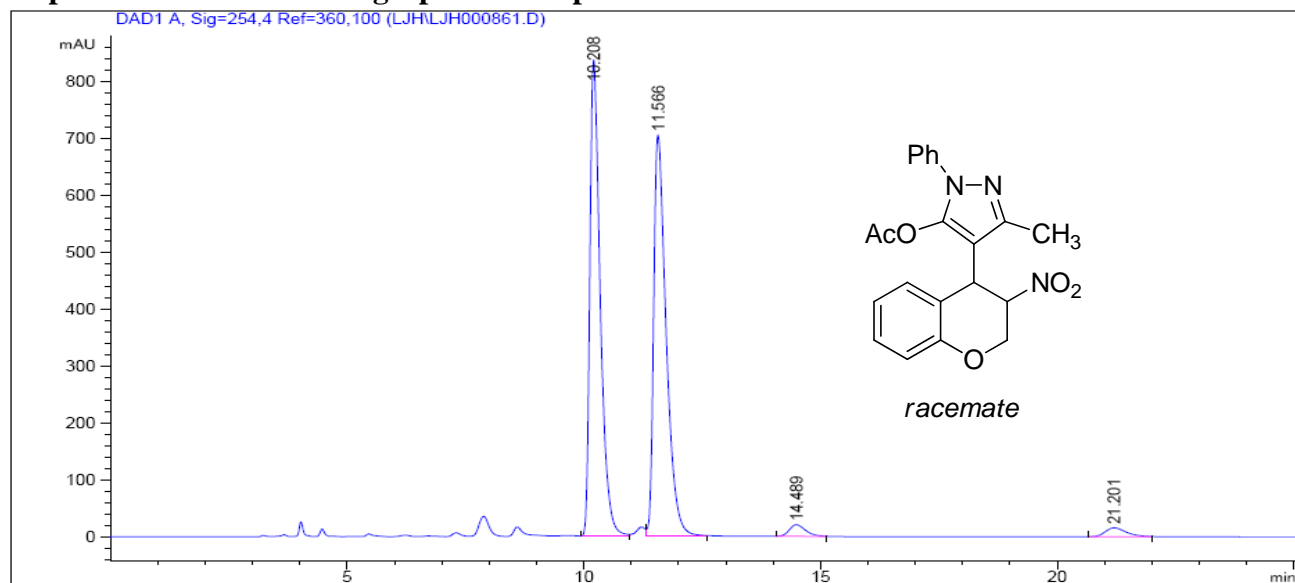




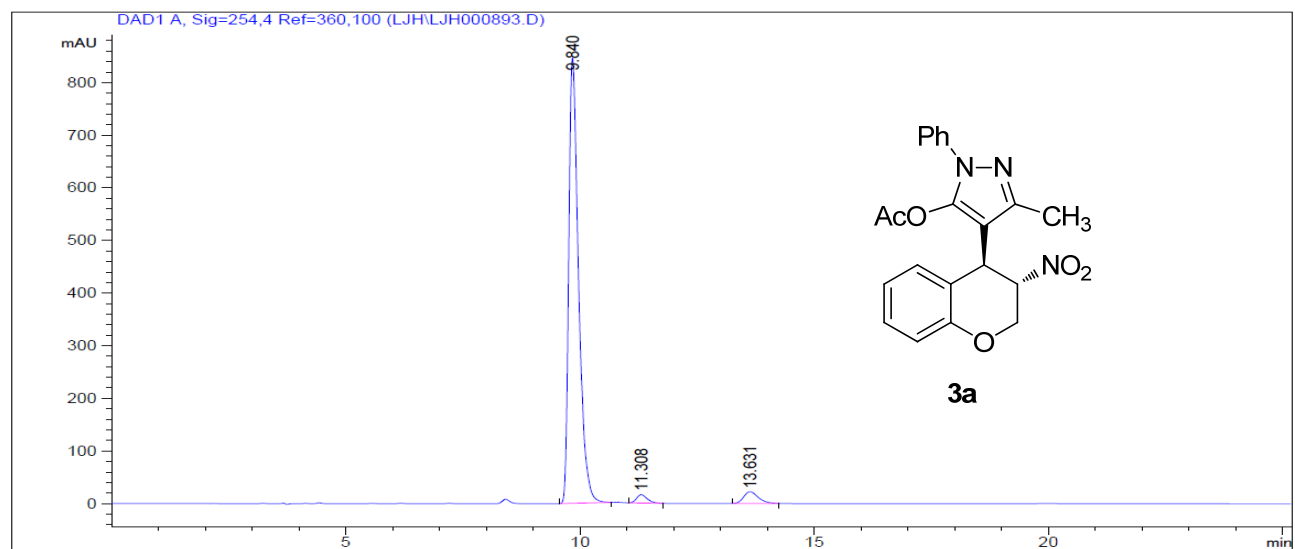




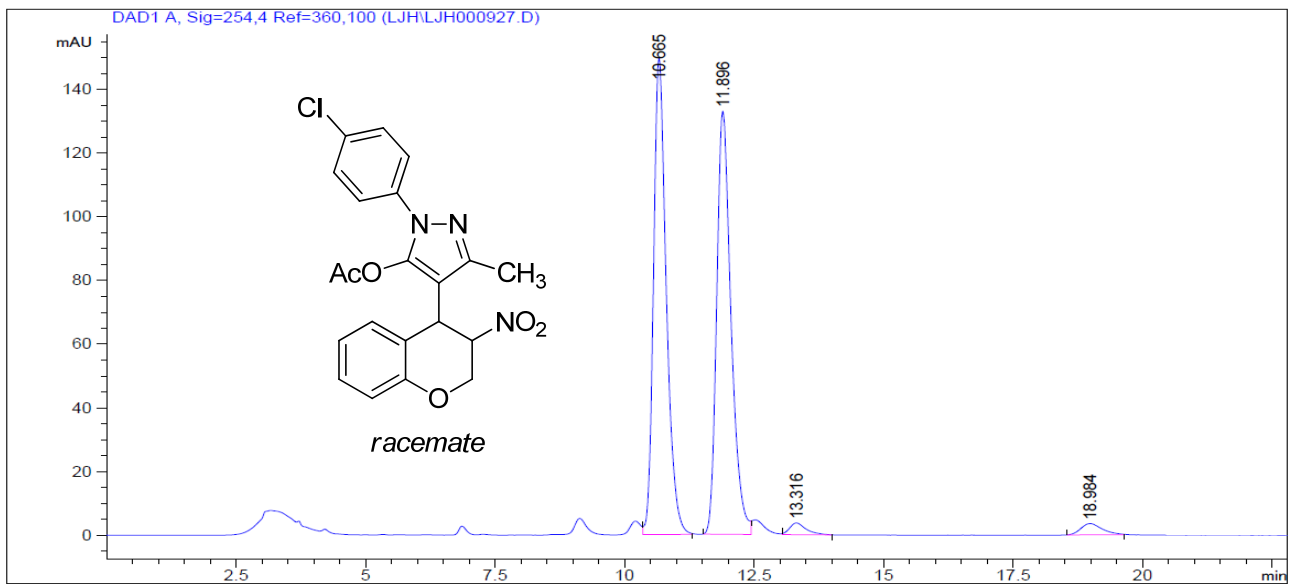
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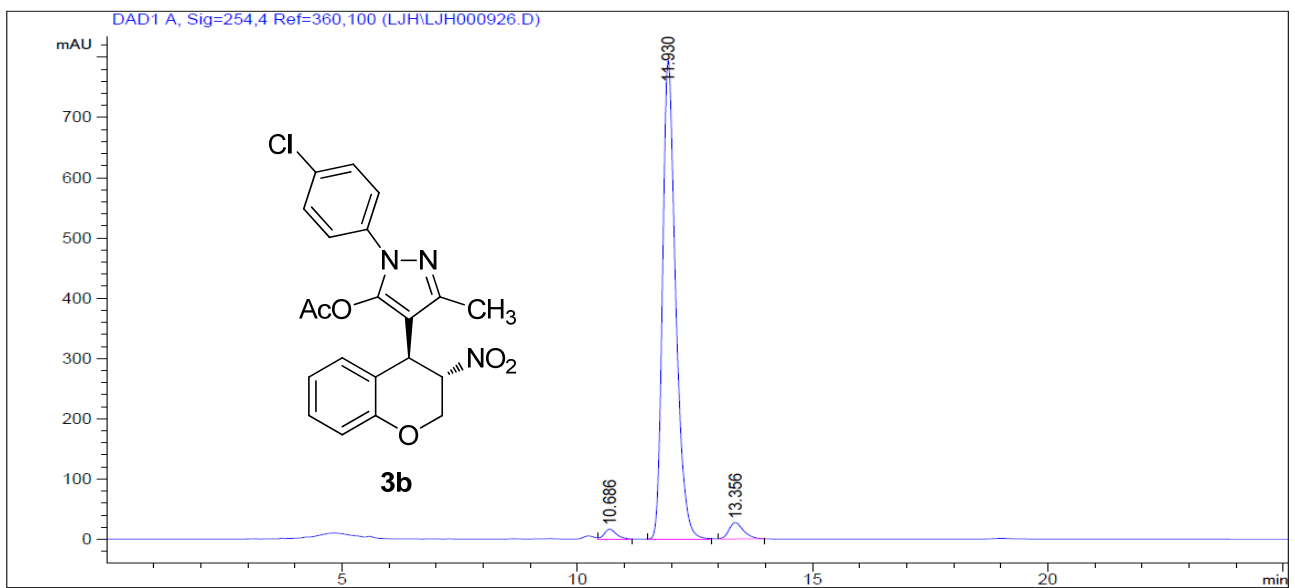
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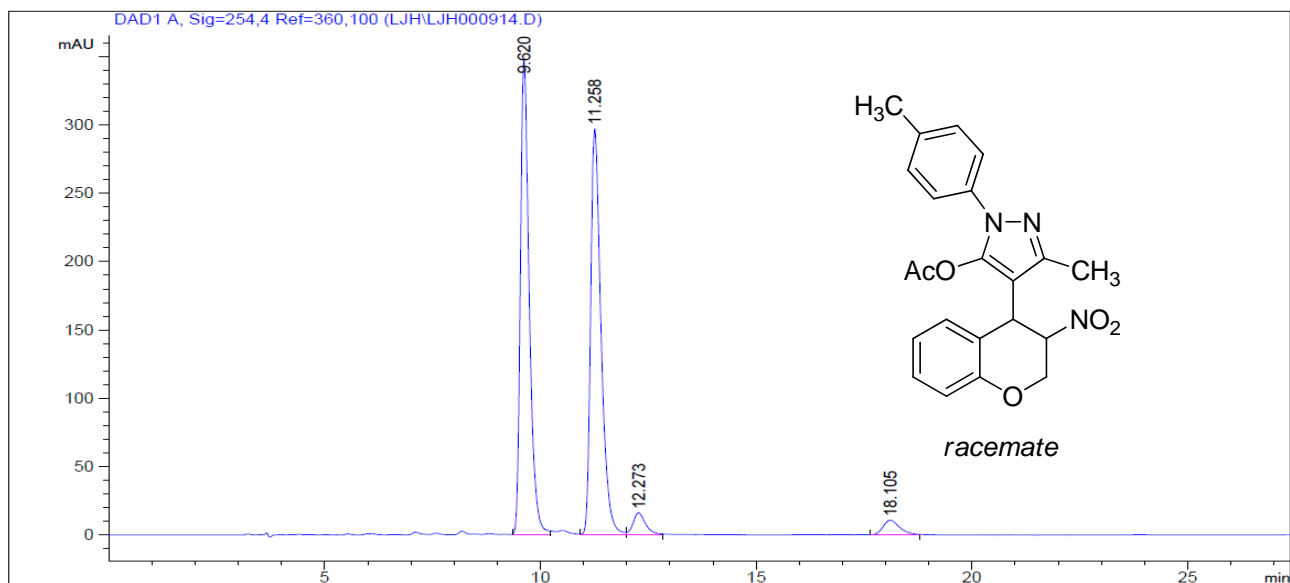
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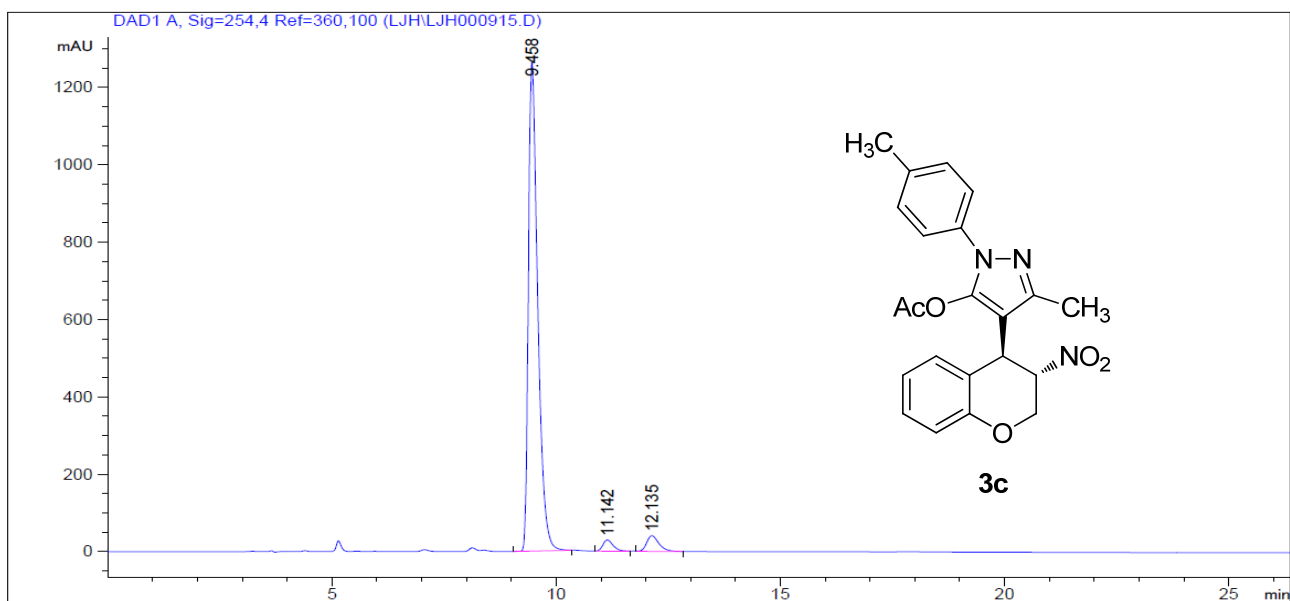
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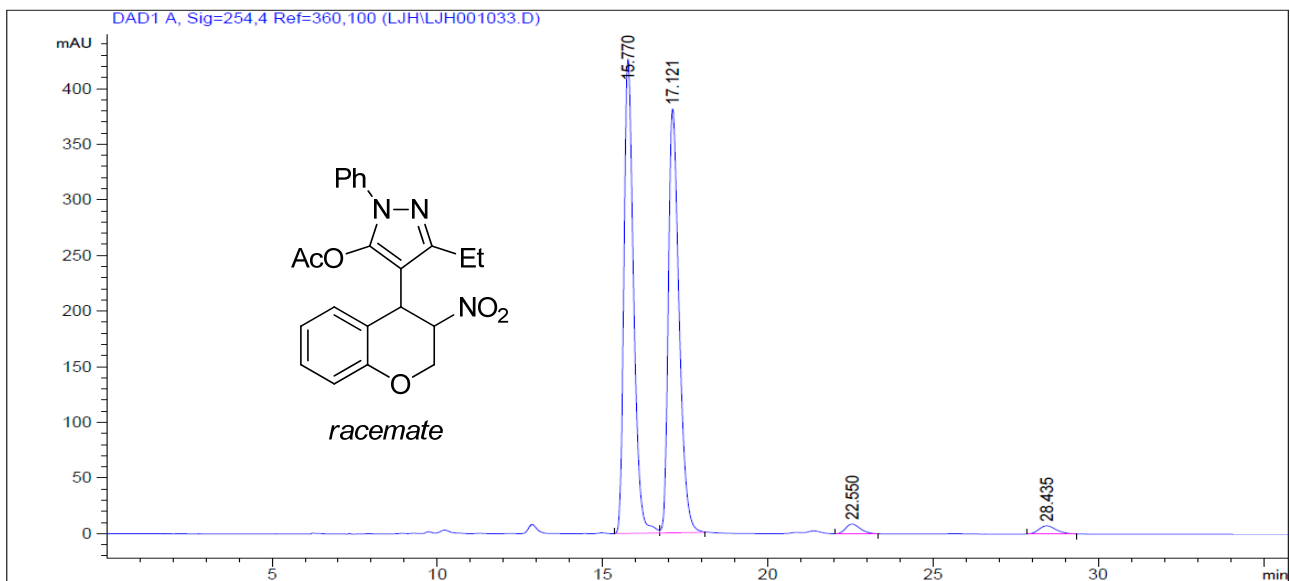
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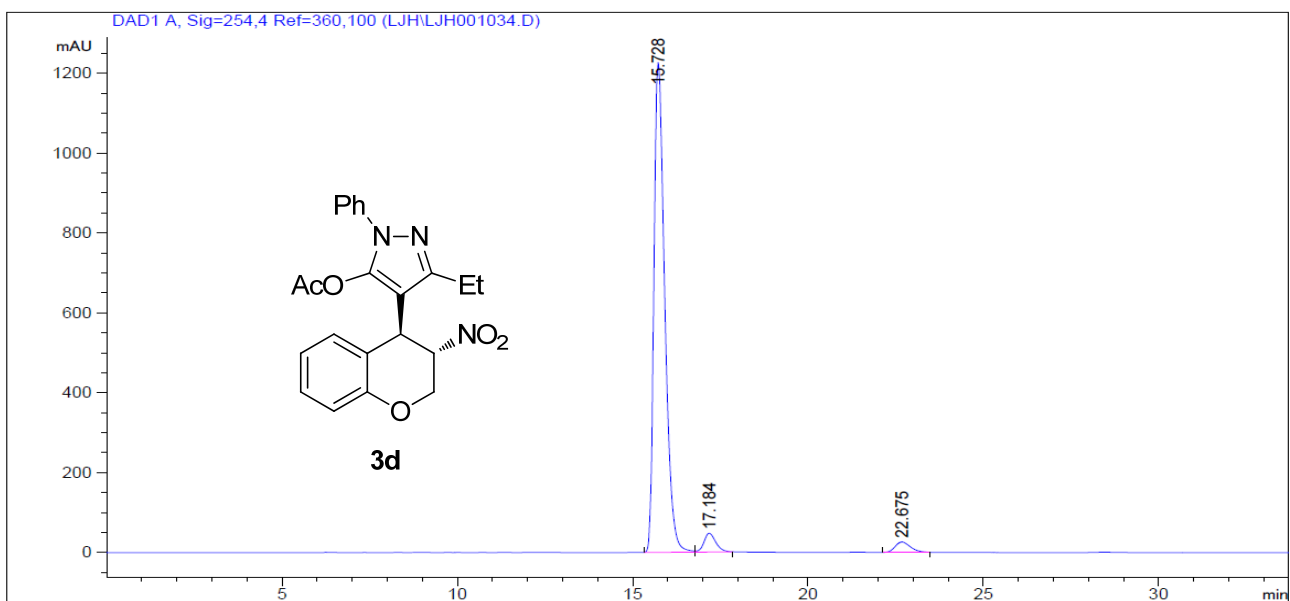
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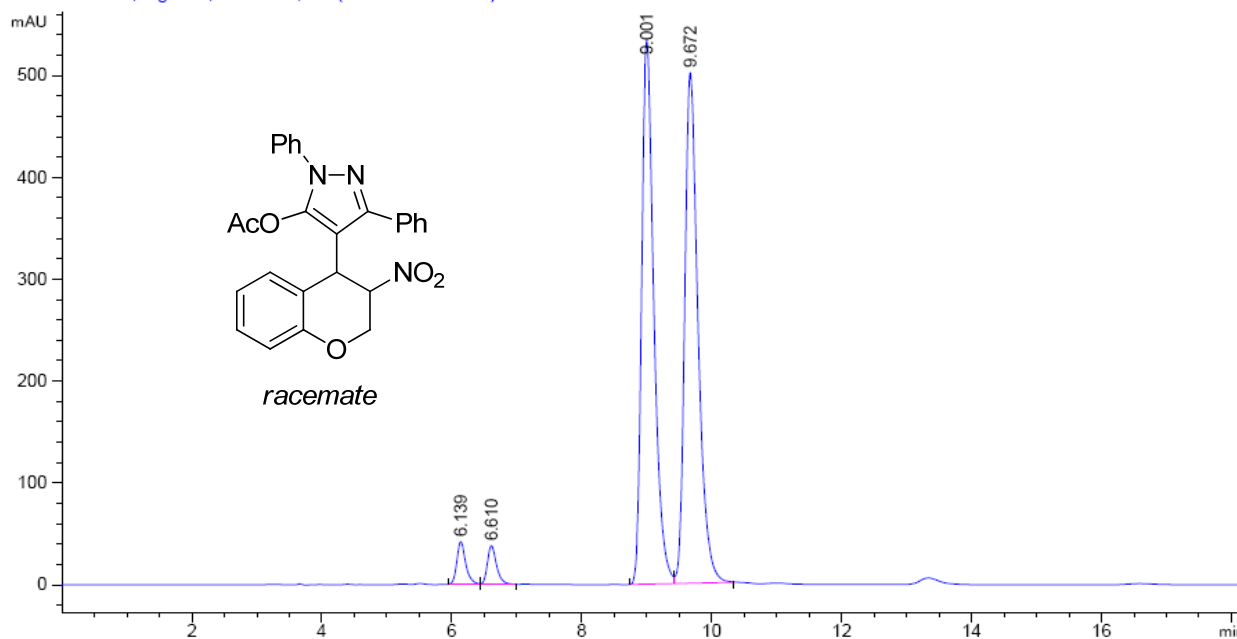


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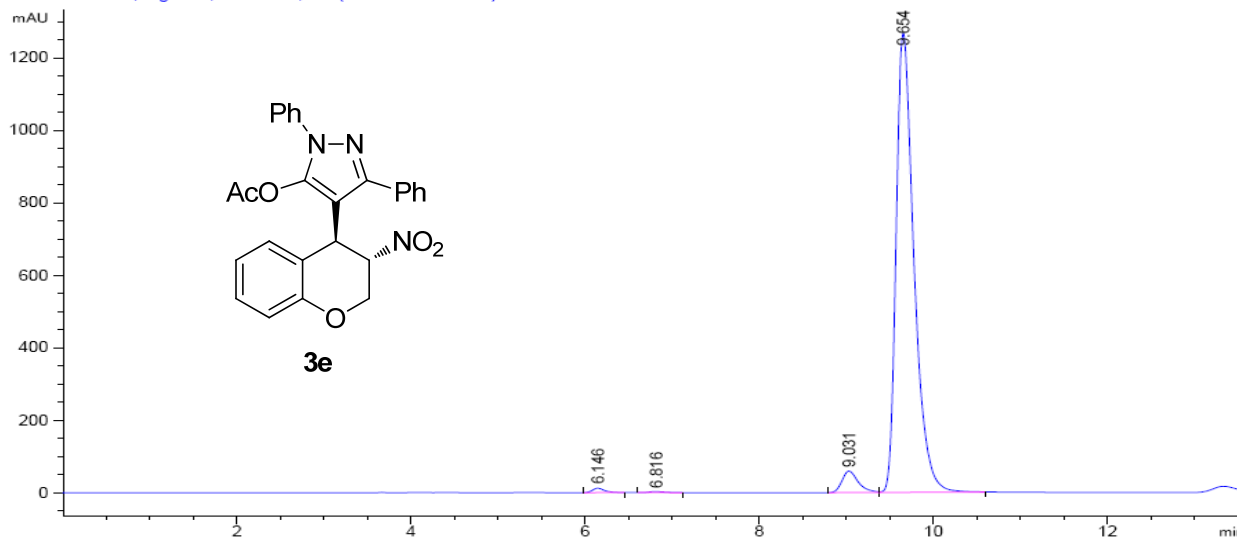
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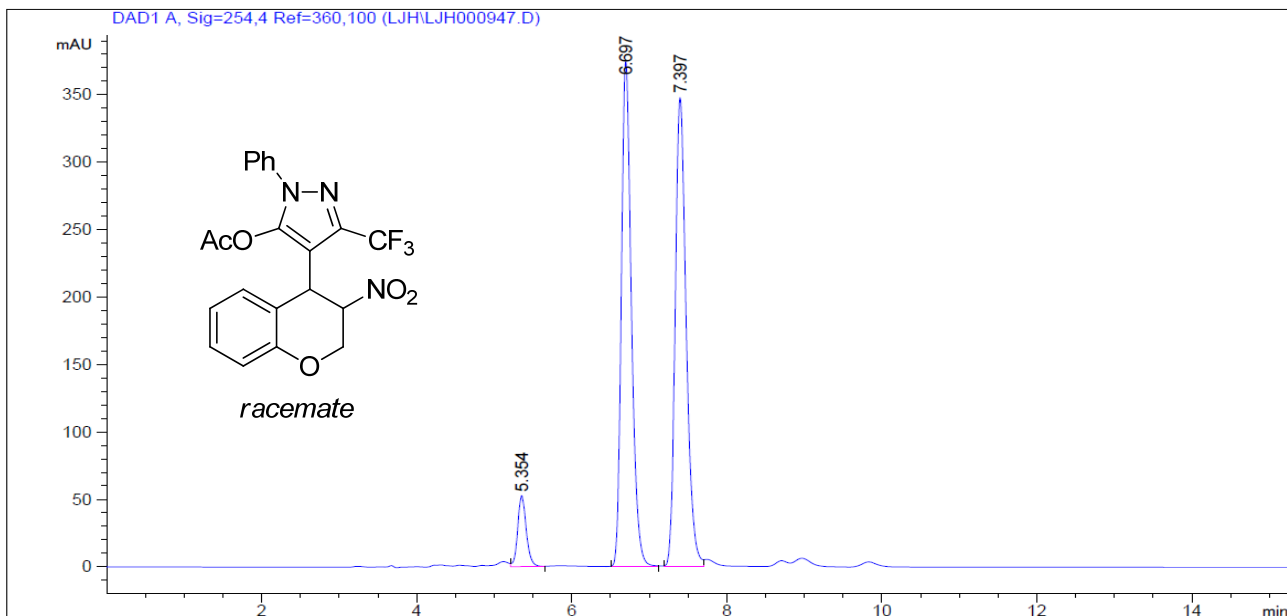


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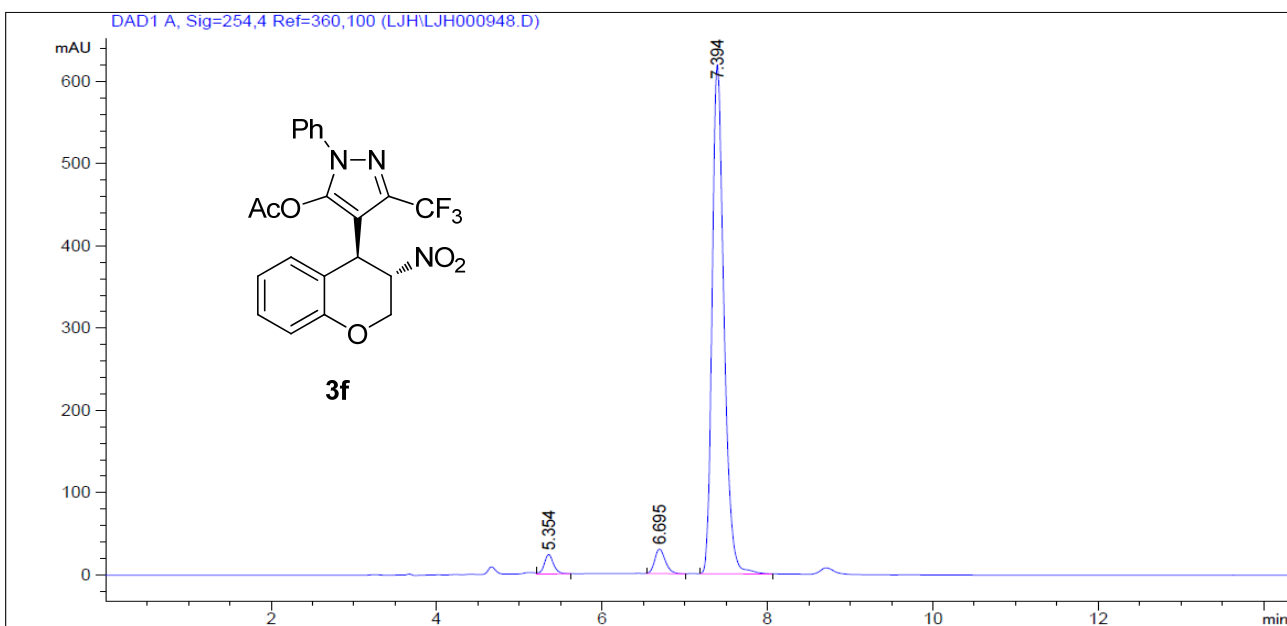
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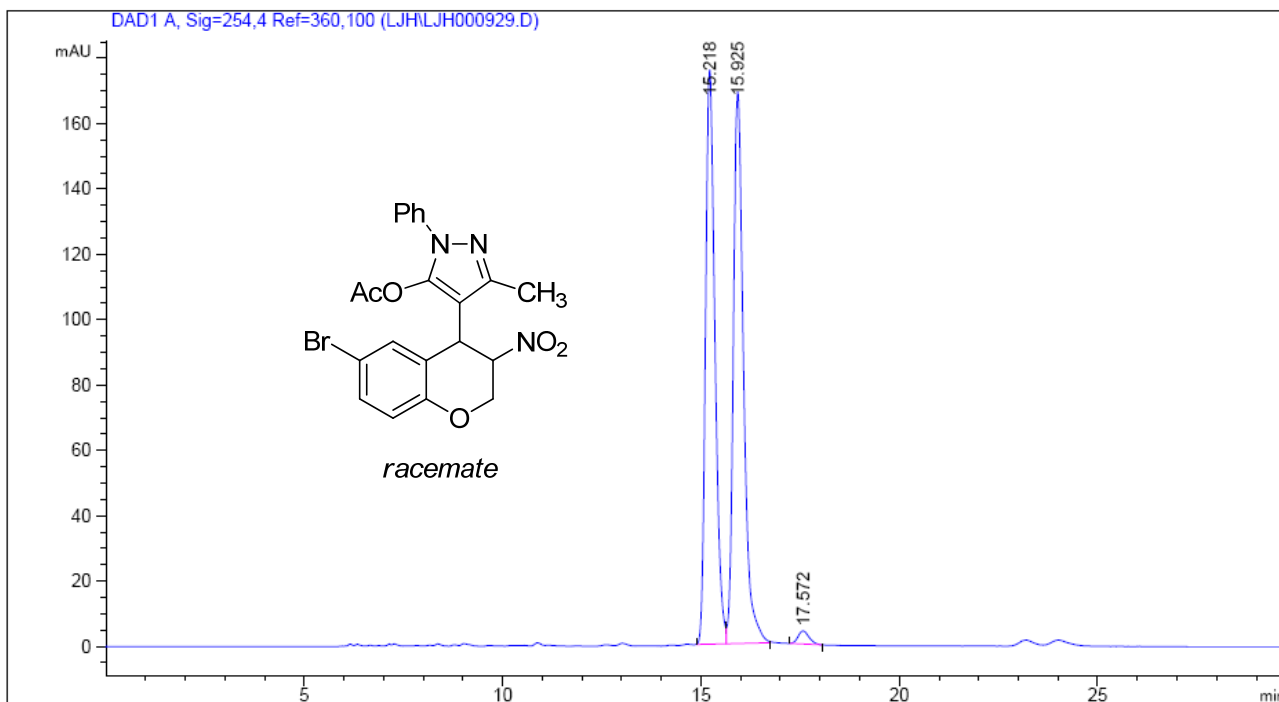
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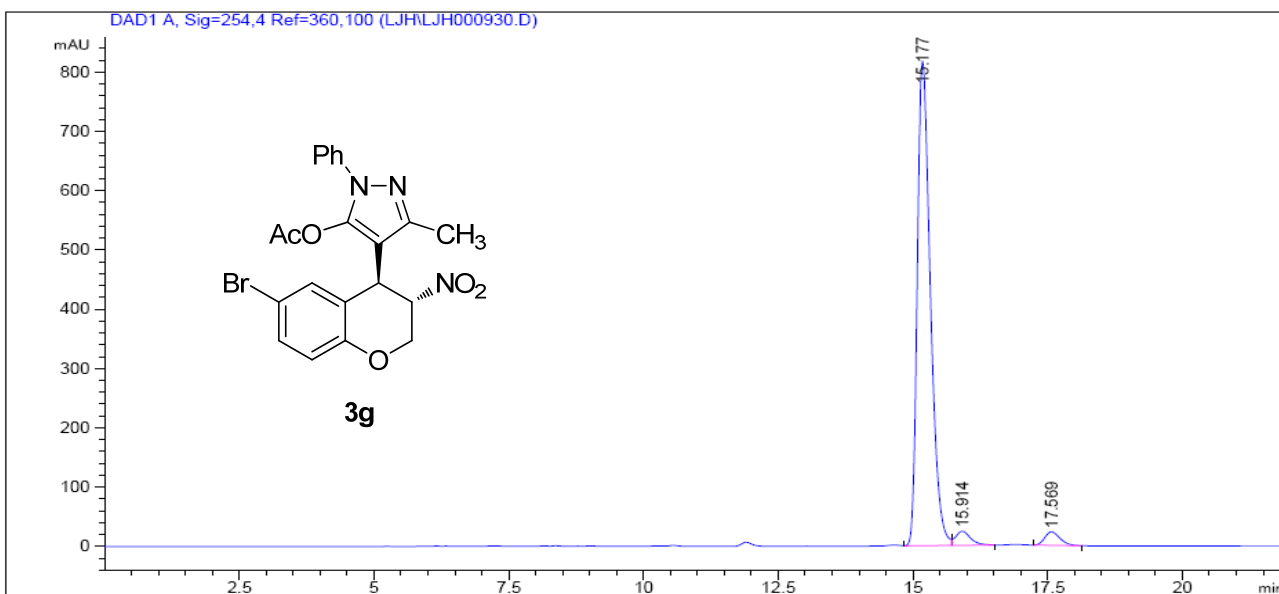
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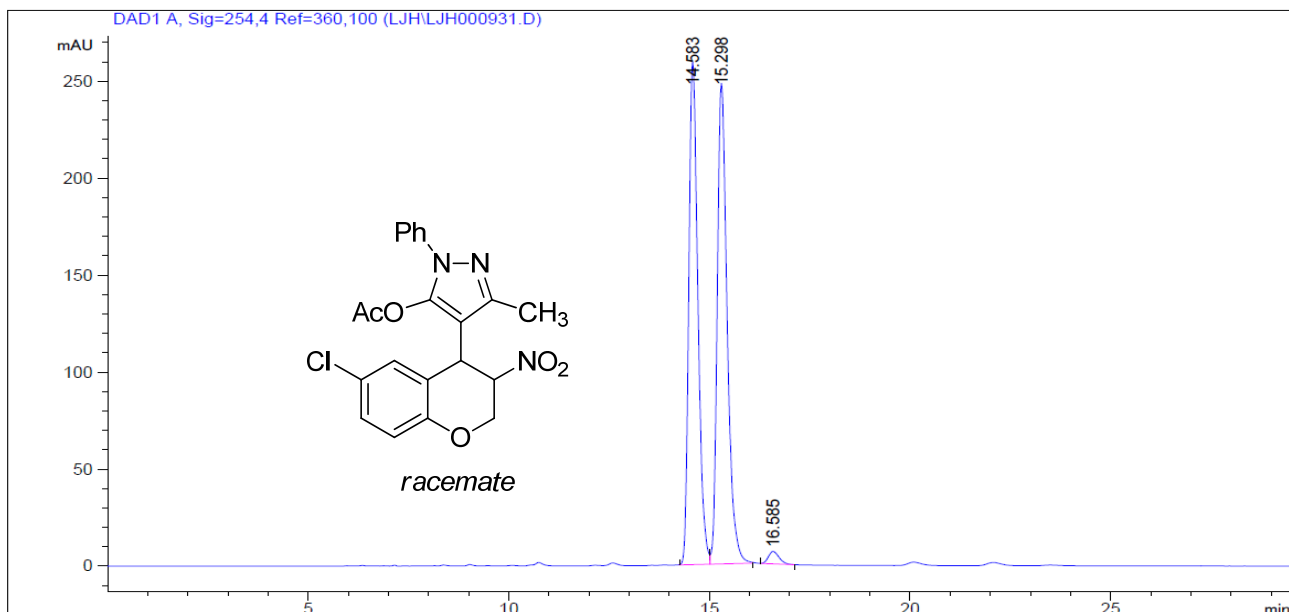


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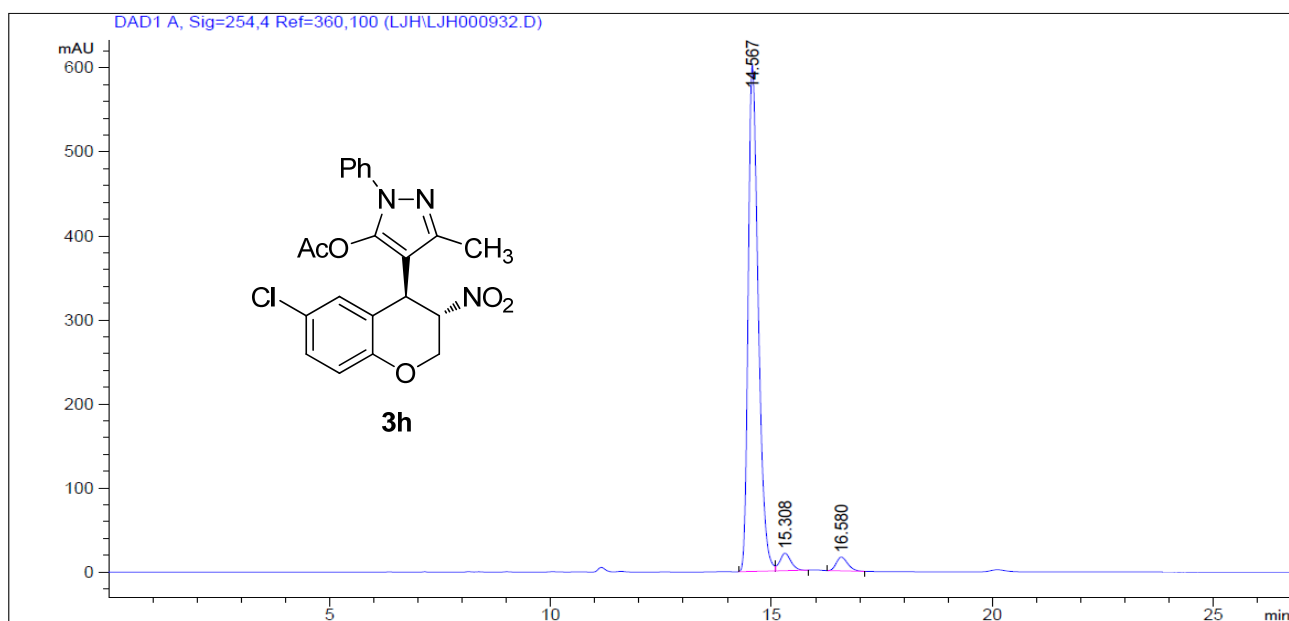


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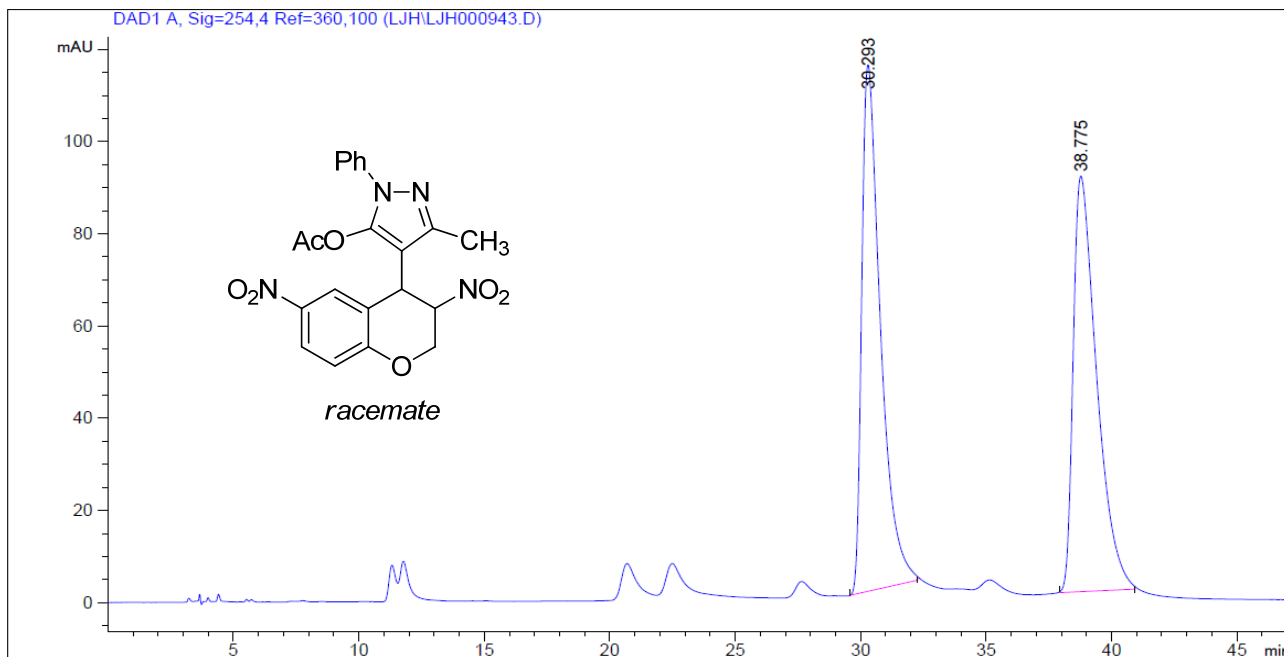




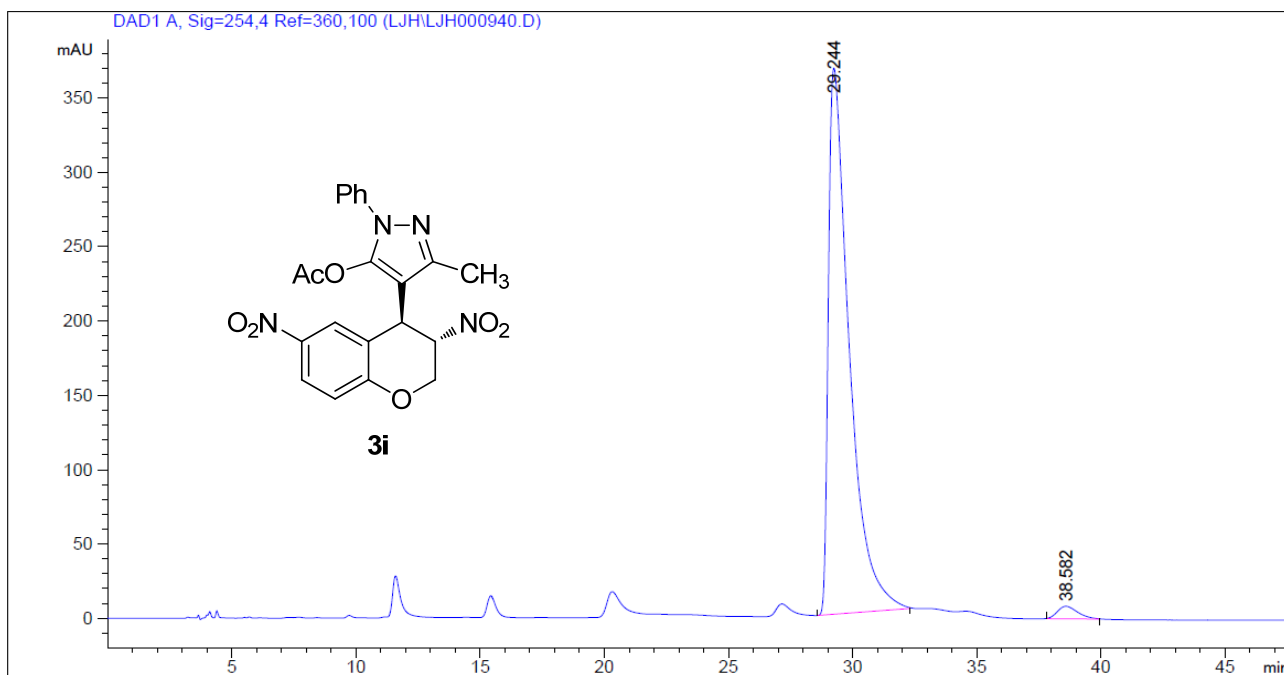
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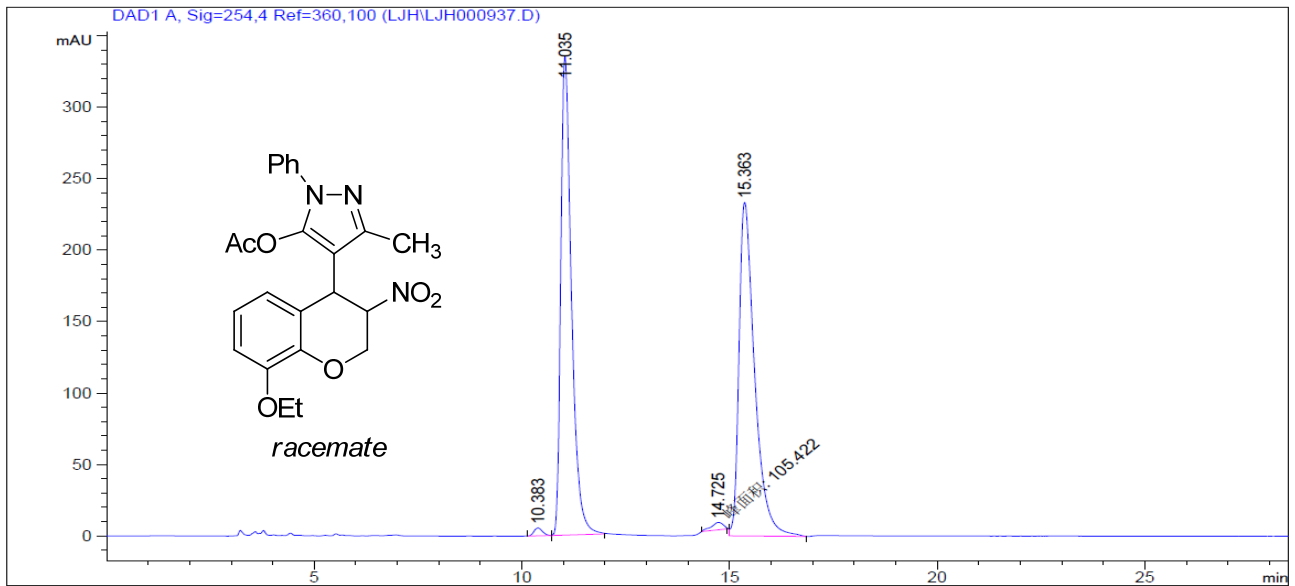
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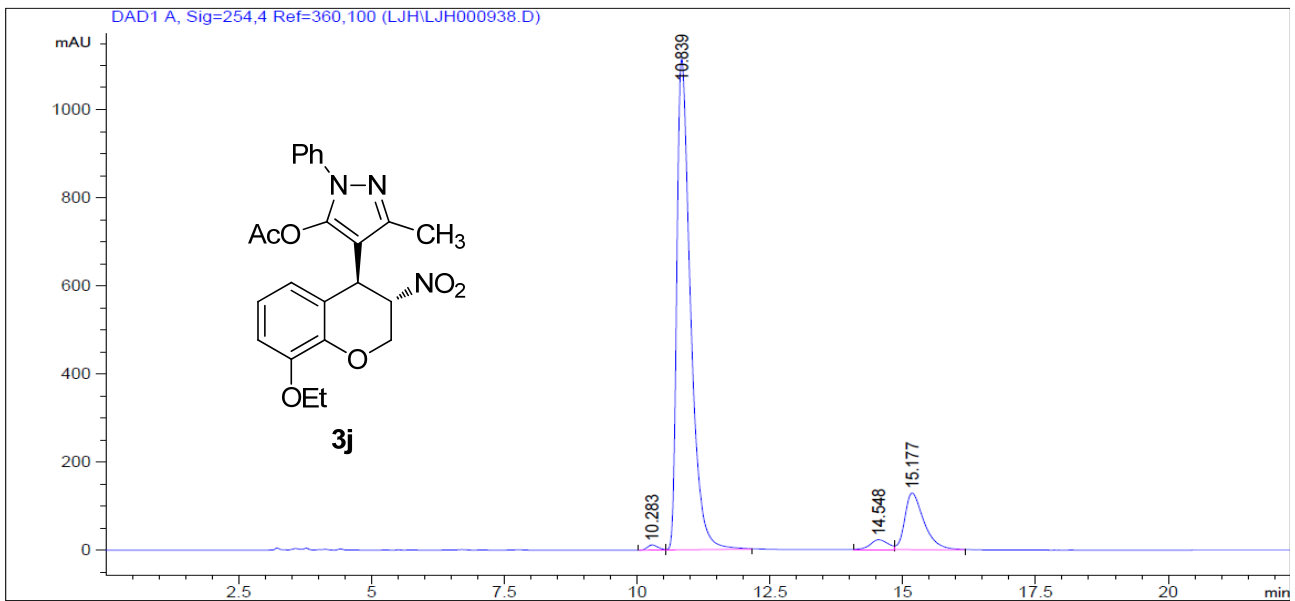
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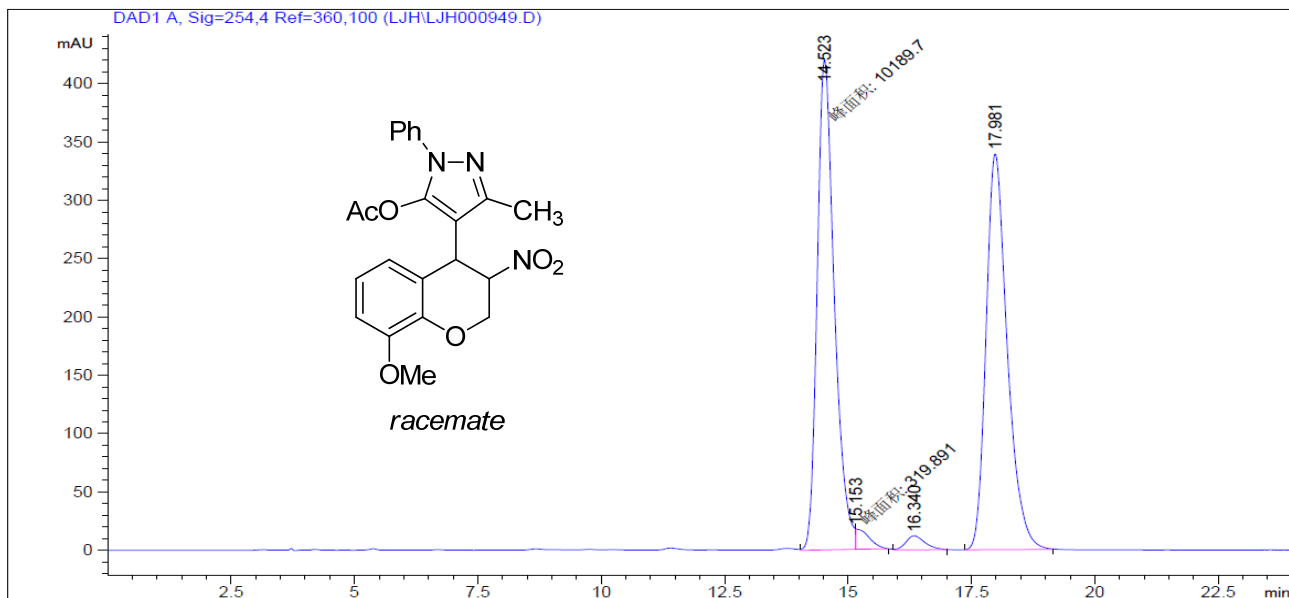
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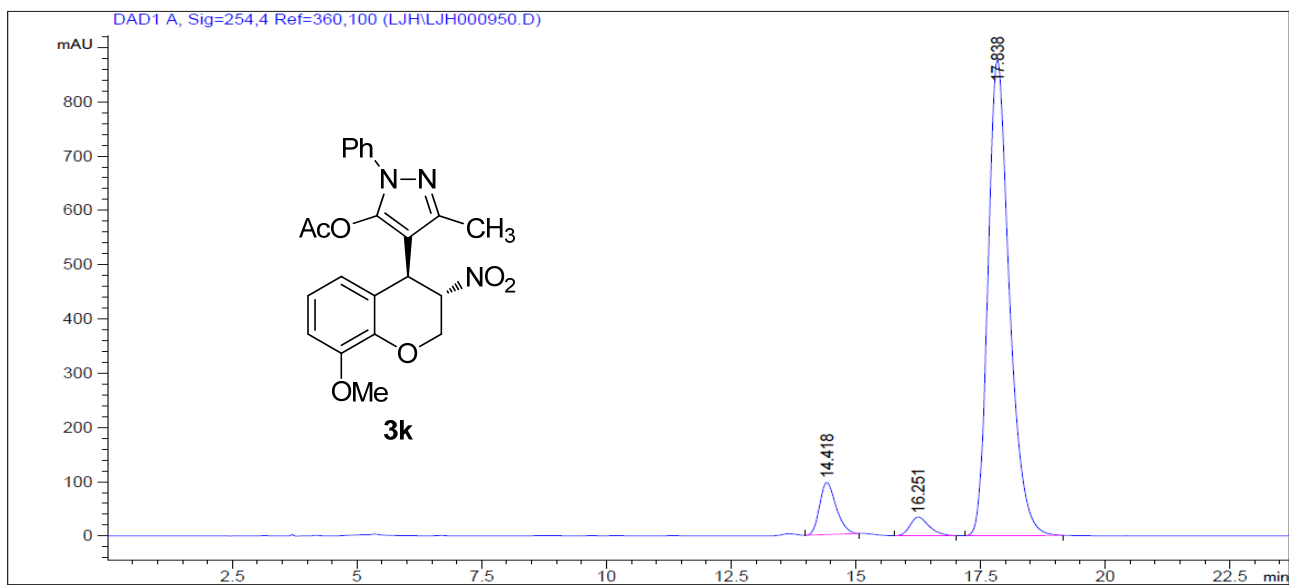
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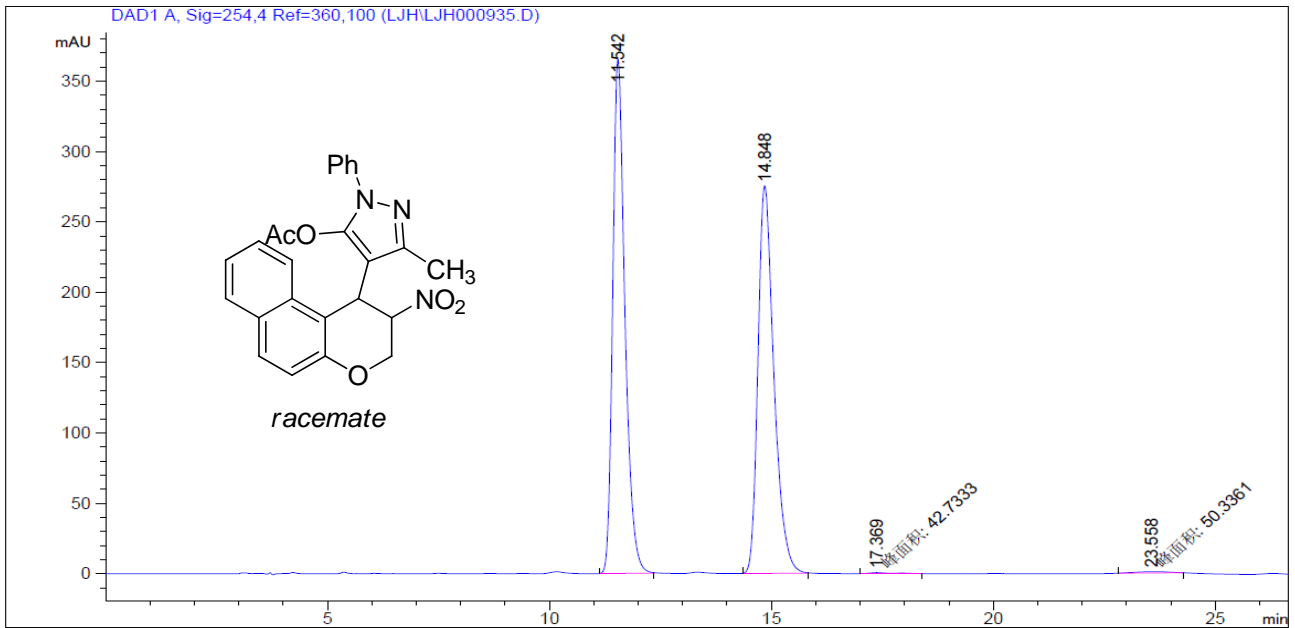
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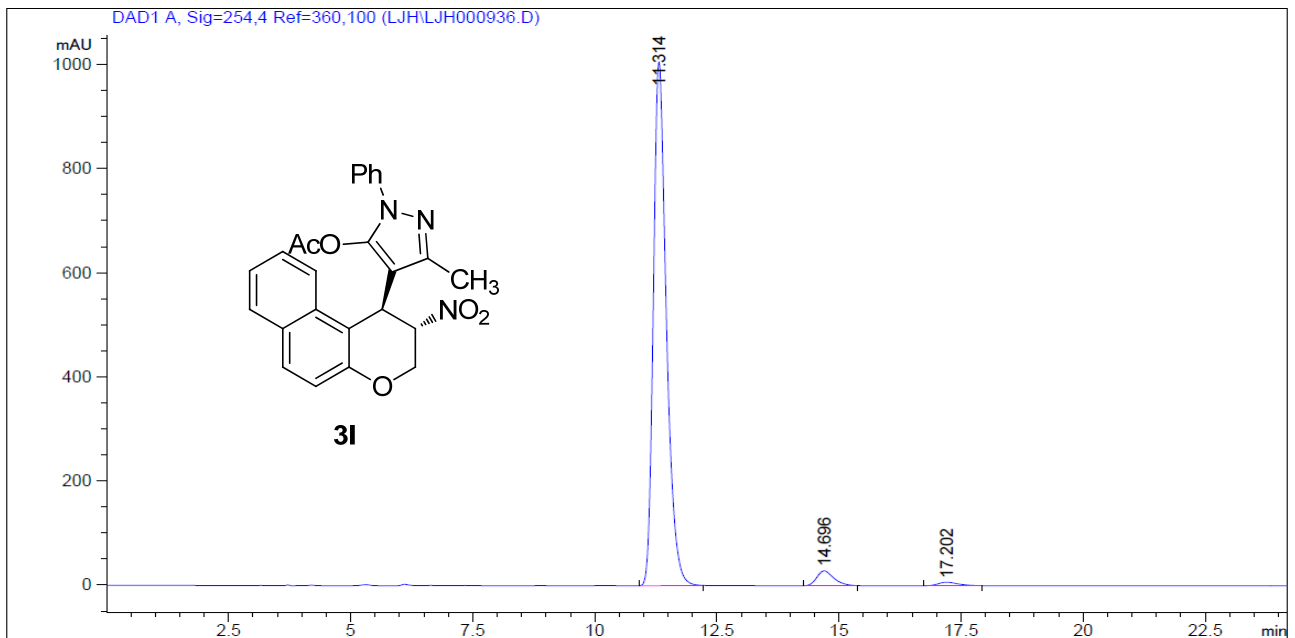
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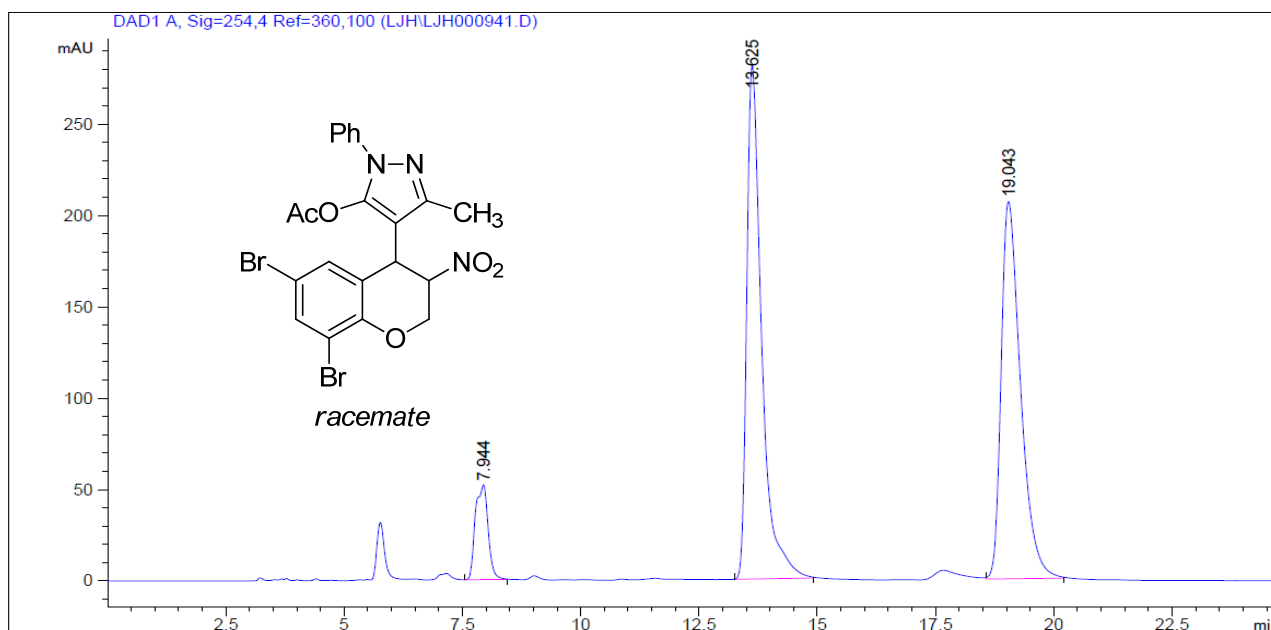
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3	17.838	BB	0.4530	2.62206e4	876.54102	89.3334



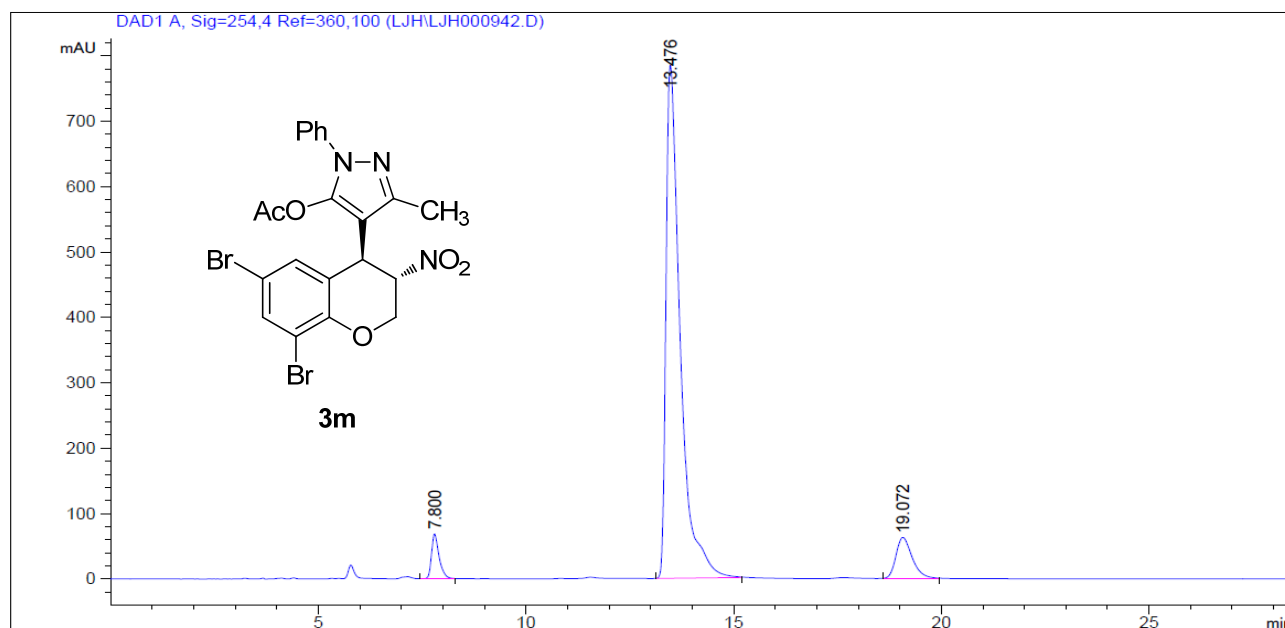
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.542	BB	0.2890	6988.13477	365.60602	50.0565
2	14.848	BB	0.3775	6879.29834	275.36487	49.2769
3	17.369	MM T	0.7941	42.73328	8.96930e-1	0.3061
4	23.558	MM T	0.8885	50.33610	9.44263e-1	0.3606



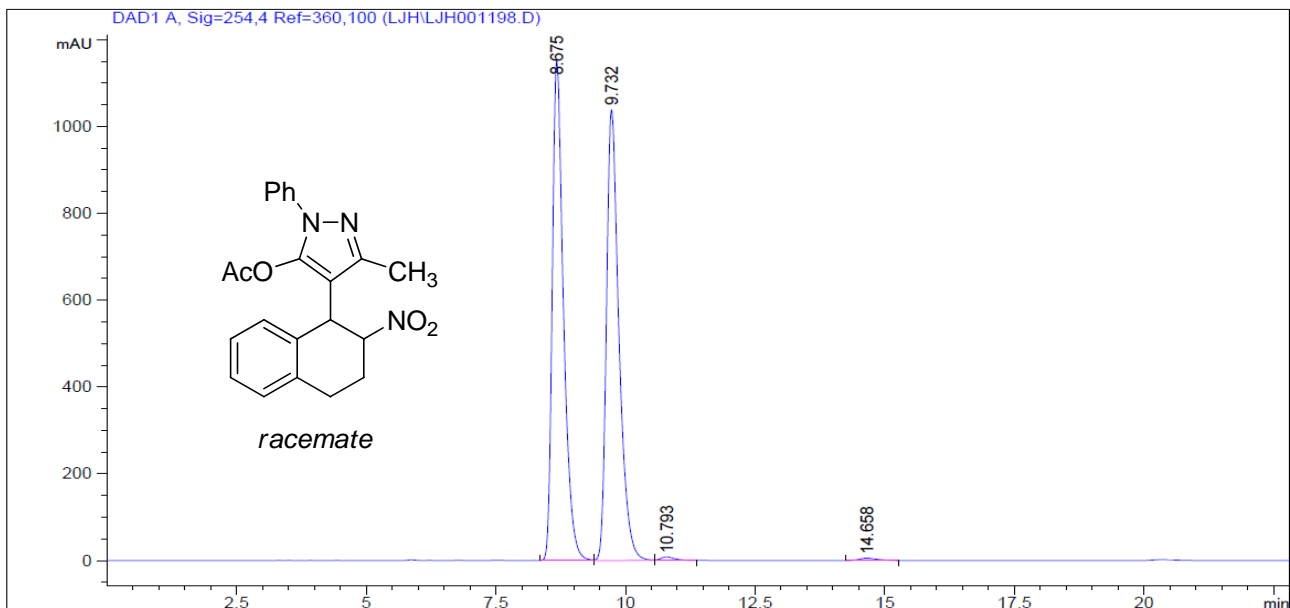
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.314	BB	0.2802	1.86409e4	1006.06665	95.3873
2	14.696	BB	0.3689	698.48407	28.60257	3.5742
3	17.202	BB	0.4310	202.94693	6.94380	1.0385



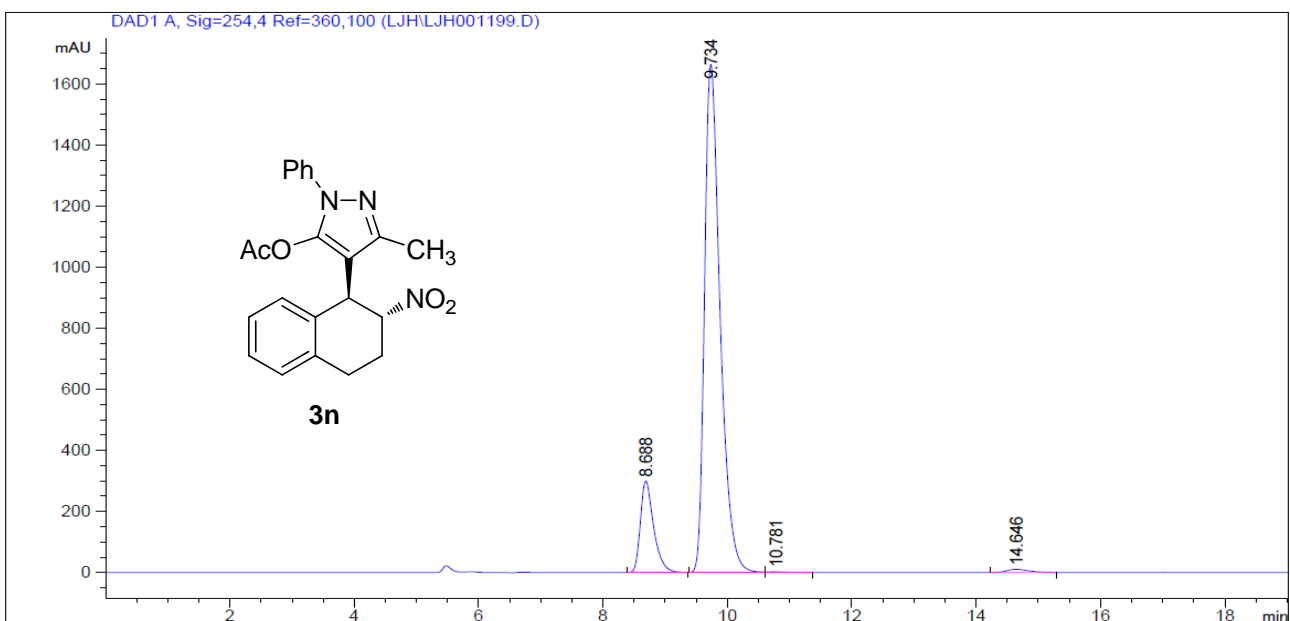
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.944	VB	0.2537	969.41046	51.94637	7.4544
2	13.625	BB	0.3273	6155.04590	281.32617	47.3298
3	19.043	BB	0.4322	5880.14404	206.51729	45.2159



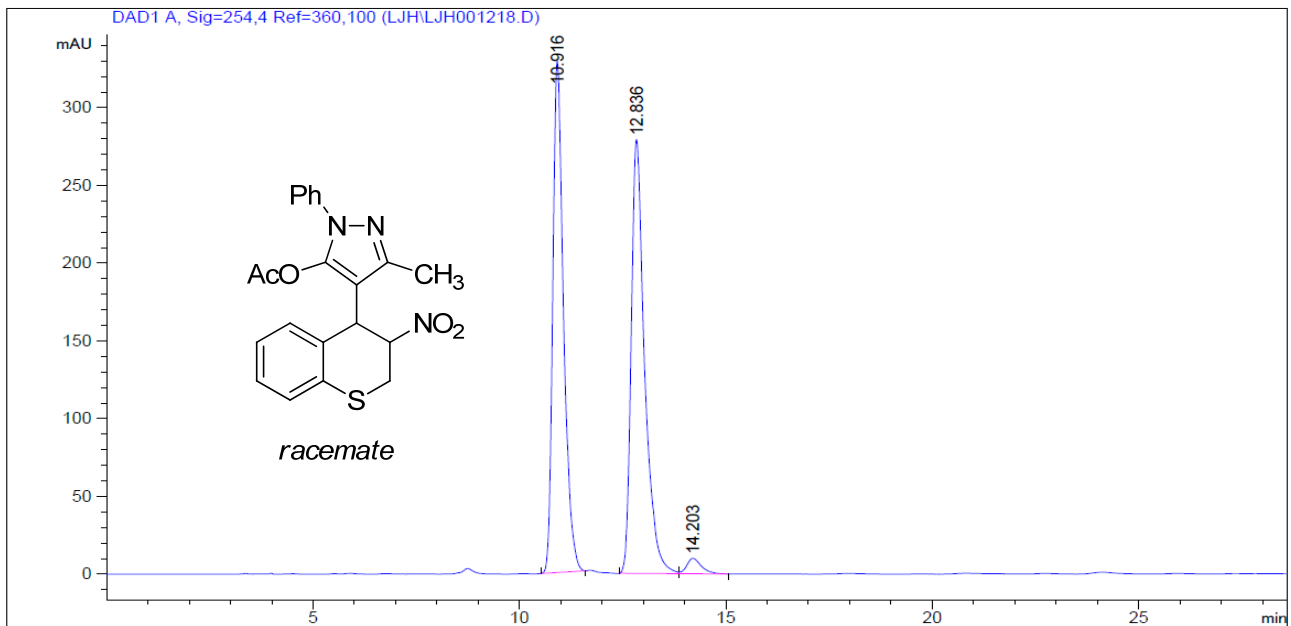
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.800	VB	0.1876	868.34729	68.64314	4.0899
2	13.476	BB	0.3514	1.86623e4	784.95703	87.8995
3	19.072	BB	0.4162	1700.75464	62.74880	8.0105



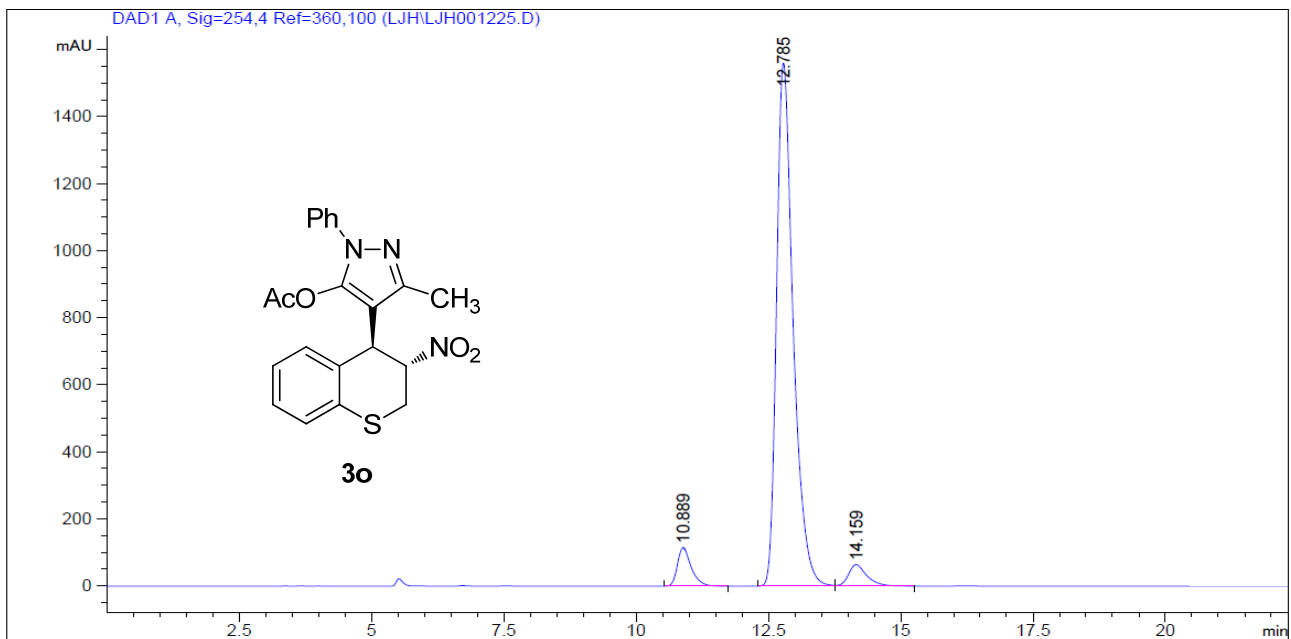
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.675	BV	0.2253	1.73021e4	1151.75610	49.4300
2	9.732	VB	0.2495	1.74095e4	1038.66602	49.7368
3	10.793	BB	0.2765	152.83694	8.16014	0.4366
4	14.658	BB	0.3654	138.81177	5.67385	0.3966



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.688	BB	0.2228	4443.10303	299.98254	13.1801
2	9.734	BB	0.2630	2.89537e4	1663.89624	85.8891
3	10.781	BB	0.2940	47.98732	2.27609	0.1424
4	14.646	BB	0.3736	265.77264	10.70810	0.7884

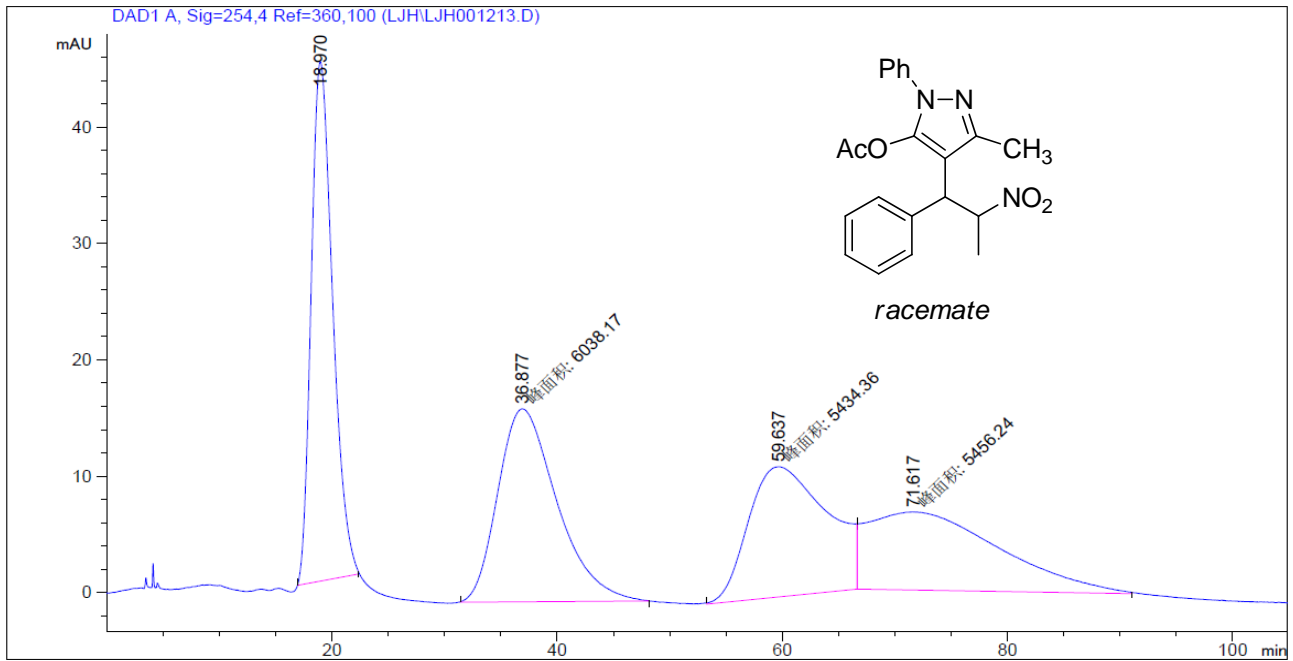


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.916	BB	0.2711	5953.88770	328.99158	47.7208
2	12.836	BB	0.3324	6276.94189	279.12079	50.3101
3	14.203	BB	0.3718	245.68704	10.02890	1.9692

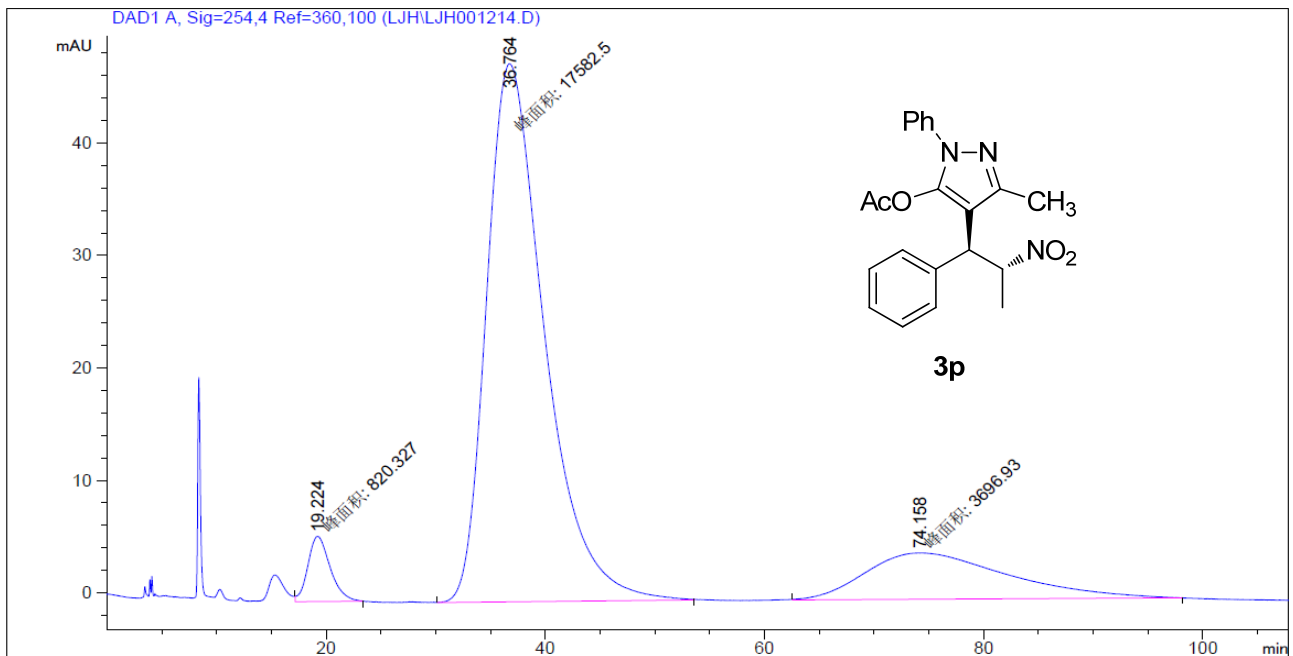


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.889	BB	0.2697	2082.86938	115.87124	5.5172
2	12.785	BV	0.3311	3.41155e4	1560.22046	90.3659
3	14.159	VB	0.3588	1554.23596	64.12645	4.1169

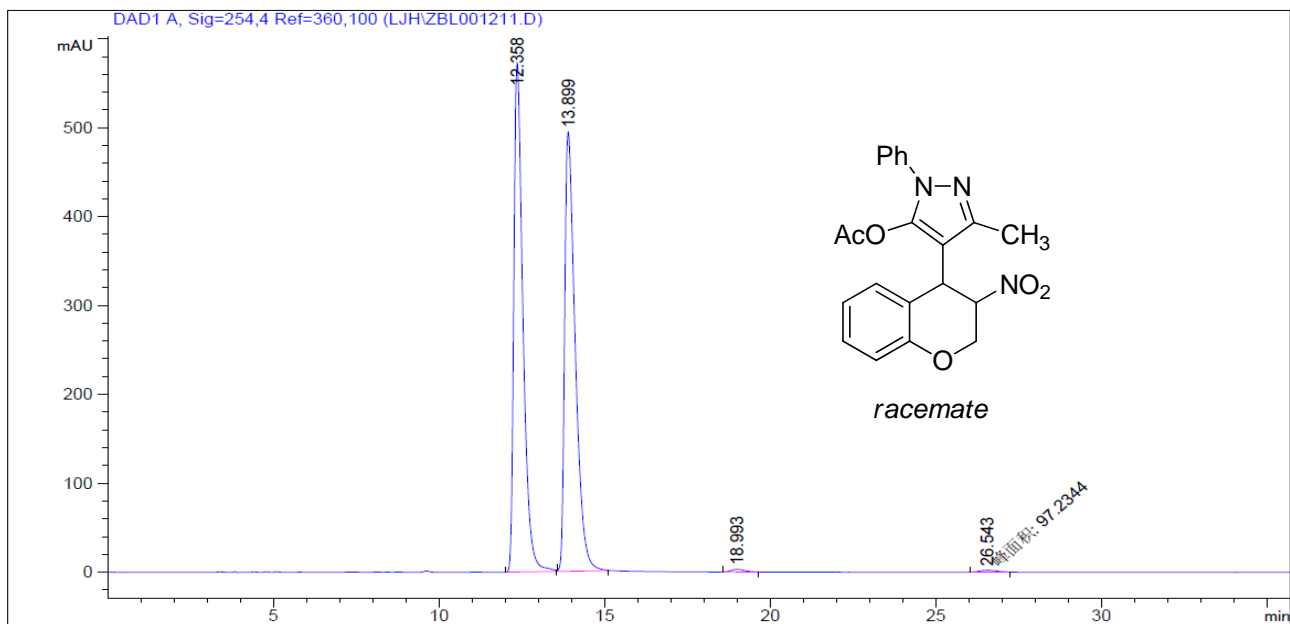




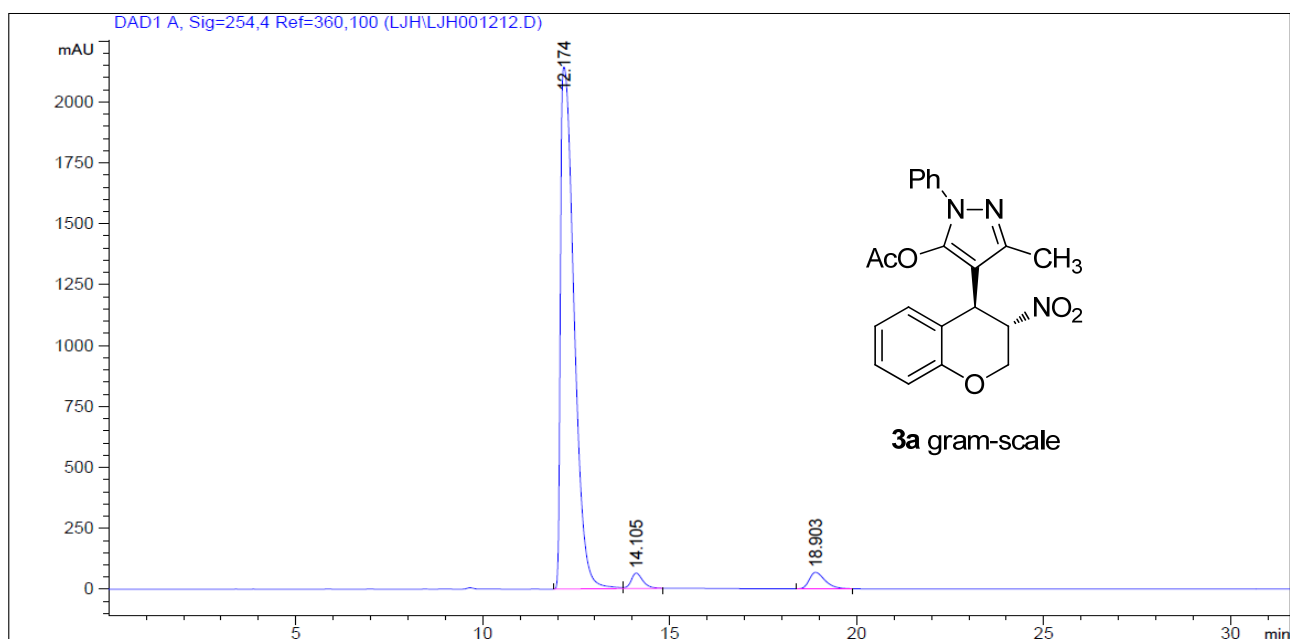
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	18.970	BB	1.6618	5921.86572	44.63595	25.9155
2	36.877	MM T	6.0658	6038.17480	16.59081	26.4245
3	59.637	MM T	8.0894	5434.36133	11.19650	23.7821
4	71.617	MM T	13.5522	5456.23926	6.71015	23.8778



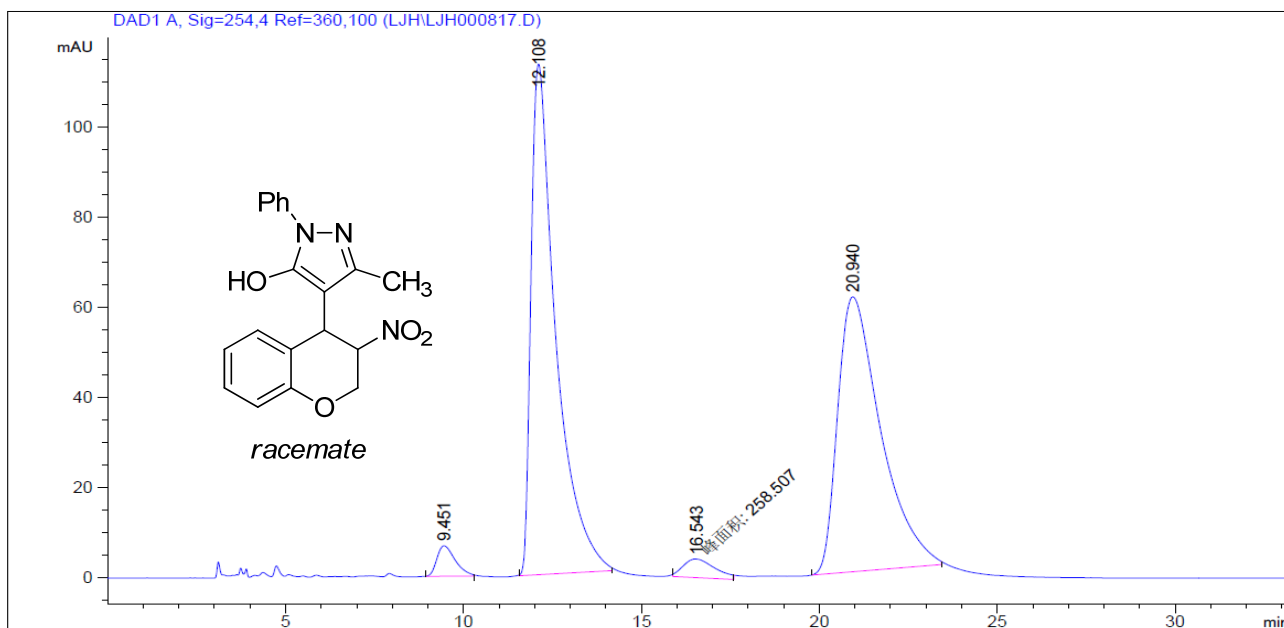
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	19.224	MM T	2.3581	820.32660	5.79803	3.7119
2	36.764	MM T	6.1232	1.75825e4	47.85720	79.5597
3	74.158	MM T	14.9238	3696.92822	4.12866	16.7284



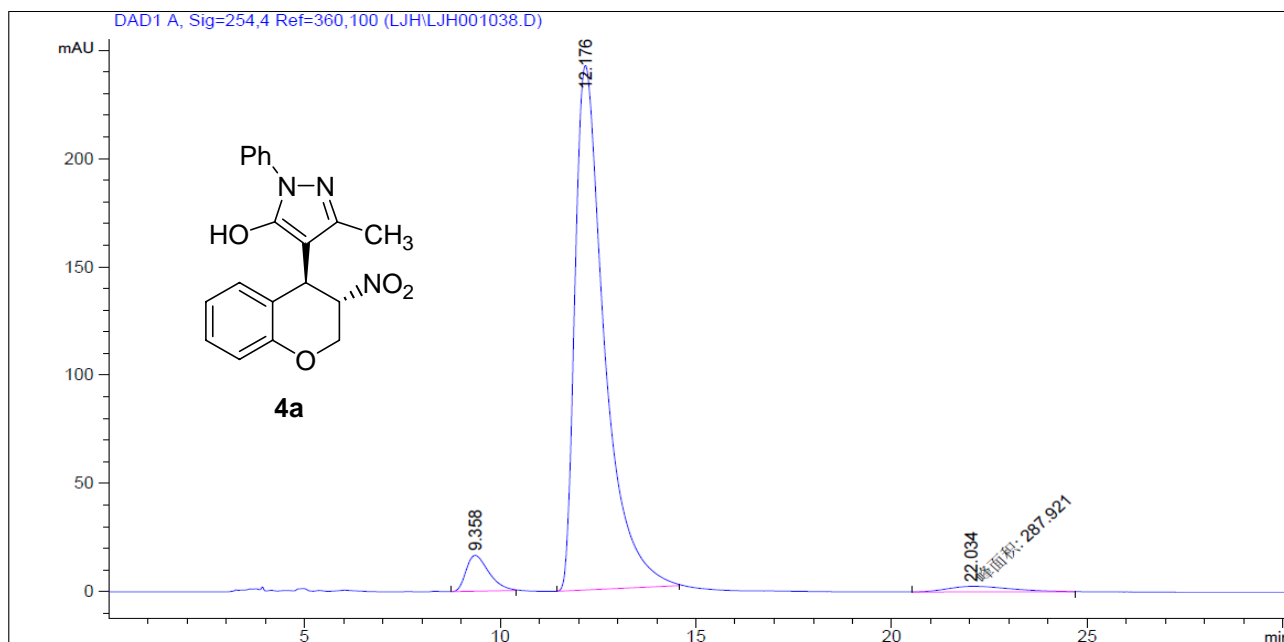
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.358	BB	0.2873	1.09746e4	573.29218	49.6322
2	13.899	BB	0.3344	1.09541e4	494.63974	49.5393
3	18.993	BB	0.3997	85.95161	3.02278	0.3887
4	26.543	MM T	0.6742	97.23435	2.40364	0.4397



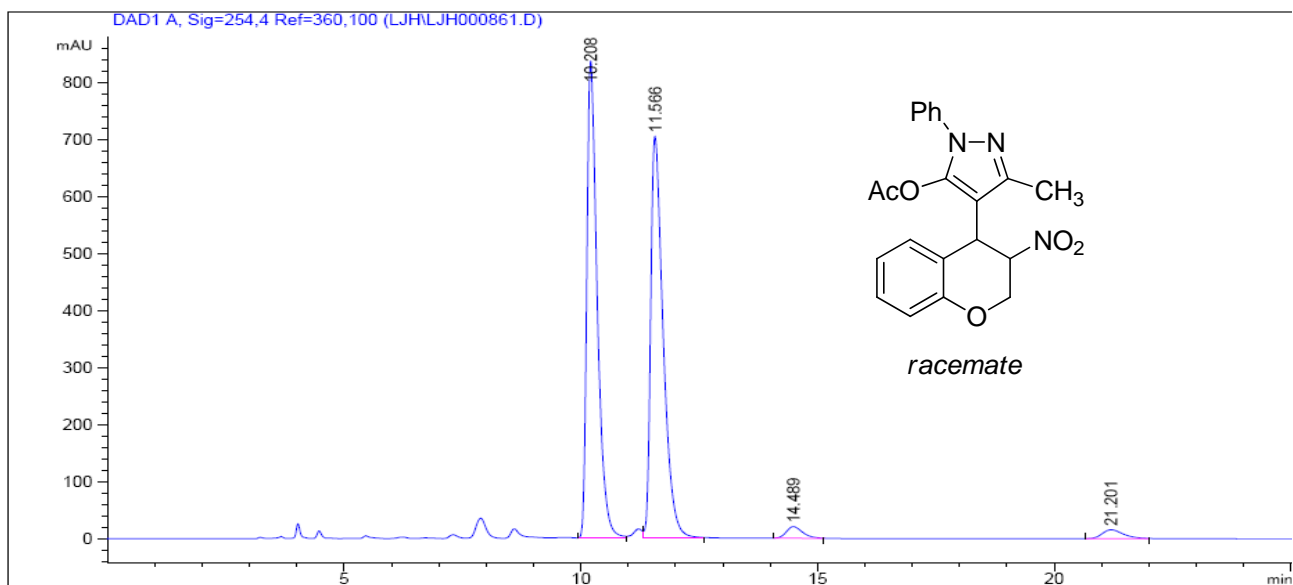
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.174	BB	0.3916	5.39359e4	2142.89673	94.1388
2	14.105	BB	0.3299	1376.23254	63.24031	2.4021
3	18.903	BB	0.4472	1981.88550	67.76789	3.4592



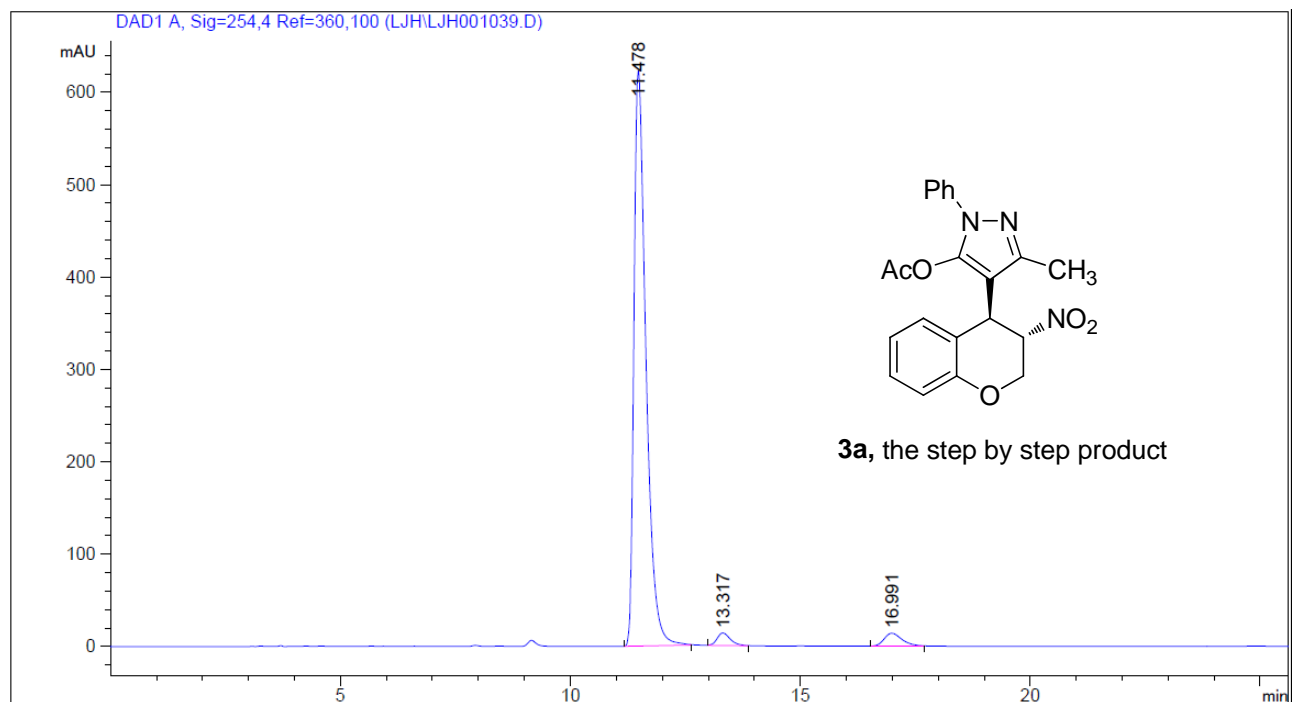
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.451	BB	0.5241	241.29678	6.76617	2.1675
2	12.108	BB	0.6999	5493.77393	113.26569	49.3487
3	16.543	MM T	1.0374	258.50714	4.15311	2.3221
4	20.940	BB	1.2174	5138.98438	60.96671	46.1617



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.358	BB	0.6012	664.80646	16.52992	4.8944
2	12.176	BB	0.7807	1.26302e4	242.06503	92.9859
3	22.034	MM T	1.8746	287.92090	2.55979	2.1197



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.208	BV	0.2297	1.27380e4	836.39545	47.9487
2	11.566	VB	0.2750	1.28584e4	704.38898	48.4018
3	14.489	BB	0.3634	486.42966	20.45481	1.8310
4	21.201	BB	0.4739	483.11777	15.57310	1.8186



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.478	BB	0.2736	1.13007e4	623.09637	94.5934
2	13.317	BB	0.3028	269.56384	13.62671	2.2564
3	16.991	BB	0.4107	376.34366	13.95327	3.1502