

Electronic Supplementary Information

Dinuclear zinc complex catalyzed asymmetric methylation and alkynylation of aromatic aldehydes

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^a *College of Chemistry and Chemical Engineering, Shaanxi University of Science and Technology, 6 Xuefu Road, Weiyang District, Xi'an, Shaanxi 710021, P. R. China*

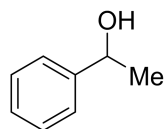
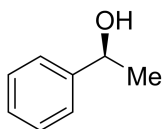
^b *The College of Chemistry and Molecular Engineering, Zhengzhou University, No. 75 Daxue Road, Zhengzhou, Henan 450052, P. R. China*

E-mail: wangmincan@zzu.edu.cn

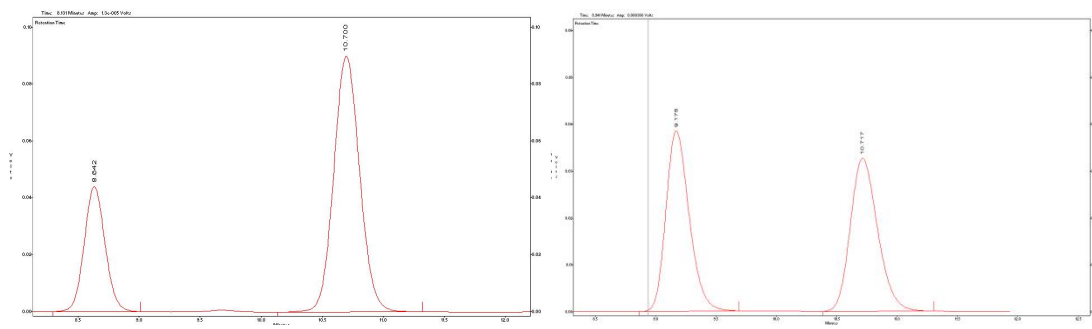
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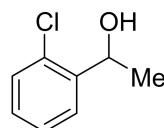
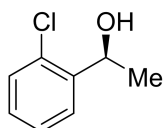
1. Chiral HPLC spectra for the methylation products



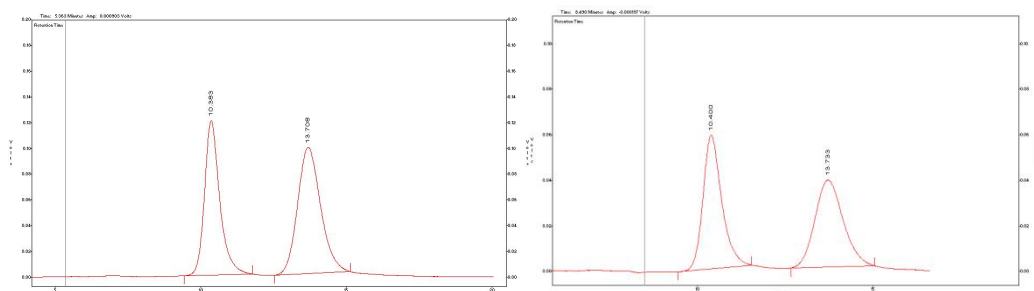
1-Phenylethanol-1-ol (3aa)



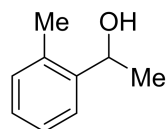
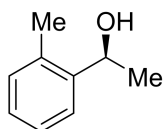
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
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10.700	1334212	71.593	10.717	512582	49.936



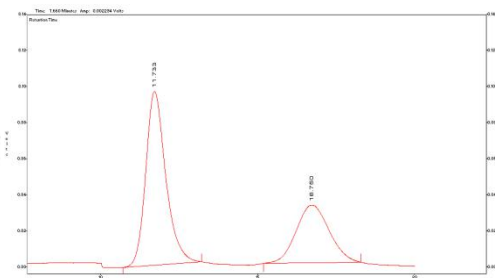
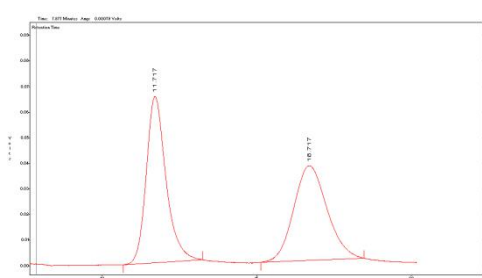
1-(2-Chlorophenyl)ethanol-1-ol (3ba)



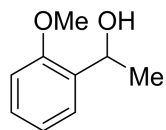
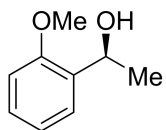
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
10.383	4413232	43.226	10.400	2285503	50.105
13.708	5796491	56.774	13.733	2275879	49.895



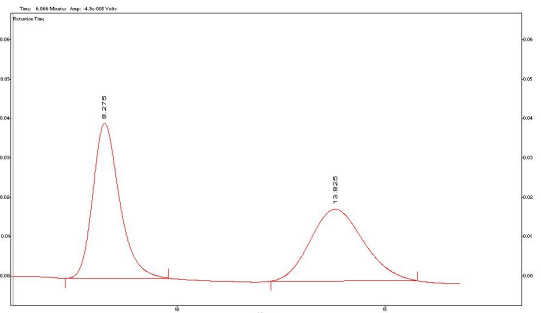
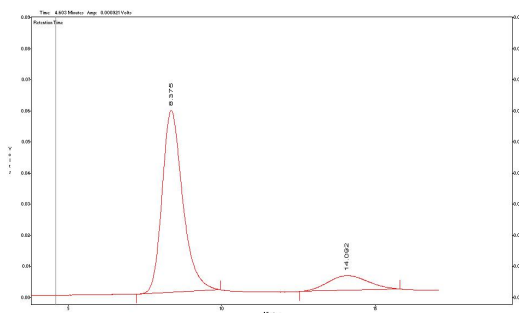
1-(o-Tolyl)ethan-1-ol (3ca)



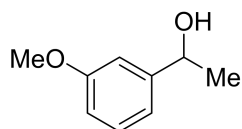
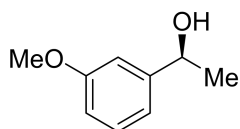
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16.750	2600716	36.519	16.717	2976764	49.895



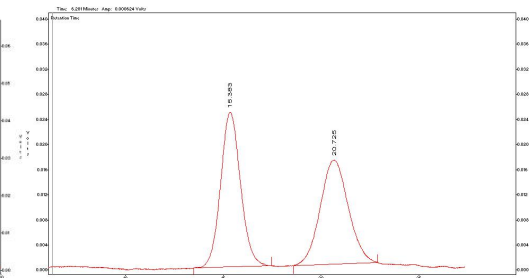
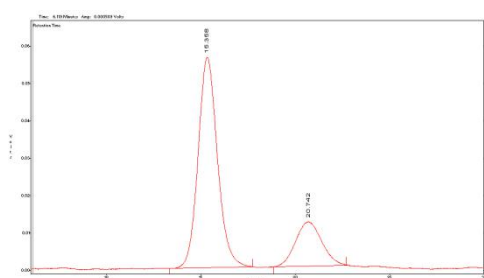
1-(2-Methoxyphenyl)ethan-1-ol (3da)



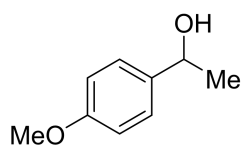
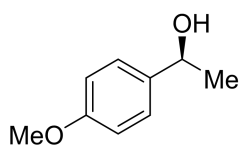
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
8.375	2822609	86.379	8.275	1773960	51.218
14.092	445109	13.621	13.825	1689620	48.782



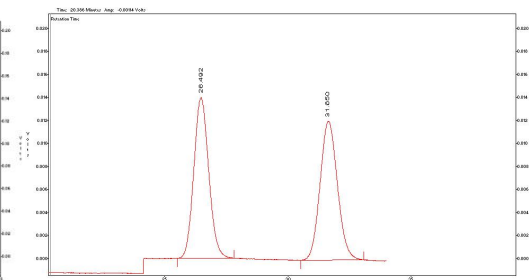
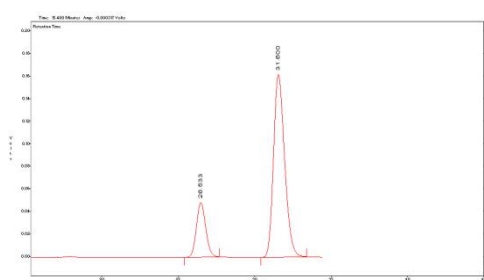
1-(3-Methoxyphenyl)ethan-1-ol (3ea)



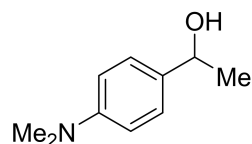
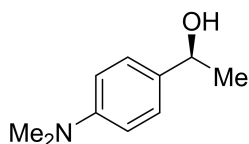
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20.742	1138468	22.084	20.725	1661763	48.870



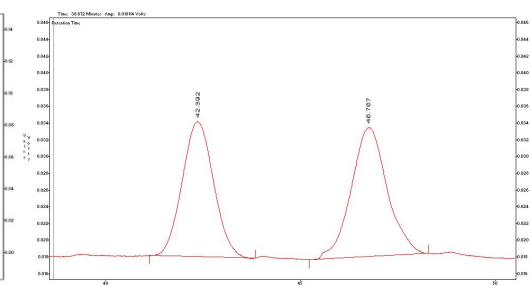
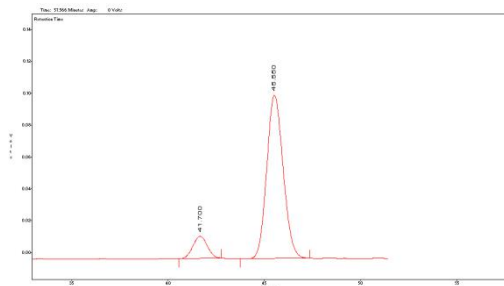
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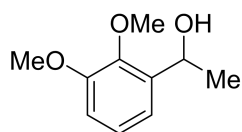
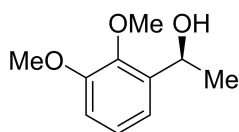
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31.600	8164648	80.126	31.650	583645	49.765



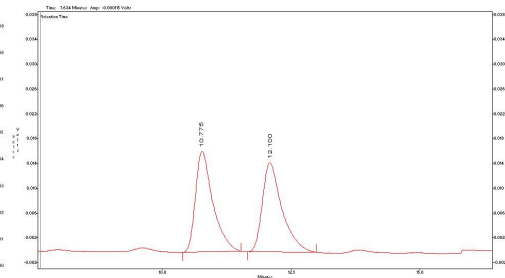
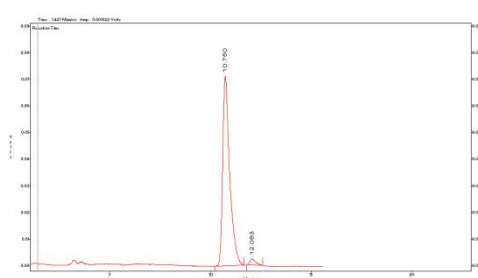
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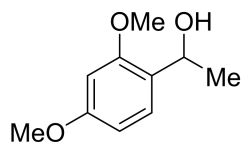
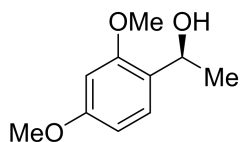
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45.550	6048975	89.575	46.767	971513	51.844



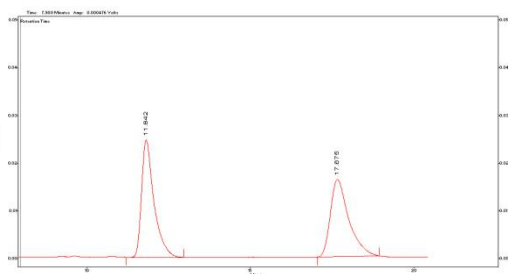
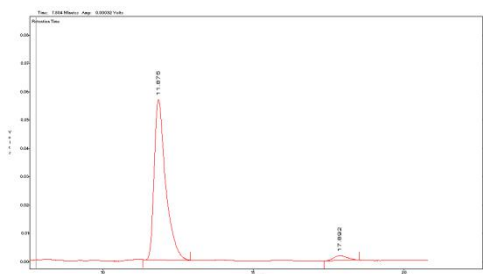
1-(2,3-Dimethoxyphenyl)ethan-1-ol (3pa)



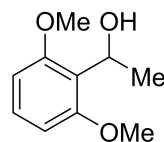
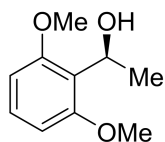
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12.083	47477	2.693	12.100	382716	49.837



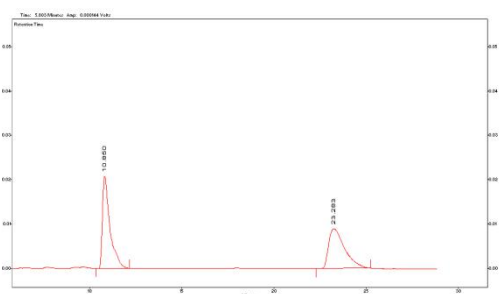
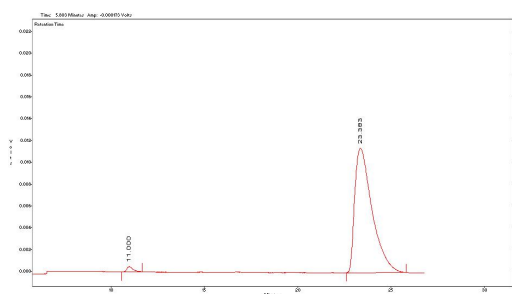
1-(2,4-Dimethoxyphenyl)ethan-1-ol (3qa)



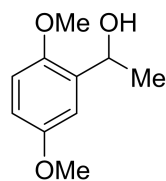
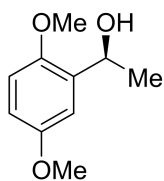
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11.875	1525417	96.422	11.842	647947	50.237
17.892	56605	3.578	17.675	641826	49.763



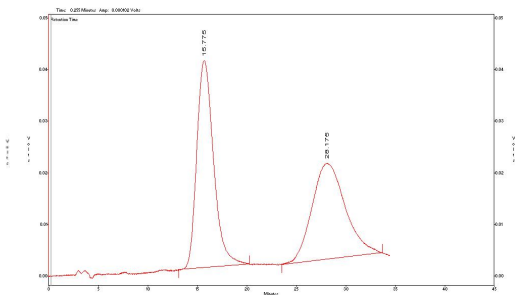
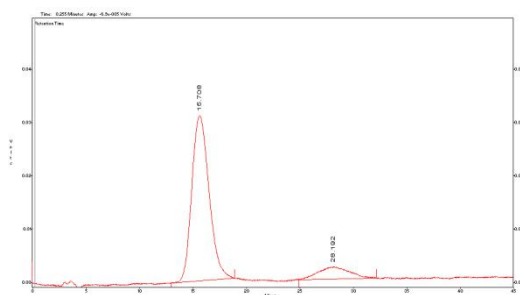
1-(2,6-Dimethoxyphenyl)ethan-1-ol (3ra)



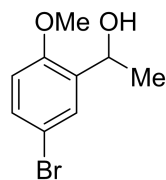
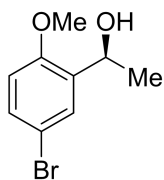
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23.383	738136	98.787	23.283	536902	49.095



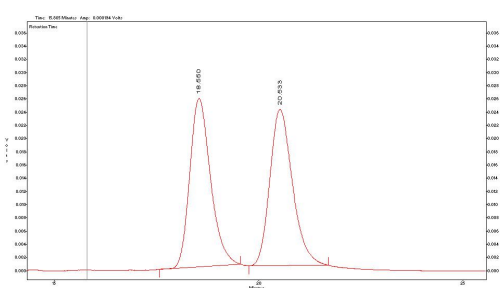
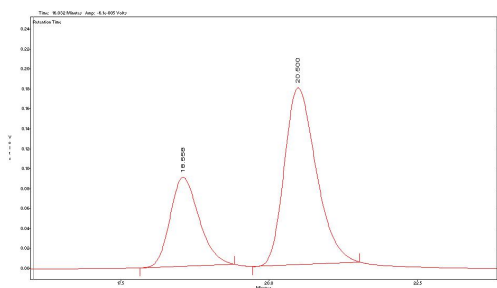
1-(2,5-Dimethoxyphenyl)ethan-1-ol (3sa)



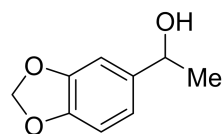
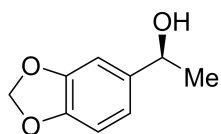
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
15.708	3617919	90.759	15.775	4482309	50.233
28.192	368351	9.240	28.175	4440773	49.767



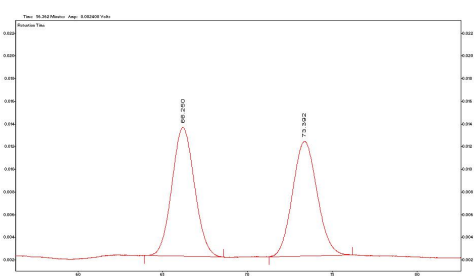
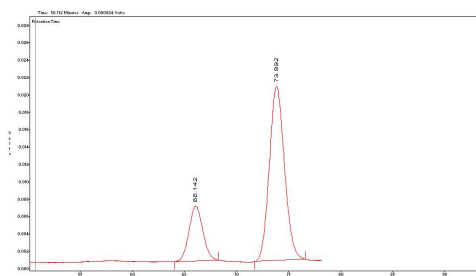
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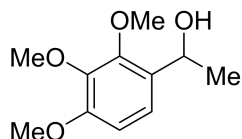
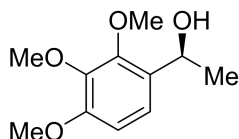
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18.558	3138812	30.773	18.550	908684	49.265
20.500	7060967	69.227	20.535	935787	50.735



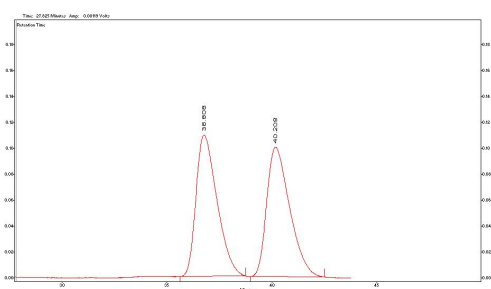
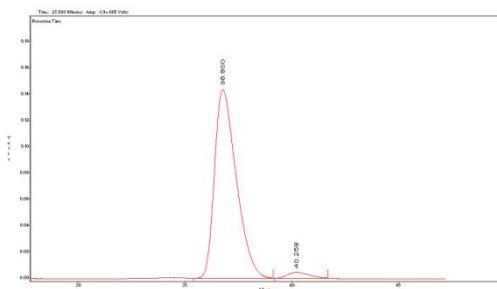
1-(Benzo[d][1,3]dioxol-5-yl)ethan-1-ol (3ua)



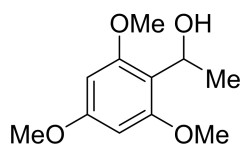
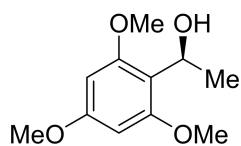
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66.142	555783	21.199	66.250	1058352	50.802
73.892	2065942	78.801	73.392	1024931	49.198



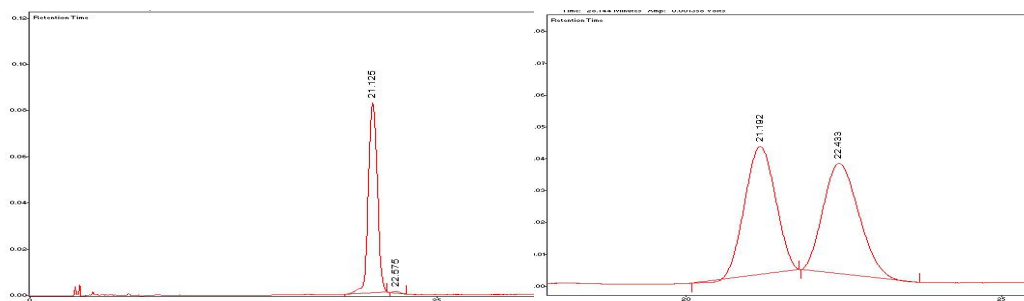
1-(2,3,4-Trimethoxyphenyl)ethan-1-ol (3va)



Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
36.800	10120167	97.099	36.808	7591207	49.908
40.258	302419	2.901	40.208	7619338	50.092

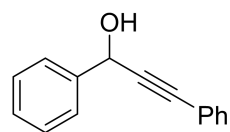
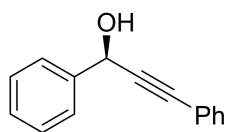


1-(2,4,6-Trimethoxyphenyl)ethan-1-ol (3wa)

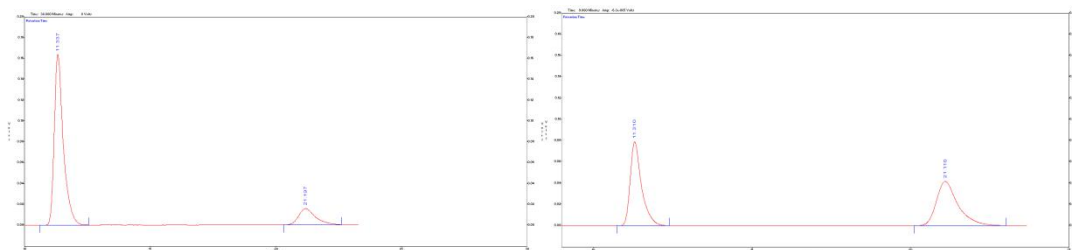


Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
21.125	3124200	99.542	21.192	1391409	50.333
22.575	14366	0.458	22.433	1372986	49.667

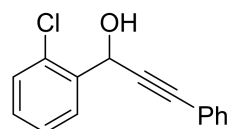
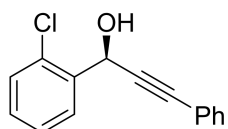
2. Chiral HPLC spectra for the alkynylation products



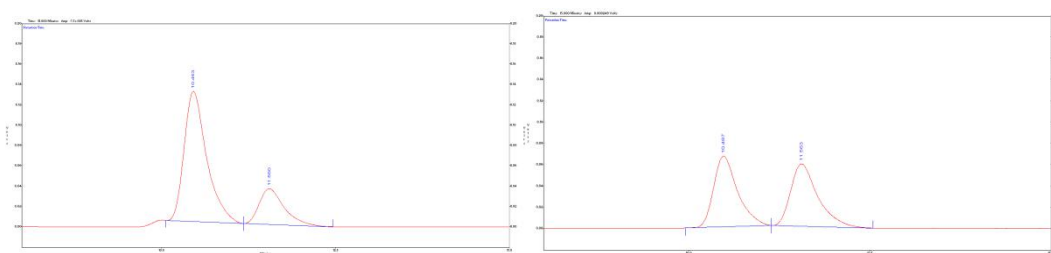
1,3-Diphenylprop-2-yn-1-ol (5ab)



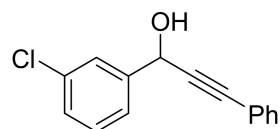
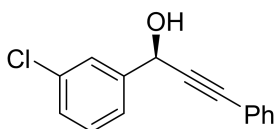
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
11.337	4100876	87.744	11.310	1954166	49.999
21.197	572788	12.256	21.110	1954216	50.001



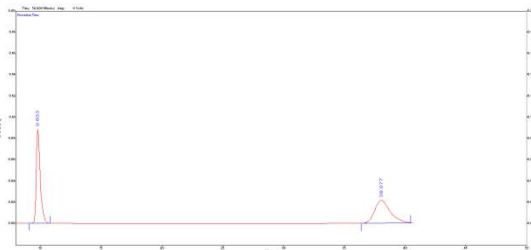
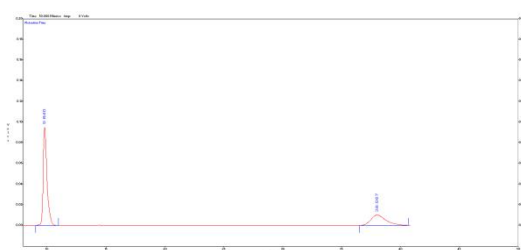
1-(2-Chlorophenyl)-3-phenylprop-2-yn-1-ol (5bb)



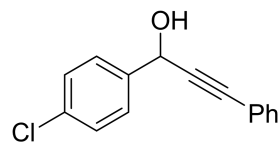
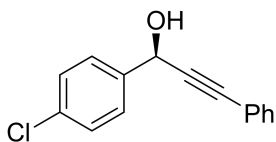
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
10.463	2890034	76.862	10.487	1528899	50.041
11.560	869983	23.138	11.563	1526377	49.959



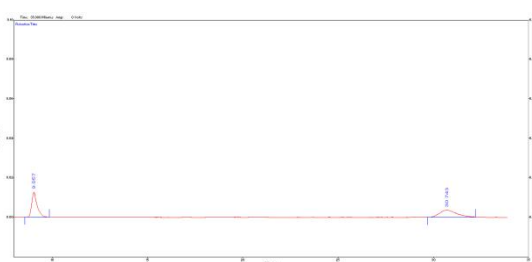
1-(3-Chlorophenyl)-3-phenylprop-2-yn-1-ol (5hb)



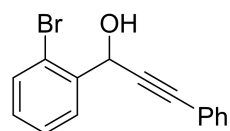
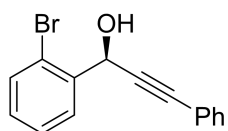
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
9.840	2130587	73.086	9.833	1985706	51.307
38.067	784585	26.914	38.077	1884536	48.693



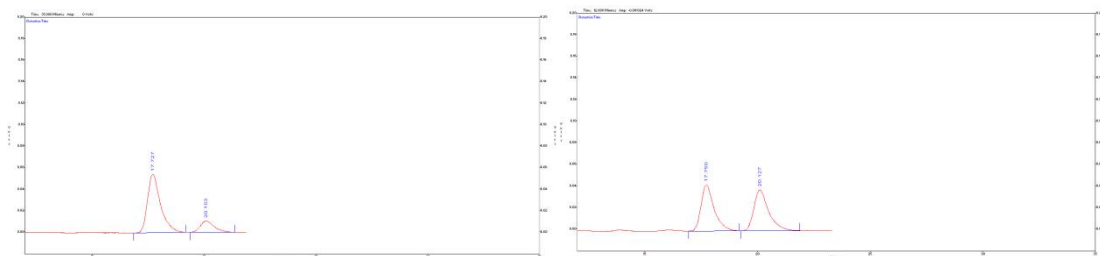
1-(4-Chlorophenyl)-3-phenylprop-2-yn-1-ol (5ib)



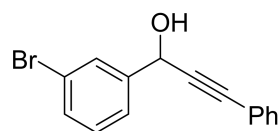
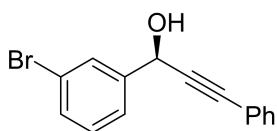
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
9.070	2723839	74.471	9.057	245849	53.602
30.027	933726	25.529	30.743	212807	46.398



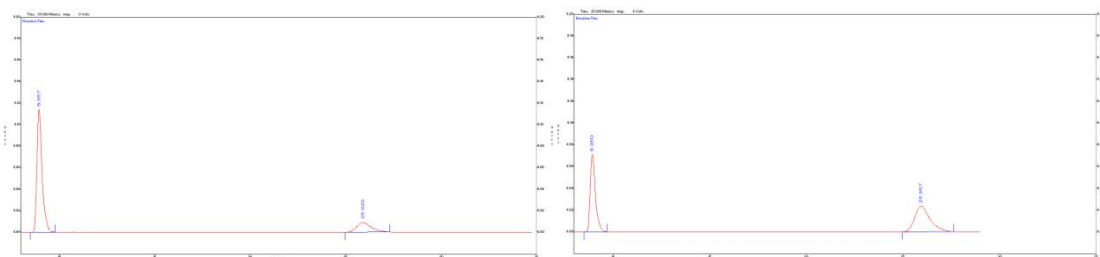
1-(2-Bromophenyl)-3-phenylprop-2-yn-1-ol (5jb)



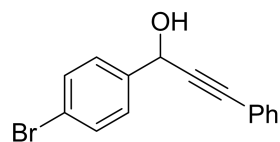
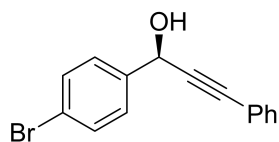
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
17.727	2196380	85.695	17.750	1712709	49.889
20.103	366637	14.305	20.127	1720309	50.111



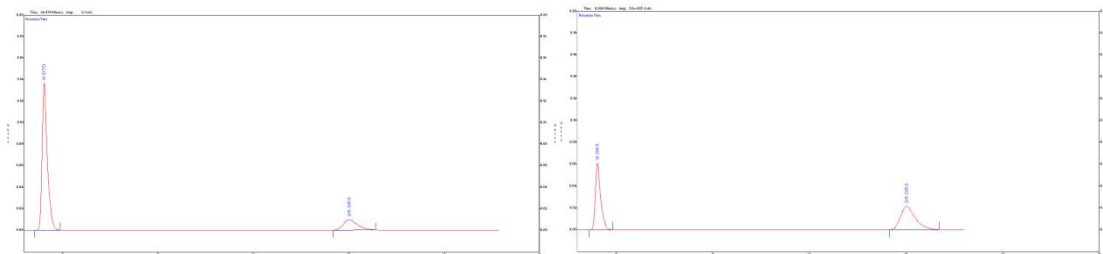
1-(3-Bromophenyl)-3-phenylprop-2-yn-1-ol (5kb)



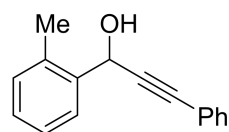
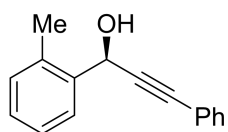
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
8.957	2120170	81.464	8.950	1316694	50.565
25.920	482403	18.536	25.957	1287278	49.435



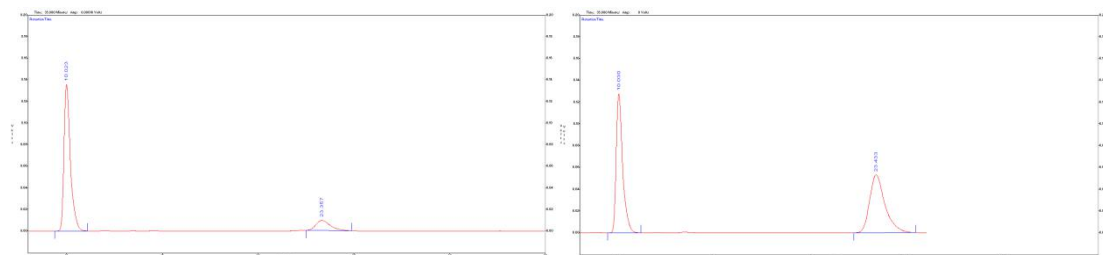
1-(4-Bromophenyl)-3-phenylprop-2-yn-1-ol (5lb)



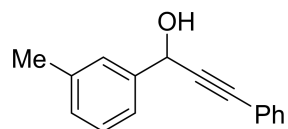
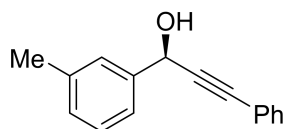
Ret. Time (min)	Area	Area (%)	Ret.Time (min)	Area	Area (%)
9.070	2607715	83.948	9.063	1162019	50.621
25.053	498643	16.052	25.053	1133494	49.379



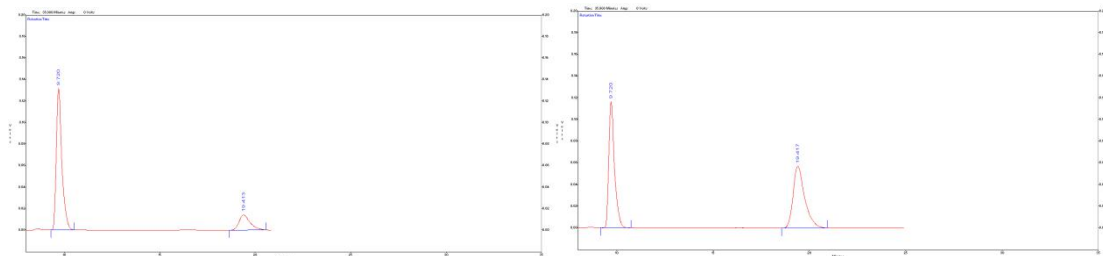
3-Phenyl-1-(o-tolyl)prop-2-yn-1-ol (5cb)



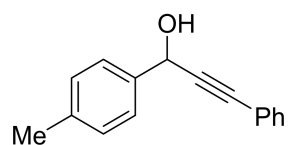
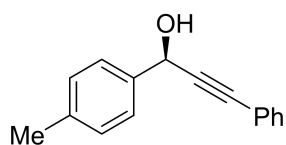
Ret. Time (min)	Area	Area (%)	Ret.Time (min)	Area	Area (%)
10.023	3128076	86.455	10.030	2960439	49.941
23.357	490082	13.545	23.433	2967418	50.059



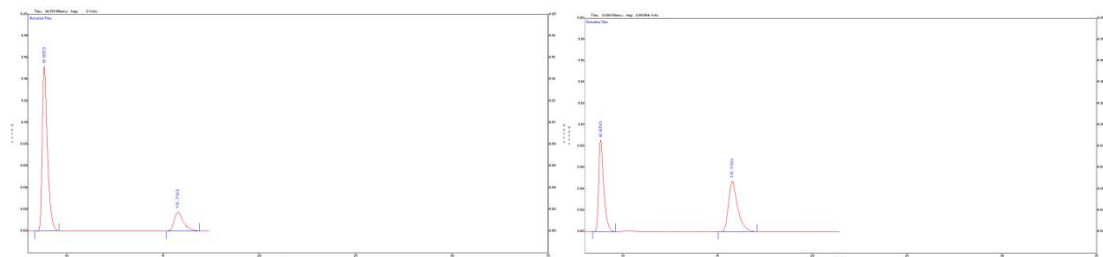
3-Phenyl-1-(*m*-tolyl)prop-2-yn-1-ol (5mb)



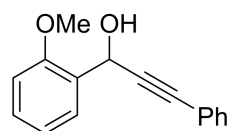
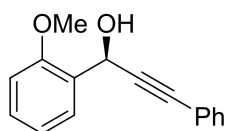
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
9.720	2651170	82.480	9.720	2378914	49.987
19.413	563150	17.520	19.417	2380127	50.013



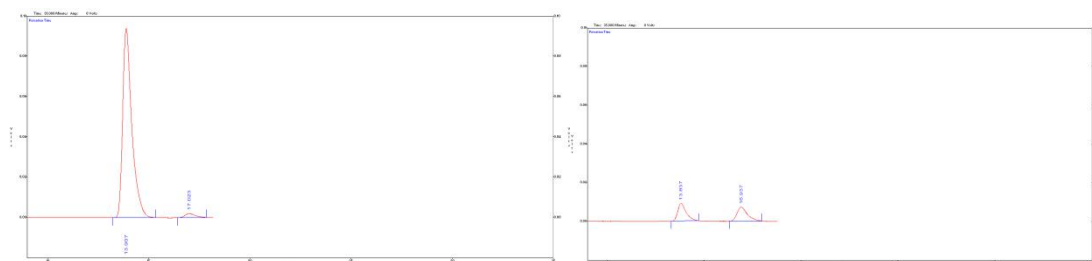
3-Phenyl-1-(*p*-tolyl)prop-2-yn-1-ol (5nb)



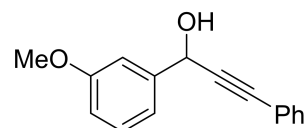
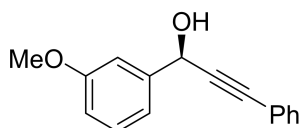
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
8.853	2800193	82.664	8.850	1565642	49.909
15.793	587231	17.336	15.790	1571367	50.091



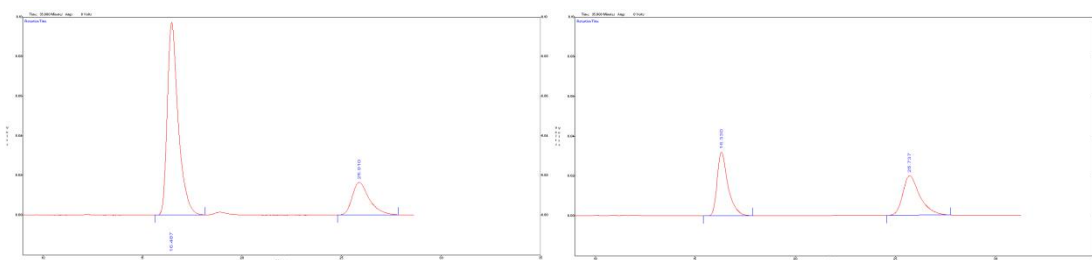
1-(2-Methoxyphenyl)-3-phenylprop-2-yn-1-ol (5db)



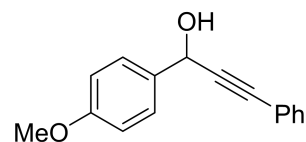
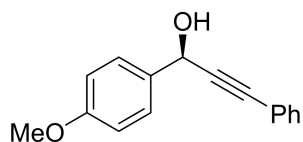
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
13.907	2946190	97.689	13.837	276159	50.919
17.023	69698	2.311	16.937	266188	49.081



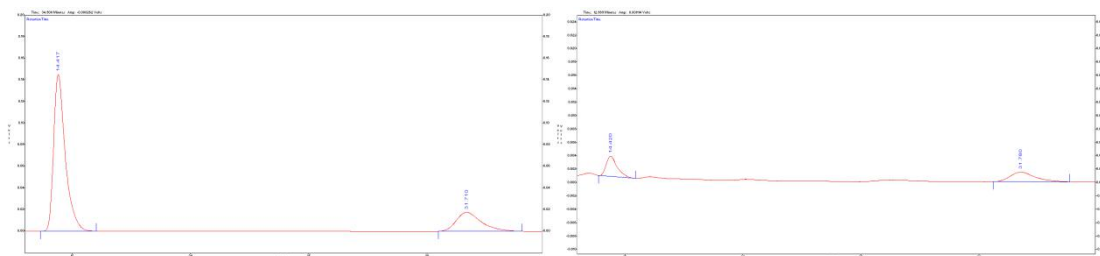
1-(3-Methoxyphenyl)-3-phenylprop-2-yn-1-ol (5eb)



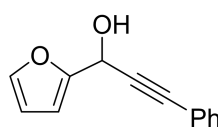
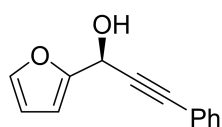
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
16.487	3673328	80.679	16.330	1195851	50.321
25.910	879675	19.321	25.737	1180592	49.679



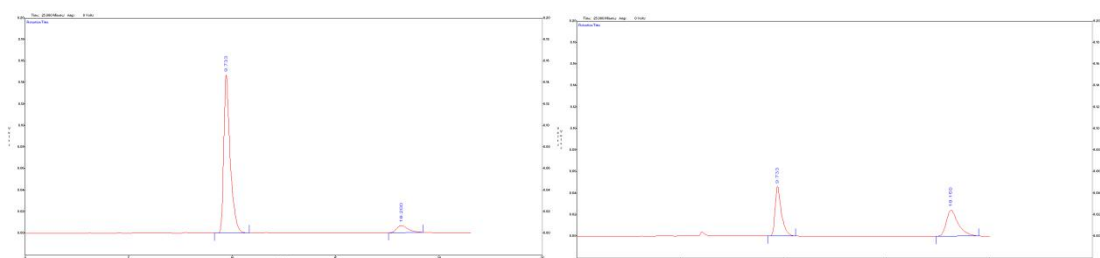
1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-ol (5fb)



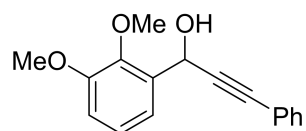
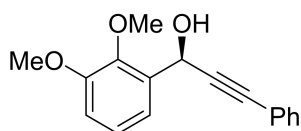
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
14.417	4943364	79.115	14.420	98126	48.053
31.710	1304933	20.885	31.780	106079	51.947



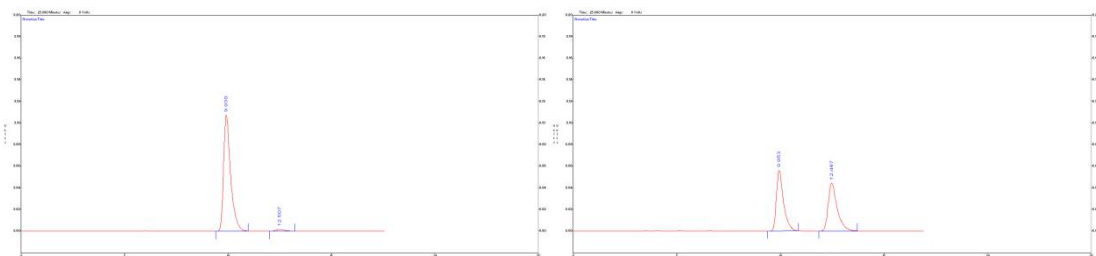
1-(Furan-2-yl)-3-phenylprop-2-yn-1-ol (5ob)



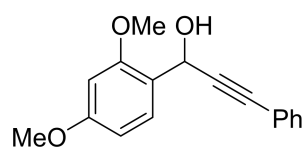
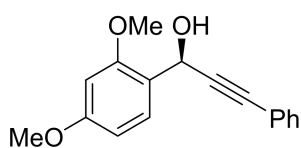
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
9.733	3151141	92.548	9.733	978425	50.334
18.200	253726	7.452	18.150	965422	49.666



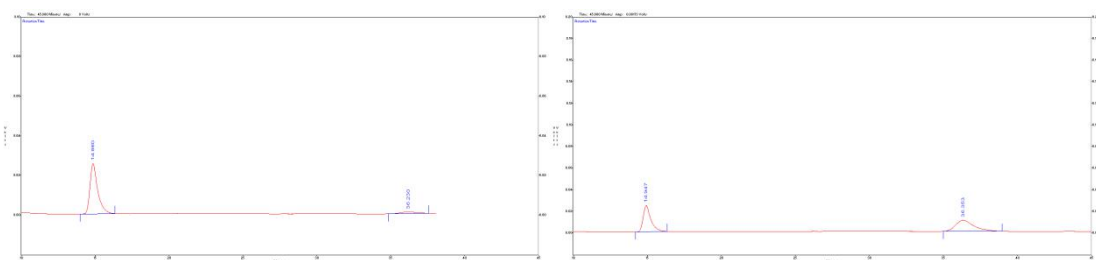
1-(2,3-Dimethoxyphenyl)-3-phenylprop-2-yn-1-ol (5pb)



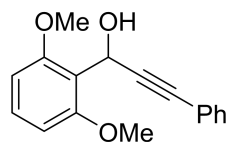
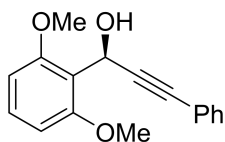
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
9.930	2539684	98.102	9.953	1332778	49.913
12.507	49136	1.898	12.487	1337424	50.087



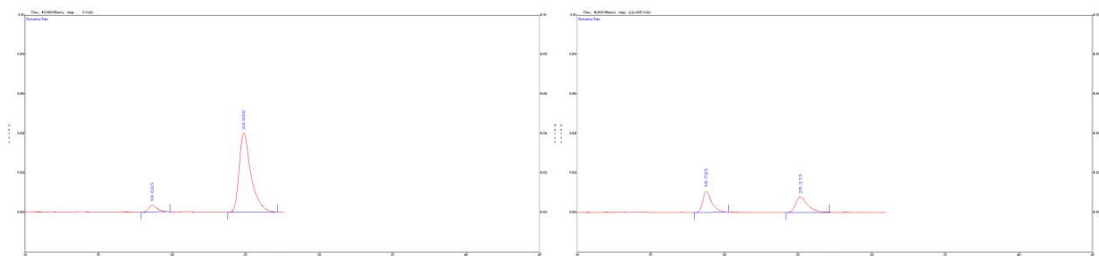
1-(2,4-Dimethoxyphenyl)-3-phenylprop-2-yn-1-ol (5qb)



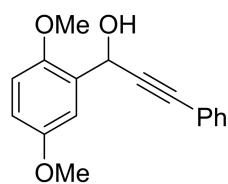
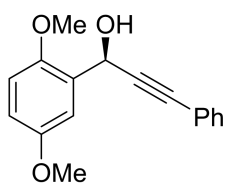
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
14.880	925668	95.155	14.947	880676	50.252
36.230	47130	4.845	36.353	871851	49.748



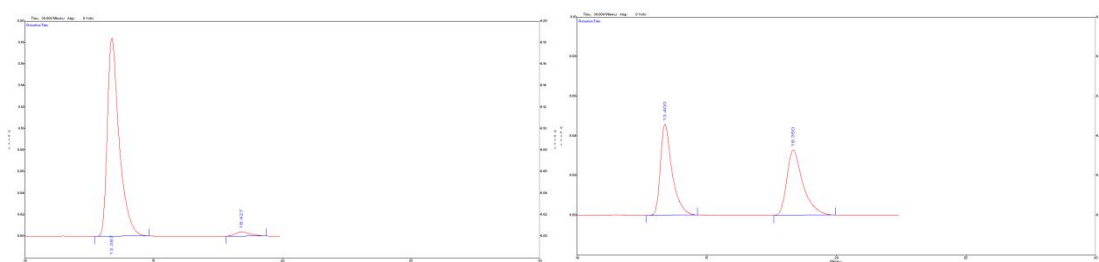
1-(2,6-Dimethoxyphenyl)-3-phenylprop-2-yn-1-ol (5rb)



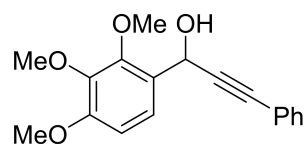
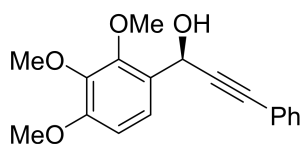
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
18.693	121614	5.184	18.793	452604	50.354
24.900	2224377	94.816	25.213	446237	49.646



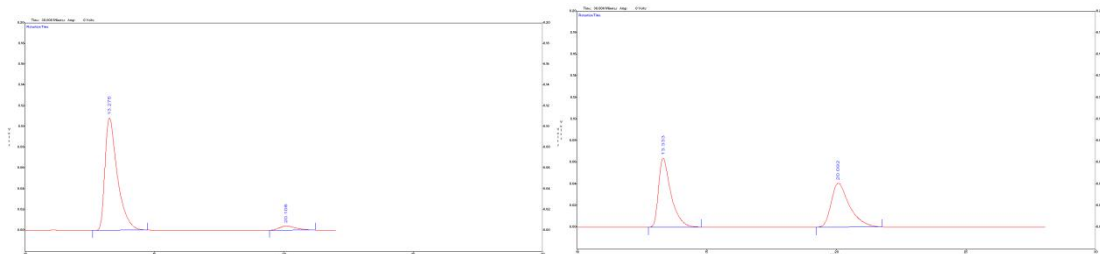
1-(2,5-Dimethoxyphenyl)-3-phenylprop-2-yn-1-ol (5sb)



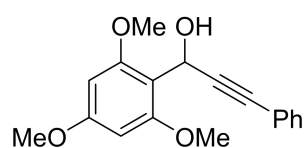
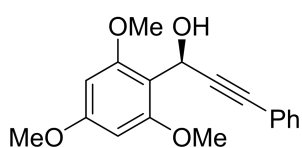
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
13.387	5873576	97.440	13.400	1434639	50.168
18.427	154324	2.560	18.350	1425030	49.832



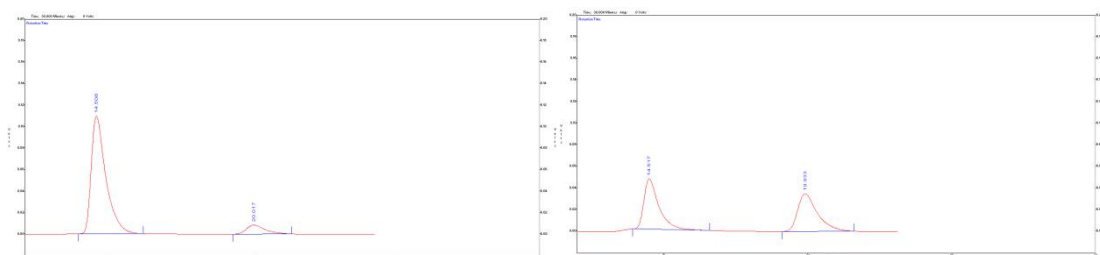
3-Phenyl-1-(2,3,4-trimethoxyphenyl)prop-2-yn-1-ol (5vb)



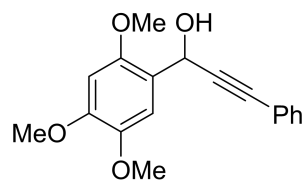
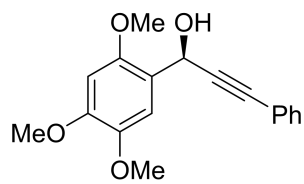
Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
13.275	3603159	95.239	13.333	2124017	51.693
20.108	180117	4.761	20.092	1984904	48.307



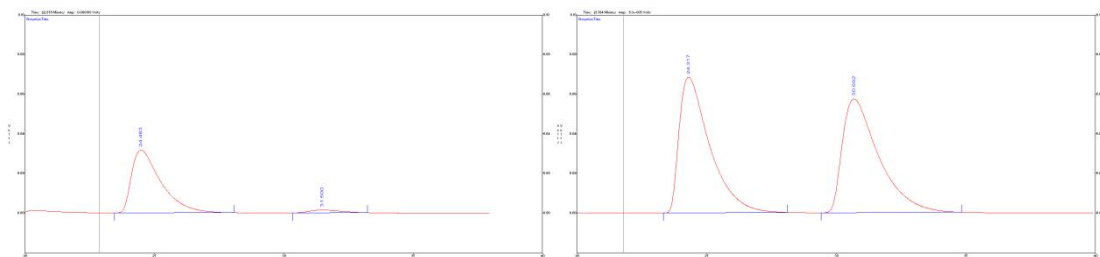
3-Phenyl-1-(2,4,6-trimethoxyphenyl)prop-2-yn-1-ol (5wb)



Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
14.508	3890355	92.145	14.517	1693551	50.553
20.017	331658	7.855	19.933	1656490	49.447



3-Phenyl-1-(2,4,5-trimethoxyphenyl)prop-2-yn-1-ol (5xb)



Ret. Time (min)	Area	Area (%)	Ret. Time (min)	Area	Area (%)
24.483	2510663	96.146	24.317	5634093	50.046
31.500	100644	3.854	30.692	5623834	49.954