NHC-Catalyzed Reaction of Enals with Hydroxy Chalcones: Diastereoselective Synthesis of Functionalized Coumarins

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Supporting Information

1. General Information

Unless otherwise specified, all reactions were carried out under an atmosphere of argon in flame-dried reaction vessels with Teflon screw cap. Dry DME was purchased from commercial sources and stored under argon over 4 Å molecular sieves. The 2'-hydroxy acetophenone was purchased from commercial sources, 2-acetyl-1-napthol was purchased from Sigma Aldrich, 5'-bromo-2'-hydroxy acetophenone was purchased from Acros Organics and they were used without any further purification. The α,β-unsaturated aldehydes were synthesized from corresponding aldehydes following the literature procedure.[1] DBU was purchased from Sigma Aldrich and was distilled, prior to use. The imidazolium salt **4** was synthesized following the literature procedure.[2]

Analytical thin layer chromatography was performed on TLC Silica gel 60 F_{254}. Visualization was accomplished with short wave UV light or KMnO4 staining solutions followed by heating. Flash chromatography was performed on silica gel (230-400 mesh) by standard techniques eluting with solvents as indicated.

All compounds were fully characterized. ^{1}H and ^{13}C NMR spectra were recorded on Bruker AV 400, AV 500, and JEOL 400 in solvents as indicated. Chemical shifts (δ) are given in ppm. The residual solvent signals were used as references and the chemical shifts converted to the TMS scale ($CDCl_3$: δH = 7.26 ppm, δC = 77.16 ppm). Infrared spectra were recorded on a Perkin-Elmer 1615 FT Infrared Spectrophotometer Model 60B. The wave numbers (n) of recorded IR-signals are quoted in cm^{-1}. HRMS mass spectra were recorded on a Thermo Scientific Q-Exactive, Accela 1250 pump.

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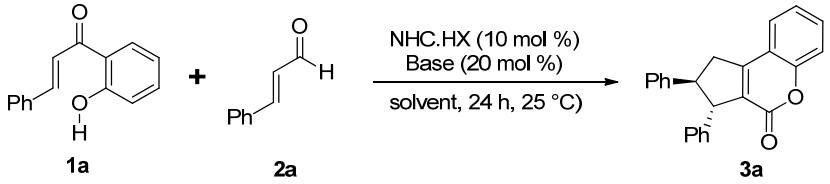
[1] (a) Wube, A. A.; Hüfner, A.; Thomaschitz, C.; Blunder, M.; Kollroser, M.; Bauer, R.; Bucar, F. *Bioorg. Med. Chem*. **2011**, *19*, 567. (b) Orita, A.; Uehara, G.; Miwa, K.; Otera, J. *Chem. Commun.* **2006**, 4729. (c) Gadakh, S. K.; Reddy, R. S.; Sudalai, A. *Tetrahedron: Asymmetry*, **2012**, *23*, 898.

[2] (a) Arduengo, A. J.; Krafczyk, R.; Schmutzler, R.; Craig, H. A.; Goerlich, J. R.; Marshall, W. J.; Unverzagt, M. *Tetrahedron* **1999***, 55,* 14523. (b) Cooke , J.; Lightbody, O. C. *J. Chem. Educ.* **2009**, *86*, 610.

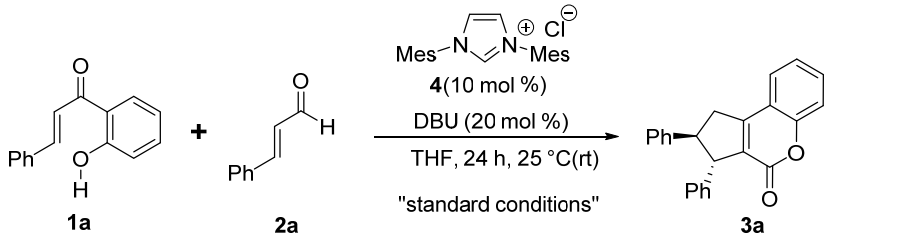
2. **General Procedure for the Optimization of Reaction Conditions**

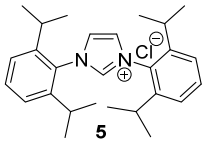


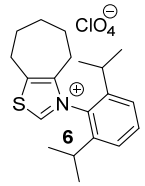
To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the azolium salt NHC.HX (0.025 mmol) and (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the *trans* cinnamaldehyde **2a** (33 mg, 31 μL, 0.25 mmol) followed by the addition of DBU (7.6 mg, 7.5 μL, 0.05 mmol). After 24 hour stirring, the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 μL, 0.25 mmol) as the internal standard.

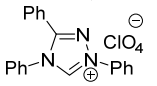
3. Optimization Studies

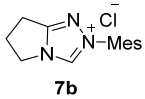
Our optimization study commenced with treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** with *trans* cinnamaldehyde **2a**. Treatment of **1a** with **2a** in the presence of the carbene generated from **4** by deprotonation using DBU resulted in the formation of functionalized coumarin derivative **3a** in 88% yield (based on ^{1}H NMR spectroscopy). Notably, in contrast to this NHC, other common NHCs derived from precursors **5-8** are less effective (entries 2-5). Other bases such as NaOAc, KO*t*-Bu, NEt_3, and DMAP furnished the desired product in reduced yields (Table 1, entries 6-9). Among the various solvents screened, THF and 1,4-dioxane resulted in comparable result (entries 1 and 10). Gratifyingly, reaction carried out in DME shows excellent reactivity to get almost quantitative yield (Table 1, entry 13). Additionally, reaction carried out using 7 mol % of **4** and 14 mol % loadings of DBU, resulted in reduced the yield of **3a** (entry 14).

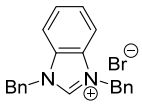








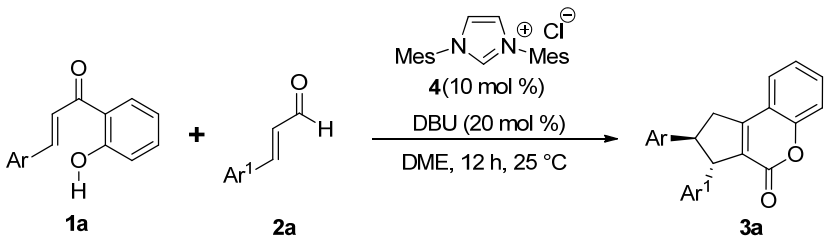




entry	variation of the standard conditions[a]	*dr*[b]	yield of **3a** (%)[c]
1	None	>20:1	88(86)
2	**5** instead of **4**	n.d	<1
3	**6** instead of **4**	n.d	<1
4	**7a** instead of **4**	n.d	<1
5	**7b** instead of **4**	>20:1	67
6	**8** instead of **4**	n.d	<1
7	NaOAc instead of DBU	>20:1	46
8	KOt-Bu instead of DBU	>20:1	86
9	Et_3N instead of DBU	>20:1	10
10	DMAP instead of DBU	>20:1	6
11	1,4-dioxane instead of THF	>20:1	89
12	Toluene instead of 1THF	>20:1	49
13	DCM instead of THF	>20:1	50
14	DME instead of THF	>20:1	99(98)[d,]
15	7 mol % of **4**, 14 mol % DBU in DME	>20:1	72

[a] Standard conditions: **1a** (0.25 mmol), **2a** (0.25 mmol), NHC·HX (10 mol %), DBU (20 mol %), THF (1.0 mL), 25 °C and 24 h. [b] Determined by ^{1}H-NMR analysis of crude products. [c]The yields were determined by ^{1}H-NMR analysis of crude products using CH_2Br_2 as the internal standard, Isolated yield in 1.0 mmol scale in parentheses. [d] The reaction was completed in 12 h.

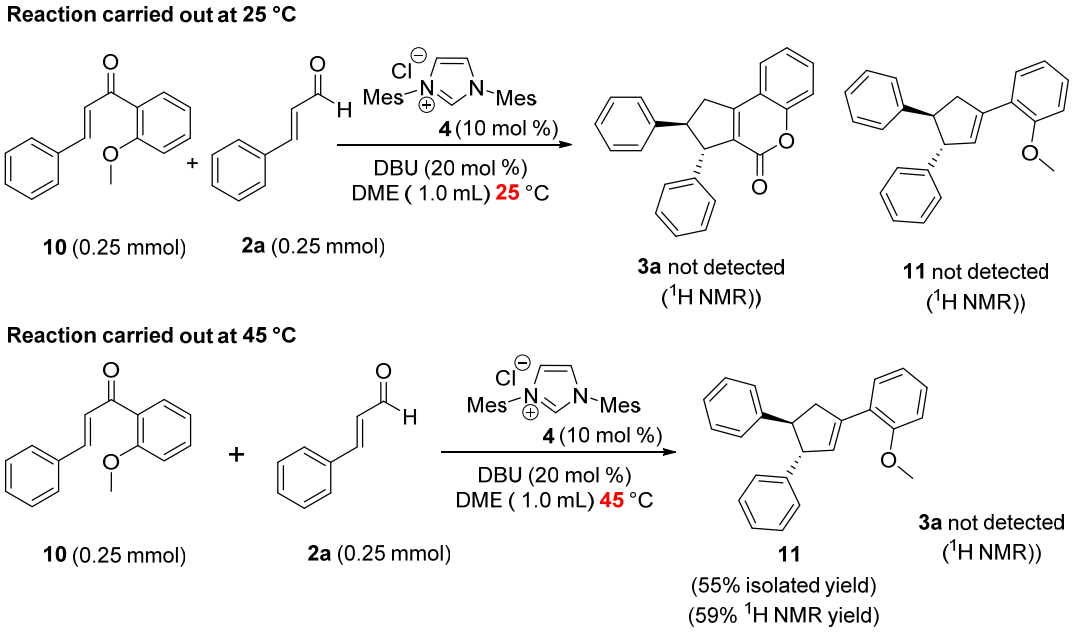
4. General Procedure for the NHC-Catalyzed Annulation Reaction



To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (0.034 g, 0.1 mmol) and the 2'-hydroxychalcone **1a** (1.0 mmol) was added. Then the screw-capped tube was evacuated and backfilled with argon. To this mixture was added DME (4.00 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the aldehyde **2a** (1.0 mmol) (*solid* aldehydes were transferred to the screw-capped tube by closing the argon flow and *liquid* aldehydes were transferred via syringe under argon flow) and the DBU (0.030 gm, 30 μL, 0.20 mmol) were successively added. Then the reaction mixture was stirred at 25° C for 12 h. When the reaction is complete, the solvent was evaporated and the crude residue was purified by flash column chromatography on silica gel to afford the corresponding functionalized coumarin derivatives.

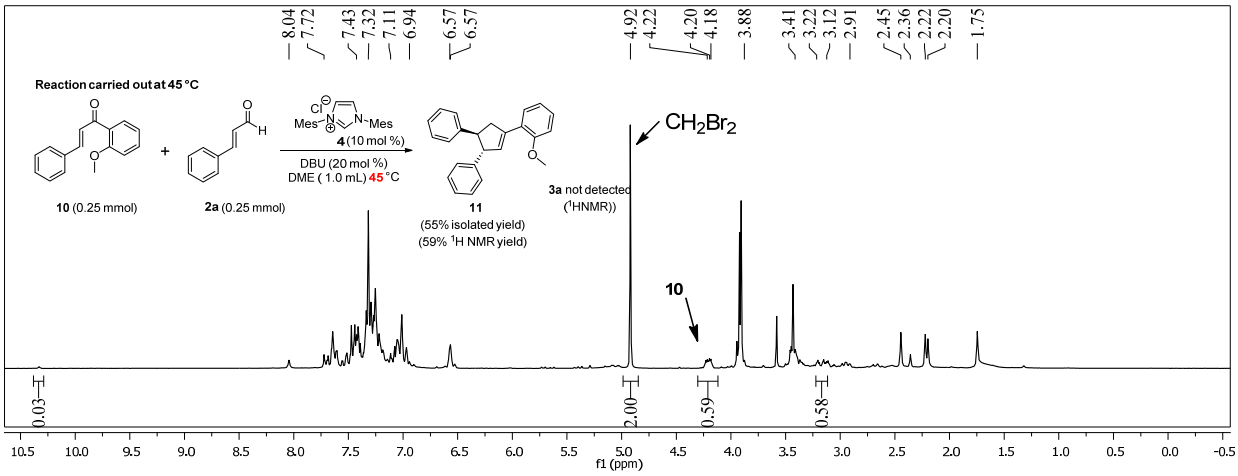
5. Mechanistic Experiments

a) Reaction Employing 2'-Methoxy Chalcone as Substrate

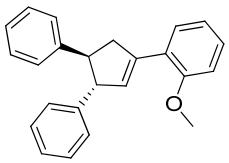


To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol) was added. Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the (*E*)-1-(2-methoxyphenyl)-3-phenylprop-2-en-1-one **10** (60 mg, 0.25 mmol) and the *trans* cinnamaldehyde **2a** (33 mg, 31 µL, 0.25 mmol) was successively added followed by DBU (7.6 mg, 7.5 µL, 0.05 mmol). Then the reaction mixture is placed in a preheated oil bath at 45 °C. After 12 h, the reaction mixture cooled and the mixture was diluted with CH_2Cl_2 (5.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2. The solvent was evaporated and the crude residue purified by flash column chromatography on silica gel to afford (4-(2-methoxyphenyl)cyclopent-3-ene-1,2-diyl)dibenzene **11** (45 mg, 55%).

^{1}H-NMR of Crude Reaction Mixture after 12 h at 45 °C ($CDCl_3$)



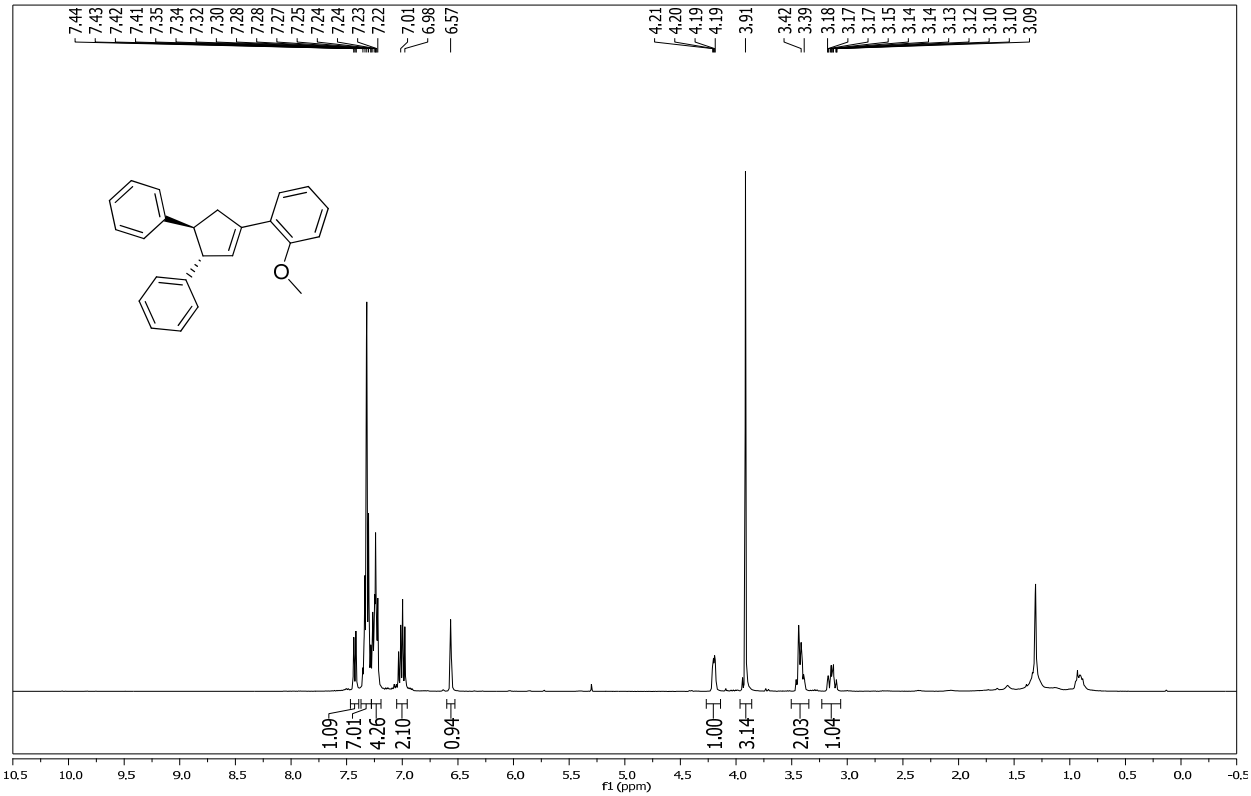
4-(2-Methoxyphenyl)cyclopent-3-ene-1,2-diyl)dibenzene (11)

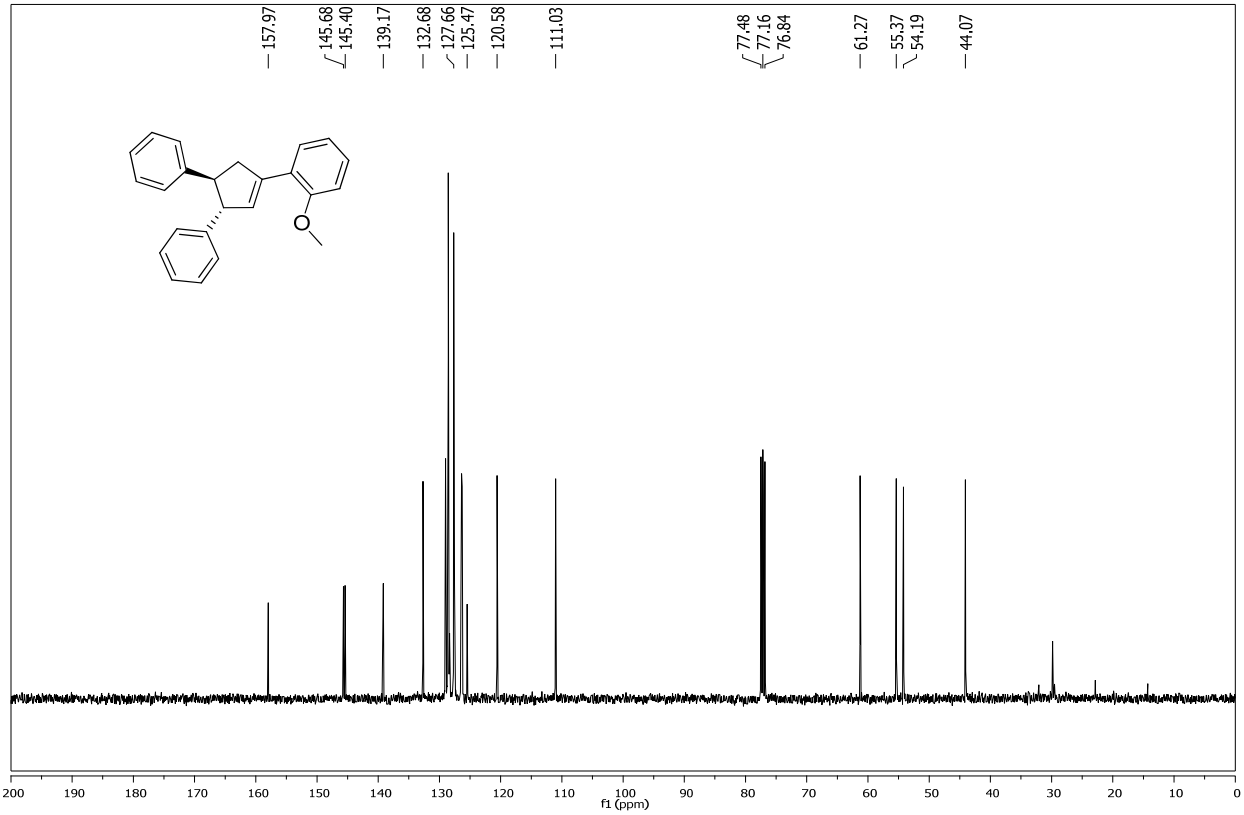


R_f (Pet. ether /EtOAc = 80/20): 0.85 **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.44-7.41 (m, 1H, H_{ar}), 7.35-7.28 (m, 7H, H_{ar}), 7.27-7.22 (m, 4H, H_{ar}), 7.03-6.98 (m, 2H, H_{ar}), 6.57 (bs, 1H, CH), 4.21-4.19 (m, 1H, CH), 3.91 (s, 3H, CH_3), 3.46-3.39 (m, 2H), 3.18-3.09 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 157.97, 145.68, 145.40, 139.17, 132.68, 129.00, 128.54, 128.51, 128.36, 127.66, 127.57, 126.40, 126.27, 125.47, 120.58, 111.03, 61.27, 55.37, 54.19, 44.07. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{23}O$: 327.1743, found: 327.1735. **FTIR (cm^{-1})** 3060, 3026, 2925, 2852, 1600, 1576, 1492, 1454, 1435, 1295, 1251, 1181, 1161, 1125, 1077, 1057, 1028, 992, 868, 751, 700, 668, 563, 493.

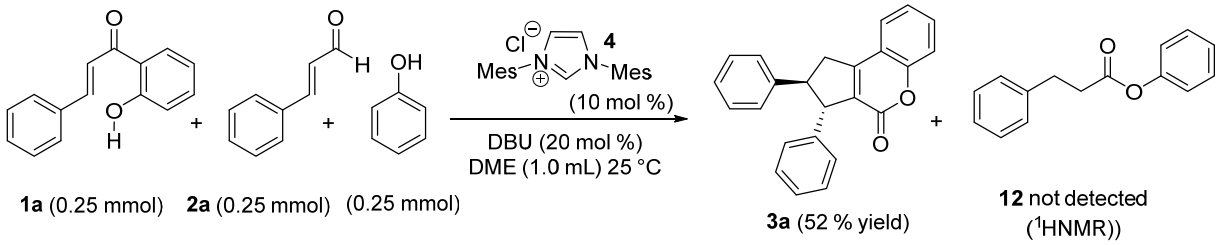
*This experiment reveals that in the absence of free OH group at the 2'-position of chalcone, the reaction does not proceed at all. However the reaction leads to the formation of cyclopentene derivative **11** at 45 °C without the formation of the functionalized coumarin **3a**.*

4-(2-Methoxyphenyl)cyclopent-3-ene-1,2-diyl)dibenzene (11)



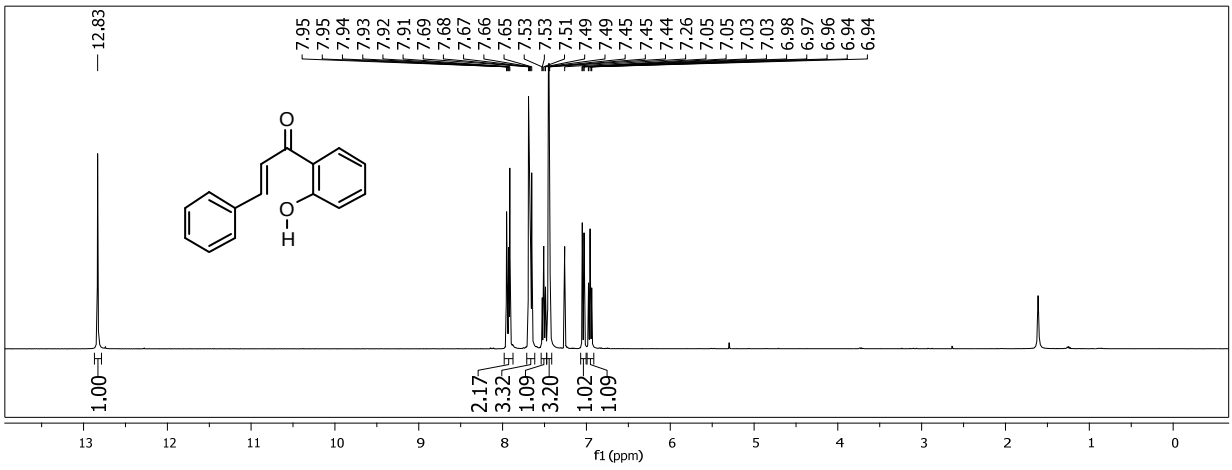


b) Reaction Carried out in the Presence of Phenol



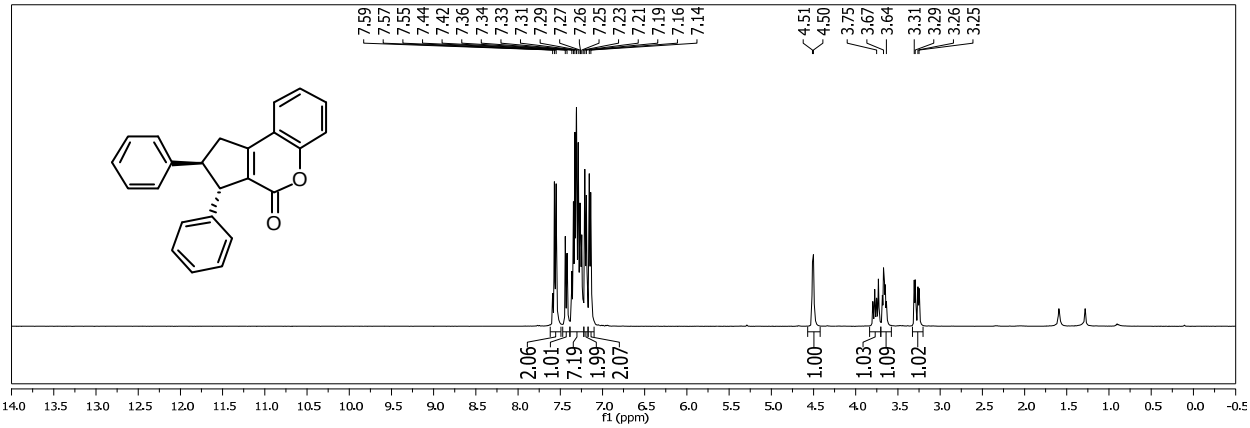
To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol), (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol) and phenol (23.6 mg, 0.25 mmol) was added. Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the *trans* cinnamaldehyde **2a** (33 mg, 31 µL, 0.25 mmol) followed by DBU (7.6 mg, 7.5 µL, 0.05 mmol). After 12 hour stirring the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 µL, 0.25 mmol) as the internal standard. ^{1}H NMR analaysis shows that the crude mixture contains 52% product, 33% unreacted hydroxyl chalcone **1a,** and 30% unreacted *trans* cinnamaldehyde **2a**, but there is no detectable amounts of phenyl 3-phenylpropanoate **12**.[3]

^{1}H-NMR Spectrum of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)

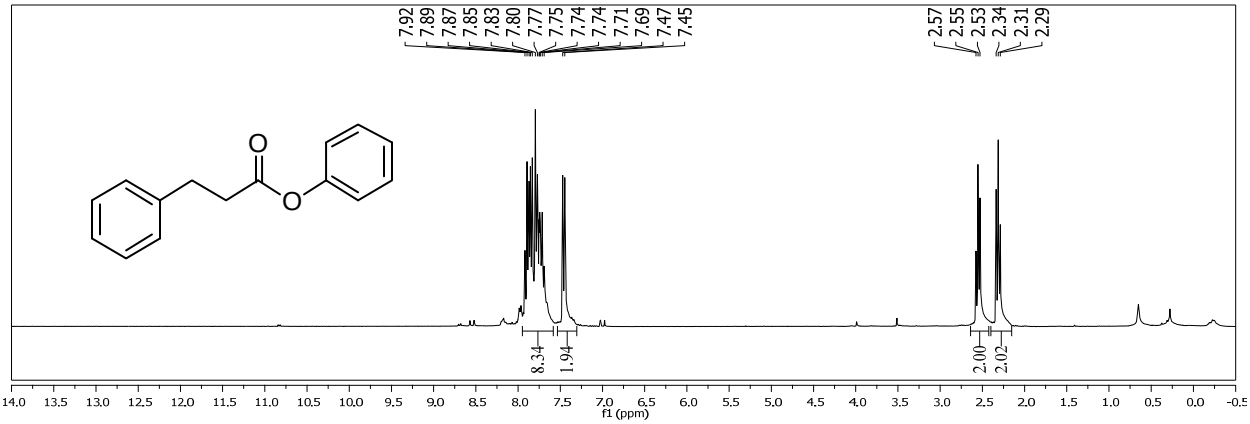


[3] Chan, A.; Scheidt, K. A. *Org. Lett.* **2004**, *7*, 905.

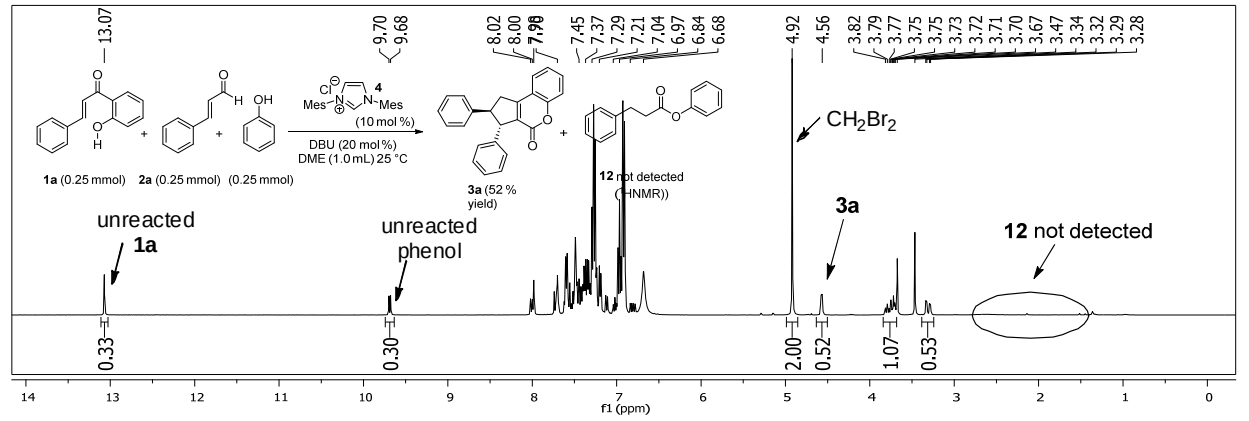
^{1}H-NMR Spectrum of 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one (3a)



^{1}H-NMR of phenyl 3-phenylpropanoate (12)

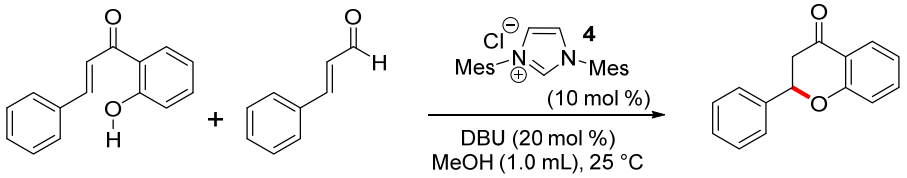


^{1}H-NMR of Crude Reaction Mixture after 12 h ($CDCl_3$)



*This result tends to indicate that the proton transfer events are intramolecular (Scheme 4 of manuscript) and the nucleophilic attack of homoenolate equivalent **A** onto 2'-hydroxy chalcone is more important than its protonation (leading to redox-esterification product).*

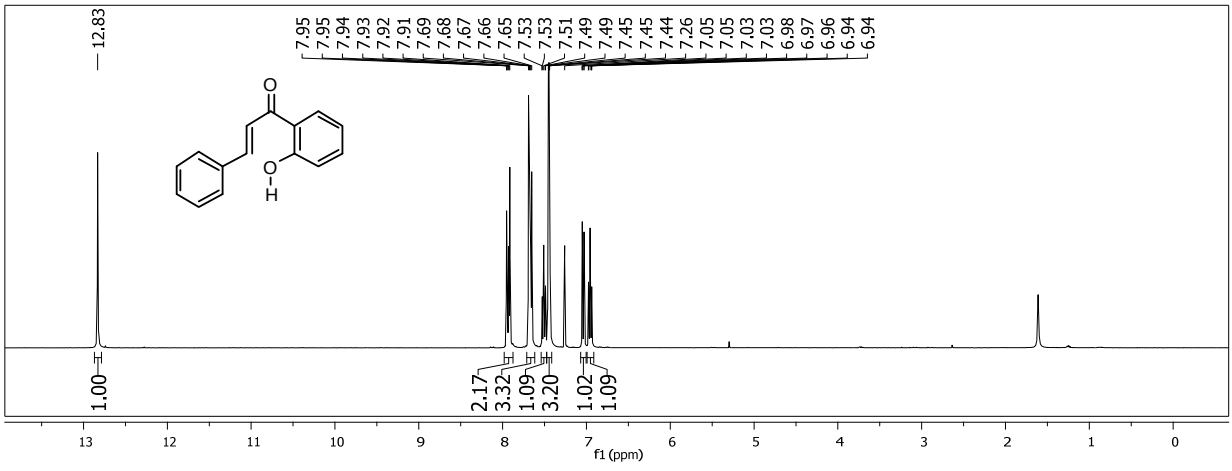
c) Reaction Employing Methanol as a Solvent



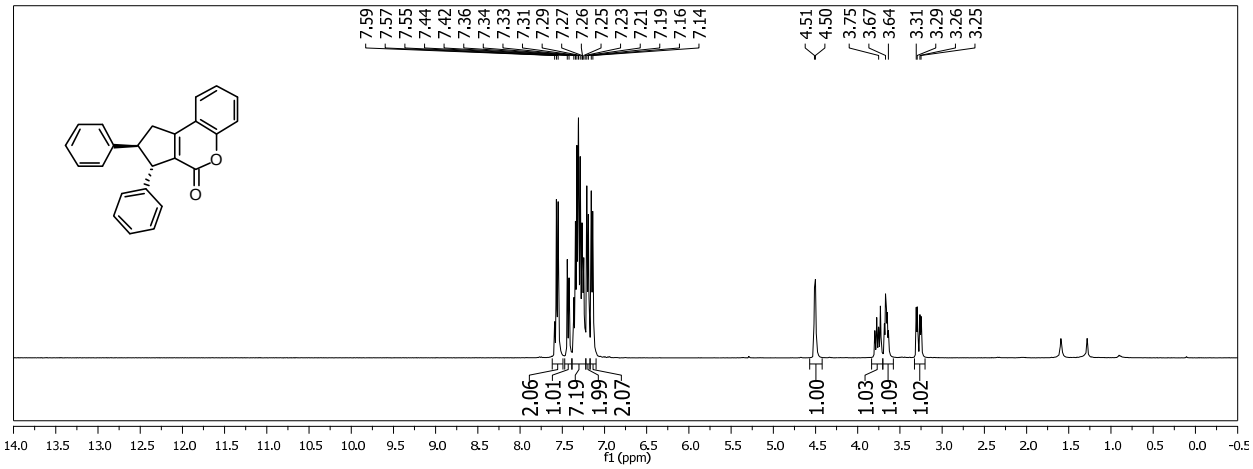
1a (0.25 mmol) **2a** (0.25 mmol) **9** (58%)

To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol) and (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in MeOH (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the *trans* cinnamaldehyde **2a** (33 mg, 31 µL, 0.25 mmol) followed by DBU (7.6 mg, 7.5 µL, 0.05 mmol). After 12 hour stirring, the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 µL, 0.25 mmol) as the internal standard. ^{1}H NMR analysis shows that the crude mixture contains 58% of 2-phenylchroman-4-one **9**.

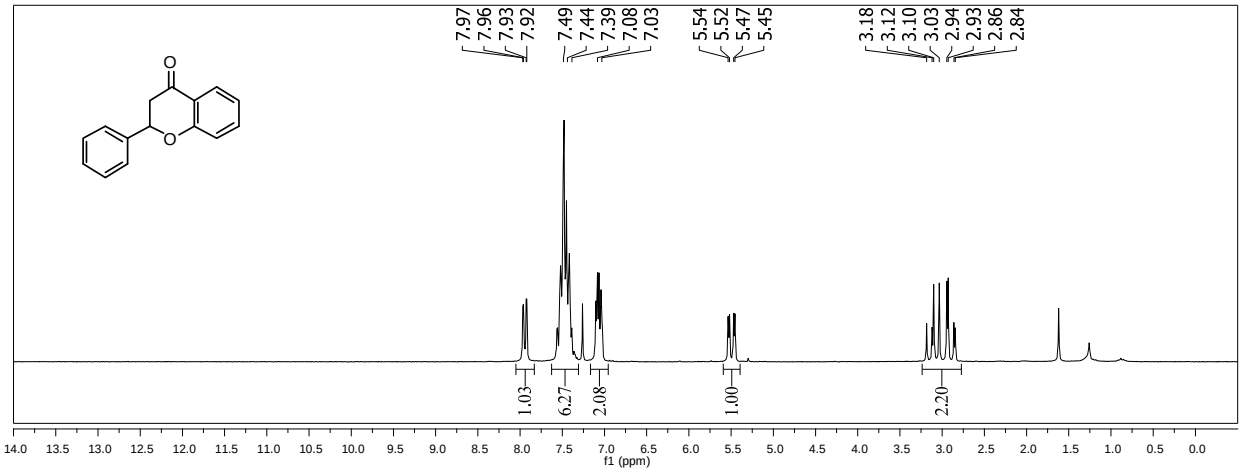
^{1}H-NMR Spectrum of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)



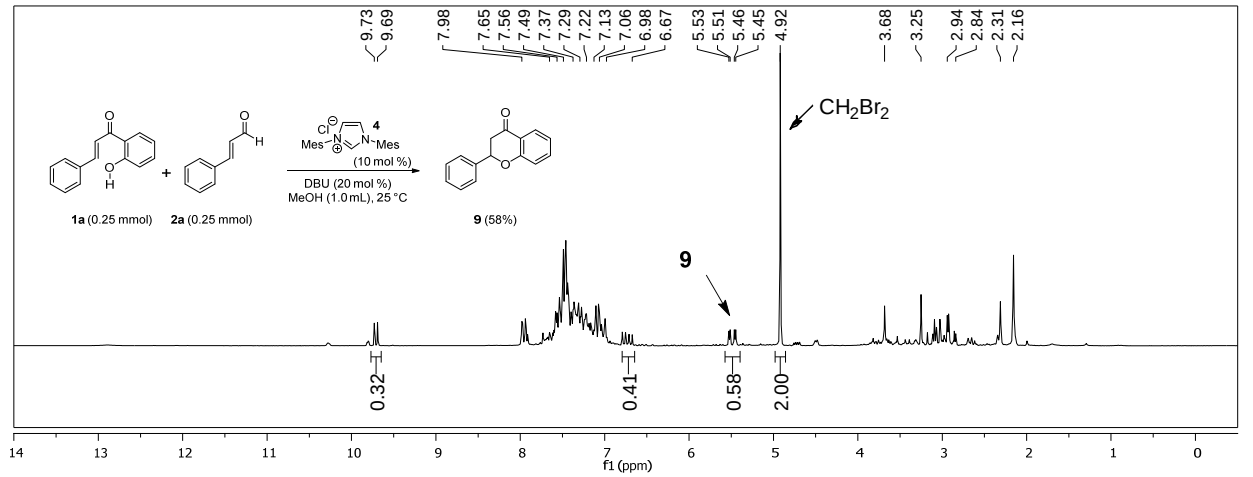
^{1}H-NMR Spectrum of 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one (3a)



^{1}H-NMR Spectrum of 2-phenylchroman-4-one (9)

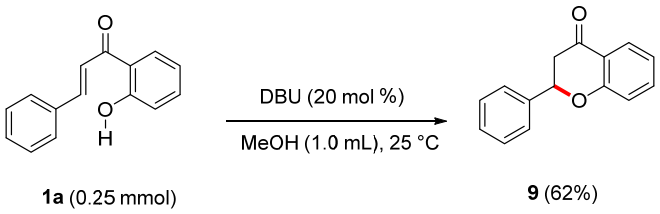


^{1}H-NMR of Crude Reaction Mixture after 12 h ($CDCl_3$)



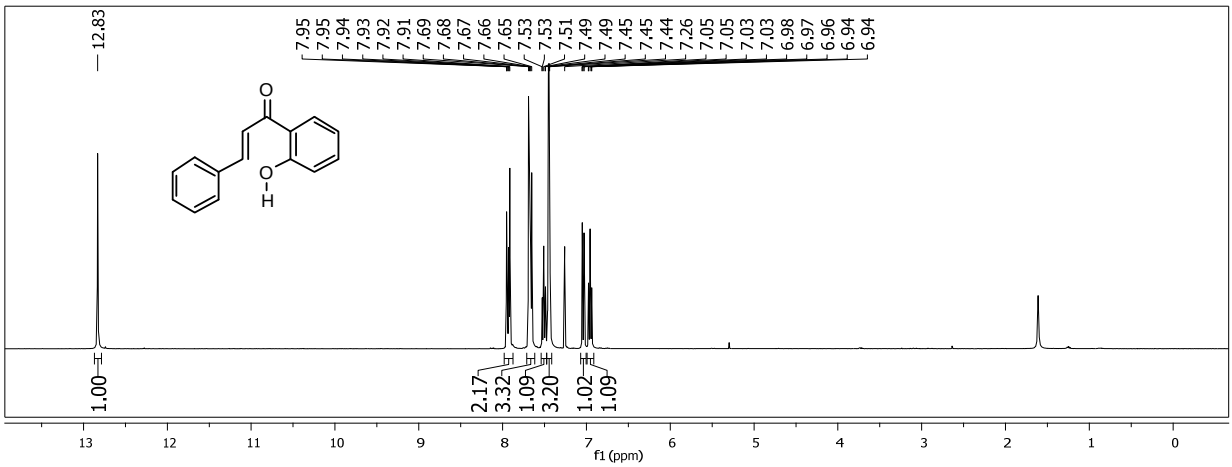
d) Blank reaction in Methanol as a Solvent and DBU as a catalyst

To a flame-dried screw-capped test tube equipped with a magnetic stir bar was (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in MeOH (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added DBU (7.6 mg, 7.5 µL, 0.05 mmol). After 12 hour stirring the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^1H NMR using CH_2Br_2 (18.0 µL, 0.25 mmol) as the internal standard. ^1H NMR analaysis shows that the crude mixture contains 62% 2-phenylchroman-4-one **9**.

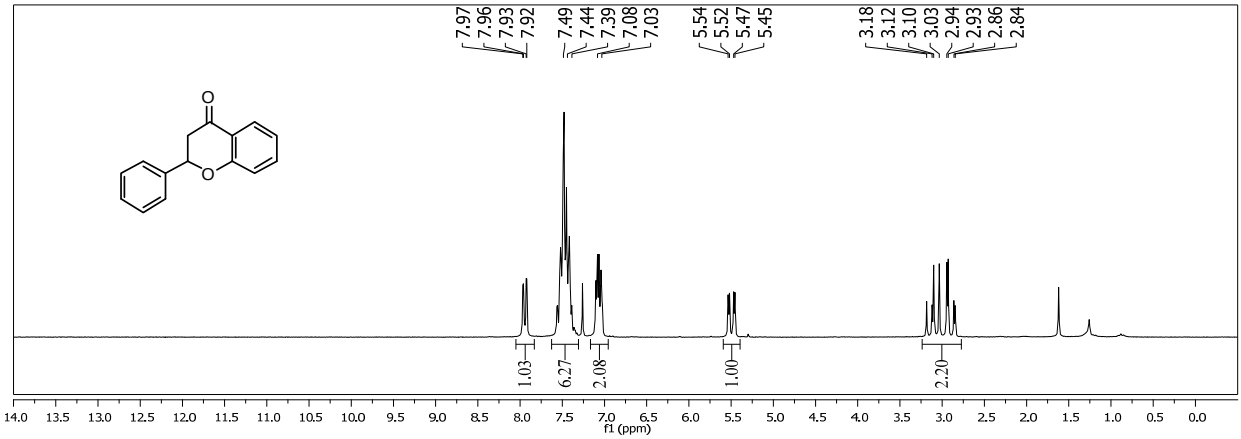


*This indicates that in methanol as solvent, **1a** undergoes intramolecular cyclization catalyzed by DBU leading to the formation of **9**.*

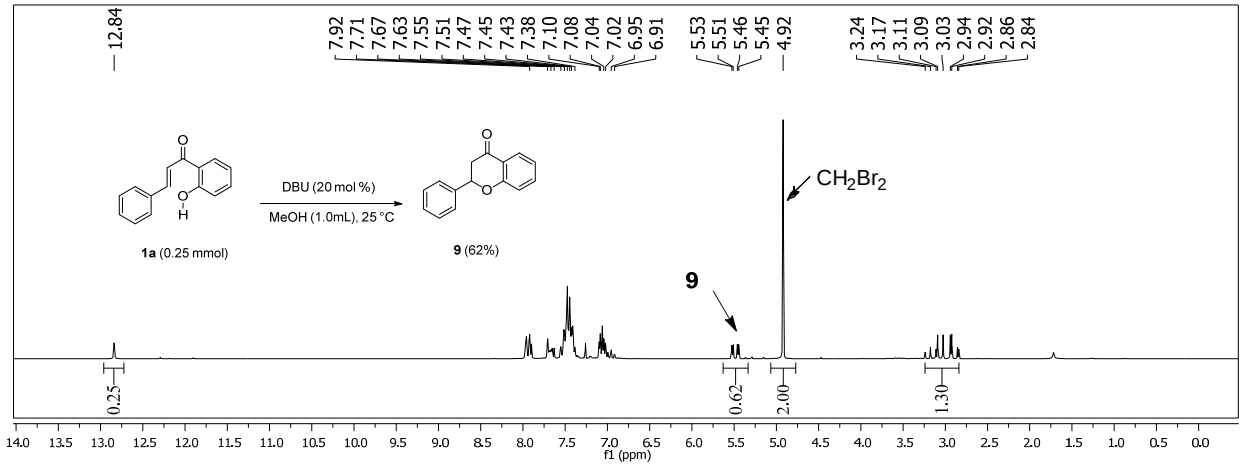
^{1}H-NMR Spectrum of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)



^{1}H-NMR Spectrum of 2-phenylchroman-4-one (9)

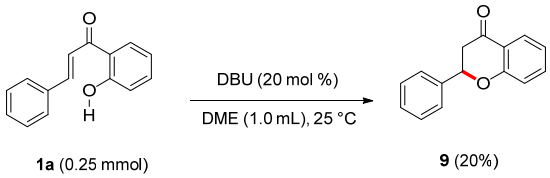


^{1}H-NMR of Crude Reaction Mixture after 12 h ($CDCl_3$)

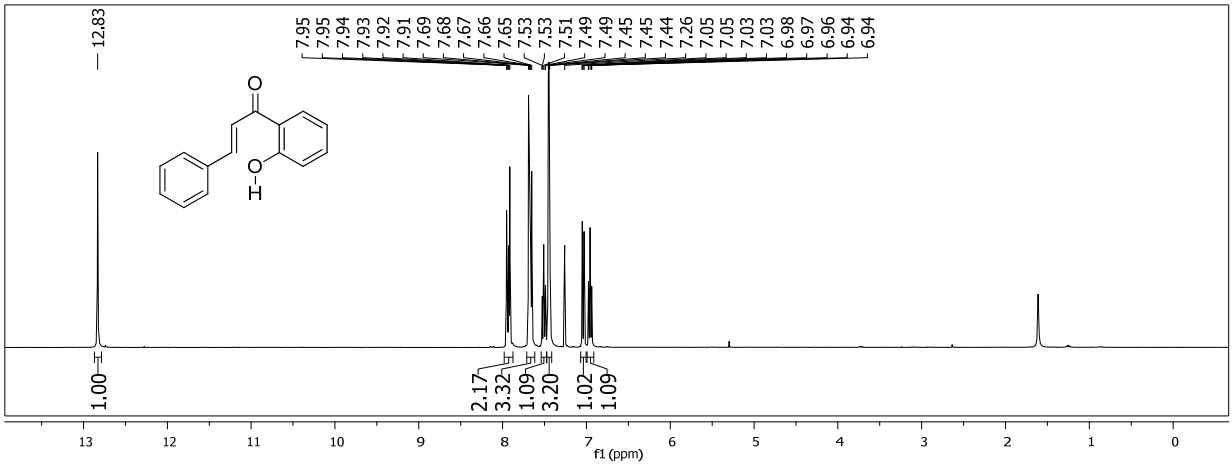


e) Blank reaction in DME as a Solvent

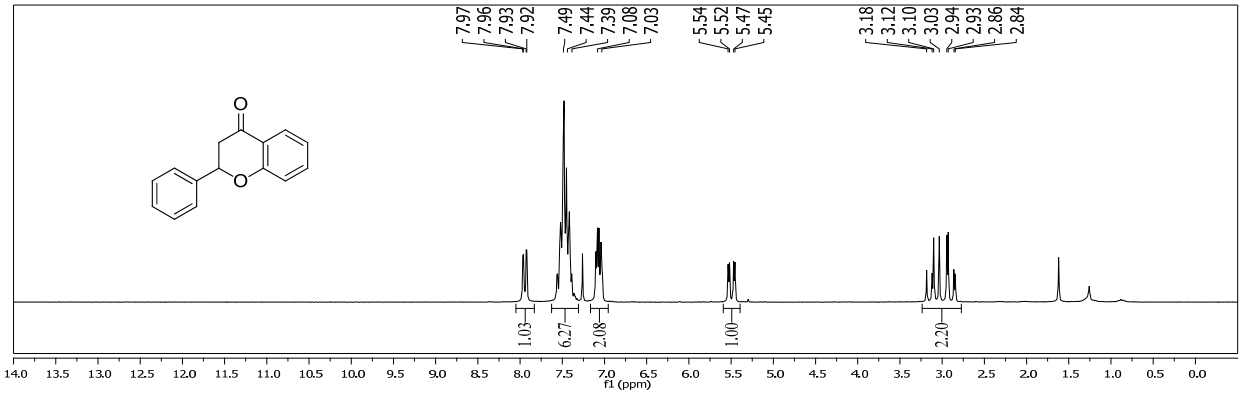
To a flame-dried screw-capped test tube equipped with a magnetic stir bar was (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added DBU (7.6 mg, 7.5 µL, 0.05 mmol). After 12 hour stirring the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 µL, 0.25 mmol) as the internal standard. ^{1}H NMR study shows that the crude mixture contains 20% 2-phenylchroman-4-one.



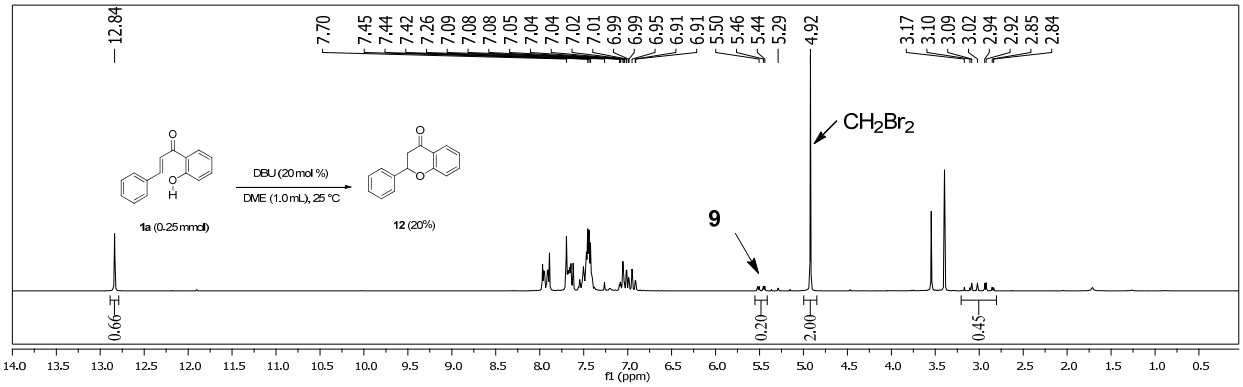
^{1}H-NMR Spectrum of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)



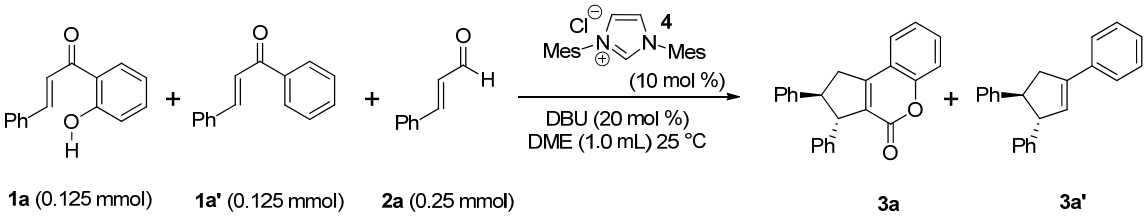
^{1}H-NMR Spectrum of 2-phenylchroman-4-one (9)



^{1}H-NMR of Crude Reaction Mixture after 12 h ($CDCl_3$)



f) Competition Experiments Between 2'-Hydroxy Chalcone (1a) and Chalcone (1a')



entry	Time (min)	Yield of **3a** (%)	Yield of **3a'** (%)
1	5	46	not detected
2	10	60	not detected
3	15	76	~1
4	30	90	10
5	45	98	14
6	60	>99	24
7	120	>99	48

The yields were determined by ^{1}H-NMR analysis of crude products using CH_2Br_2 as the internal standard.

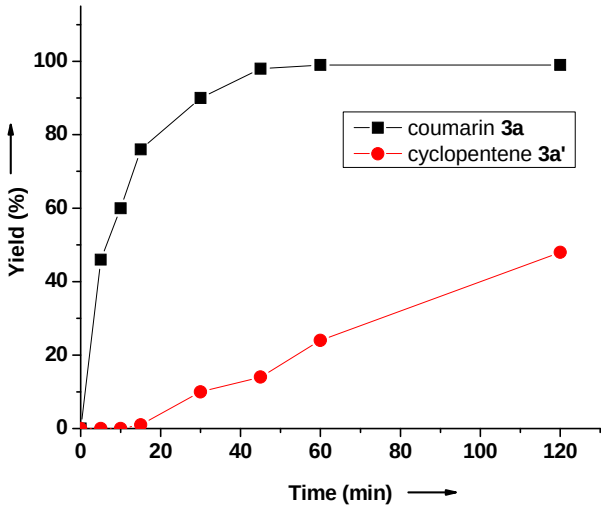
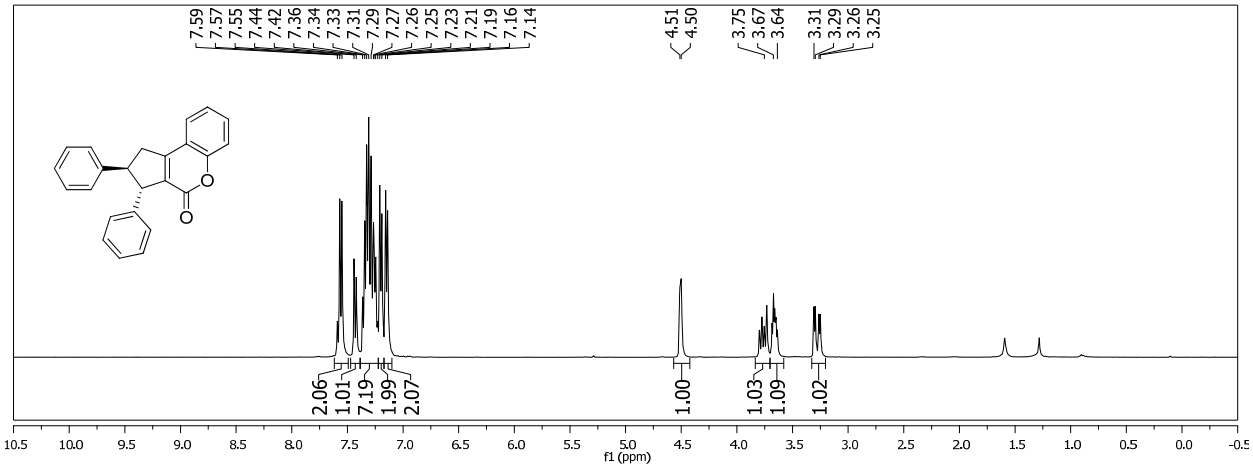


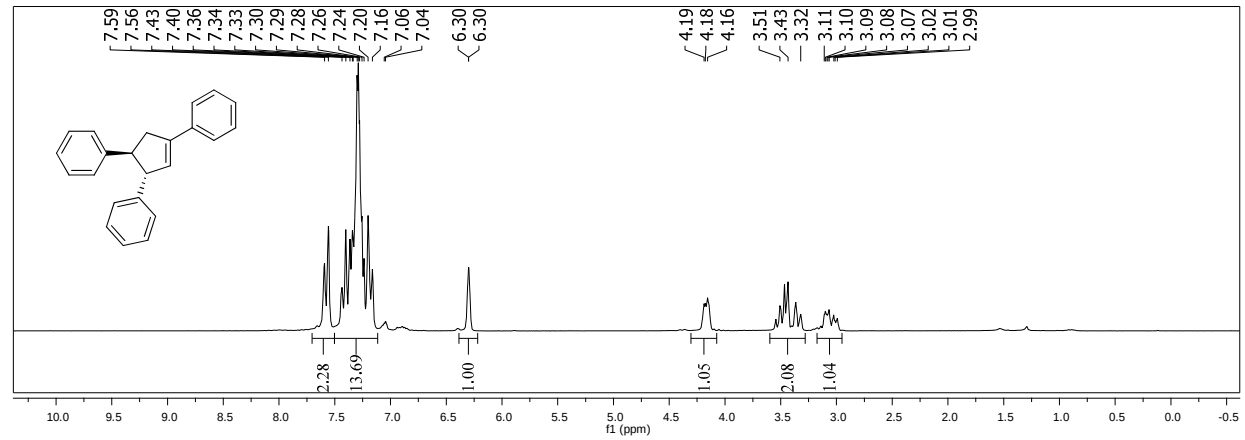
Figure 1. Intermolecular competition experiments between 2'-hydroxy chalcone **1a** and chalcone **1a'**

Seven reactions were carried out parallel. To each of the flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol) (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (28 mg, 0.125 mmol) and (*E*)-chalcone **1a'** (26 mg, 0.125 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the *trans* cinnamaldehyde **2a** (33 mg, 31 μL, 0.25 mmol) followed by DBU (7.6 mg, 7.5 μL, 0.05 mmol). After 5 minutes stirring the reaction is quenched and the mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 μL, 0.25 mmol) as the internal standard. The same procedure is followed for other six reactions and they were quenched at 10 min, 15 min, 30 min, 45 min, 60 min, and 120 min respectively.

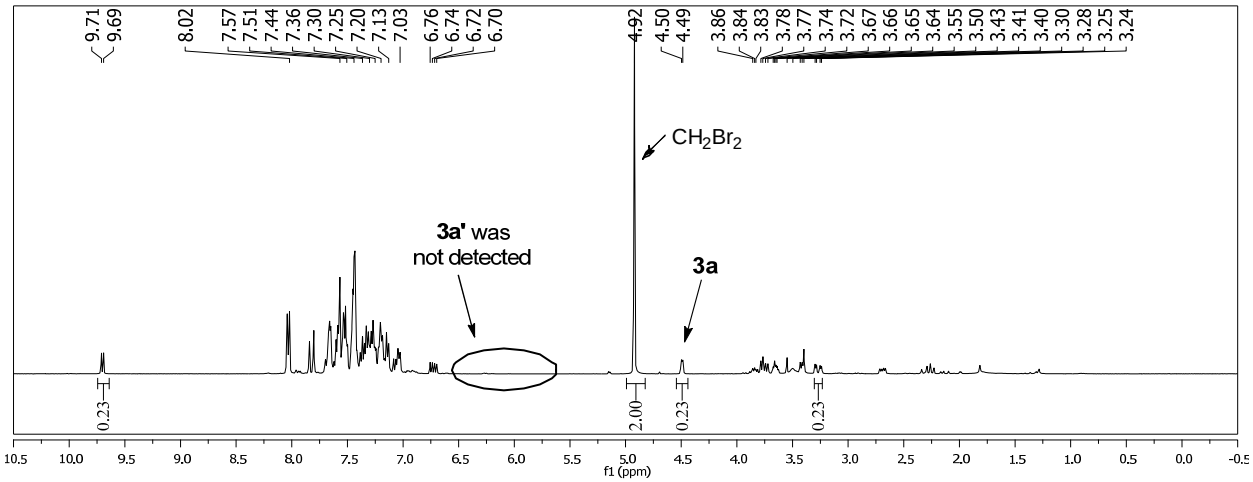
^{1}H-NMR Spectrum of 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one (3a)



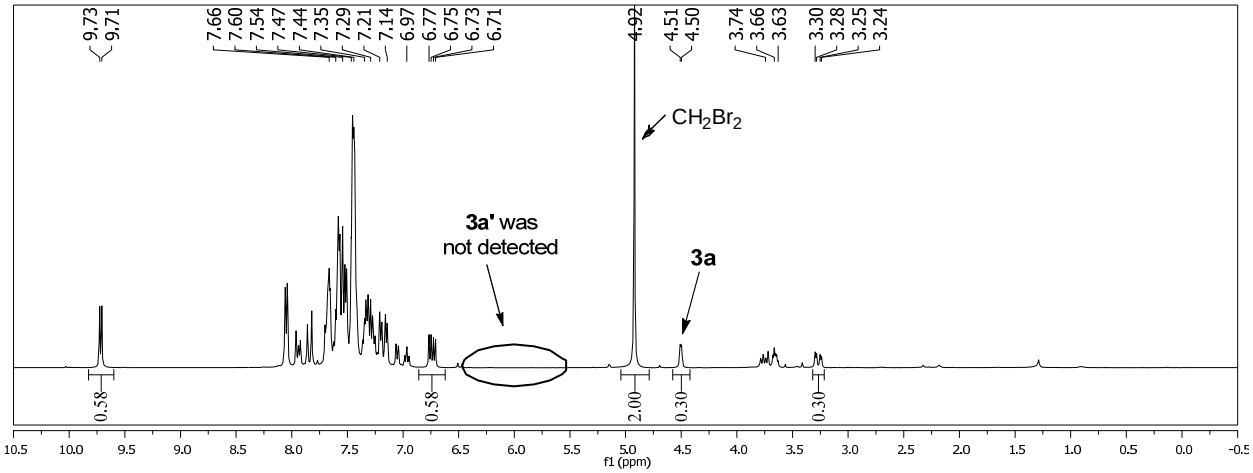
^{1}H-NMR Spectrum of cyclopent-3-ene-1,2,4-triyltribenzene (3a')



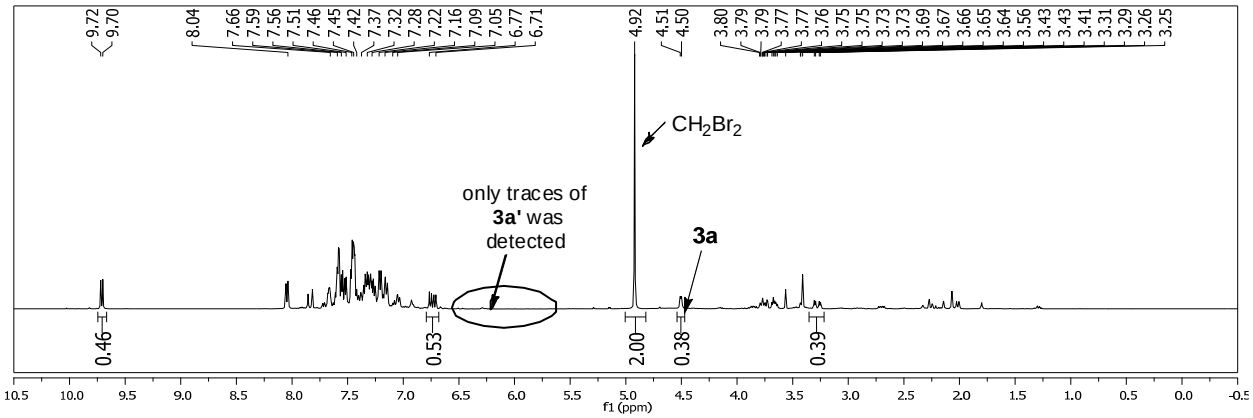
^{1}H-NMR of Crude Reaction Mixture after 5 minutes ($CDCl_3$)



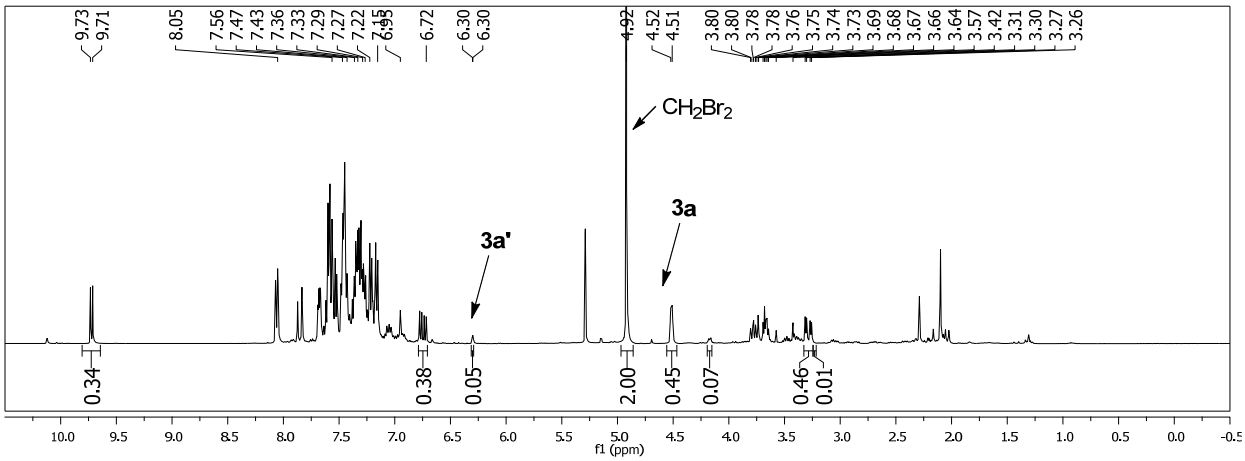
^{1}H-NMR of Crude Reaction Mixture after 10 minutes ($CDCl_3$)



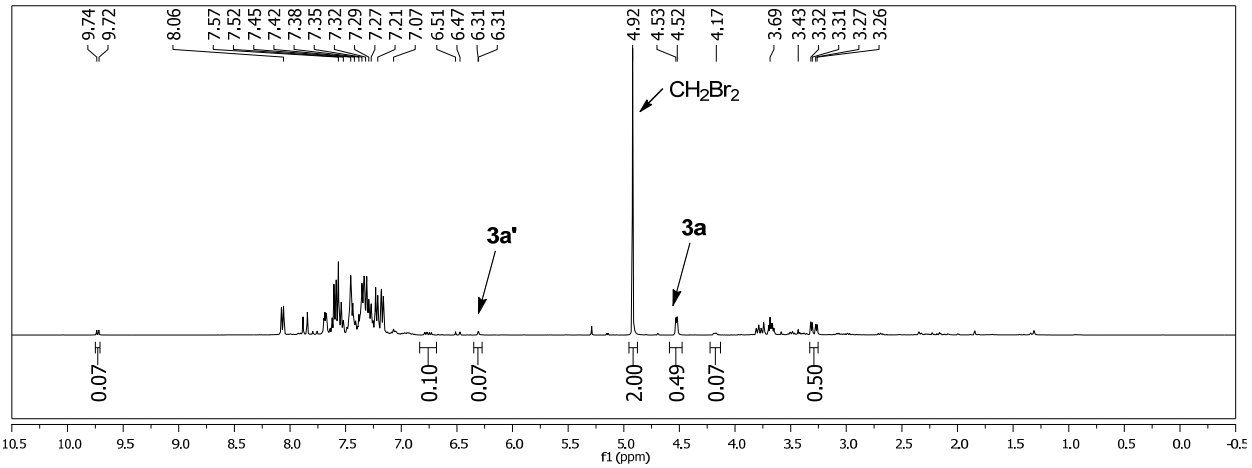
^{1}H-NMR of Crude Reaction Mixture after 15 minutes ($CDCl_3$)



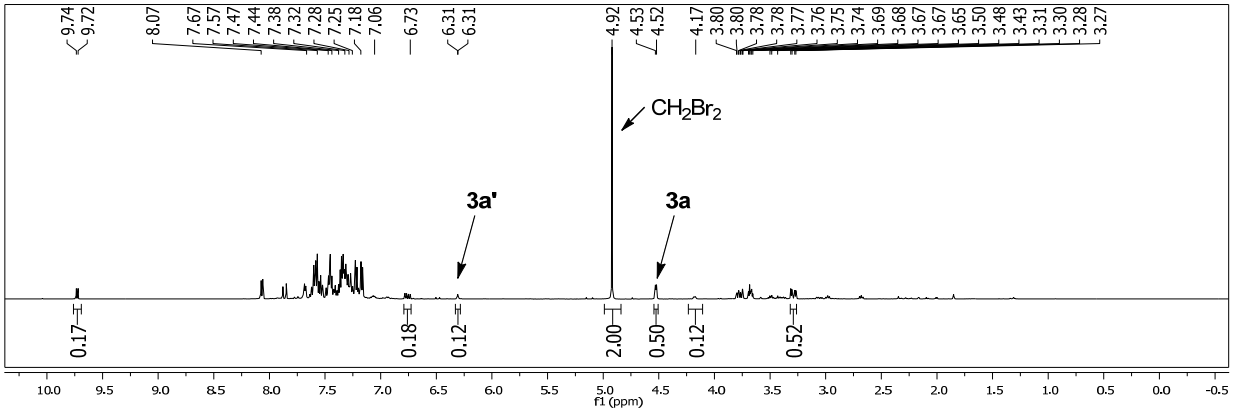
^{1}H-NMR of Crude Reaction Mixture after 30 minutes ($CDCl_3$)



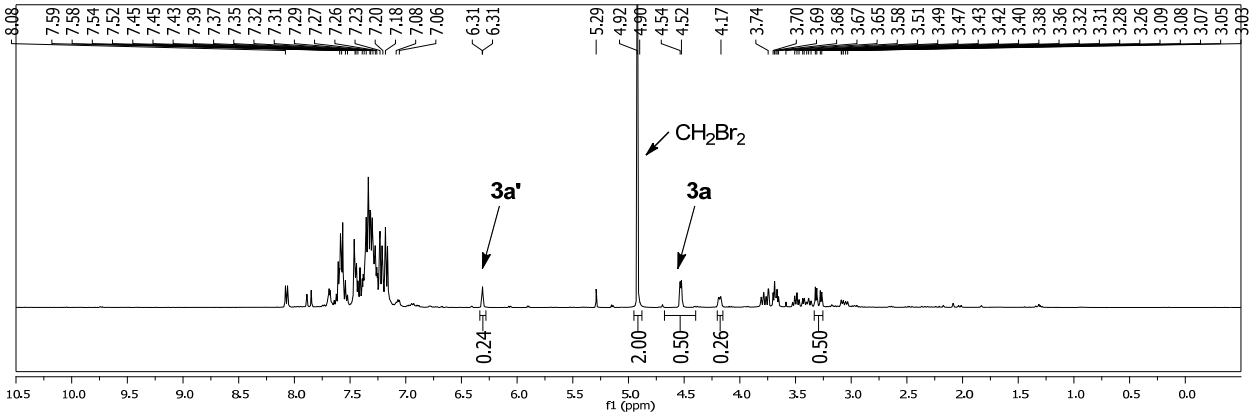
^{1}H-NMR of Crude Reaction Mixture after 45 minutes ($CDCl_3$)



H-NMR of Crude Reaction Mixture after 60 minutes ($CDCl_3$)

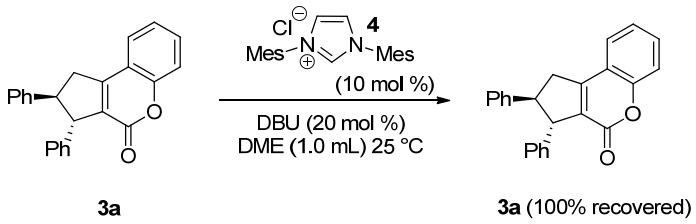


^{1}H-NMR of Crude Reaction Mixture after 120 minutes ($CDCl_3$)



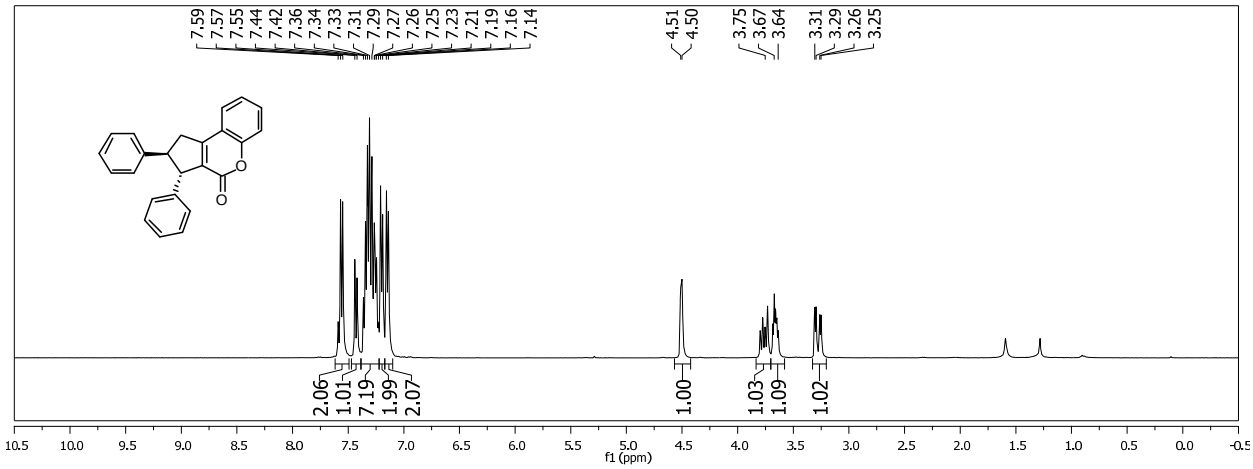
*It is interesting to note, that the formation of **3a** proceeds first and the formation of cyclopentene **3a'** begins when most of **1a** has been consumed. Thus, it is reasonable to assume that the thermodynamically more feasible δ-lactonization proceeds over the β-lactonization.*

g) Test for Product Stability

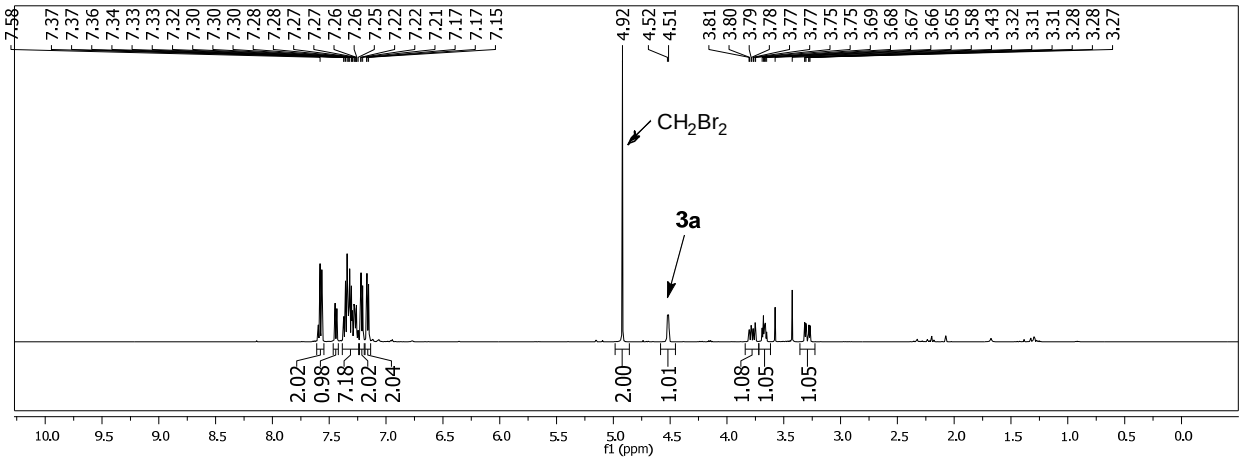


To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol) and 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one **3a** (84.6 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture, DBU (7.6 mg, 7.5 μL, 0.05 mmol) was added. After 12 hour stirring the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^{1}H NMR using CH_2Br_2 (18.0 μL, 0.25 mmol) as the internal standard.

^{1}H-NMR Spectrum of 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one (3a)



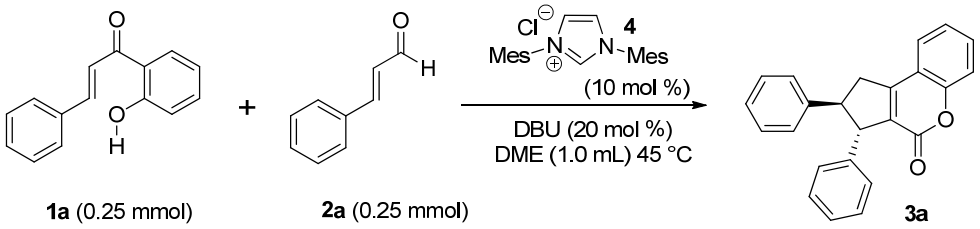
^{1}H-NMR of Crude Reaction Mixture after 12 hour ($CDCl_3$)



h) Kinetics Study of the Reaction

To a flame-dried screw-capped test tube equipped with a magnetic stir bar was added the imidazolium salt **4** (8.5 mg, 0.025 mmol) and (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (56 mg, 0.25 mmol). Then the screw-capped tube was evacuated and backfilled with argon. The mixture was dissolved in DME (1.0 mL) under argon atmosphere. The resultant reaction mixture was kept stirring at 25 °C. To this mixture was added the *trans* cinnamaldehyde **2a** (33 mg, 31 µL, 0.25 mmol) followed by DBU (7.6 mg, 7.5 µL, 0.05 mmol). After 15 minutes stirring the reaction mixture was diluted with CH_2Cl_2 (2.0 mL) and filtered through a short pad of silica

gel and eluted with CH_2Cl_2 (10 mL). The solvent was evaporated to obtain the crude product, which was analyzed using ^1H NMR using CH_2Br_2 (18.0 μL, 0.25 mmol) as the internal standard. Similar procedure followed for other three reactions, which were analyzed after 30 min, 45 min, and 60 min respectively.



entry	Time (min)	Yield of **3a** (%)
1	15	11
2	30	25
3	45	43
4	60	50

The yields were determined by ^1H-NMR analysis of crude products using CH_2Br_2 as the internal standard.

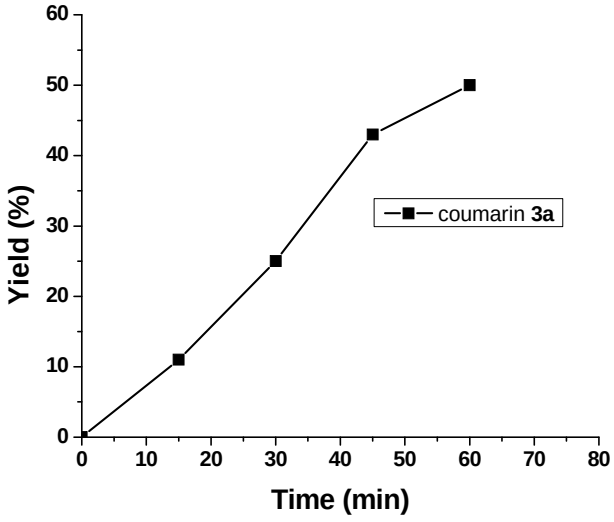
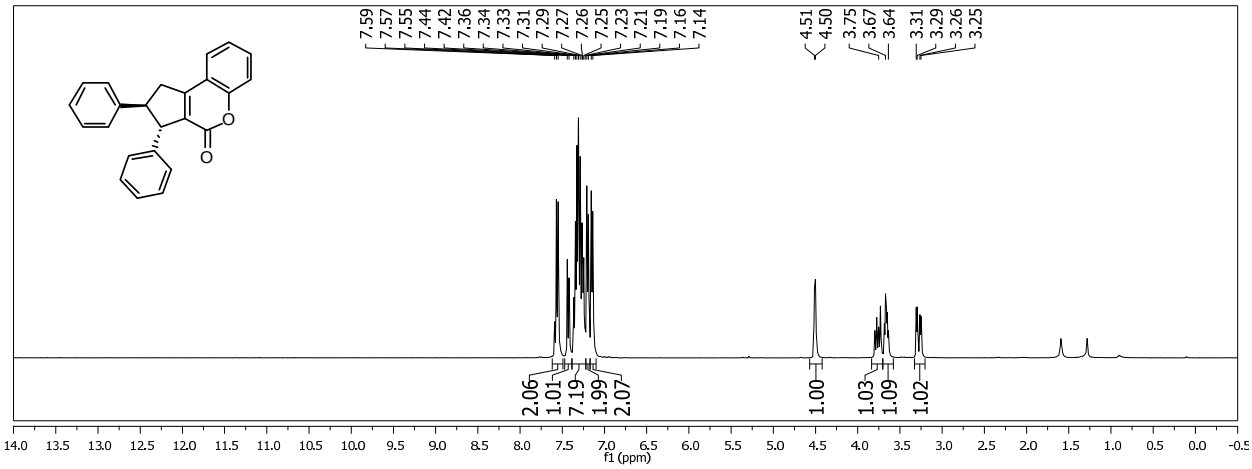
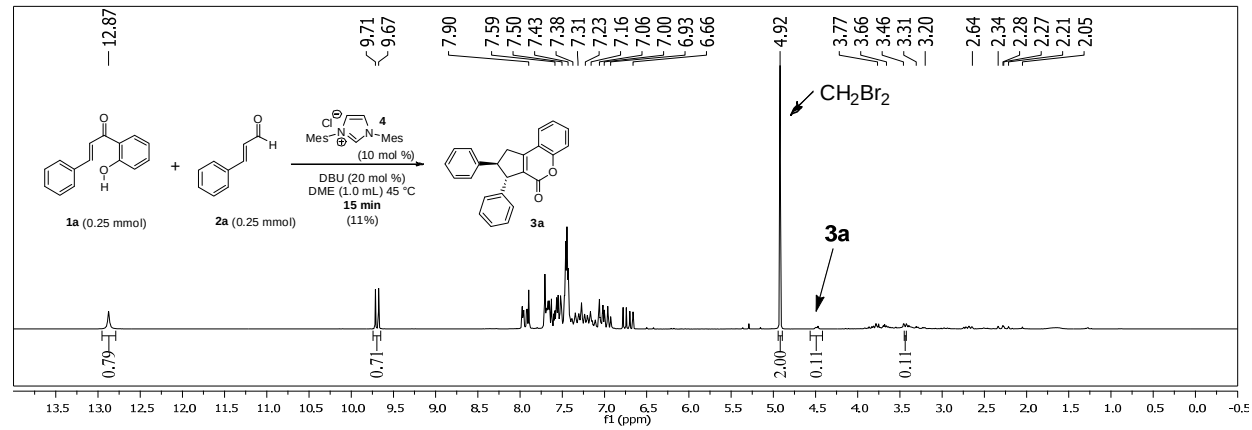


Figure 2. Kinetics study

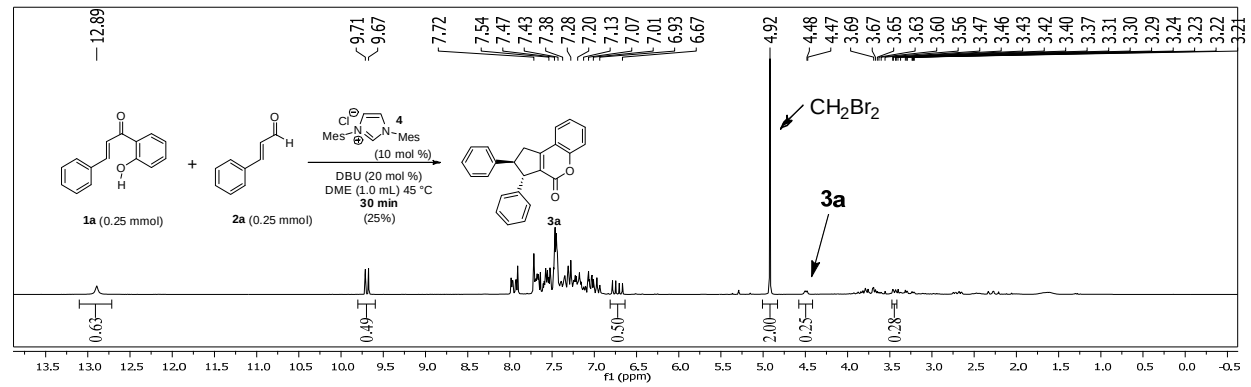
^{1}H-NMR Spectrum of 2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1H)-one (3a)



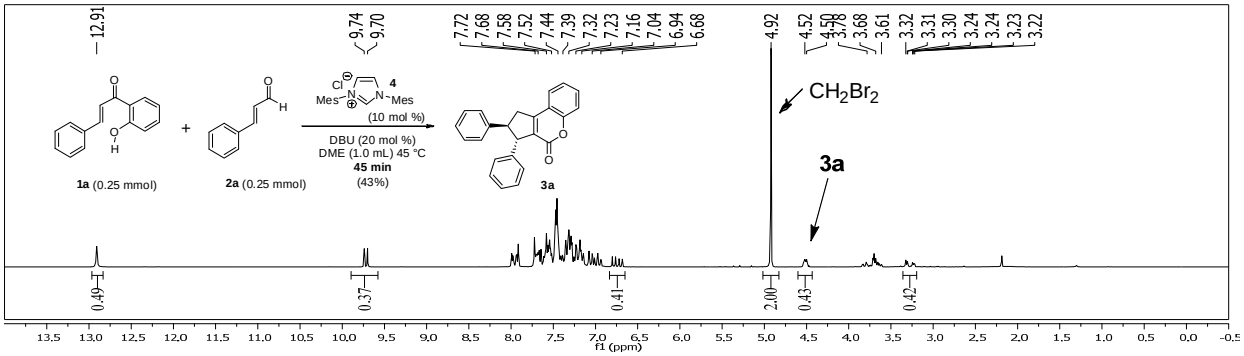
^{1}H-NMR of Crude Reaction Mixture after 15 minutes ($CDCl_3$)



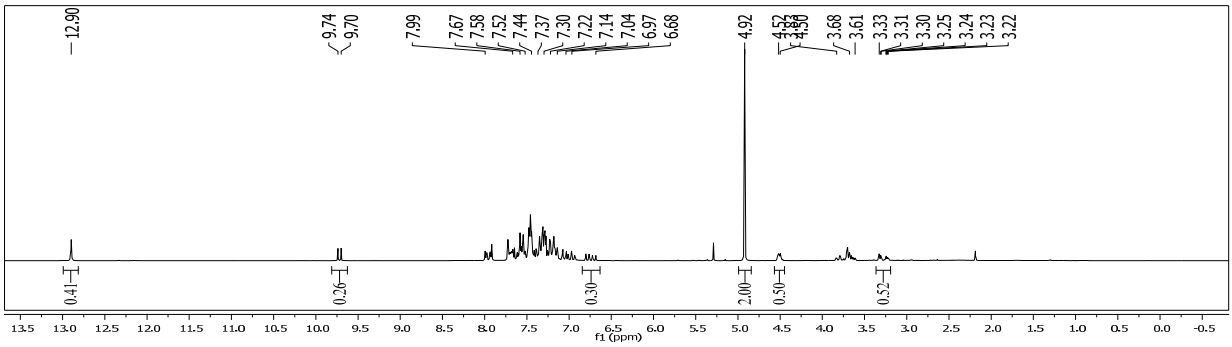
^{1}H-NMR of Crude Reaction Mixture after 30 minutes ($CDCl_3$



^{1}H-NMR of Crude Reaction Mixture after 45 minutes ($CDCl_3$)

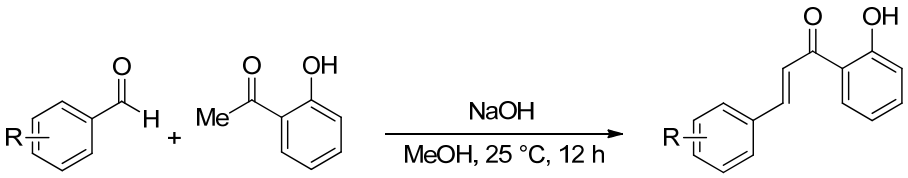


^{1}H-NMR of Crude Reaction Mixture after 60 minutes ($CDCl_3$)

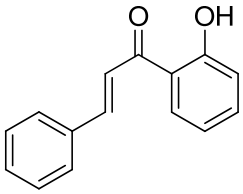


6. Synthesis and Characterization of 2'-Hydroxy Chalcones

The 2'-hydroxy chalcones used in the present study were prepared following the procedure by Bai and coworkers.[4]



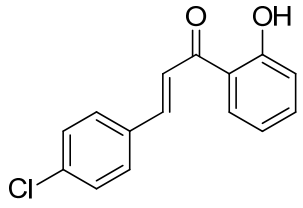
(*E*)-1-(2-Hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)



Following the known procedure, 1-(2-hydroxyphenyl)ethanone (1.36 g, 1.2 mL, 10.0 mmol) and benzaldehyde (1.06 g, 1.01 mL, 10 mmol) were treated with NaOH (10.0 g, in 20 mL water) in methanol (50.0 mL) at 25 °C for 12 h. The reaction mixture was poured into ice cold water and was subsequently neutralized with dropwise addition of Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** as a crystalline yellow solid (1.58 g, 70%).

***R*$_f$** (Pet. ether/EtOAc = 80/20): 0.80; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.83 (s, 1H, OH), 7.95-7.91 (m, 2H, H$_{ar}$), 7.69-7.65 (m, 3H, H$_{ar}$), 7.53-7.49 (m, 1H, H$_{ar}$), 7.45-7.44 (m, 3H, H$_{ar}$), 7.04 (d, *J* = 8.5 Hz, 1H, H$_{ar}$), 6.96 (t, *J* = 7.1 Hz, 1H, H$_{ar}$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.88, 163.73, 145.63, 136.57, 134.71, 131.09, 129.80, 129.19, 128.81, 120.22, 119.01, 118.78. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{13}O_2$: 225.0910, found: 225.0909. **FTIR (cm^{-1})** 3057, 2925, 1638, 1487, 1440, 1487, 1366, 1340, 1308, 1268, 1235, 1206, 1154, 1030, 1020, 999, 864, 837, 778, 754, 740, 694, 665, 578, 478.

(*E*)-3-(4-Chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1b)



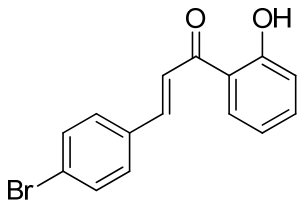
Following the known procedure, 1-(2-hydroxyphenyl) ethanone (1.36 g, 1.2 mL, 10.0 mmol) and 4-chlorobenzaldehyde (1.40 g, 10 mmol) were treated with NaOH (10 g, in 20 mL water) in methanol (50.0 mL) at 25 °C for 12 h. The reaction mixture was poured into ice cold water

[4] Liu, B.; Wang, H.; Wang, T.; Bao, Y.; Du, F.; Tian, J.; Li, Q.; Bai, R. *Chem. Commun*. **2012,** *48*, 2867.

and was subsequently neutralized with dropwise addition of Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-3-(4-chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1b** as a crystalline yellow solid (1.61 g, 62%).

R_f (Pet. ether /EtOAc = 80/20): 0.73; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.76 (s, 1H, OH), 7.92-7.84 (m, 2H, H_{ar}), 7.65-7.59 (m, 3H, H_{ar}), 7.53-7.49 (m, 1H, H_{ar}), 7.41 (d, *J* = 8.5 Hz, 2H, H_{ar}), 7.04 (d, *J* = 8.5 Hz, 1H, H_{ar}), 6.95 (t, *J* = 8.1 Hz, 1H, H_{ar}). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.52, 163.70, 144.00, 136.94, 136.65, 133.14, 129.88, 129.71, 129.42, 120.59, 119.99, 119.01, 118.76. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{12}O_2Cl$: 259.0520, found: 259.0521. **FTIR (cm^{-1})** 2298, 1644, 1579, 1486, 14440, 1406, 1369, 1342, 1301, 1262, 1205, 1091, 1011, 984, 862, 819, 785, 754, 646, 488.

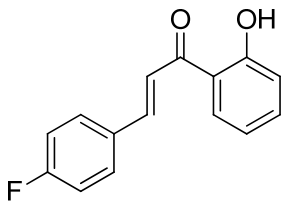
(*E*)-3-(4-Bromophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1c)



Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 4-bromobenzaldehyde (0.925 g, 5.0 mmol) were treated with NaOH (5 g, in 10 mL water) in methanol (25.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralized with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-3-(4-bromophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1c** as a crystalline yellow solid (0.8 g, 65%).

R_f (Pet. ether /EtOAc = 80/20): 0.81. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.75 (s, 1H, OH), 7.91-7.89 (m, 1H, H_{ar}), 7.84 (d, *J* = 15.4 Hz, 1H, H_{ar}), 7.63 (d, *J* = 15.5 Hz, 1H, H_{ar}), 7.58-7.49 (m, 5H, H_{ar}), 7.03 (d, *J* = 8.4 Hz, 1H, H_{ar}), 6.95 (t, *J* = 8.0 Hz, 1H, H_{ar}). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.57, 163.74, 144.12, 136.71, 133.60, 132.43, 130.10, 129.74, 125.40, 120.75, 120.02, 119.05, 118.82. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{12}O_2Br$: 304.9986, found: 304.9986. **FTIR(cm^{-1})** 2985, 2113, 1645, 1575, 1486, 1439, 1401, 1370, 1339, 1265, 1206, 1179, 1150, 107 0, 1023, 1007, 982, 816, 781, 754, 669.

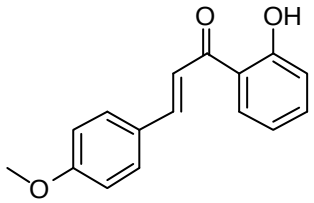
(*E*)-3-(4-Fluorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1d)



Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 4-fluorobenzaldehyde (0.62 g, 0.53 mL, 5 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralized with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-3-(4-fluorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1d** as a crystalline yellow solid (0.666 g, 70%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.72 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.75 (s, 1H, OH), 7.93-7.89 (m, 1H, H_{ar}), 7.84 (d, *J* = 15.4 Hz, 1H, H_{ar}), 7.63 (d, *J* = 15.5 Hz, 1H, H_{ar}), 7.59-7.49 (m, 5H, H_{ar}), 7.04 (d, *J* = 8.4 Hz, 1H, H_{ar}), 6.96 (t, *J* = 8.0 Hz, 1H, H_{ar}). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.63, 165.40, 163.72, 163.39, 144.24, 136.59, 130.98 (d, $J_{C\text{-}F}$ = 3.2 Hz), 130.73 (d, $J_{C\text{-}F}$ = 8.6 Hz), 120.05, 119.91, 118.79 (d, $J_{C\text{-}F}$ = 26.7 Hz), 117.67, 116.37 (d, $J_{C\text{-}F}$ = 22.0 Hz), 114.63. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{12}O_2F$: 243.0816, found: 243.0813. **FTIR(cm^1)** 3019, 2106, 1637, 1578, 1491, 1442, 1366, 1340, 1299, 1204, 1156, 1022, 984, 868, 827, 762, 749, 660.

(*E*)-1-(2-Hydroxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-one (1e)

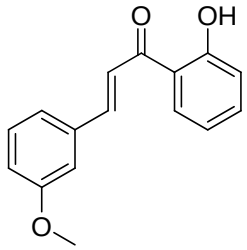


Following the known procedure, 1-(2-hydroxyphenyl) ethanone (1.36 g, 1.2 mL, 10.0 mmol) and 4-methoxybenzaldehyde (1.36 g, 1.22 mL, 10 mmol) were treated with NaOH (10 g, in 20 mL water) in methanol (50.0 mL) at 25 °C for 12 hr, followed by pouring the reaction mixture into ice cold water and made neutralized with Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-one **1e** as a crystalline yellow solid (1.65 g, 65%)

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.7 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.97 (s, 1H, OH), 7.92-7.87 (m, 2H, H_{ar}), 7.61 (d, *J* = 8.7 Hz, 2H, H_{ar}), 7.54-7.46 (m, 2H, H_{ar}), 7.02 (d, *J* = 8.4 Hz, 1H, H_{ar}), 6.95-6.91 (m, 3H, H_{ar}), 3.85 (s, 3H, CH_3). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.74, 163.63, 162.11, 145.45, 136.24, 130.66, 129.64, 127.39, 120.19, 118.66, 118.65, 117.60, 114.60, 55.53. **HRMS** calculated $[M+H]^+$ for $C_{16}H_{15}O_3$: 255.1016, found: 255.1015. **FTIR (cm^{-1})** 3262, 2843,

2205, 2053, 1699, 1637, 1605, 1583, 1511, 1442, 1489, 1424, 1343, 1303, 1258, 1204, 1174, 1157, 1128, 1114, 1024, 981, 940, 863, 829, 805, 764, 720, 660.

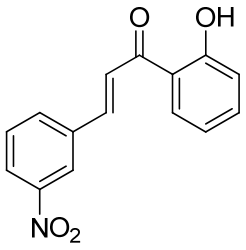
(*E*)-1-(2-Hydroxyphenyl)-3-(3-methoxyphenyl)prop-2-en-1-one (1f)



Following the known procedure, 1-(2-hydroxyphenyl) ethanone (1.36 g, 1.2 mL, 10.0 mmol) and 3-methoxybenzaldehyde (1.36 g, 1.22 mL, 10 mmol) were treated with NaOH (10 g, in 20 mL water) with methanol (50.0 mL) at 25 °C for 12 h. The reaction mixture was poured into ice cold water and was subsequently neutralized with dropwise addition of Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-(3-methoxyphenyl)prop-2-en-1-one **1f** as yellow solid (1.71 g, 67%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.7 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.92 (s, 1H, OH), 8.02-7.95 (m, 2H, H$_{ar}$), 7.72 (d, *J* = 15.5 Hz, 1H, H$_{ar}$), 7.60 (t, *J* = 8.5 Hz, 1H, H$_{ar}$), 7.45 (t, *J* = 7.6 Hz, 1H, H$_{ar}$), 7.35 (d, *J* = 7.6 Hz, 1H, H$_{ar}$), 7.26(s, 1H, H$_{ar}$), 7.14-7.02 (m, 3H, H$_{ar}$), 3.96 (s, 3H, CH$_3$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.79, 163.70, 160.08, 145.48, 136.54, 136.04, 130.14, 129.78, 121.38, 120.47, 120.09, 118.97, 118.73, 116.71, 113.83, 55.48. **HRMS** calculated [M+H]$^+$ for $C_{16}H_{15}O_3$: 255.1016, found: 255.1014. **FTIR (cm^{-1})** 3004, 2940, 2836, 1640, 1579, 1488, 1443, 1363, 1341, 1317, 1292, 1273, 1247, 1202, 1158, 1129, 1047, 1024, 978, 861, 817, 788, 757, 736, 697, 664, 594.

(*E*)-1-(2-Hydroxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one (1g)

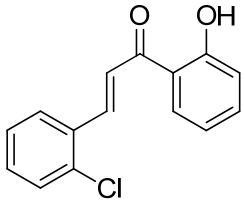


Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 3-nitrobenzaldehyde (0.756 g, 5 mmol) were treated with NaOH (5 g, in 10 mL water) in methanol (25.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one **1g** as a crystalline yellow solid (1.00 g, 77%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.70 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.62 (s, 1H, OH), 8.54, (bs, 1H, H$_{ar}$), 8.30-8.27 (m, 1H, H$_{ar}$), 7.95-7.91 (m, 3H, H$_{ar}$), 7.77 (d, *J* = 15.6 Hz, 1H, H$_{ar}$), 7.64

(t, J = 8.0 Hz, 1H, H_{ar}), 7.56-7.52 (m, 1H, H_{ar}), 7.05 (d, J = 8.3 Hz, 1H, H_{ar}), 7.01-6.97 (m, 1H, H_{ar}), **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.17, 163.84, 148.88, 142.39, 137.12, 136.46, 134.72, 130.30, 129.88, 125.12, 123.11, 122.58, 119.88, 119.26, 118.93. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{11}O_4N$: 270.0761, found: 270.0760. **FTIR (cm^{-1})** 3419, 2101, 1645, 1590, 1524, 1487, 1439, 1358, 1289, 1211, 1157, 1020, 973, 756, 730, 659, 483.

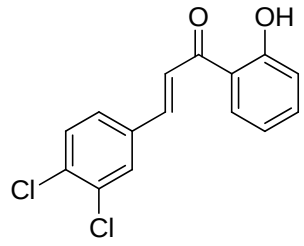
(*E*)-3-(2-Chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1h)



Following the known procedure, 1-(2-hydroxyphenyl)ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 2-chlorobenzaldehyde (0.70 g, 0.56 mL, 5.0 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralized with Conc. HCl. Solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-3-(2-chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1h** as a crystalline yellow solid (0.86 g, 66%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.73. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 12.74 (s, 1H, OH), 8.30 (d, J = 15.4 Hz 1H, H_{ar}), 7.90 (dd, J_1 = 8 Hz & J_2 = 1.4 Hz, 1H, H_{ar}), 7.76 (dd, J_1 = 7.3 Hz & J_2 = 2.0 Hz, 1H, H_{ar}), 7.63 (d, J = 15.5 Hz, 1H, H_{ar}), 7.53-7.49 (m, 1H, H_{ar}), 7.46-7.45 (m, 1H, H_{ar}), 7.37-7.31 (m, 2H, H_{ar}), 7.04-7.03 (m, 1H, H_{ar}), 6.96-6.93 (m, 1H, H_{ar}). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.61, 163.75, 141.27, 136.73, 135.85, 133.02, 131.67, 130.53, 129.85, 128.04, 127.26, 122.81, 120.00, 119.06, 118.80. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{12}O_2Cl$: 259.0520,found:259.0520.**FTIR(cm^1)** 2922, 1639, 1582, 1486, 1467, 1441, 1339, 1317, 1262, 1 233, 1205, 1157, 1020, 972, 864, 753, 659,589.

(*E*)-3-(3,4-Dichlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1i)

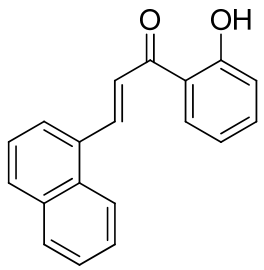


Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 3,4-dichlorobenzaldehyde (0.875 g, 5 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 hr, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-3-(3,4-

dichlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1i** as a crystalline yellow solid (0.987 g, 68%).

R_f (Pet. ether /EtOAc = 80/20): 0.80 **^{1}H NMR (400 MHz, $CDCl_3$)** δ 12.67 (s, 1H, OH), 7.90 (dd, J_1 = 8.1 Hz & J_2 = 1.0 Hz, 1H, H_{ar}), 7.80-7.73 (m, 2H, H_{ar}), 7.61 (d, J = 15.5 Hz, 1H, H_{ar}), 7.53-7.50 (m, 2H, H_{ar}), 7.47-7.45 (m, 1H, H_{ar}), 7.03 (d, J = 8.4 Hz, 1H, H_{ar}), 6.96 (t, J = 7.8 Hz, 1H, H_{ar}). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.26, 163.79, 142.61, 136.89, 134.93, 134.73, 133.56, 131.17, 130.01, 129.76, 127.84, 121.84, 119.93, 119.13, 118.87. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{11}O_2Cl_2$: 293.0131, found: 293.0129. FTIR (cm^{-1}) 2923, 1644, 1571, 1439, 1363, 1341, 1208, 1156, 1020, 981, 811, 756, 648.

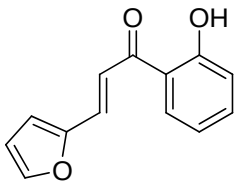
(*E*)-1-(2-Hydroxyphenyl)-3-(naphthalene-1-yl)prop-2-en-1-one (1j)



Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 mL, 5.0 mmol) and 1-naphthaldehyde (0.781 g, 0.68 mL, 5 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 hr, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-(naphthalene-1-yl)prop-2-en-1-one **1j** as a crystalline yellow solid (1.04 g, 73% yield)

R_f (Pet. ether /EtOAc = 80/20): 0.71 **^{1}H NMR (400 MHz, $CDCl_3$)** δ 12.89 (s, 1H, OH), 8.78 (d, J = 15.2 Hz, 1H, H_{ar}), 8.28 (d, J = 8.4 Hz, 1H, H_{ar}), 7.96 (t, J = 7.2 Hz, 2H, H_{ar}), 7.91 (t, J = 7.1 Hz, 1H, H_{ar}), 7.74 (d, J = 15.2 Hz, 1H, H_{ar}), 7.63-7.60 (m, 1H, H_{ar}), 7.58-7.51 (m, 3H, H_{ar}), 7.07 (d, J = 8.5 Hz, 1H, H_{ar}), 6.96 (t, J = 7.5 Hz, 1H, H_{ar}). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 193.74, 163.84, 142.55, 136.64, 133.90, 132.22, 131.93, 131.39, 129.90, 128.98, 127.31, 126.57, 125.58, 125.50, 123.57, 122.88, 120.14, 119.08, 118.83. **HRMS** calculated $[M+H]^+$ for $C_{19}H_{15}O_2$: 275.1067,found:275.1066.**FTIR(cm^1)** 3058, 1945, 1688, 1637, 1579, 1487, 1443, 1398, 1307, 1279, 1250, 1201, 1157, 1023, 973, 860, 799, 774, 755, 662, 601.

(*E*)-3-(Furan-2-yl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1k)

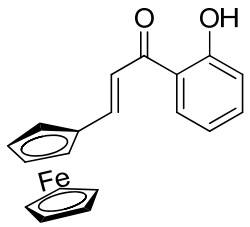


Following the known procedure, 1-(2-hydroxyphenyl)ethanone (1.36 g, 1.2 mL, 10.0 mmol) and furan-2-carbaldehyde (0.97 g, 0.83 mL, 10 mmol) were treated with NaOH (10 g, in 20 mL water) in methanol (50.0 mL) at

25 °C for 12 h. The reaction mixture was poured into ice cold water and was subsequently neutralized with dropwise addition of Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-3-(furan-2-yl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1k** as yellow solid (1.40 g, 65%).

R_f (Pet. ether /EtOAc = 80/20): 0.66 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.91 (s, 1H, OH), 7.91 (d, *J* = 8.0 Hz, 1H, H_{ar}), 7.68 (d, *J* = 15.0 Hz, 1H, H_{ar}), 7.57-7.46 (m, 3H, H_{ar}), 7.01 (d, *J* = 8.5 Hz, 1H, H_{ar}), 6.93 (t, *J* = 7.3 Hz, 1H, H_{ar}), 6.76 (d, *J* = 3.3 Hz, 1H, H_{ar}), 6.54-6.53 (m, 1H, H_{ar}). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.43, 163.64, 151.61, 145.55, 136.42, 131.24, 129.75, 120.14, 118.97, 118.63, 117.68, 117.29, 113.02. **HRMS** calculated $[M+H]^+$ for $C_{13}H_{11}O_3$: 215.0703, found: 215.0701. **FTIR (cm^{-1})** 3149, 3129, 2924, 1643, 1582, 1554, 1488, 1474, 1441, 1363, 1337, 1308, 1271, 1259, 1236, 1215, 1189, 1160, 1079, 1016, 969, 929, 883, 858, 831, 745, 720, 696, 653.

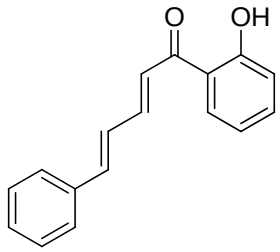
(*E*)-1-(2-Hydroxyphenyl)-3-(ferrocenyl)prop-2-en-1-one (1l)



Following the known procedure, 1-(2-hydroxyphenyl)ethanone (0.68 g, 0.6 mL, 5.0 mmol) and ferrocene carboxaldehyde (1.07 g, 5.0 mmol) were treated with NaOH (5.0 g, in 10 mLwater) in methanol (25 mL) at 25 °C for 12 h. The reaction mixture was poured into ice cold water and was subsequently neutralized with dropwise addition of Conc. HCl. The solid obtained was collected by filtration and was purified by crystallization in ethanol to afford (*E*)-1-(2-hydroxyphenyl)-3-(ferroceniyl)prop-2-en-1-one **1l** as a crystalline red solid (772 mg, 46%).

R_f (Pet. ether /EtOAc = 80/20): 0.6 ^{1}H NMR (200 MHz, CDCl$_3$) δ 13.07 (s, 1H, OH), 7.94-7.84 (m, 2H, H_{ar}), 7.53-7.44 (m, 1H, Har), 7.28-7.21 (m, 1H, Har), 7.04-6.89 (m, 2H, H_{ar}), 4.65-4.63 (m, 2H, bs), 4.55-4.53 (m, 2H, bs), 4.22-4.18 (m, 5H, bs). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 192.84, 163.70, 148.10, 136.23, 136.01, 129.51, 127.06, 121.44, 120.13, 118.80, 118.68, 118.16, 116.79, 72.07, 70.13, 69.47. **HRMS** calculated $[M+H]^+$ for $C_{19}H_{16}O_2Fe$: 332.0494, found: 332.0497. **FTIR (cm^{-1})** 3053, 2926. 2855, 1955, 1692, 1639, 1615, 1582, 1487, 1463, 1448, 1369, 1323, 1303, 1244, 1220, 1158, 1066, 1025, 1003, 961, 836, 818, 756, 738, 648, 620, 596, 562, 522, 487.

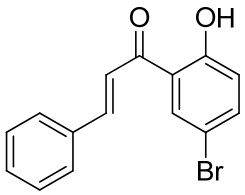
(2*E*,4*E*)-1-(2-Hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one (1m)



Following the known procedure, 1-(2-hydroxyphenyl) ethanone (0.68 g, 0.6 ml, 5.0 mmol) and *trans* cinnamaldehyde (0.66 g, 0.62 ml, 5 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 hr, before the reaction mixture was poured into ice cold water and made neutralized with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (2*E*,4*E*)-1-(2-hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one **1m** as a crystalline orange solid (0.80 g, 66%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.70 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.95 (s, 1H, OH), 7.90 (d, *J* = 7.9 Hz, 1H, H$_{ar}$), 7.79-7.74 (m, 1H, H$_{ar}$), 7.58-7.55 (m, 2H, H$_{ar}$), 7.53 (d, *J* = 7.2 Hz, 1H, H$_{ar}$), 7.46-7.43 (m, 2H, H$_{ar}$), 7.41-7.38 (m, 1H, H$_{ar}$), 7.30 (d, *J* = 9.6 Hz, 1H, H$_{ar}$), 7.12-7.10 (m, 2H, H$_{ar}$), 7.07 (d, *J* = 8.4 Hz, 1H, H$_{ar}$), 6.98 (t, *J* = 7.4 Hz, 1H, H$_{ar}$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.86, 163.73, 145.67, 143.09, 136.41, 136.10, 129.66, 129.07, 127.60, 126.83, 123.61, 120.16, 118.95, 118.75. **HRMS** calculated $[M+H]^+$ for $C_{17}H_{15}O_2$: 251.1067, found: 251.1066. **FTIR (cm^1)** 2925, 1635, 1574, 1563, 1488, 1444, 1371, 1340, 1301, 1278, 1227, 1148, 1004, 803, 760, 691.

(*E*)-1-(5-Bromo-2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1n)

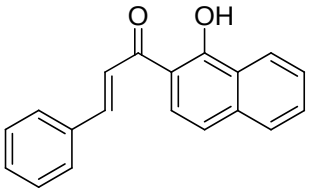


Following the known procedure, 1-(5-bromo-2-hydroxyphenyl) ethanone (1.075 g, 5.0 mmol) and benzaldehyde (0.530 g, 0.50 mL, 5 mmol) were treated with NaOH (5 g, in 10 ml water) in methanol (25.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-1-(5-bromo-2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1n** as a crystalline yellow solid (1.515 g, 69%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.75 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 12.75 (s, 1H, OH), 8.01 (d, *J* = 2.4 Hz, 1H, H$_{ar}$), 7.94 (d, *J* = 15.3 Hz, 1H, H$_{ar}$),7.69-7.68 (m, 2H, H$_{ar}$), 7.57 (s, 1H, H$_{ar}$), 7.56-7.54 (m, 1H, H$_{ar}$), 7.47-7.44 (m, 3H, H$_{ar}$), 6.94 (d, *J* = 8.8 Hz, 1H, H$_{ar}$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 192.86, 162.64, 146.71, 139.09, 134.43, 131.97, 131.42, 129.25, 129.00, 121.37, 120.79, 119.52, 110.59. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{12}O_2Br$: 303.0015, found:

303.0008.**FTIR(cm^{1})** 3391, 1642, 1576, 1471, 1449, 1398, 1361, 1341, 1307, 1292, 1269, 1191, 1183, 1019, 977, 848, 809, 731, 701, 689, 626, 581.

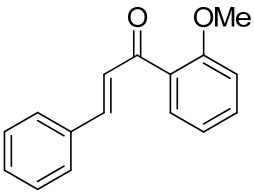
(*E*)-1-(1-Hydroxynaphthalen-2-yl)-3-phenylprop-2-en-1-one (1o)



Following the known procedure, 1-(1-hydroxynaphthalen-2-yl) ethanone (1.862 g, 10.0 mmol) and benzaldehyde (1.061 g, 1.01 ml, 10 mmol) were treated with NaOH (10 g, in 20 ml water) in methanol (50.0 mL) for 12 h, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford(*E*)-1-(1-hydroxynaphthalen-2-yl)-3-phenylprop-2-en-1-one **1o** as a crystalline red solid (2.0 g, 74%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.74 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 14.89 (s, 1H, OH), 8.53 (d, *J* = 8.4 Hz, 1H, H$_{ar}$), 8.03-7.99 (m, 1H, H$_{ar}$), 7.86 (d, *J* = 8.9 Hz, 1H, H$_{ar}$), 7.81-7.65 (m, 5H, H$_{ar}$), 7.59-7.55 (m, 1H, H$_{ar}$), 7.48-7.47 (m, 3H, H$_{ar}$), 7.33 (d, *J* = 8.9 Hz, 1H, H$_{ar}$), 6.96 (t, *J* = 7.8 Hz, 1H, H$_{ar}$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 193.39, 164.57, 145.23, 137.53, 134.91, 130.99, 130.37, 129.19, 128.82, 127.55, 126.09, 125.63, 124.66, 124.06, 120.60, 118.38, 113.60. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{11}O_2Cl_2$: 293.0131,found: 293.0129. **FTIR (cm^{1})** 2923, 1644, 1571, 1439, 1363, 1341, 1208, 1156, 1020, 981, 811, 756, 648.

(*E*)-1-(2-Methoxyphenyl)-3-phenylprop-2-en-1-one (9)



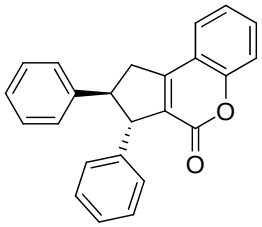
Following the general procedure, 1-(2-methoxyphenyl) ethanone (1.50 g, 1.4 mL, 10.0 mmol) and benzaldehyde (1.17 g, 1.12 mL, 11 mmol) were treated with NaOH (10 g, in 20 ml water) in methanol (50.0 mL) for 12 hr, before the reaction mixture was poured into ice cold water and made neutralised with Conc. HCl. The solid was collected by filtration followed by crystallization in ethanol to afford (*E*)-1-(2-methoxyphenyl)-3-phenylprop-2-en-1-one **9** as a colourless liquid (2.1 g, 88%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.72; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.66-7.64 (m, 1H, H$_{ar}$), 7.63-7.62 (m, 1H, H$_{ar}$), 7.59-7.57 (m, 2H, H$_{ar}$), 7.48-7.44 (m, 1H, H$_{ar}$), 7.41-7.37 (m, 4H, H$_{ar}$) 7.03 (t, *J* = 7.4 Hz, 1H, H$_{ar}$), 6.99 (d, *J* = 8.2 Hz, 1H, H$_{ar}$), 3.87 (s, 3H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 192.90, 158.11, 143.16, 135.08, 132.92, 130.30, 130.25, 129.22, 128.87, 128.37,

127.05, 120.71, 111.65, 55.71. **HRMS** calculated $[M+H]^+$ for $C_{16}H_{15}O_2$: 239.1067, found: 239.1063.**FTIR(cm^{1})** 3015, 2966, 2839, 2401, 1658, 1604, 1485, 1464, 1436, 1333, 1289, 1244, 1216, 1180, 1163, 1114, 1059, 1032, 978, 891, 869, 812, 754, 698, 667, 601, 568, 483.

7. Synthesis and Characterization Functionalized Coumarins

2,3-Diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3a)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2,3 diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3a** as a white solid (0.336 g, 98%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.62; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.59-7.55 (m, 2H, H_{ar}), 7.43 (d, J = 8.2 Hz, 1H, H_{ar}), 7.36-7.25 (m, 7H, H_{ar}), 7.20 (d, J = 7.6 Hz, 2H, H_{ar}), 7.15 (d, J = 7.4 Hz, 2H, H_{ar}) 4.51 (d, J = 4.6 Hz, 1H, CH), 3.80-3.75 (m, 1H, CH), 3.68-3.64 (m, 1H, CH), 3.27 (dd, J_1 = 5.0 Hz, J_2 = 17.8 Hz, 1H, CH). **^{13}C NMR (125 MHz, CDCl$_3$)** δ 158.96, 155.65, 154.92, 144.69, 142.50, 131.61, 129.01, 128.86, 128.76, 127.19, 127.08, 126.96, 125.17, 124.39, 118.47, 117.11, 59.29, 53.52, 39.63. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{19}O_2$: 339.1380, found: 339.1380. **FTIR (cm^{-1})** 3063, 3028, 2927, 2853, 1728, 1627, 1607, 1568, 1494, 1453, 1432, 1388, 1322, 1274, 1250, 1218, 1134, 1078, 1059, 1037, 925, 883, 754, 700, 666, 527.

X-ray Crystal Structure Analysis of 3a.[5]

Single crystals of the compound were grown by slow evaporation from a mixture of ethyl acetate and Pet. ether. Data was collected on SMART APEX-II CCD using Mo-Kα radiation (λ = 0.7107 Å) to a maximum θ range of 25.00°. Colourless plate like crystal of approximate size

[5] Sheldrick, G. M. SHELX-97 program for crystal structure solution and refinement, University of Gottingen, Germany, 1997; 2008

0.44 x 0.13 x 0.02 mm^3, was used for data collection. Crystal to detector distance 5.00 cm, 512 x 512 pixels / frame, Oscillation / frame -0.5º, maximum detector swing angle = –30.0º, beam center = (260.2, 252.5), in plane spot width = 1.24, Multi run data acquisition. Total scans = 3, total frames = 1800, exposure / frame = 15.0 sec / frame, θ range = 1.86 to 25.00 º, completeness to θ of 25.00 º, is 100.0 %. $C_{24}H_{18}O_2$, M = 338.38. Crystals belong to Monoclinic, space group $P2_1/c$, a = 12.9452(6) , b = 8.9427(4), c = 31.393(2) Å, β= 101.7470(8)°, V = 3558.1(3) $Å^3$, Z = 8, D_c = 1.263 g /cc, μ (Mo–Kα) = 0.079 mm^{-1}, 27804 reflections measured, 6270 unique [I>2σ(I)], R value 0.0567, wR2 = 0.1164. Largest diff. peak and hole 0.151 and -0.233 e. $Å^{-3}$. All the data were corrected for Lorentzian, polarisation and absorption effects. SHELX-97 (ShelxTL)[ref] was used for structure solution and full matrix least squares refinement on F^2. Hydrogen atoms were included in the refinement as per the riding model. There are two molecules in the asymmetric unit. The overlap shows that the phenyl rings are differently oriented in two molecules.

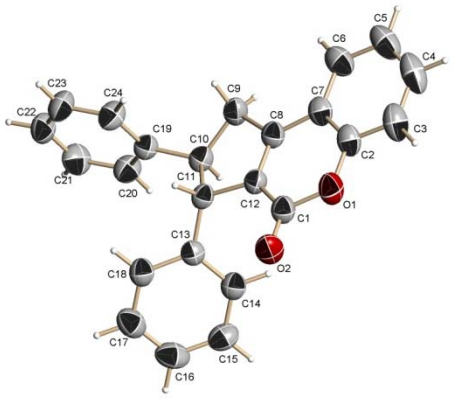


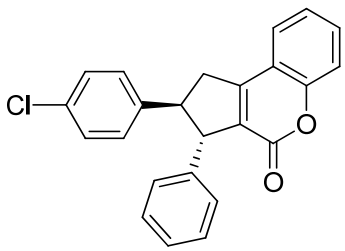
Figure 3. ORTEP diagram of one of the molecules of **3a** drawn at 50 % probability.

Crystal data and structure refinement for 3a.

Empirical formula	$C_{24}H_{18}O_2$
Formula weight	338.38
Temperature	296(2) K
Wavelength	0.71073 Å
Crystal system	Monoclinic

Space group	P21/c	
Unit cell dimensions	a = 12.9452(6) Å	α= 90°.
	b = 8.9427(4) Å	β= 101.7470(8)°.
	c = 31.393(2) Å	γ = 90°.
Volume	3558.1(3) $Å^3$	
Z	8	
Density (calculated)	1.263 g/cc	
Absorption coefficient	0.079 mm^{-1}	
F(000)	1424	
Crystal size	0.44 x 0.13 x 0.02 mm^3	
Theta range for data collection	1.86 to 25.00°.	
Index ranges	-15<=h<=15, -10<=k<=10, -34<=l<=37	
Reflections collected	27804	
Independent reflections	6270 [R(int) = 0.0359]	
Completeness to theta = 25.00°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.9981 and 0.9658	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	6270 / 0 / 469	
Goodness-of-fit on F^2	1.141	
Final R indices [I>2sigma(I)]	R1 = 0.0567, wR2 = 0.1164	
R indices (all data)	R1 = 0.0762, wR2 = 0.1245	
Largest diff. peak and hole	0.151 and -0.233 $e.Å^{-3}$	

2-(4-Chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3b)

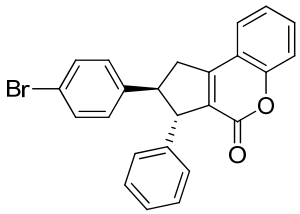


Following the general procedure, treatment of (*E*)-3-(4-chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1b** (0.259 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h

followed by flash column chromatography afforded 2-(4-chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3b** as a white solid (0.356 g, 96%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.63; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.59-7.54 (m, 2H, H$_{ar}$), 7.42 (d, *J* = 8.3 Hz, 1H, H$_{ar}$), 7.37-7.23 (m, 6H, H$_{ar}$), 7.13-7.08 (m, 4H, H$_{ar}$), 4.43 (d, *J* = 5.0 Hz, 1H, CH), 3.79-3.72 (m, 1H, CH), 3.65-3.60 (m, 1H, CH), 3.22 (dd, J_1 = 5.7 Hz, J_2 = 18.1 Hz, 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 158.75, 155.42, 154.80, 142.84, 142.06, 132.67, 131.67, 129.01, 128.83, 128.35, 127.12, 127.09, 125.12, 124.41, 118.25, 116.99, 59.24, 53.02, 39.40. **HRMS** calculated $[M+Na]^+$ for $C_{24}H_{17}O_2ClNa$: 395.0809, found: 395.0803. **FTIR (cm^{-1})** 3020, 2401, 1725, 1629, 1608, 1569, 1511, 1454, 1389, 1322, 1272, 1216, 1079, 1040, 927, 823, 757, 701, 669, 528.

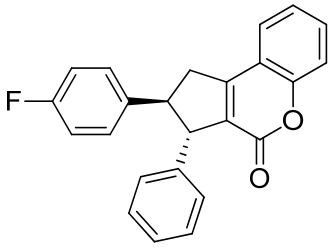
2-(4-Bromophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3c)



Following the general procedure, treatment of (*E*)-3-(4-bromophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1c** (0.303 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(4-bromophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3c** as a white solid (0.391 g, 94%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.59; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.60-7.55 (m, 2H, H$_{ar}$), 7.44 (t, *J* = 8.2 Hz, 3H, H$_{ar}$), 7.37-7.24 (m, 4H, H$_{ar}$), 7.13 (d, *J* = 7.0 Hz, 2H, H$_{ar}$), 7.08 (d, *J* = 8.5 Hz, 2H, H$_{ar}$) 4.45 (d, *J* = 5.2 Hz, 1H, CH), 3.80-3.73 (m, 1H, CH), 3.64-3.60 (m, 1H, CH), 3.23 (dd, J_1 = 5.6 Hz, J_2 = 18.0 Hz, 1H, CH). **^{13}C NMR (125 MHz, CDCl$_3$)** δ 158.76, 155.35, 154.90, 143.46, 142.09, 132.05, 131.71, 128.89, 128.75, 128.50, 127.20, 127.13, 125.12, 124.43, 120.82, 118.31, 117.10, 59.25, 53.10, 39.43. **HRMS** calculated $[M+Na]^+$ for $C_{24}H_{17}O_2BrNa$: 439.0304, found: 439.0301. **FTIR (cm^{-1})** 3061, 3027, 2930, 1724, 1627, 1607, 1567, 1491, 1453, 1407, 1388, 1273, 1217, 1134, 1077, 1037, 1010, 923, 883, 819, 753, 700, 663, 525.

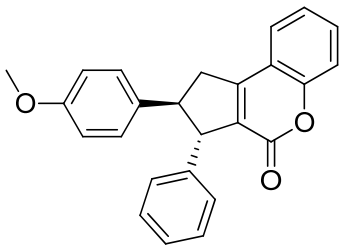
2-(4-Fluorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3d)



Following the general procedure, treatment of (*E*)-3-(4-fluorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1d** (0.121 g 0.5 mmol) and *trans* cinnamaldehyde **2a** (0.066 g, 63 µL, 0.5 mmol) with imidazolium salt **4** (0.017 g, 0.05 mmol) and DBU (0.015 g, 15 µL, 0.1 mmol) in DME (2.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(4-fluorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3d** as a white solid (0.159 g, 89%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.55; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.18-8.11 (m, 2H, H$_{ar}$), 7.96 (d, *J* = 10.4 Hz, 1H, H$_{ar}$), 7.89-7.71 (m, 4H, H$_{ar}$), 7.64-7.56 (m, 4H, H$_{ar}$), 7.47-7.41 (m, 2H, H$_{ar}$), 4.21 (d, *J* = 6.4 Hz, 1H, CH), 3.44-3.33 (m, 1H, CH), 3.26-3.19 (m, 1H, CH), 2.76-2.68 (m 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 161.89 (d, *J* = 244.8 Hz), 158.88, 155.48, 154.92, 142.22, 140.26 (d, *J* = 3.0 Hz), 131.71, 128.90, 128.58, 128.48 (d, *J* = 8.1 Hz), 127.18, 127.15, 125.15, 124.44, 118.38, 117.14, 115.80 (d, *J* = 21.7 Hz), 59.45, 52.94, 39.66. **HRMS** calculated $[M+Na]^+$ for $C_{24}H_{17}O_2FNa$: 379.1105, found: 379.1099. **FTIR (cm^{-1})** 3062, 3018, 2928, 2855, 1725, 1608, 1569, 1511, 1496, 1454, 1388, 1301, 1248, 1217, 1178, 1158, 1064, 1038, 923, 909, 831, 756, 701, 667, 557.

2-(4-Methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3e)

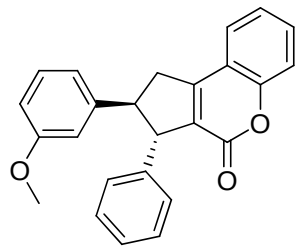


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-one **1e** (0.255 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 µL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 µL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(4-methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3e** as a white solid (0.339 g, 92%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.56; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.61-7.57 (m, 2H, H$_{ar}$), 7.45 (d, *J* = 7.8 Hz, 1H, H$_{ar}$), 7.39-7.25 (m, 4H, H$_{ar}$), 7.18-7.11 (m, 4H, H$_{ar}$), 6.89 (d, *J* = 8.6 Hz, 2H, H$_{ar}$), 4.49 (d, *J* = 4.9 Hz, 1H, CH), 3.84-3.74 (m, 4H, CH), 3.66-3.61 (m, 1H, CH), 3.26 (dd,

J_1 = 5.6 Hz, J_2 = 17.9 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.88, 158.56, 155.64, 154.83, 142.48, 136.53, 131.51, 128.74, 128.62, 127.93, 127.14, 126.94, 125.14, 124.32, 118.43, 116.98, 114.24, 59.35, 55.33, 52.91, 39.62. **HRMS** calculated $[M+H]^+$ for $C_{25}H_{21}O_3$: 369.1485, found: 369.1485. **FTIR (cm^{-1})** 3438, 3060, 3027, 2934, 2836, 1729, 1625, 1607, 1584, 1492, 1453, 1388, 1320, 1288, 1263, 1215, 1156, 1078, 1038, 1001, 924, 887, 761, 737, 699.

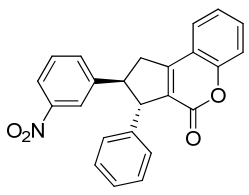
2-(3-Methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3f)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-(3-methoxyphenyl)prop-2-en-1-one **1f** (0.255 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(3-methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta [*c*]chromen-4(1*H*)-one **3f** as a white solid (0.335 g, 91%)

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.53; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.55 (d, J = 6.9 Hz, 2H, Har), 7.41 (d, J = 8.4 Hz, 1H, H_{ar}), 7.35-7.23 (m, 5H, H_{ar}), 7.16 (d, J = 6.6.Hz, 2H, H_{ar}), 6.83-6.75 (m, 3H, H_{ar}), 4.51 (bs, 1H, CH), 3.77-3.71 (m, 4H, CH), 3.64-3.63 (m, 1H, CH), 3.27 (dd, J_1 = 4.5 Hz, J_2 = 17.8 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.90, 158.82, 155.57, 154.78, 146.16, 142.45, 131.52, 129.95, 128.74, 128.55, 127.12, 126.97, 125.12, 124.32, 119.13, 118.34, 116.92, 113.03, 111.83, 59.07, 55.22, 53.45, 39.42. **HRMS** calculated $[M+H]^+$ for $C_{25}H_{21}O_3$: 369.1485, found: 369.1478. **FTIR (cm^{-1})** 3060, 3028, 2935, 2837, 2251, 1947, 1725, 1607, 1492, 1454, 1388, 1320, 1263, 1217, 1157, 1078, 1039, 1001, 911, 888, 754, 704, 667, 573, 550, 520.

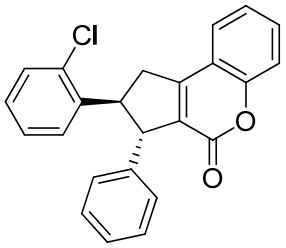
2-(3-Nitrophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3g)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one **1g** (0.269 g 1.0 mmol) and *trans*-cinnamaldehyde **1a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.0304 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(3-nitrophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3g** as a white solid (0.322 g, 84%).

R_f (Pet. ether /EtOAc = 60/40): 0.53; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.15-8.12 (m, 1H, H_{ar}), 8.09 (s, 1H, H_{ar}), 7.61-7.55 (m, 2H, H_{ar}), 7.51-7.50 (m, 2H, H_{ar}), 7.44 (d, *J* = 8.3 Hz, 1H, H_{ar}), 7.38-7.28 (m, 4H, H_{ar}), 7.13-7.11 (m, 2H, H_{ar}), 4.47 (d, *J* = 4.2 Hz, 1H, CH), 3.84-3.75 (m, 2H, CH), 3.31-3.26 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.68, 154.98, 148.68, 146.39, 141.61, 133.31, 131.97, 130.12, 129.11, 128.35, 127.53, 127.15, 125.12, 124.58, 122.32, 122.06, 118.16, 117.27, 59.32, 53.27, 39.35. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{18}O_4N$: 384.1230, found: 384.1226. **FTIR (cm^{-1})** 3028, 2926, 1727, 1626, 1607, 1528, 1495, 1453, 1388, 1349, 1218, 1038, 925, 889, 754, 700.

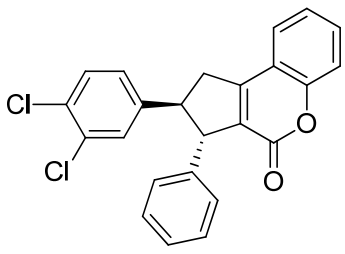
2-(2-Chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3h)



Following the general procedure, treatment of (*E*)-3-(2-chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1h** (0.259 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded2-(2-chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*] chromen-4(1*H*)-one **3h** as a white solid (0.356 g, 95%).

R_f (Pet. ether /EtOAc = 80/20): 0.56; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.60-7.56 (m, 2H, H_{ar}), 7.45-7.41 (m, 2H, H_{ar}), 7.38-7.30 (m, 3H, H_{ar}), 7.27-7.19 (m, 6H, H_{ar}), 4.64 (d, *J* = 3.6 Hz, 1H, CH), 4.20-4.16 (m, 1H, CH), 3.85-3.78 (m, 1H, CH), 3.25 (dd, J_1 = 4.6 Hz, J_2 = 18.3 Hz, 1H, CH). **^{13}C NMR (125 MHz, $CDCl_3$)** δ 158.93, 155.40, 154.91, 142.08, 141.74, 133.74, 131.66, 130.12, 128.90, 128.83, 128.23, 127.76, 127.44, 127.22, 127.16, 125.18, 124.42, 118.38, 117.09, 57.29, 49.51, 38.45. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{18}O_2Cl$: 373.0990, found: 373.0988. **FTIR (cm^{-1})** 3019, 2928, 2401, 1951, 1725, 1628, 1608, 1570, 1494, 1475, 1454, 1389, 1276, 1216, 1134, 1038, 926, 754, 700, 668, 482.

3,4-(Dichlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3i)

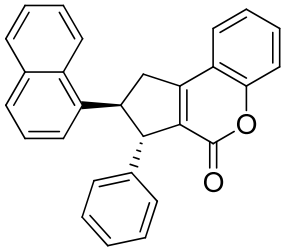


Following the general procedure, treatment of (*E*)-3-(3,4-dichlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one **3i** (0.147 g 0.5 mmol) and *trans* cinnamaldehyde **2a** (0.066 g, 63 μL, 0.5 mmol) with imidazolium salt **4** (0.017 g, 0.05 mmol) and DBU

(0.015 g, 15 μL, 0.1mmol) in DME (2.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3,4-(dichlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3i** as a white solid (0.183 g, 90%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.54; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.61-7.53 (m, 2H, H$_{ar}$), 7.43 (d, *J* = 8.3 Hz, 1H, H$_{ar}$), 7.38 (d, *J* = 8.3 Hz, 1H, H$_{ar}$), 7.35-7.31 (m, 2H, H$_{ar}$), 7.29-7.24 (m, 3H, H$_{ar}$), 7.13-7.11 (m, 2H, H$_{ar}$), 7.01 (dd, J_1 = 2.0 Hz, J_2 = 8.4 Hz, 1H, H$_{ar}$), 4.43 (d, *J* = 5.2 Hz, 1H, CH), 3.80-3.73 (m, 1H, CH), 3.62-3.57 (m, 1H, CH), 3.24-3.18 (m, 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 158.70, 155.09, 154.93, 144.72, 141.84, 132.93, 131.85, 131.10, 130.97, 129.01, 128.41, 127.38, 127.12, 126.47, 125.13, 124.51, 118.21, 117.18, 59.20, 52.77, 39.45. **HRMS** calculated $[M+Na]^+$ for $C_{24}H_{17}O_2Cl_2Na$: 429.0420, found: 429.0419. **FTIR (cm^{-1})** 3063, 3019, 2936, 1727, 1628, 1608, 1493, 1468, 1454, 1389, 1216, 1133, 1079, 1133, 1079, 1038, 886, 820, 756, 701, 668, 529.

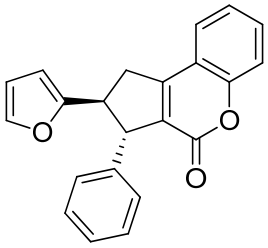
2-(Naphthalen-1-yl)-3-phenyl-2,3-dihydrocyclopenta[c]chromen-4(1H)-one (3j)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1j** (0.275 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(naphthalen-1-yl)-3-phenyl-2,3-dihydrocyclopenta [*c*]chromen-4(1*H*)-one **3j** as a white solid (0.353 g, 91%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.50; **^{1}H NMR (500 MHz, CDCl$_3$)** δ 7.95 (d, *J* = 8.4 Hz, 2H, H$_{ar}$), 7.83 (d, *J* = 8.3 Hz, 1H, H$_{ar}$), 7.62-7.44 (m, 6H, H$_{ar}$), 7.40-7.35 (m, 4H, H$_{ar}$), 7.33-7.28 (m, 3H, H$_{ar}$), 4.79 (bs, 1H, CH), 4.51 (bs, 1H, CH), 3.98-3.93 (m, 1H, CH), 3.46 (dd, J_1 = 3.7 Hz, J_2 = 18.2 Hz, 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 179.45, 175.16, 174.27, 158.99, 159.19, 148.50, 145.18, 144.63, 142.24, 142.14, 141.84, 140.25, 139.71, 139.61, 138.55, 137.95, 137.73, 137.17, 136.16, 134.93, 134.76, 128.73, 126.98, 77.41, 53.13, 29.63. **HRMS** calculated $[M+H]^+$ for $C_{28}H_{21}O_2$: 389.1536, found: 389.1526. **FTIR (cm^{-1})** 3059, 2928, 1728, 1628, 1607, 1493, 1453, 1388, 1322, 1225, 1078, 1058, 1036, 925, 884, 797, 778, 760, 737, 700, 561, 473.

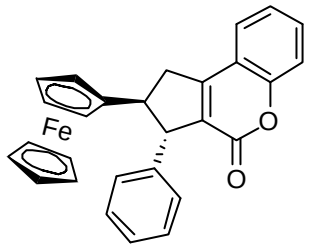
2-(Furan-2-yl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3k)



Following the general procedure, treatment of (*E*)-3-(furan-2-yl)-1-(2-hydroxyphenyl)prop-2-en-1-one **1k** (0.215 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(Furan-2-yl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3k** as a gray solid (0.303 g, 92%).

R_f (Pet. ether /EtOAc = 80/20): 0.65; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.57-7.53 (m, 2H, H_{ar}), 7.41-7.37 (m, 2H, H_{ar}), 7.35-7.30 (m, 3H, H_{ar}), 7.26-7.23 (m, 1H, H_{ar}), 7.20-7.18 (m, 1H, H_{ar}), 6.32-6.30 (m, 1H, H_{ar}), 6.10 (d, J = 3.2 Hz), 4.61 (d, J = 5.2 Hz, 1H, CH), 3.76-3.71 (m, 1H, CH), 3.68-3.60 (m, 1H, CH), 3.36 (dd, J_1 = 5.4 Hz, J_2 = 17.7 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.92, 156.20, 155.25, 154.81, 142.20, 141.98, 131.58, 128.80, 128.35, 127.24, 127.18, 125.09, 124.37, 118.43, 117.04, 110.35, 105.38, 55.93, 46.71, 36.58. **HRMS** calculated $[M+H]^+$ for $C_{22}H_{17}O_3$: 329.1172, found: 329.1167. **FTIR (cm^{-1})** 3113, 3063, 3019, 2927, 2854, 1725, 1630, 1608, 1570, 1494, 1454, 1390, 1321, 1276, 1217, 1148, 1135, 1078, 1063, 1039, 1013, 927, 894, 753, 700, 667.

2-(Ferroceniyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3l)

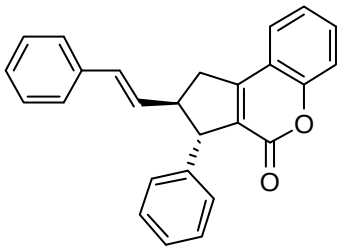


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-(ferroceniyl)prop-2-en-1-one **1l** (0.083 g 0.25 mmol) and *trans* cinnamaldehyde **2a** (0.033 g, 31 μL, 0.25 mmol) with imidazolium salt **4** (0.0085 mg, 0.025 mmol) and DBU (0.0076 mg, 7.5 μL, 0.05 mmol) in DME (1.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 2-(ferroceniyl)-3-phenyl-2,3-dihydrocyclop enta[*c*]chromen-4(1*H*)-one **3l** as a yellow solid (0.101 g, 91%).

R_f (Pet. ether /EtOAc = 80/20): 0.53; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.63-7.55 (m, 2H, H_{ar}), 7.42-7.34 (m, 4H, H_{ar}), 7.29-7.26 (m, 3H, H_{ar}), 4.42 (d, J = 3.6 Hz, 1H, CH), 4.16-4.05 (m, 9H), 3.76-3.69 (m, 1H, CH), 3.54-3.50 (m, 1H, CH), 3.27 (dd, J_1 = 4.8 Hz, J_2 = 17.7 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.02, 155.14, 154.74, 142.78, 131.43, 129.09, 128.82, 127.41, 127.02, 125.12, 124.29, 118.52, 117.00, 92.30, 68.56, 67.99, 67.88, 67.25, 65.90, 58.52, 47.47,

38.91. **HRMS** calculated $[M]^+$ for $C_{28}H_{22}O_2Fe$: 446.0964, found: 446.0962. **FTIR (cm^{-1})** 3025, 2923, 2841, 1718, 1628, 1607, 1492, 1452, 1388, 1214, 1134, 1033, 964, 924, 754, 697, 667, 527, 503.

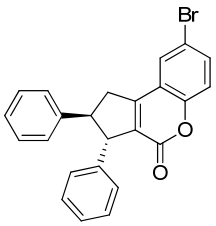
3-Phenyl-2-((*E*)-styryl)-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3m)



Following the general procedure, treatment of (2*E*,4*E*)-1-(2-hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one **1m** (0.251 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-phenyl-2-((*E*)-styryl)-2,3-dihydrocyclopenta[c]chromen-4(1H)-one **3m** as a yellow solid (0.289 g, 79%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.50; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.62-7.58 (m, 2H, H_{ar}), 7.46-7.44 (m, 1H, H_{ar}), 7.42-7.34 (m, 7H, H_{ar}), 7.32-7.25 (m, 4H, H_{ar}), 6.44 (d, *J* = 5.6 Hz, 2H, H_{ar}), 4.36 (d, *J* = 5.6 Hz, 1H, CH), 3.65-3.58 (m, 1H, CH), 3.36-3.29 (m, 1H, CH), 3.14-3.08 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.89, 155.61, 154.67, 141.85, 136.87, 131.46, 131.42, 130.56, 128.72, 128.62, 128.47, 127.53, 127.29, 126.95, 126.25, 125.10, 124.27, 118.43, 116.87, 56.86, 51.71, 37.44. **HRMS** calculated $[M+H]^+$ for $C_{26}H_{21}O_2$: 365.1536, found: 365.1535. **FTIR (cm^{-1})** 3061, 3026, 2928, 2061, 1984, 1735, 1651, 1608, 1569, 1493, 1452, 1429, 1388, 1322, 1276, 1216, 1134, 1078, 1063, 1039, 1001, 965, 925, 888, 753, 699, 667, 523.

8-bromo-2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3n)

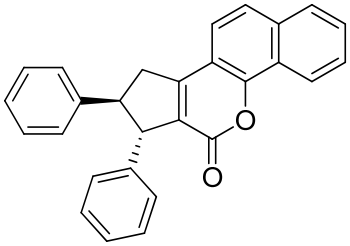


Following the general procedure, treatment of (*E*)-1-(5-bromo-2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1n** (0.303 g 1.0 mmol) and *trans*-cinnamaldehyde **1a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.0304 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 8-bromo-2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3n** as a white solid (0.363 g, 87%).

***R*$_f$** (Pet. ether /EtOAc = 60/40): 0.54 **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.69-7.66 (m, 2H, H_{ar}), 7.36-7.27 (m, 8H, H_{ar}), 7.21-7.20 (m, 1H, H_{ar}), 7.14 (d, *J* = 7.1 Hz, 2H, H_{ar}), 4.51-4.50 (m, 1H,

CH), 3.78-3.67 (m, 2H, CH), 3.29-3.24 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.25, 154.35, 153.76, 144.35, 142.13, 134.32, 129.99, 129.07, 128.93, 127.75, 127.23, 127.19, 126.90, 120.12, 118.81, 117.06, 59.32, 53.39, 39.51. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{18}O_2Br$: 417.0485, found: 417.0479. **FTIR (cm^{-1})** 3027, 2923, 1729, 1601, 1492, 1453, 1414, 1373, 1265, 1218, 1078, 1029, 932, 818, 761, 698.

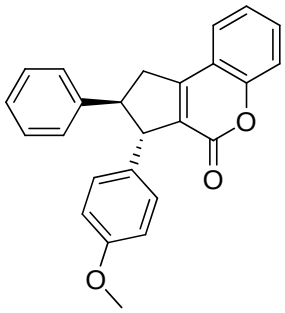
7,8-Diphenyl-8,9-dihydrobenzo[h]cyclopenta[*c*]chromen-6(7*H*)-one (3o)



Following the general procedure, treatment of (*E*)-1-(1-hydroxynaphthalen-2-yl)-3-phenylprop-2-en-1-one **1o** (0.274 g 1.0 mmol) and *trans* cinnamaldehyde **2a** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.0304 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 7,8-diphenyl-8,9-dihydrobenzo[h]cyclopenta[*c*]chromen-6(7*H*)-one **3o** as a white solid (0.354 g, 91%).

***R*$_f$** (Pet. ether /EtOAc = 60/40): 0.56 **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.57- 8.54 (m, 1H, H_{ar}), 7.69 (d, J = 8.7 Hz,1H, H_{ar}), 7.61-7.59 (m, 2H, H_{ar}), 7.49 (d, J = 8.6 Hz, 1H, H_{ar}), 7.29-7.11 (m, 10H, H_{ar}), 4.51-4.50 (m, 1H, CH), 3.81-3.74 (m, 1H, CH), 3.65-3.61 (m, 1H, CH), 3.29 (dd, J_1 = 5.3 Hz, J_2 = 18.0 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.99, 156.77, 152.07, 144.73, 142.55, 134.82, 129.02, 128.86, 128.63, 127.99, 127.92, 127.35, 127.23, 127.07, 127.02, 124.50, 123.37, 122.92, 121.11, 113.73, 59.15, 53.71, 39.97. **HRMS** calculated $[M+H]^+$ for $C_{28}H_{21}O_2$: 389.1536, found: 389.1536. **FTIR (cm^{-1})** 3019, 2400, 1722, 1611, 1565, 1531, 1495, 1370, 1353, 1216, 1080, 1030, 962, 929, 768, 668.

3-(4-methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3p)

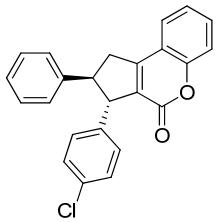


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-3-(4-methoxyphenyl)acrylaldehyde **2p** (0.162 g, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(4-methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3s** as a white solid (0.327 g,

89%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.51; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.22-8.17 (m, 2H, H$_{ar}$), 8.02 (d, *J* = 10.8 Hz, 1H, H$_{ar}$), 7.94-7.89 (m, 3H, H$_{ar}$), 7.85-7.81 (m, 1H, H$_{ar}$), 7.75 (d, *J* = 9.3 Hz, 2H, H$_{ar}$), 7.59 (d, *J* = 10.3 Hz, 2H, H$_{ar}$), 7.30 (d, *J* = 10.3 Hz, 2H, H$_{ar}$), 4.33 (d, *J* = 6.0 Hz, 1H, CH), 3.47-3.39 (m, 4H, CH), 3.32-3.26 (m, 1H, CH), 2.83 (dd, J_1 = 6.7 Hz, J_2 = 22.4 Hz, 1H, CH). **^{13}C NMR (125 MHz, CDCl$_3$)** δ 179.18, 178.13, 174.79, 174.03, 161.21, 148.79, 144.93, 141.69, 141.50, 140.76, 139.24, 137.01, 136.00, 128.59, 126.69, 123.26, 53.70, 49.63, 47.68, 29.80. **HRMS** calculated $[M+Na]^+$ for $C_{25}H_{20}O_3Na$: 391.1305, found: 391.1299. **FTIR (cm^{-1})** 3062, 3016, 2935, 2837, 1727, 1608, 1585, 1568, 1512, 1495, 1454, 1388, 1322, 1302, 1249, 1217, 1134, 1065, 1038, 923, 908, 831, 755, 701, 667, 556.

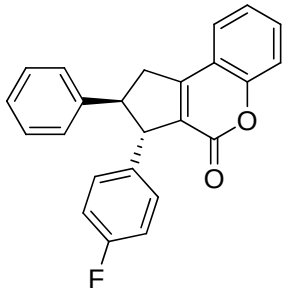
3-(4-Chlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3q)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-3-(4-chlorophenyl)acrylaldehyde **2q** (0.167 g, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.0304 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(4-chlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3q** as a white solid (0.338 g, 91%).

***R*$_f$** (Pet. ether /EtOAc = 60/40): 0.61 **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.60-7.54 (m, 2H, H$_{ar}$), 7.42 (d, *J* = 8.3 Hz, 1H, H$_{ar}$), 7.36-7.24 (m, 6H, H$_{ar}$), 7.19-7.17 (m, 2H, H$_{ar}$), 7.06-7.04 (m, 2H, H$_{ar}$), 4.47-4.45 (m, 1H, CH), 3.78-3.70 (m, 1H, CH), 3.61-3.56 (m, 1H, CH), 3.31-3.25 (m, 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 158.88, 155.96, 154.91, 143.88, 140.90, 132.78, 131.81, 129.06, 128.99, 128.59, 128.11, 127.24, 127.04, 125.19, 124.49, 118.33, 117.14, 58.71, 53.87, 39.58. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{18}O_2Cl$: 373.0990, found: 373.0990. **FTIR (cm^{-1})** 3019, 2939, 2400, 1722, 1628, 1607, 1493, 1457, 1388, 1325, 1216, 1064, 1044, 927, 828, 756 , 668.

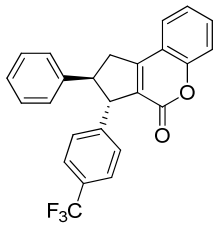
3-(4-Fluorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3r)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-3-(4-fluorophenyl)acrylaldehyde **2r** (0.150 g, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(4-fluorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3r** as a white solid (0.307 g, 86%).

R_f (Pet. ether /EtOAc = 80/20): 0.63; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.60-7.55 (m, 2H, H_{ar}), 7.44 (d, *J* = 8.2 Hz, 1H, H_{ar}), 7.37-7.27 (m, 4H, H_{ar}), 7.20 (d, *J* = 7.1 Hz, 2H, H_{ar}), 7.12-7.08 (m, 2H, H_{ar}), 6.99 (t, *J* = 8.5 Hz, 2H, H_{ar}), 4.48 (d, *J* = 5.3 Hz, 1H, CH), 3.79-3.72 (m, 1H, CH), 3.63-3.58 (m, 1H, CH), 3.29 (dd, J_1 = 5.9 Hz, J_2 = 18.1 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 161.94 (d, *J* = 241.8 Hz), 158.85, 155.73, 154.90, 144.08, 138.15 (d, *J* = 2.8 Hz), 131.72, 129.03, 128.69 (d, *J* = 8.5 Hz), 128.39, 127.17, 127.01, 125.18, 124.45, 118.37, 117.10, 115.64 (d, *J* = 21.16 Hz), 58.57, 53.87, 39.50. **HRMS** calculated $[M+Na]^+$ for $C_{24}H_{17}O_2FNa$: 379.1105, found: 379.1101. **FTIR (cm^{-1})** 3030, 2925, 2854, 1728, 1683, 1625, 1601, 1509, 1455, 1378, 1298, 1275, 1236, 1158, 1124, 1097, 1037, 973, 818, 758, 723, 701, 495.

3-(4-(Trifluromethyl)phenyl)-2,3-dihydro-2-phenylcyclopenta[*c*]chromen-4(1*H*)-one (3s)

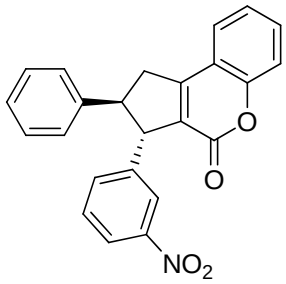


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.112 g 0.5 mmol) and (*E*)-3-(4-(trifluromethyl) phenyl)acrylaldehyde **2s** (0.100 g, 0.5 mmol) with imidazolium salt **4** (0.017 g, 0.05 mmol) and DBU (0.0152 g, 15 μL, 0.1 mmol) in DME (2.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(4-(trifluromethyl)phenyl)-2,3-dihydro-2-phenylcyclopenta[*c*]chromen-4(1H)-one **3s** as a white solid (0.197 g, 97%).

R_f (Pet. ether /EtOAc = 60/40): 0.58; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.61-7.54 (m, 4H, H_{ar}), 7.44 (d, *J* = 8.2 Hz, 1H, H_{ar}), 7.37-7.33 (m, 3H, H_{ar}), 7.30-7.29 (m, 1H, H_{ar}), 7.23 (d, *J* = 7.9 Hz, 2H, H_{ar}), 7.18 (d, *J* = 7.2 Hz, 2H, H_{ar}), 4.55-4.54 (m, 1H, CH), 3.80-3.74 (m, 1H, CH), 3.63-3.60 (m, 1H, CH), 3.31 (dd, J_1 = 6.2 Hz, J_2 = 18.2 Hz, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.84, 156.26, 154.98, 146.42, 143.70, 131.94, 129.14, 127.82, 127.59, 127.37, 127.06,

125.86, 125.83, 125.24, 124.56, 118.29, 117.20, 59.08, 53.81, 39.75. **HRMS** calculated $[M+H]^+$ for $C_{25}H_{18}O_2F_3$: 407.1253, found: 407.1249. **FTIR (cm^{-1})** 3029, 2029, 1726, 1620, 1607, 1496, 1454, 1420, 1389, 1326, 1218, 1164, 1110, 1064, 1018, 925, 842, 757, 701, 602, 459.

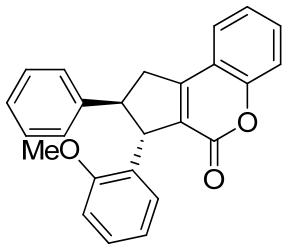
3-(3-Nitrophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3t)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.112 g 0.5 mmol) and (*E*)-3-(3-nitrophenyl)acrylaldehyde **2t** (0.088 g, 0.5 mmol) with imidazolium salt **4** (0.017 g, 0.05 mmol) and DBU (0.015 g, 15 μL, 0.1 mmol) in DME (2.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(3-nitrophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3t** as a white solid (0.167 g, 87%).

***R*$_f$** (Pet. ether /EtOAc = 60/40): 0.61; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.12-8.09 (m, 1H, H_{ar}), 7.98 (bs, 1H, H_{ar}), 7.62-7.56 (m, 2H, H_{ar}), 7.47-7.42 (m, 3H, H_{ar}), 7.39-7.29 (m, 4H, H_{ar}), 7.20-7.18 (m, 2H, H_{ar}), 4.60-4.58 (m, 1H, CH), 3.84-3.77 (m, 1H, CH), 3.66-3.61 (m, 1H, CH), 3.37-3.30 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.78, 156.58, 154.97, 148.69, 144.47, 143.01, 134.01, 132.12, 129.71, 129.21, 127.52, 127.29, 127.06, 125.30, 124.65, 122.29, 122.00, 118.18, 117.22, 58.85, 54.04, 39.75. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{18}O_4N$: 384.1230, found: 384.1229. **FTIR(cm^{-1})** 3020, 2930, 2401, 1957, 1723, 1627, 1608, 1530, 1496, 1454, 1389, 1352, 1216, 1065, 1046, 942, 883, 805, 757, 701, 668.

3-(2-Methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3u)

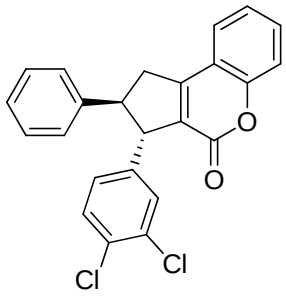


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-3-(2-methoxyphenyl)acrylaldehyde **2u** (0.162 g, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography 3-(2-methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3u** as a white solid (0.331 g, 89%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.59; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.60-7.56 (m, 2H, H_{ar}), 7.46 (d, *J* = 8.5 Hz, 1H, H_{ar}), 7.38-7.30 (m, 3H, H_{ar}), 7.27-7.22 (m, 4H, H_{ar}), 6.95-6.86 (m, 3H,

H_{ar}), 4.84 (d, J = 2.7 Hz, 1H, CH), 3.73-3.64 (m, 5H), 3.29-3.23 (m, 1H, CH). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.86, 157.28, 156.05, 154.84, 145.65, 131.34, 130.24, 128.66, 128.47, 128.15, 127.55, 126.87, 126.69, 125.07, 124.29, 120.64, 118.59, 117.04, 111.06, 55.35, 53.60, 51.85, 39.04. **HRMS** calculated $[M+H]^+$ for $C_{25}H_{21}O_3$: 369.1485, found: 369.1482. **FTIR (cm^{-1})** 3062, 3027, 2936, 2837, 1725, 1626, 1607, 1493, 1454, 1439, 1389, 1272, 1288, 1246, 1134, 1110, 1092, 1033, 974, 926, 754, 701, 667, 475.

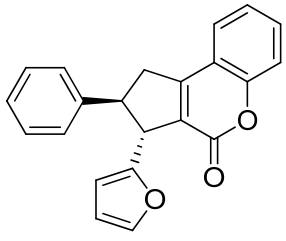
3-(3,4-Dichlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3v)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.056 g 0.25 mmol) and (*E*)-3-(3,4-dichlorophenyl)acrylaldehyde **2v** (0.050 g, 0.25 mmol) with imidazolium salt **4** (0.0085 g, 0.025 mmol) and DBU (0.0076 g, 7.5 µL, 0.050 mmol) in DME (1.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-(3,4-Dichlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3v** as a white solid (0.082 g, 81% after crystalisation in Pet. ether).

R_f (Pet. ether /EtOAc = 80/20): 0.49; **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.62-7.60 (m, 2H, H_{ar}), 7.44-7.26 (m, 7H, H_{ar}), 7.15 (d, J = 6.9 Hz, 2H, H_{ar}), 7.05 (dd, J_1 = 2.0 Hz, J_2 = 8.3 Hz, 1H, H_{ar}) 4.45 (d, J = 5.1 Hz, 1H, CH), 3.82-3.75 (m, 1H, CH), 3.65-3.60 (m, 1H, CH), 3.23 (dd, J_1 = 5.7 Hz, J_2 = 18.1 Hz, 1H, CH). **^{13}C NMR (125 MHz, $CDCl_3$)** δ 158.58, 155.08, 154.81, 144.60, 141.78, 132.77, 131.75, 130.94, 130.86, 128.96, 128.89, 128.22, 127.26, 127.06, 126.45, 125.10, 124.43, 118.12, 117.00, 59.09, 52.72, 39.30. **HRMS** calculated $[M+H]^+$ for $C_{24}H_{17}O_2Cl_2$: 407.0600, found: 407.0601. **FTIR (cm^{-1})** 3029, 1726, 1683, 1625m 1607, 1568, 1494, 1470, 1454, 1400, 1288, 1217, 1133, 1066, 1030, 935, 819, 757, 719, 700, 670, 479.

3-(Furan-2-yl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3w)

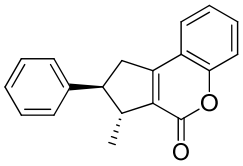


Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-3-(furan-2-yl)acrylaldehyde **2w** (0.122 g, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 µL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-

(furan-2-yl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3w** as a white solid (0.271 g, 82%).

***R*$_f$** (Pet. ether /EtOAc = 80/20): 0.62; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.59-7.53 (m, 2H, H$_{ar}$), 7.42 (d, *J* = 8.2 Hz, 1H, H$_{ar}$), 7.35-7.31 (m, 4H, H$_{ar}$), 7.26 (d, *J* = 6.8 Hz, 1H, H$_{ar}$), 7.25-7.21 (m, 2H, H$_{ar}$), 6.33-6.32 (m, 1H, H$_{ar}$), 6.15 (d, *J* = 3.2 Hz, 1H, H$_{ar}$), 4.59 (d, *J* = 4.7 Hz, 1H, CH), 3.92-3.87 (m, 1H, CH), 3.80-3.73 (m, 1H, CH), 3.26 (dd, J_1 = 4.8 Hz, J_2 = 17.8 Hz, 1H, CH). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 158.84, 155.91, 154.82, 154.14, 144.19, 141.87, 131.74, 129.00, 127.13, 126.81, 126.42, 125.21, 124.40, 118.41, 117.07, 110.60, 106.42, 51.99, 49.63, 39.05. **HRMS** calculated $[M+H]^+$ for $C_{22}H_{17}O_3$: 329.1172, found: 329.1165. **FTIR (cm^{-1})** 3165, 3004, 2943, 2628, 2411, 2293, 2253, 1726, 1625, 1602, 1452, 1416, 1376, 1147, 1070, 1039, 1007, 918, 758.

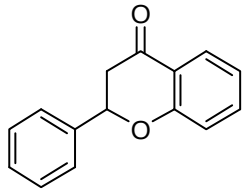
3-Methyl-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3x)



Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-but-2-enal **2x** (0.0702 g, 82 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-methyl-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one **3x** as a white solid (0.205 g, 74%) along with 2-phenylchroman-4-one **12** as a white solid (0.050 g, 22%).

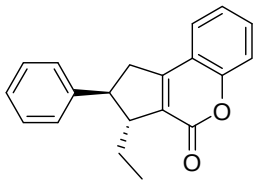
***R*$_f$** (Pet. ether /EtOAc = 60/40): 0.61; **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.55-7.51 (m, 1H, H$_{ar}$), 7.47-7.45 (m, 1H, H$_{ar}$), 7.41-7.32 (m, 3H, H$_{ar}$), 7.32-7.25 (m, 4H, H$_{ar}$), 3.57 (dq, J_1 = 1.9 Hz, J_2 = 18.7 Hz, J_3 = 17.7 Hz, J_4 = 26.5, Hz, 1H, CH), 3.43-3.38 (m, 1H, CH), 3.29-3.23 (m, 1H, CH), 3.15-3.09 (m, 1H, CH), 1.46 (d, *J* = 6.9 Hz, 3H, CH$_3$). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 159.58, 154.51, 154.09, 144.23, 131.13, 130.29, 128.86, 127.27, 126.90, 124.87, 124.22, 118.60, 116.84, 52.26, 47.90, 39.19, 18.47. **HRMS** calculated $[M+H]^+$ for $C_{19}H_{16}O_2Na$: 299.1043, found: 299.1041. **FTIR (cm^{-1})** 3062, 3020, 2960, 2930, 2871, 1950, 1720, 1625, 1608, 1584, 1571, 1493, 1430, 1453, 1389, 1373, 1320, 1288, 1217, 1135, 1078, 1092, 1033, 1019, 976, 948, 884, 756, 702, 667, 539.

2-Phenylchroman-4-one (9)[6]



R_f (Pet. ether /EtOAc = 80/20): 0.65 **^{1}H NMR (200 MHz, $CDCl_3$)** δ 7.95 (dd, J_1 = 1.8 Hz, J_2 = 8.2 Hz, 1H, H_{ar}), 7.57-7.36 (m, 6H, H_{ar}), 7.10-7.03 (m, 2H, H_{ar}), 5.50 (dd, J_1 = 3.3 Hz, J_2 = 13.0 Hz, 1H, CH), 3.19-2.85 (m, 2H, CH_2). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 192.16, 161.70, 138.86, 136.37, 129.00, 128.93, 127.20, 126.29, 121.77, 121.05, 118.28, 79.75, 44.82. **HRMS** calculated $[M+H]^+$ for $C_{15}H_{13}O_2$: 225.0910, found: 225.0910. **FTIR (cm^{-1})** 3066, 3035, 1692, 1606, 1577, 1498, 1472, 1463, 1371, 1321, 1304, 1228, 1149, 1116, 1066, 1027, 988, 906, 760, 699, 590.

3-Ethyl-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3y)



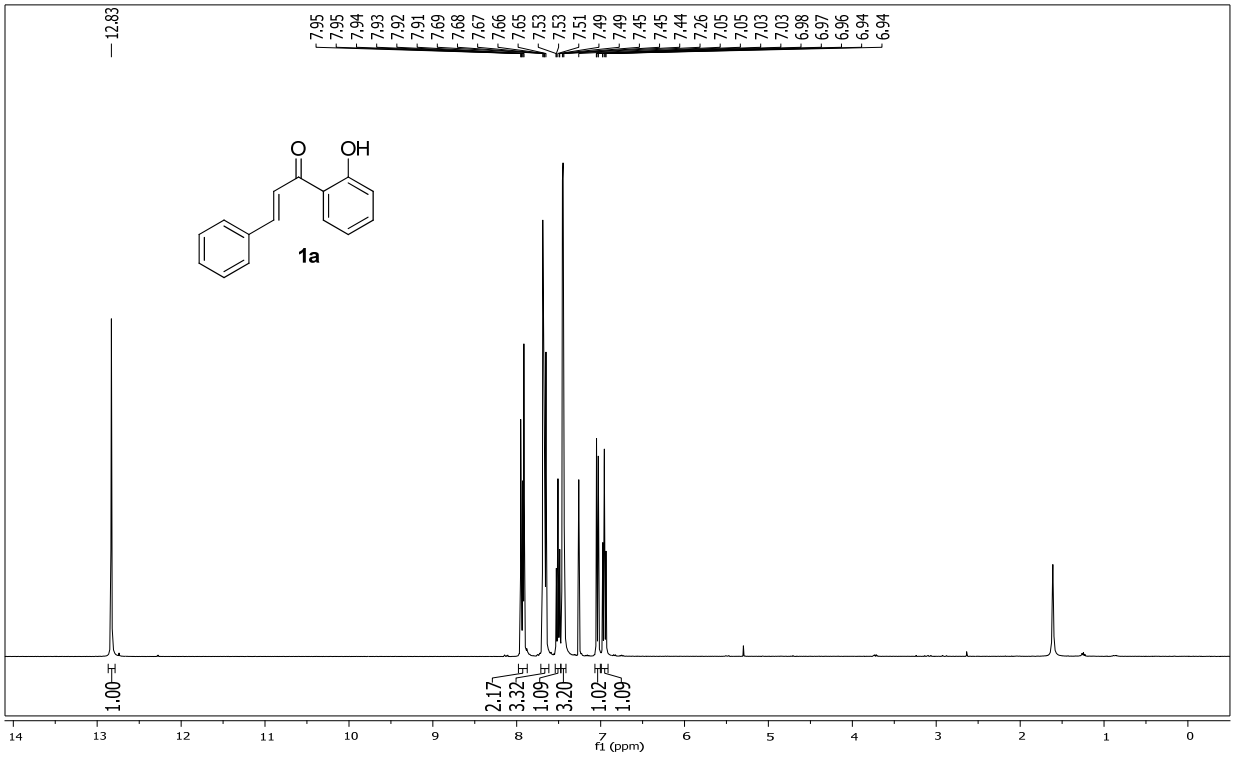
Following the general procedure, treatment of (*E*)-1-(2-hydroxyphenyl)-3-phenylprop-2-en-1-one **1a** (0.224 g 1.0 mmol) and (*E*)-pent-2-enal **2y** (0.132 g, 126 μL, 1.0 mmol) with imidazolium salt **4** (0.034 g, 0.1 mmol) and DBU (0.030 g, 30 μL, 0.2 mmol) in DME (4.0 mL) at 25 °C for 12 h followed by flash column chromatography afforded 3-ethyl-2-phenyl-2,3-dihydrocyclopenta [*c*]chromen-4(1*H*)-one **3y** as a white solid (0.251 g, 86% yield).

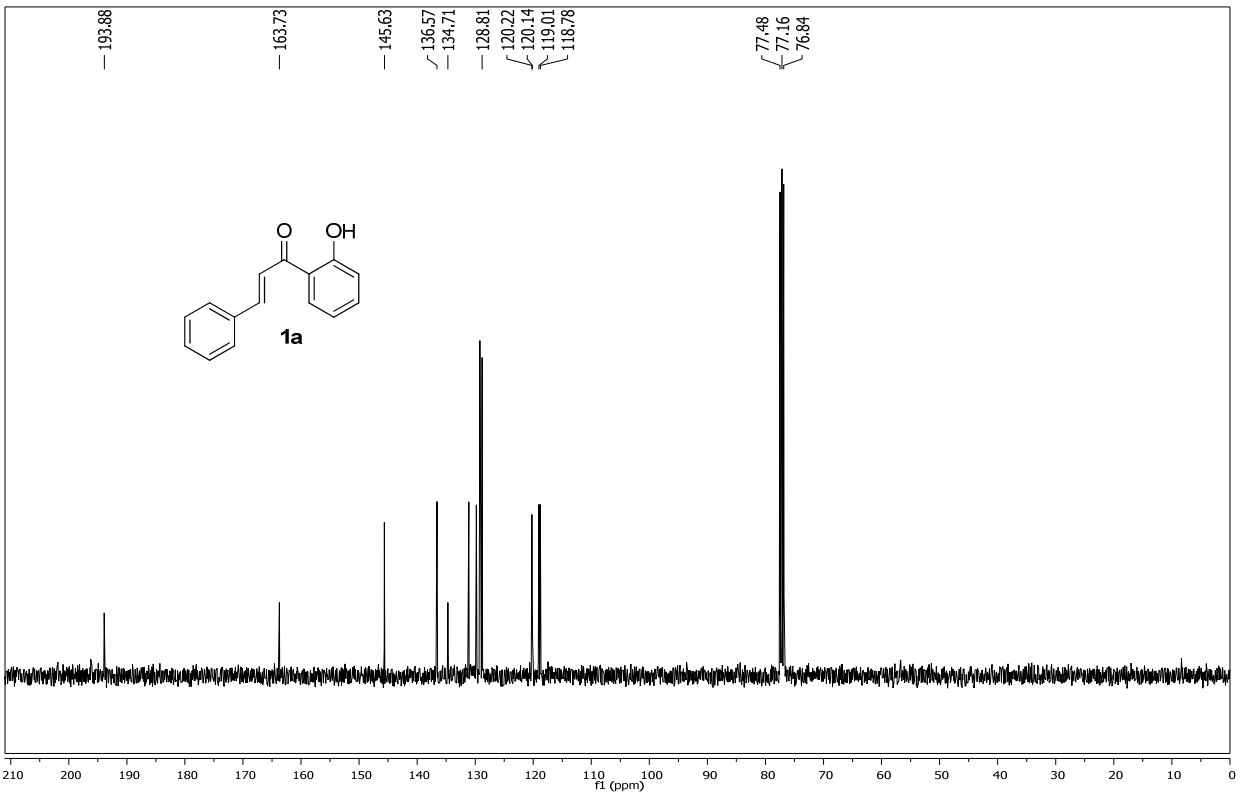
R_f (Pet. ether /EtOAc = 80/20): 0.56 **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.54-7.51 (m, 1H, H_{ar}), 7.45 (dd, J_1 = 1.5 Hz, J_2 = 7.8 Hz , 1H, H_{ar}), 7.41 (d, J = 7.9 Hz, 1H, H_{ar}), 7.32-7.28 (m, 3H, H_{ar}), 7.24-7.21 (m, 3H, H_{ar}), 3.59 (qd, J_1 = 2.3Hz, J_2 = 9.2 Hz, J_3 = 18.2 Hz, 1H, CH), 3.48-3.45 (m, 1H, CH), 3.39-3.38 (m, 1H, CH), 3.13-3.08 (m, 1H, CH), 2.07-2.02 (m, 1H, CH), 1.78-1.72 (m, 1H, CH), 0.98 (t, J = 7.7 Hz, 3H, CH_3), **^{13}C NMR (125 MHz, $CDCl_3$)** δ 159.65, 154.59, 146.25, 131.19, 129.53, 128.94, 126.94, 126.72, 124.92, 124.27, 118.62, 116.93, 54.62, 47.59, 39.91, 25.44, 11.12. **HRMS** calculated $[M+H]^+$ for $C_{20}H_{19}O_2$: 291.1380, found: 291.1378. **FTIR (cm^{-1})** 3062, 3029, 2963, 2932, 2252, 1719, 1630, 1607, 1577, 1494, 1454, 1389, 1321, 1305, 1282, 1268, 1227, 1198, 1156, 1100, 1076, 1065, 1036, 1020, 910, 886, 756, 735, 701, 648.

[6] Han, F.; Chen, G.; Zhang, X.; Liao, J. *Eur. J. Org. Chem.* **2011**, 2928.

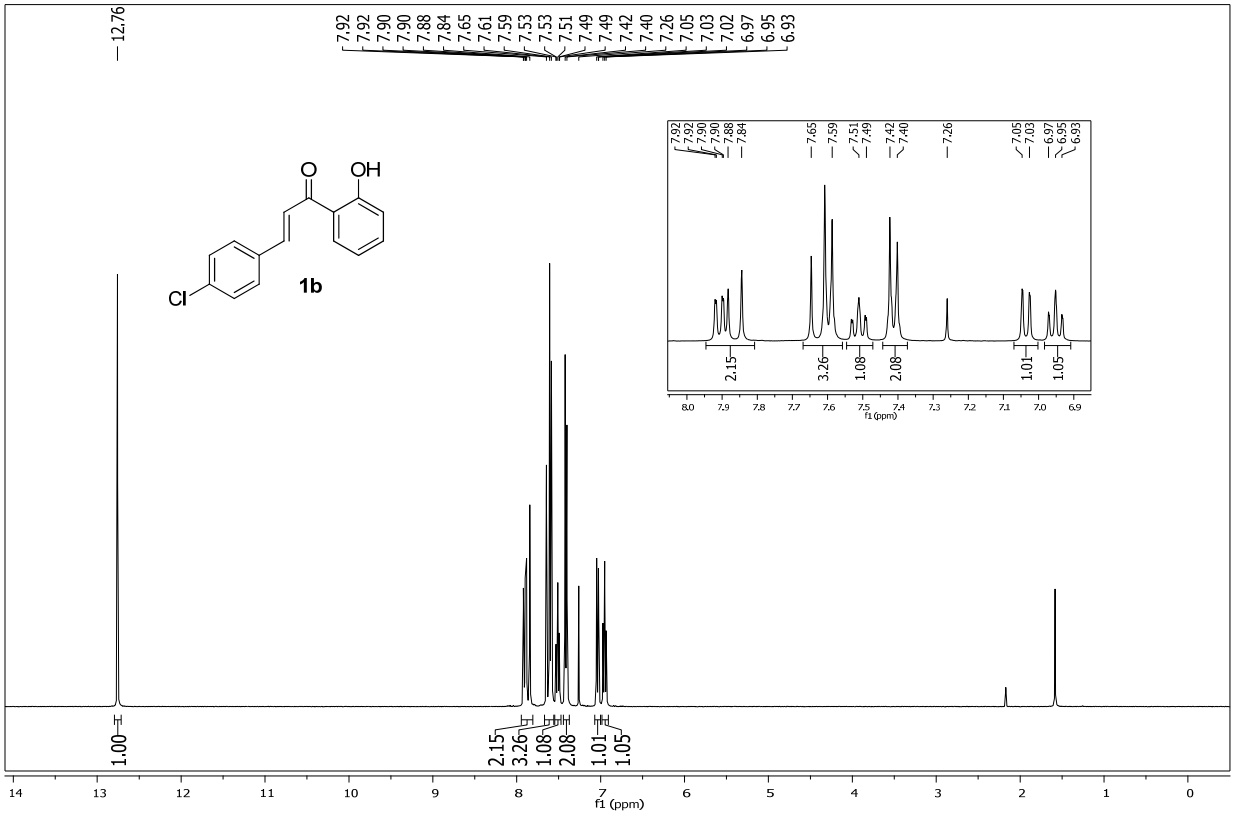
8. ^{1}H and ^{13}C NMR Spectra 2'-Hydroxy Chalcones

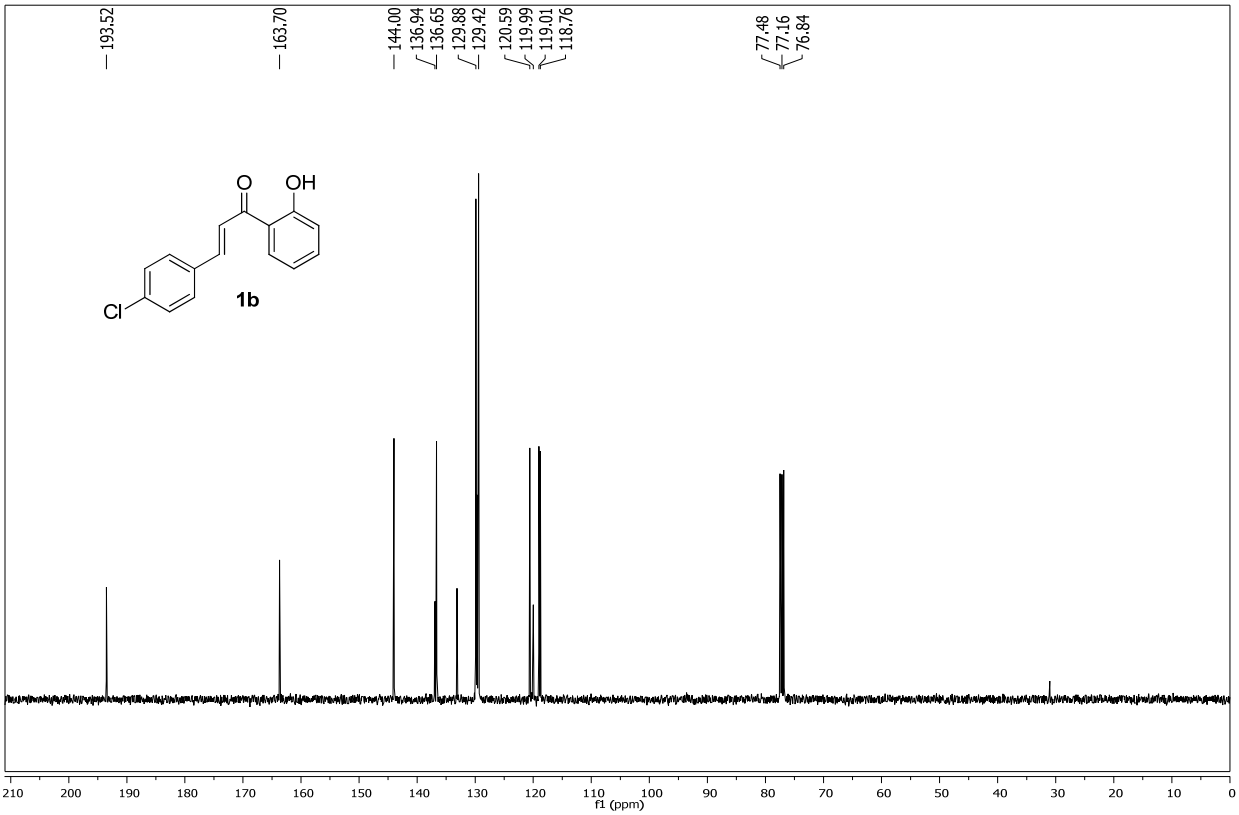
(*E*)-1-(2-Hydroxyphenyl)-3-phenylprop-2-en-1-one (1a)



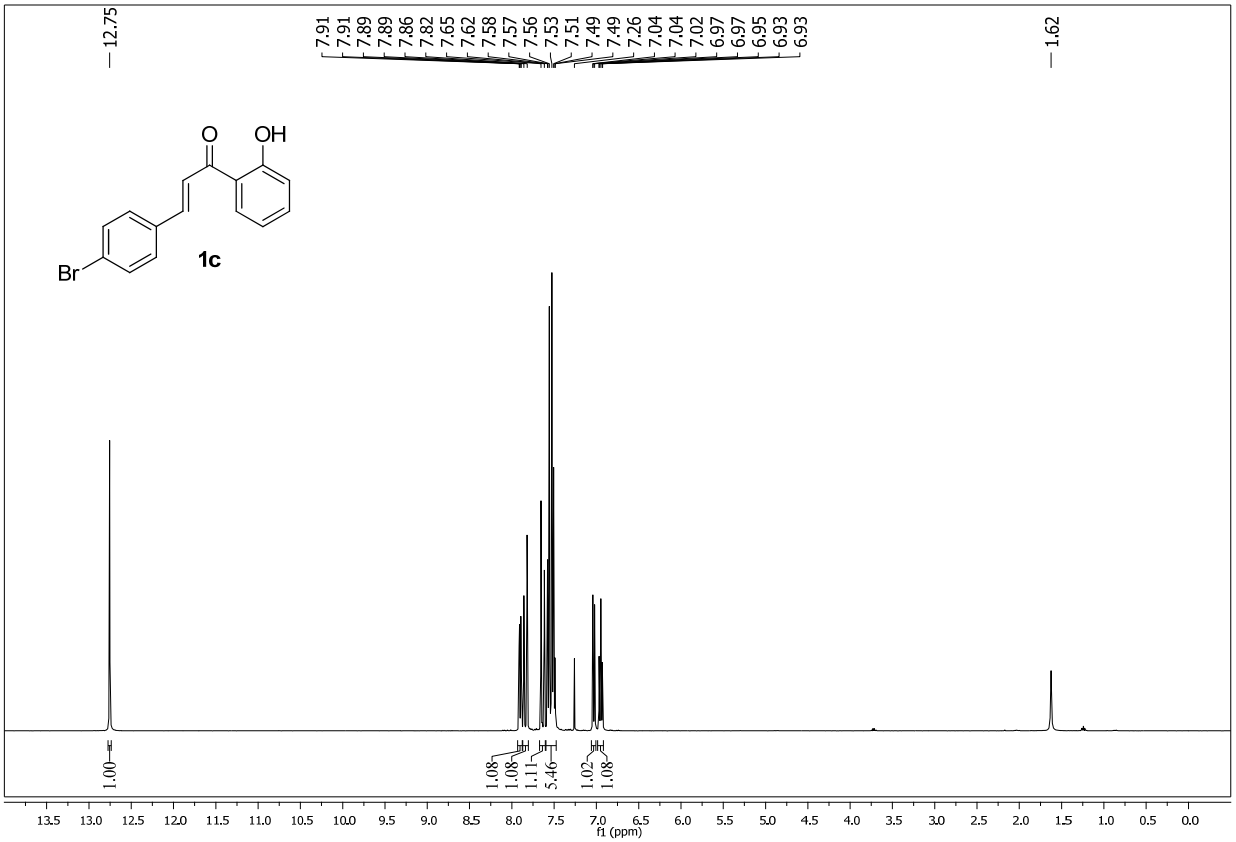


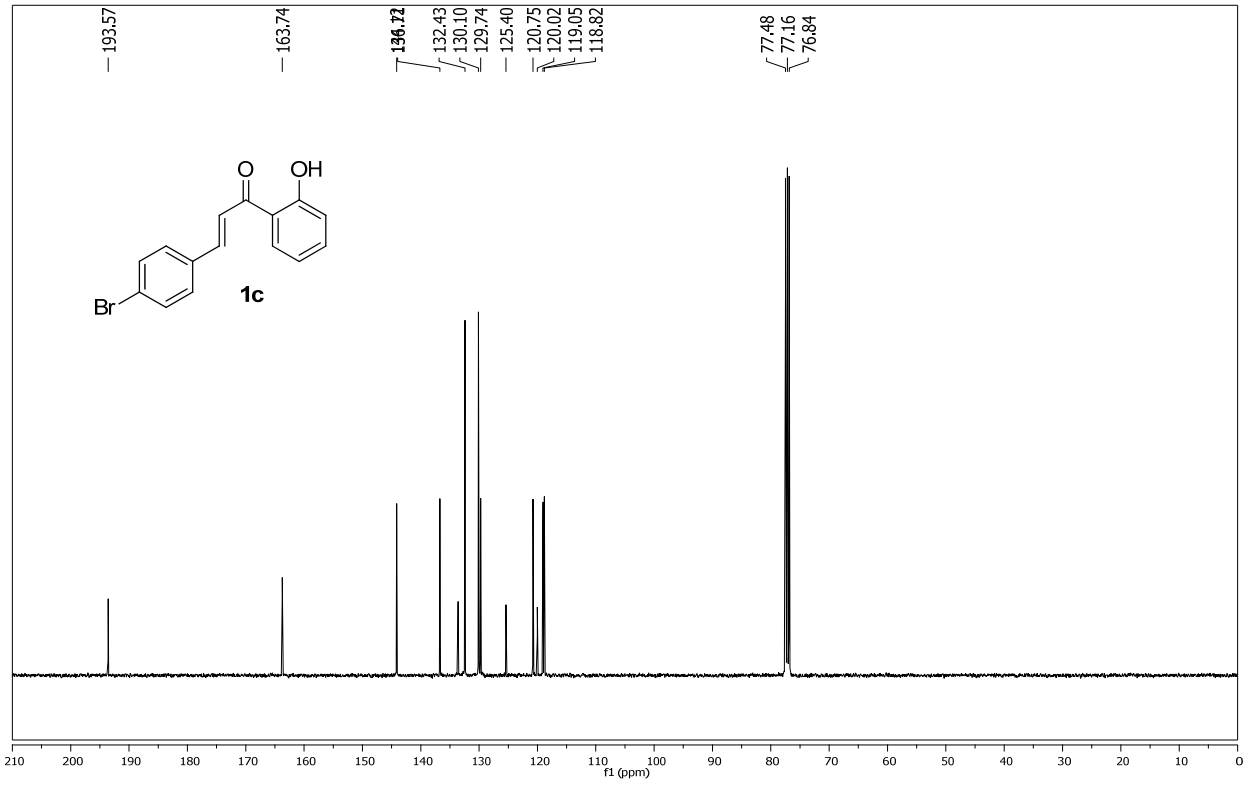
(*E*)-3-(4-Chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1b)



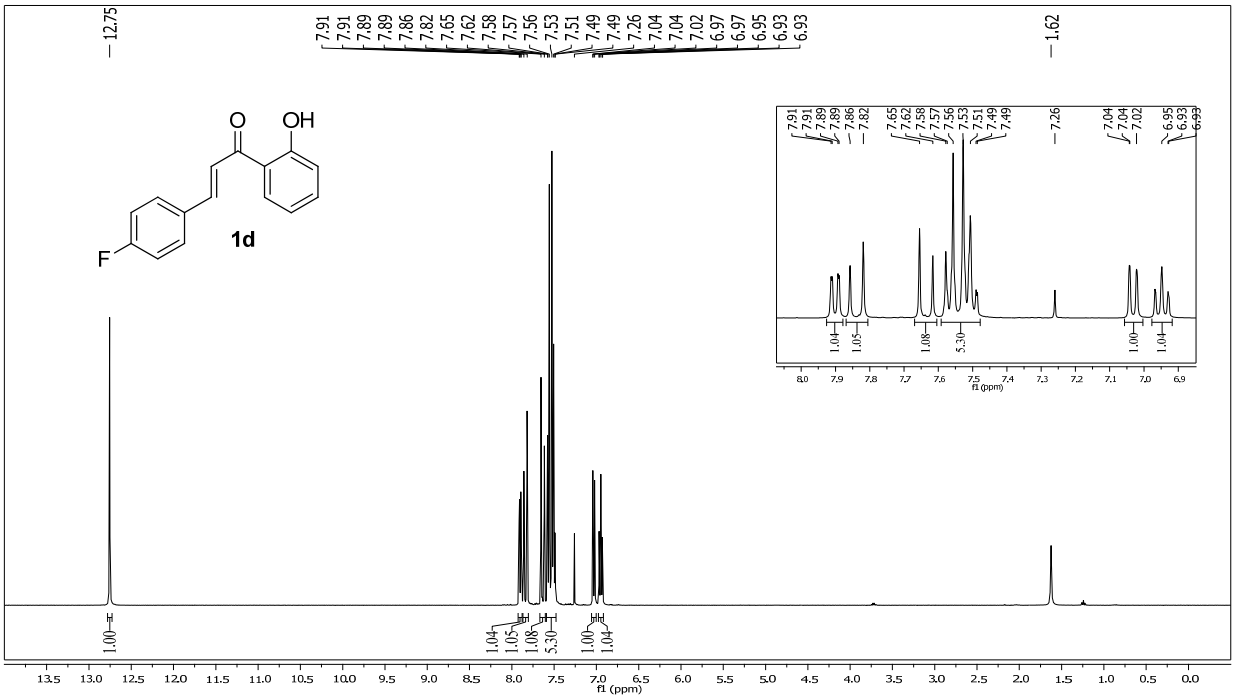


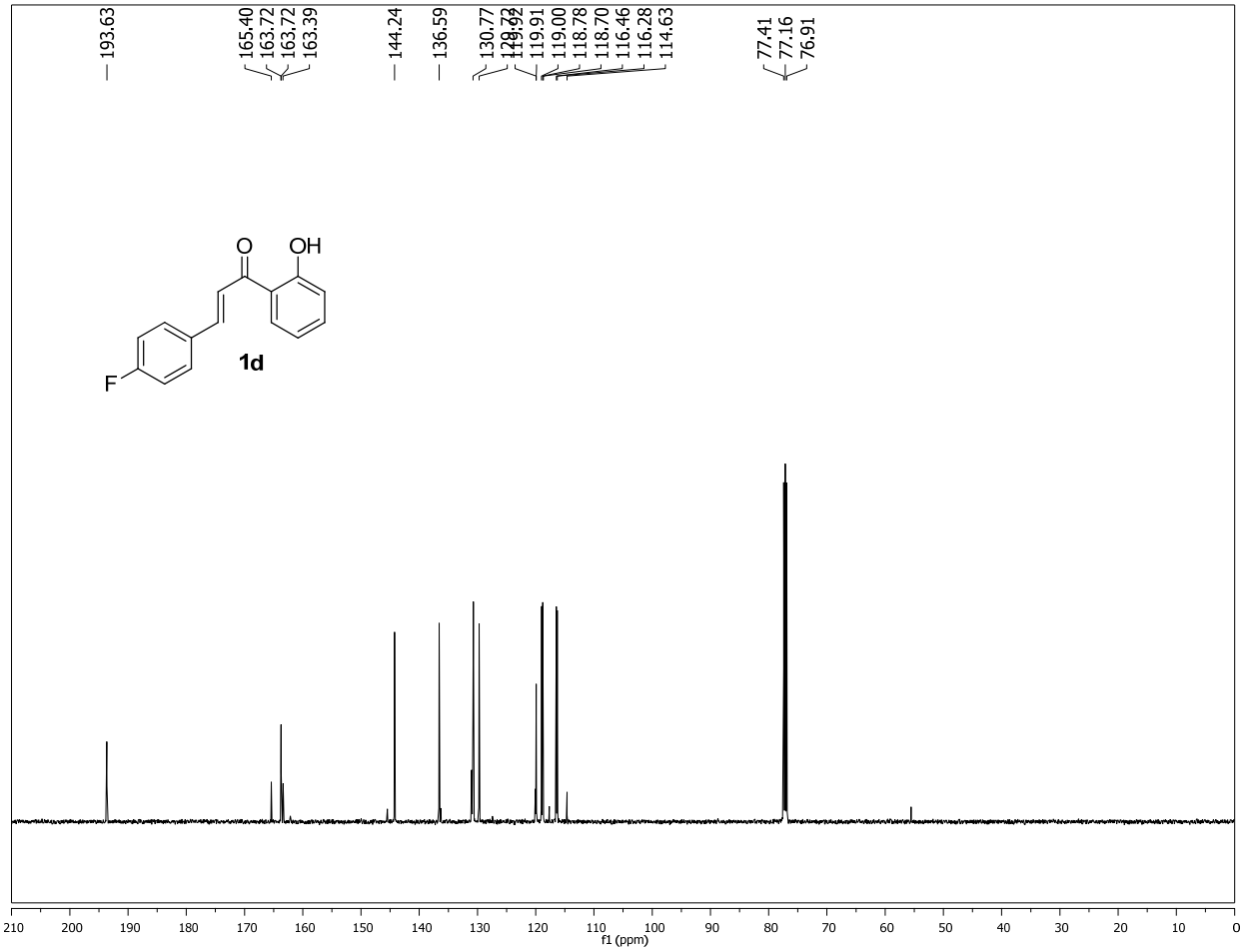
(*E*)-3-(4-Bromophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1c)



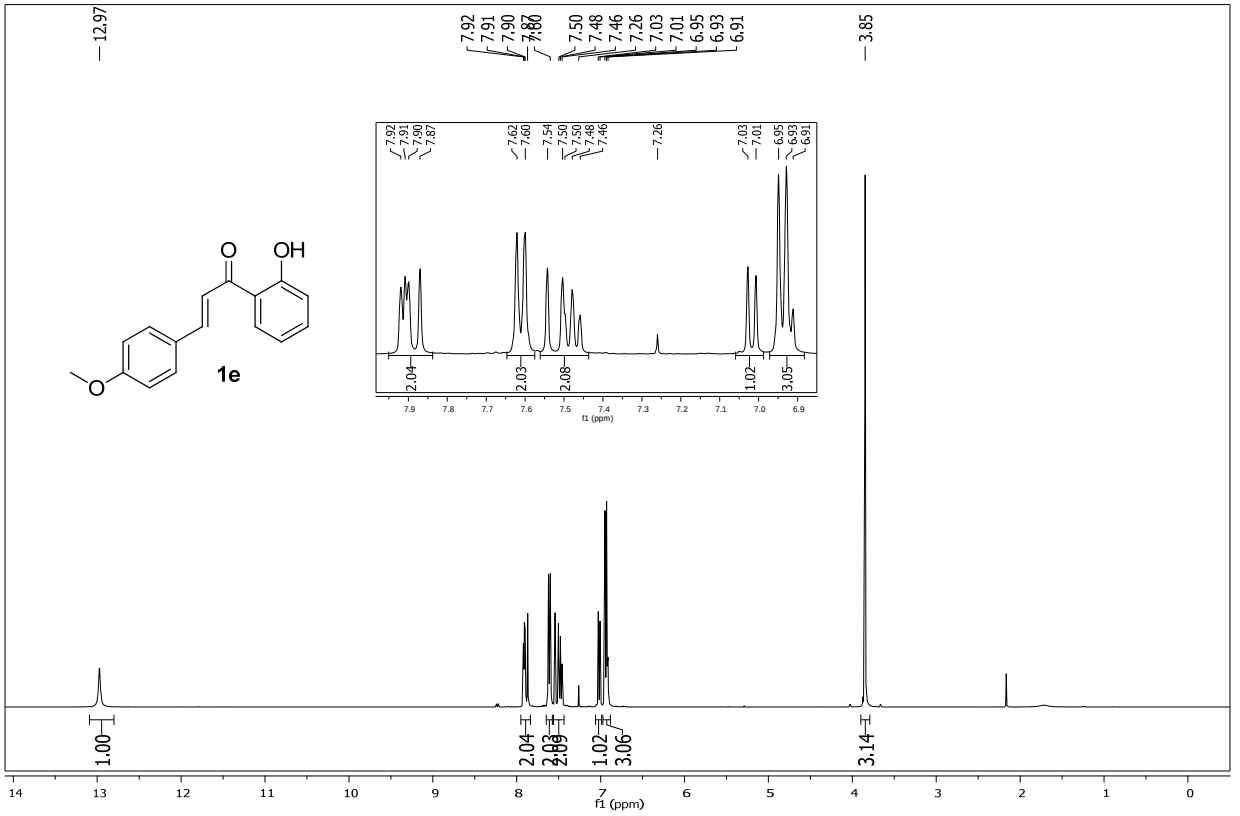


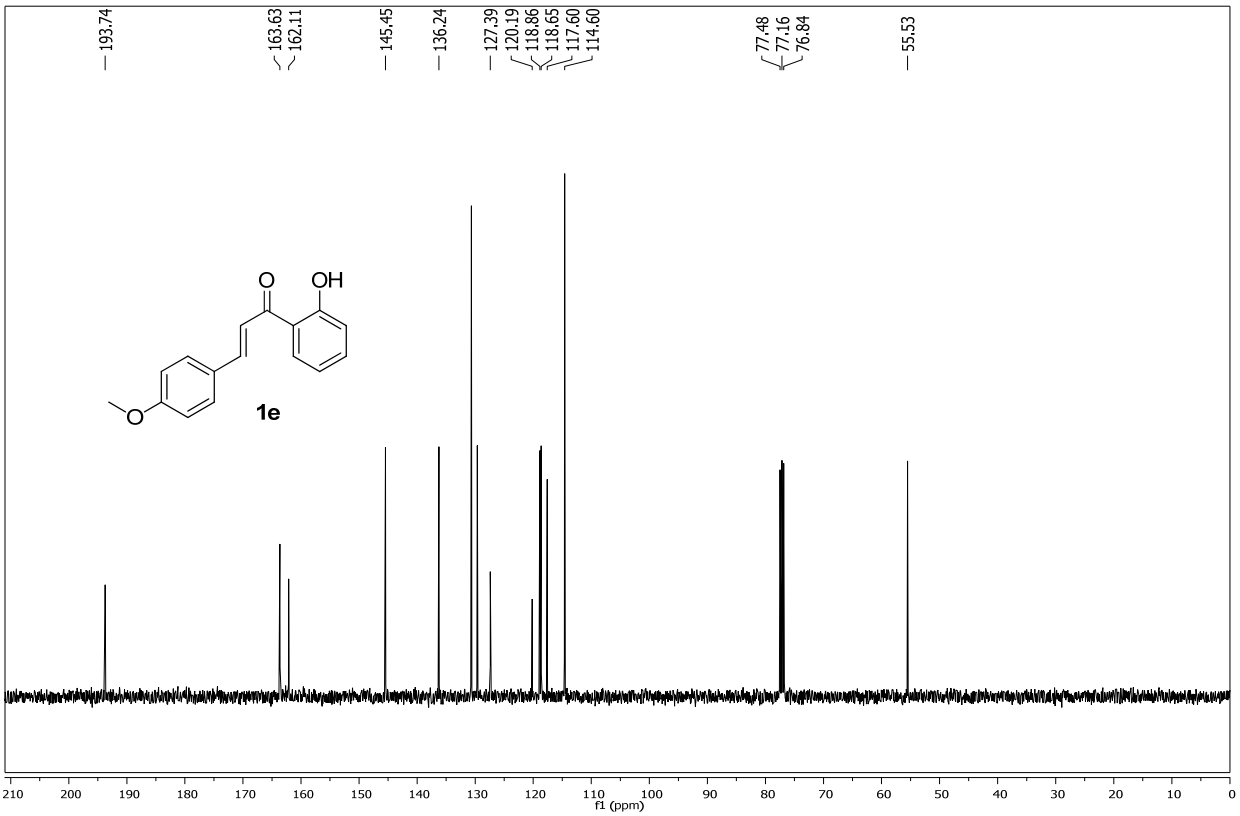
(*E*)-3-(4-Fluorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1d)



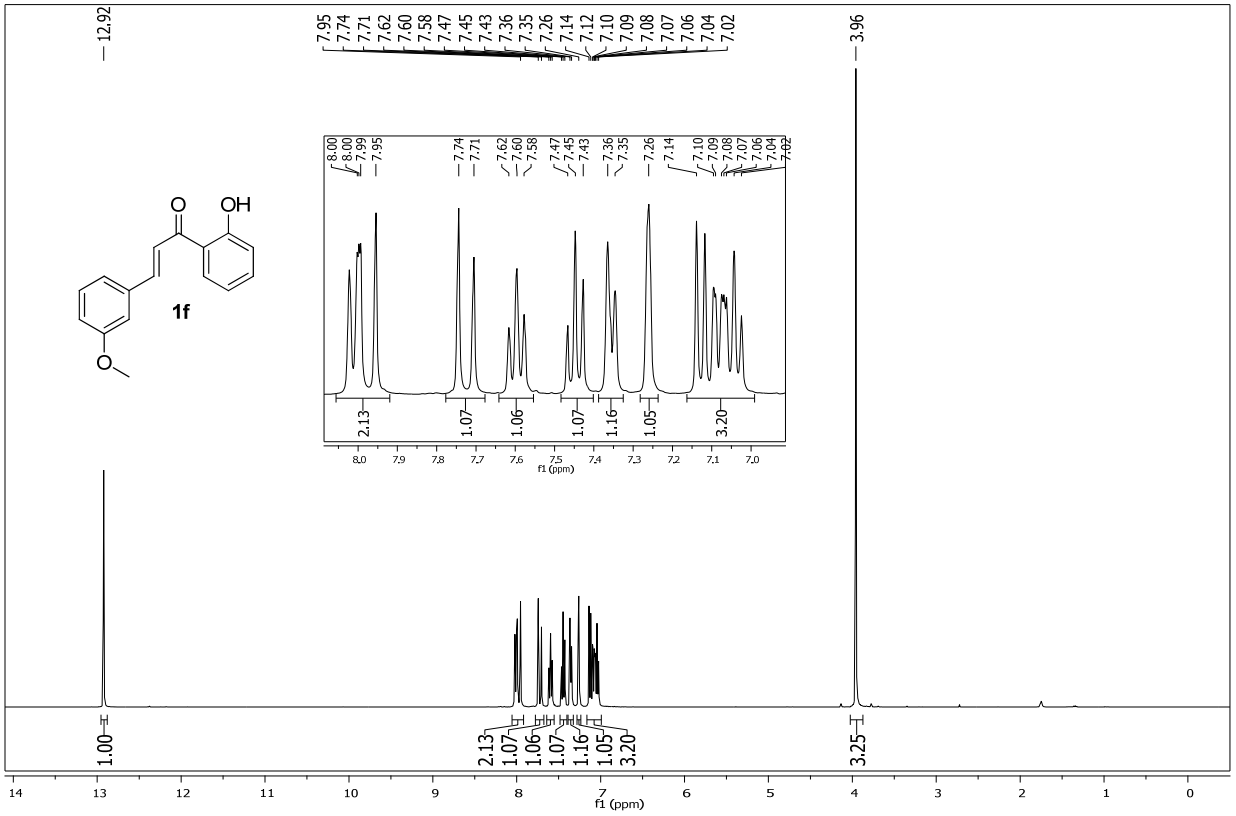


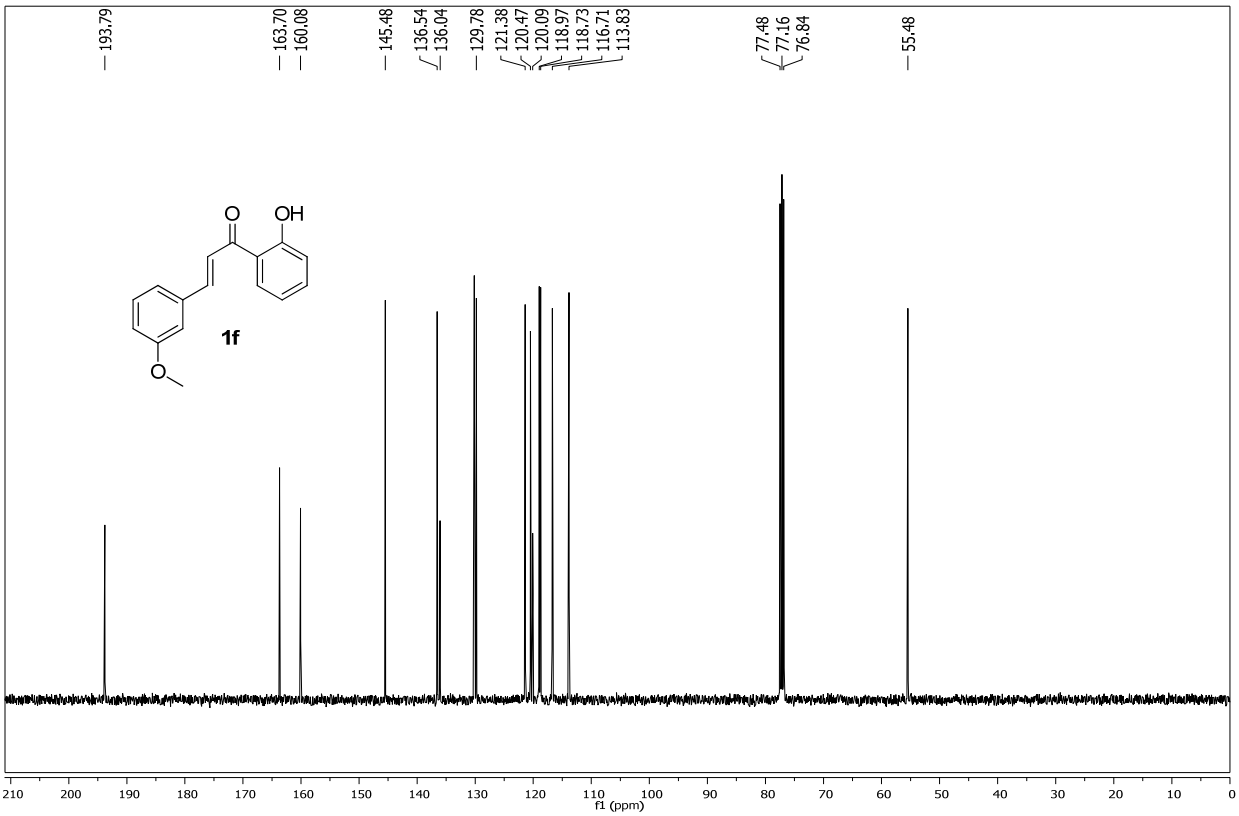
(*E*)-1-(2-Hydroxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-one (1e)



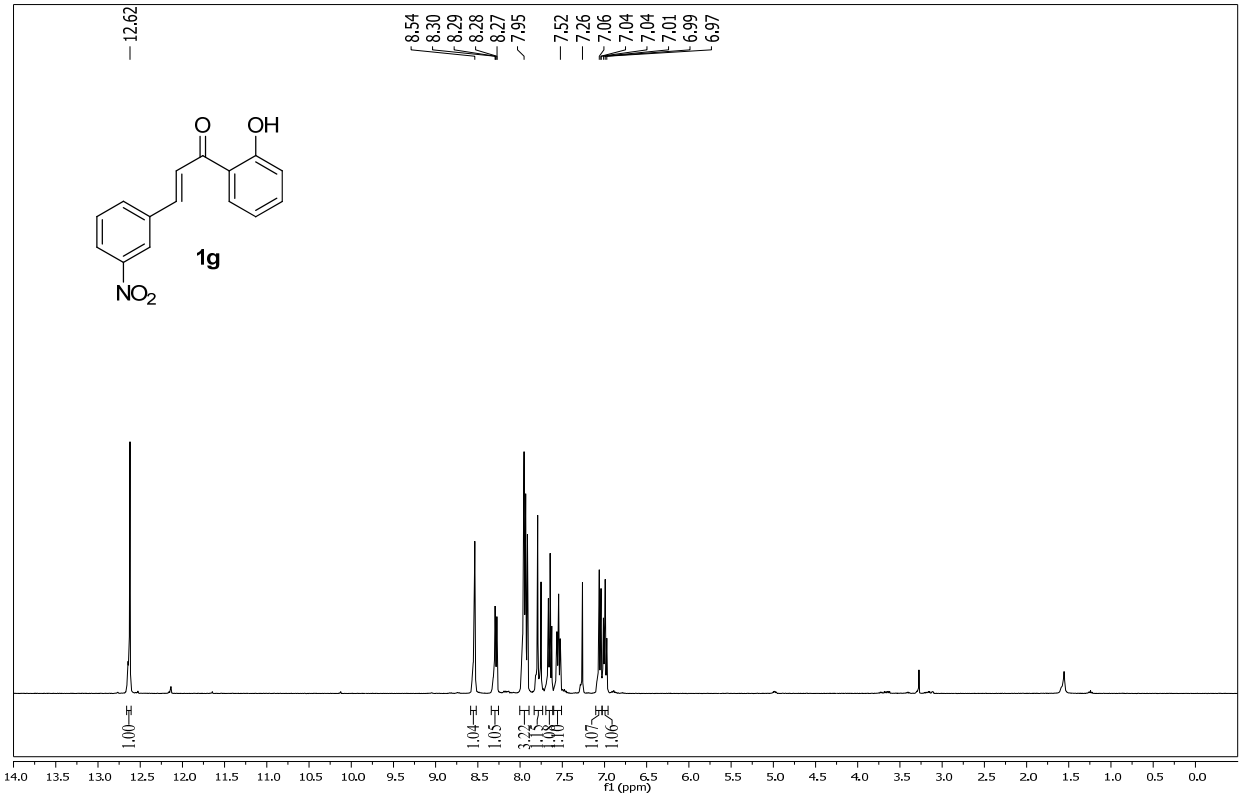


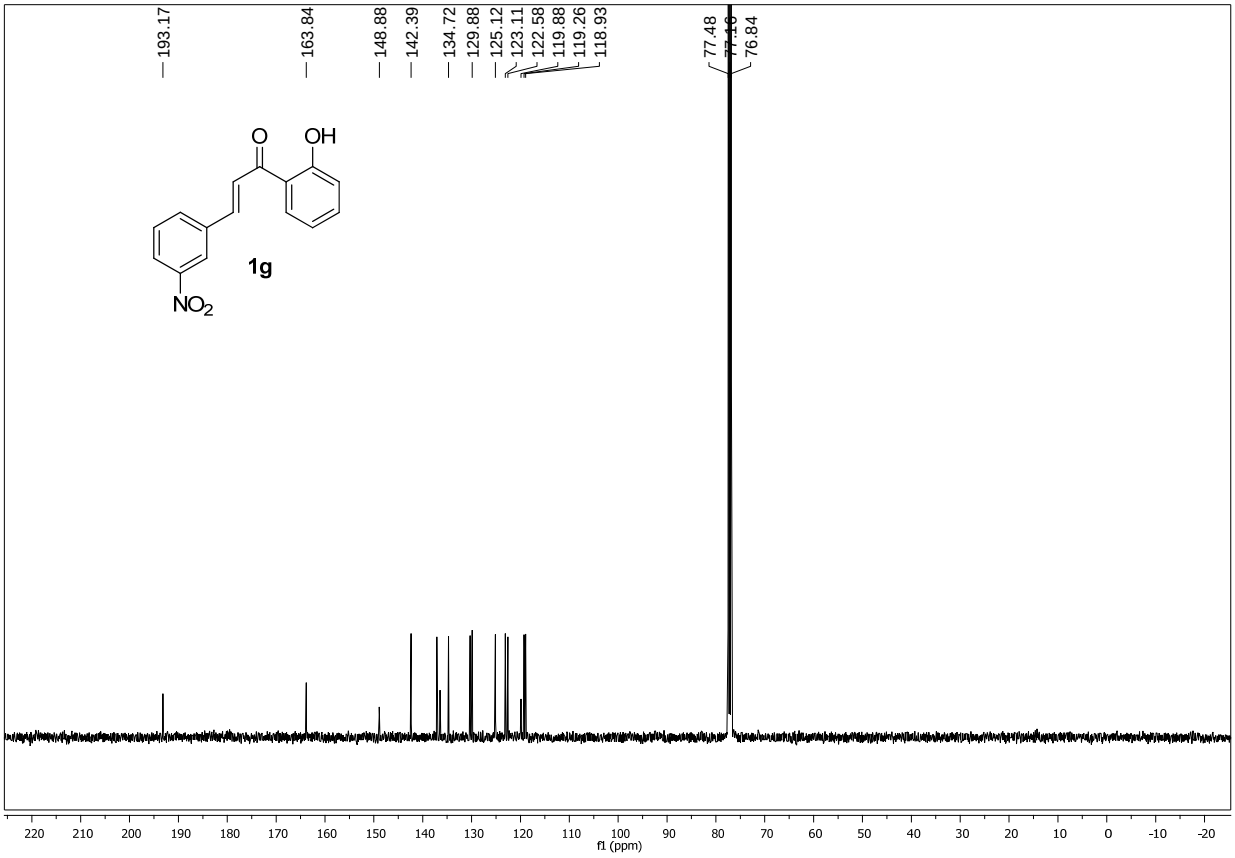
(*E*)-1-(2-Hydroxyphenyl)-3-(3-methoxyphenyl)prop-2-en-1-one (1f)



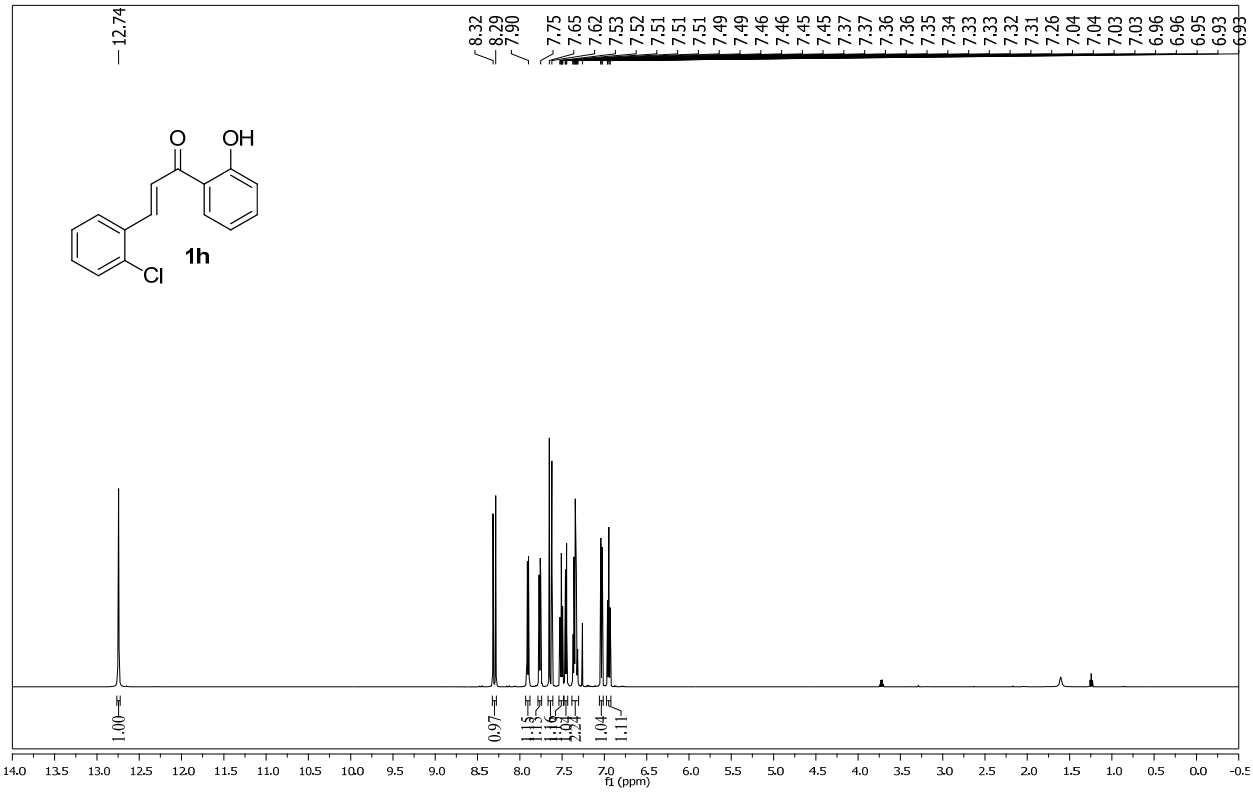


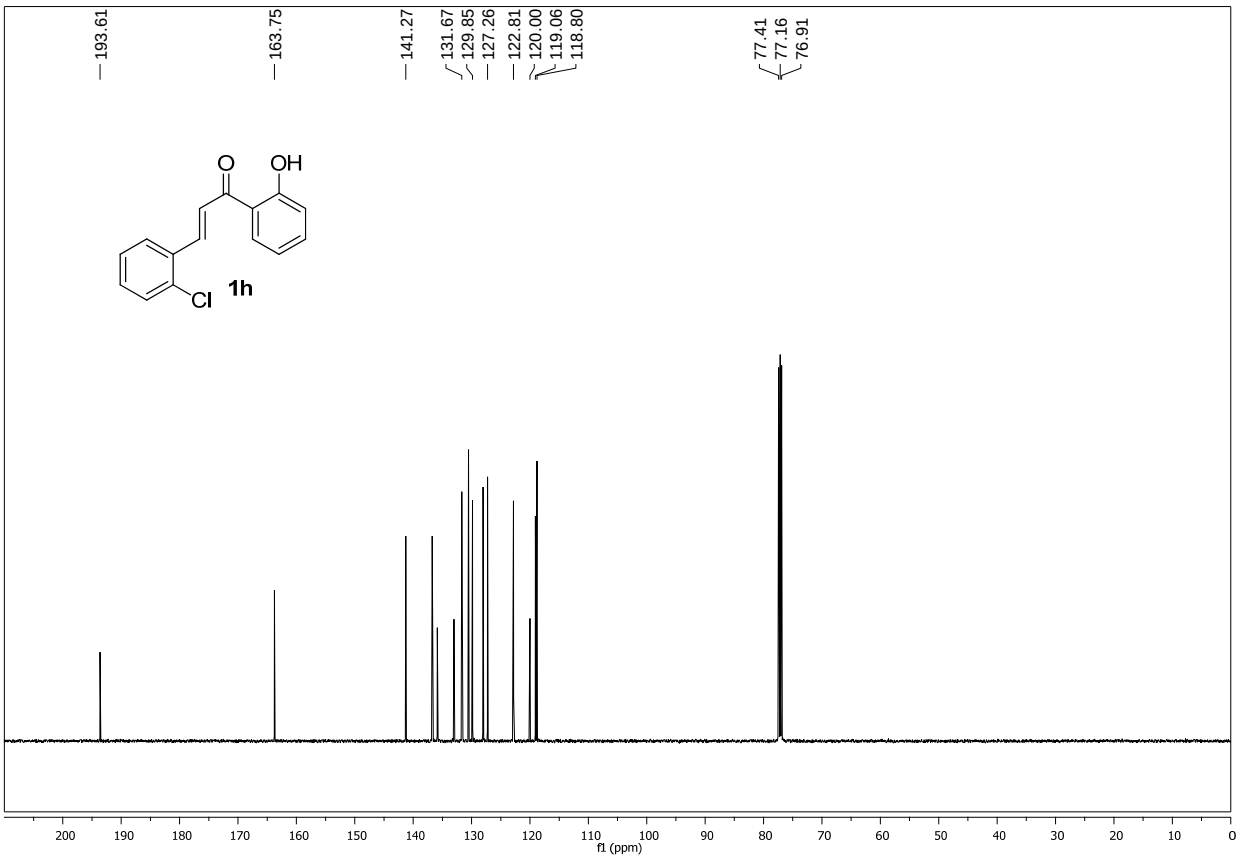
(*E*)-1-(2-Hydroxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one (1g)



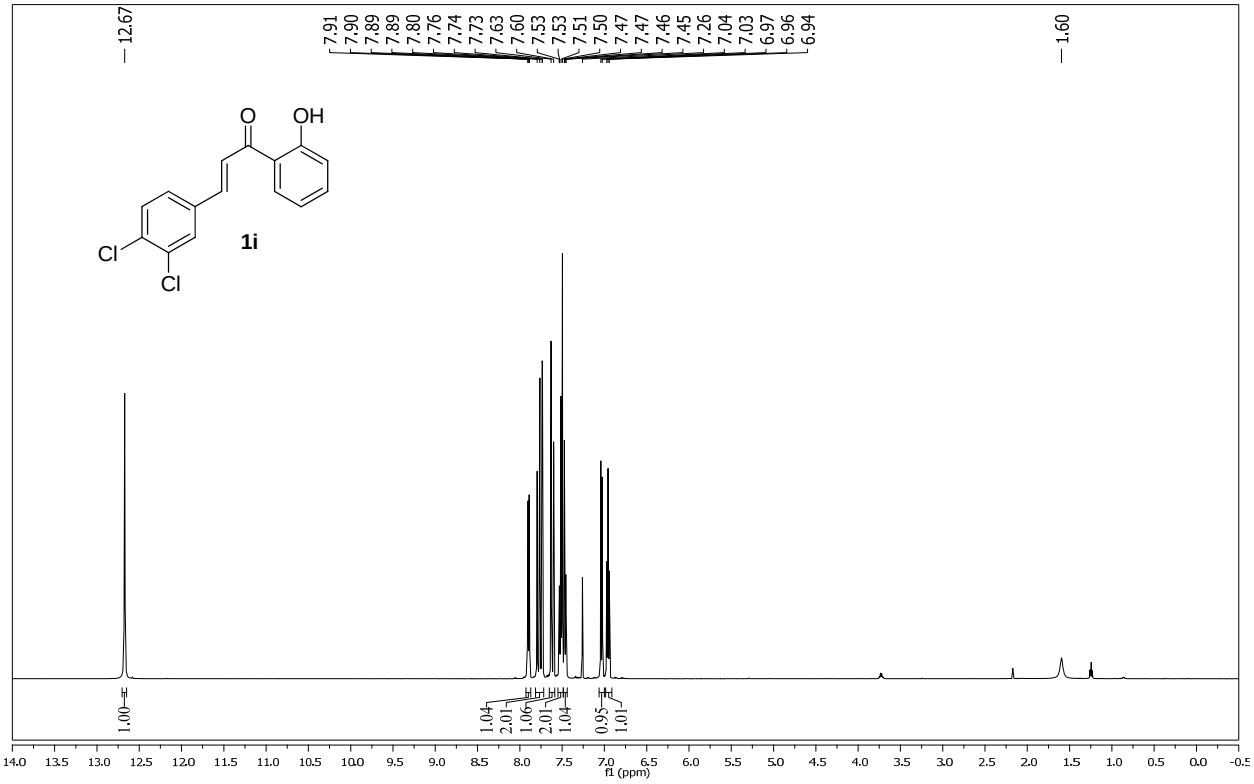


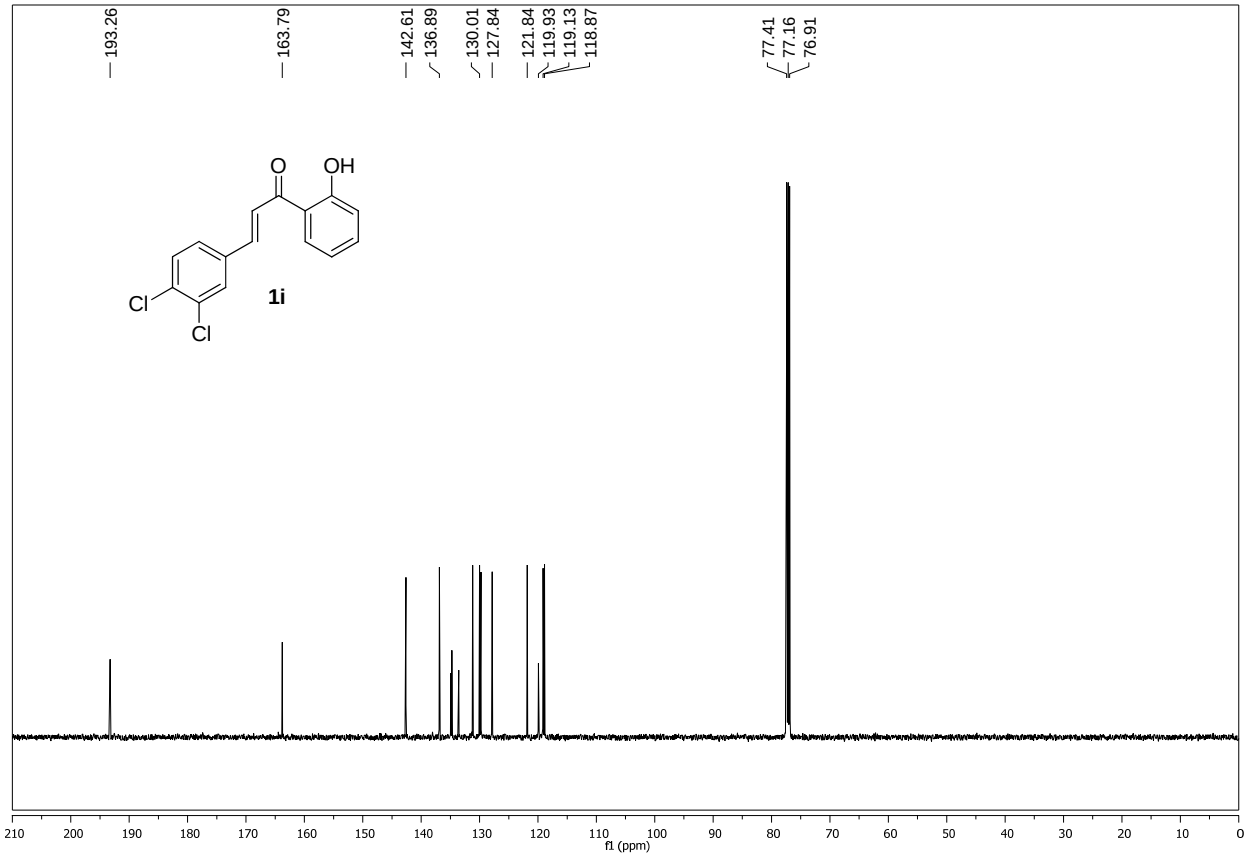
(*E*)-3-(2-Chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1h)



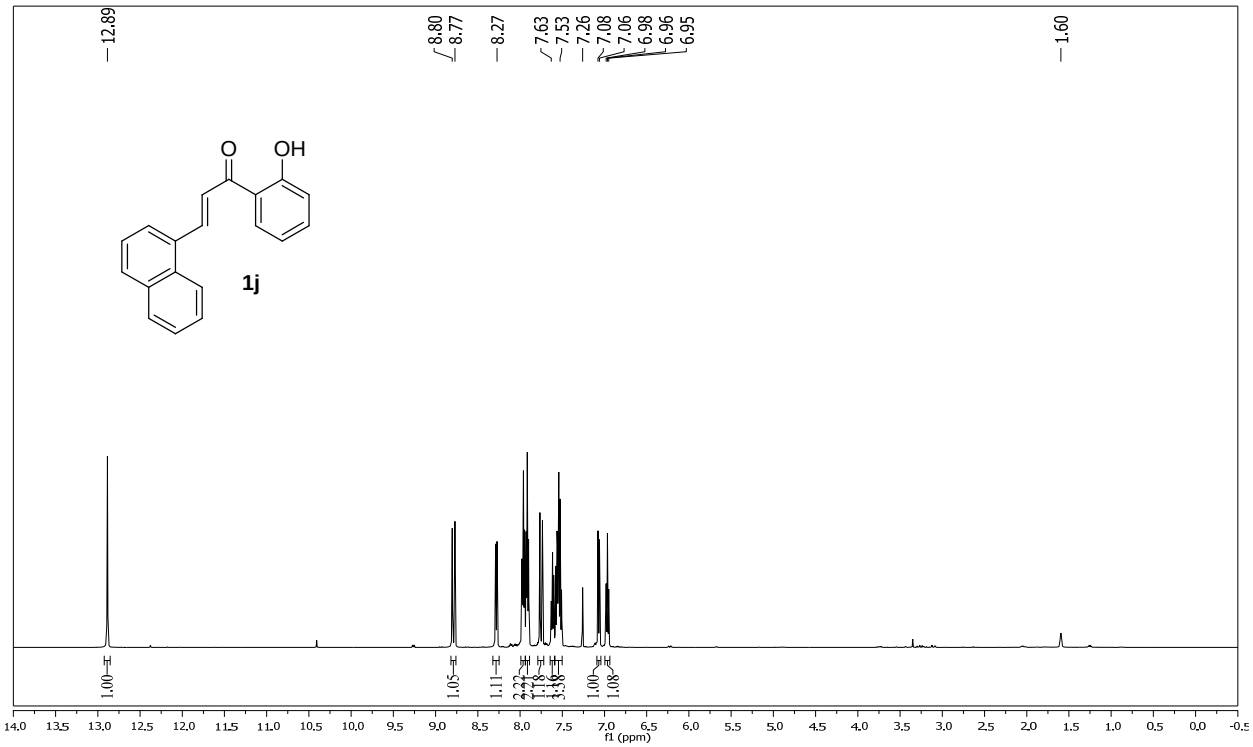


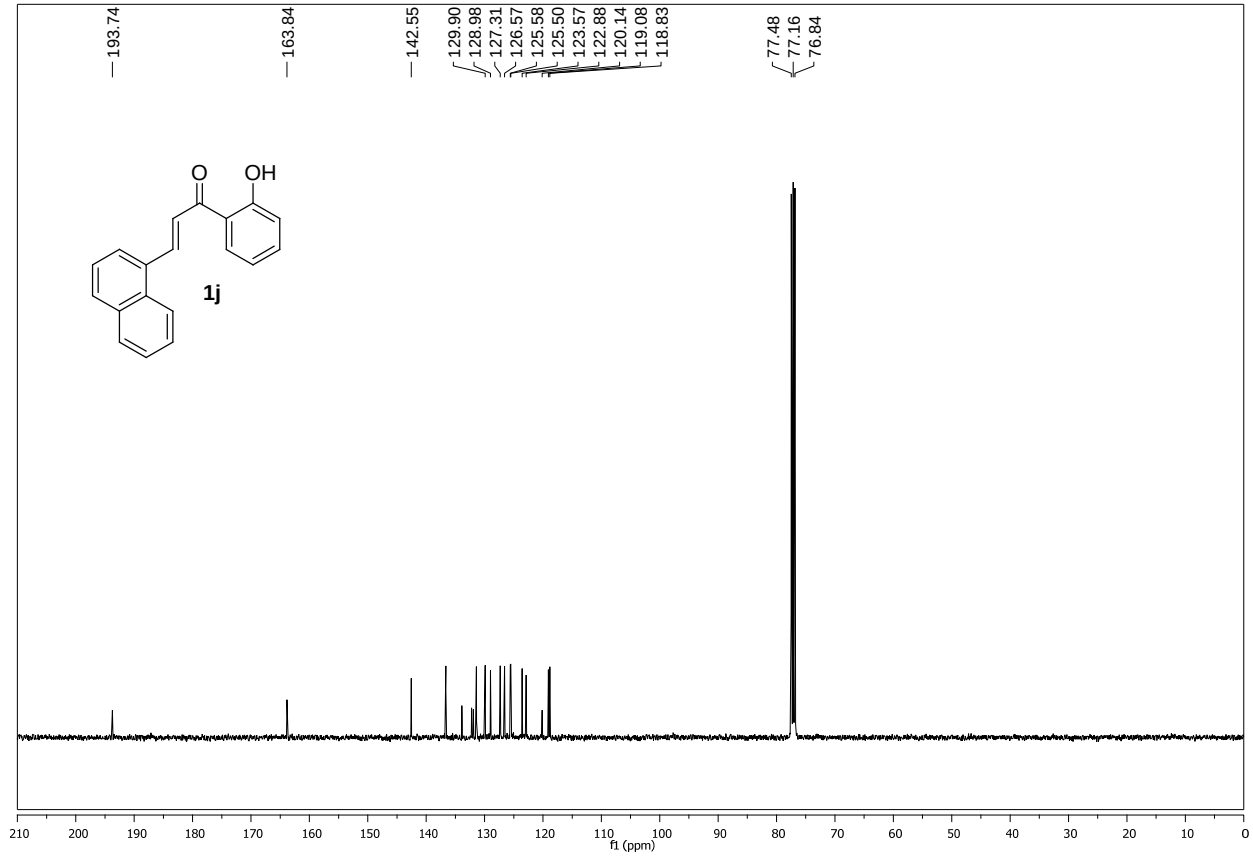
(*E*)-3-(3,4-Dichlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1i)



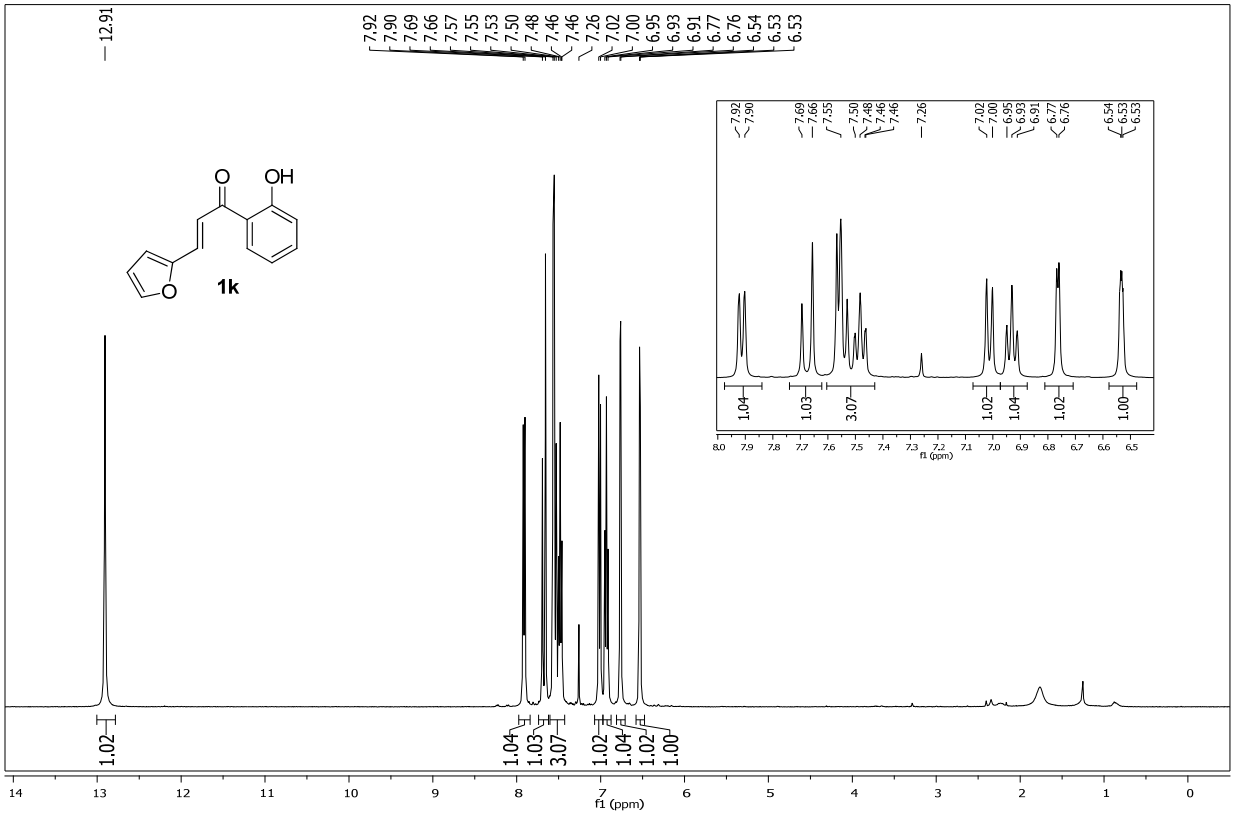


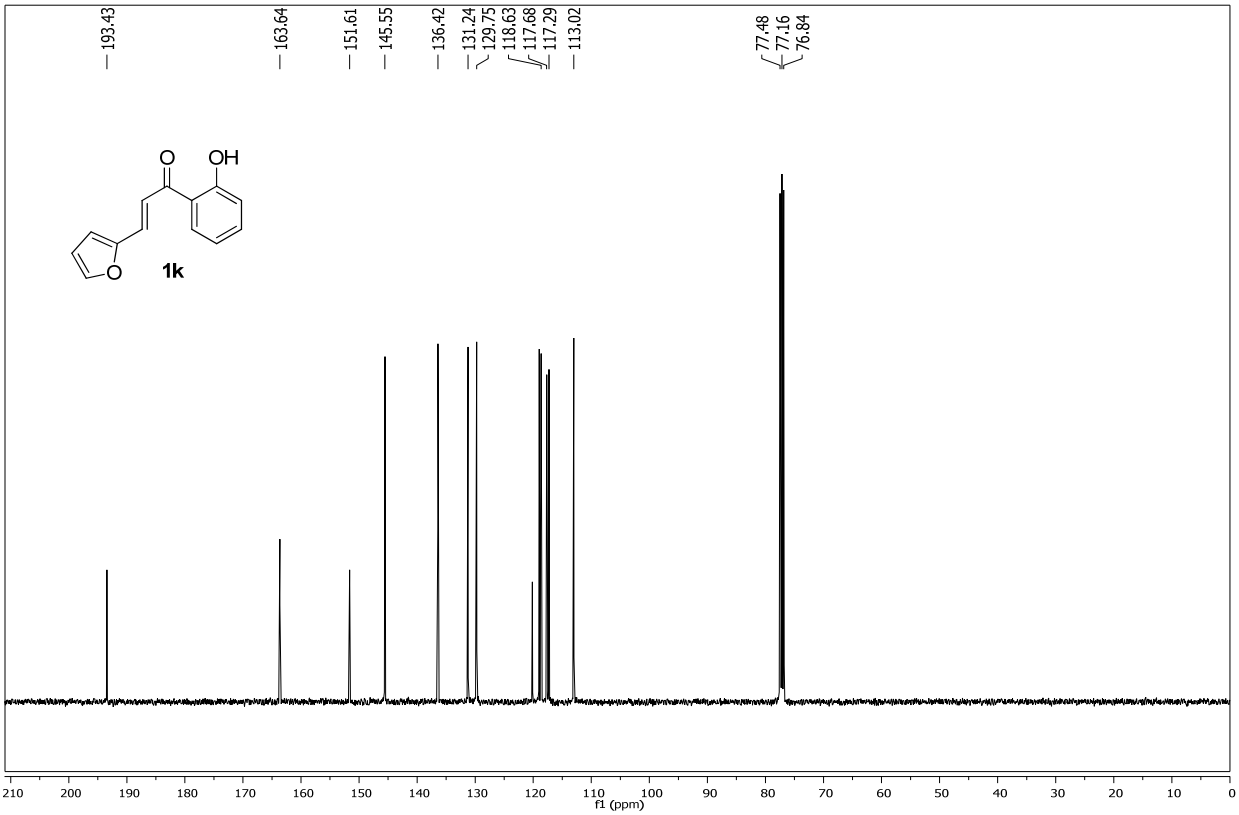
(*E*)-1-(2-Hydroxyphenyl)-3-(naphthalene-1-yl)prop-2-en-1-one (1j)



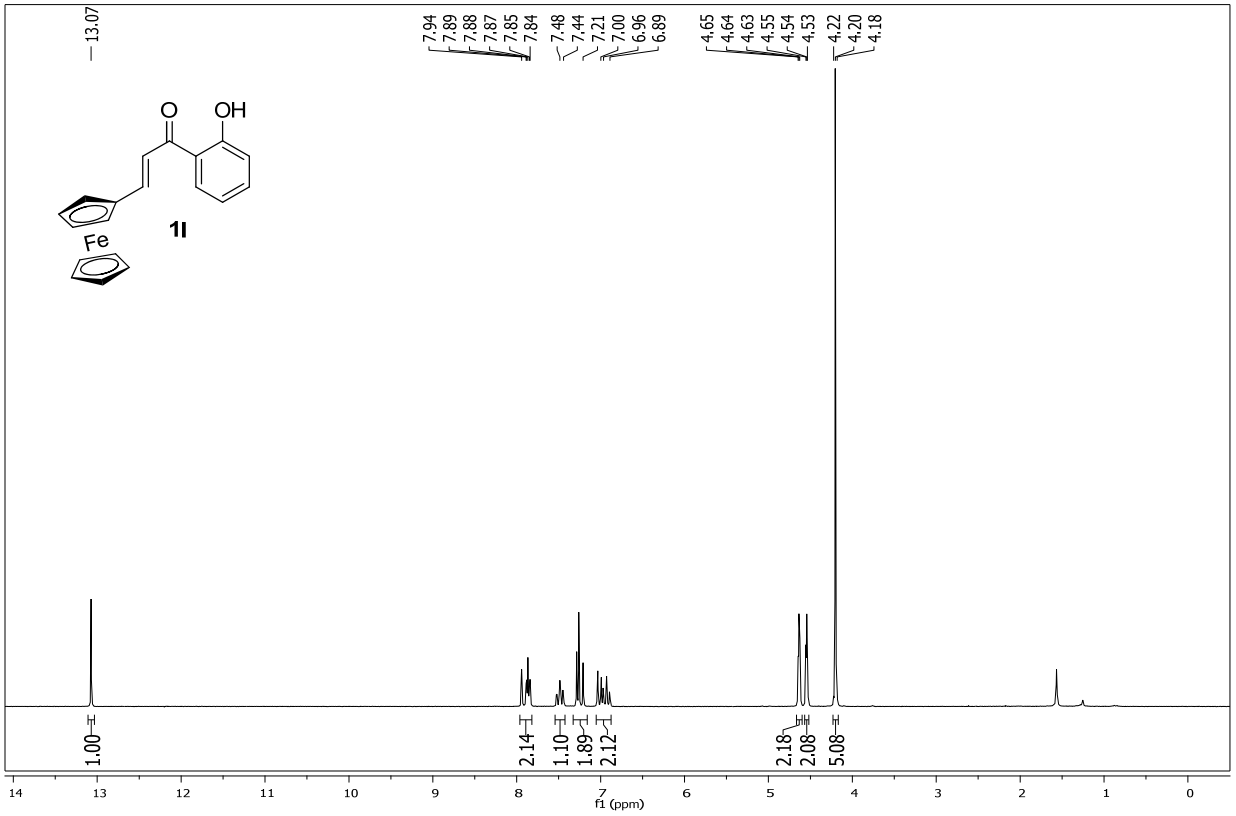


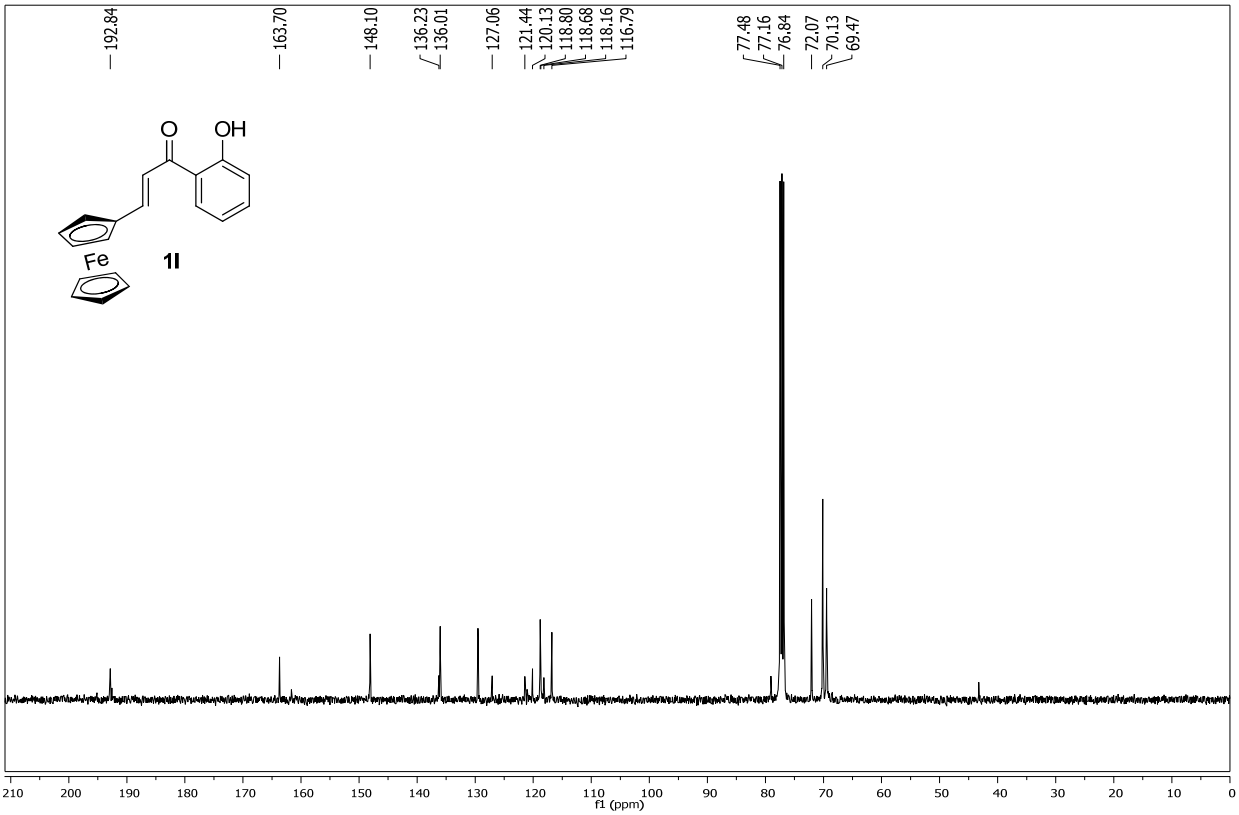
(*E*)-3-(Furan-2-yl)-1-(2-hydroxyphenyl)prop-2-en-1-one (1k)



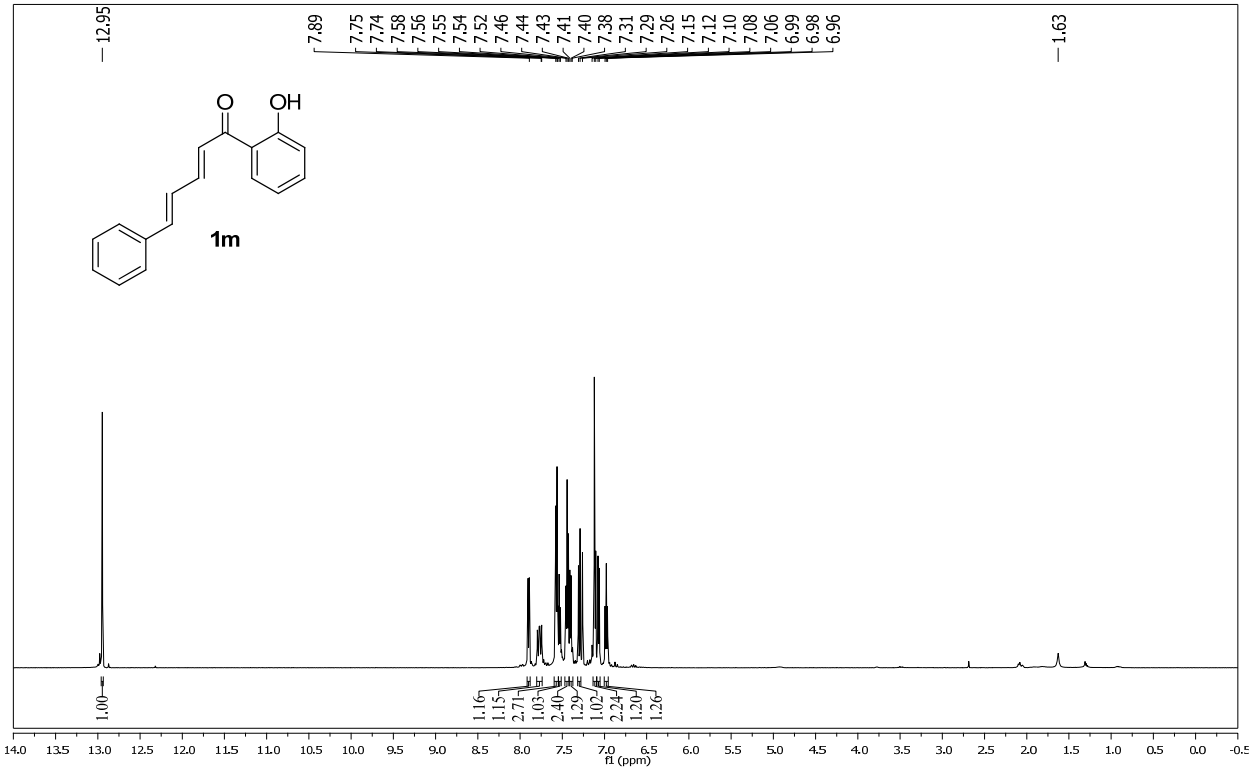


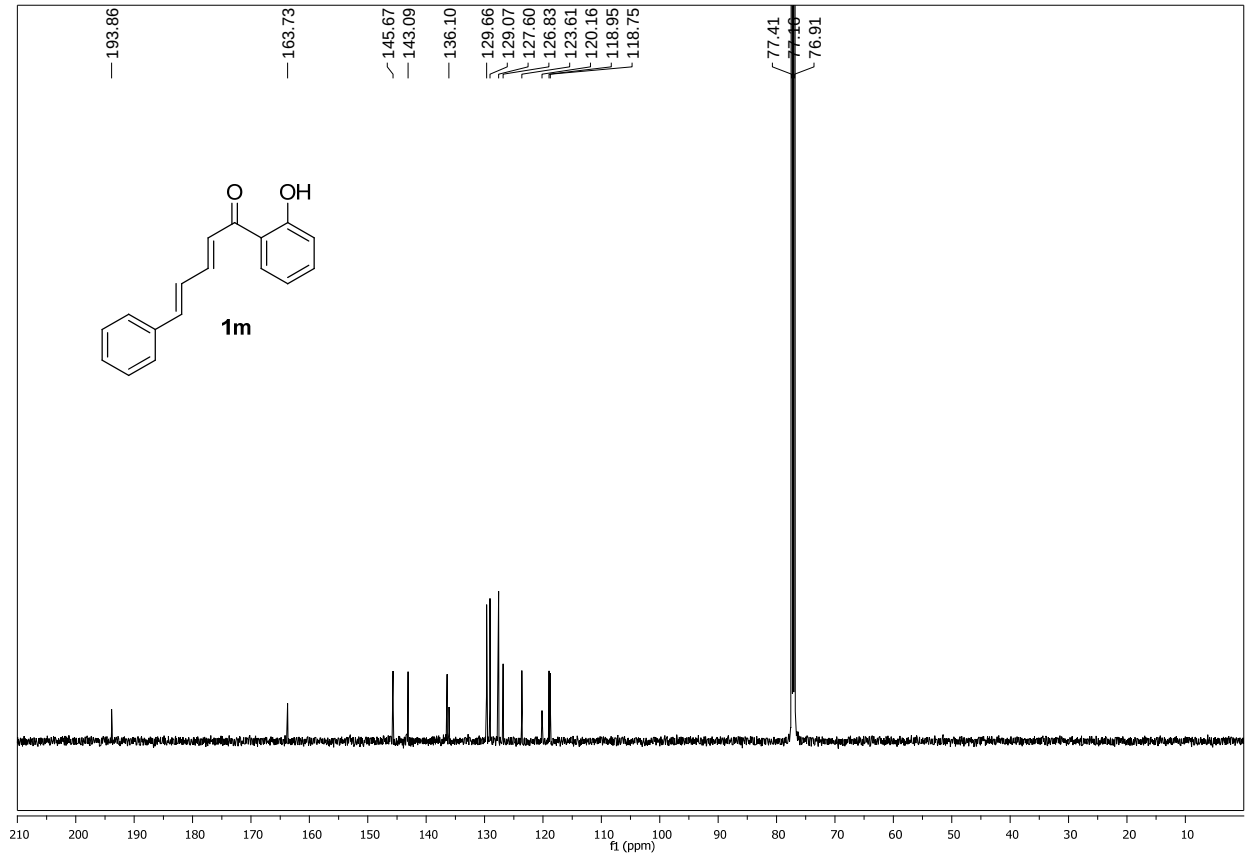
(*E*)-1-(2-Hydroxyphenyl)-3-(ferroceniyl)prop-2-en-1-one (1l)



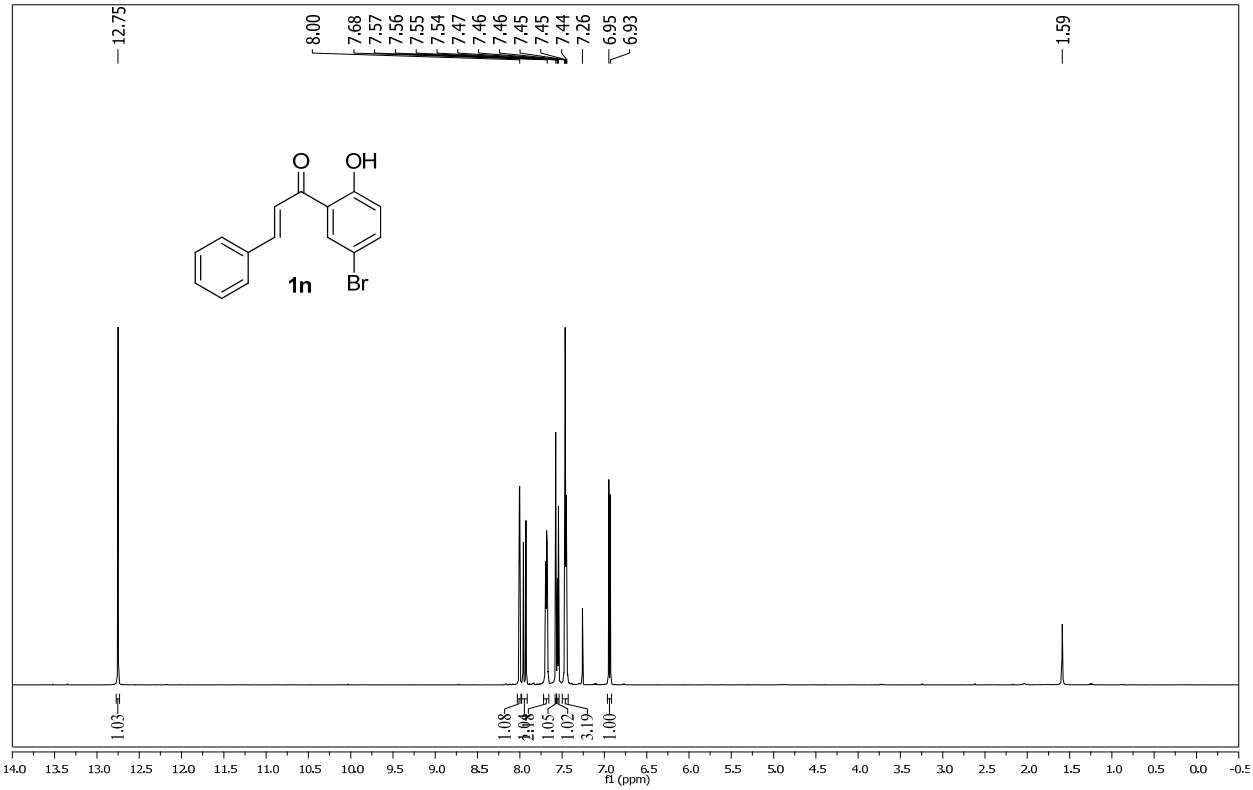


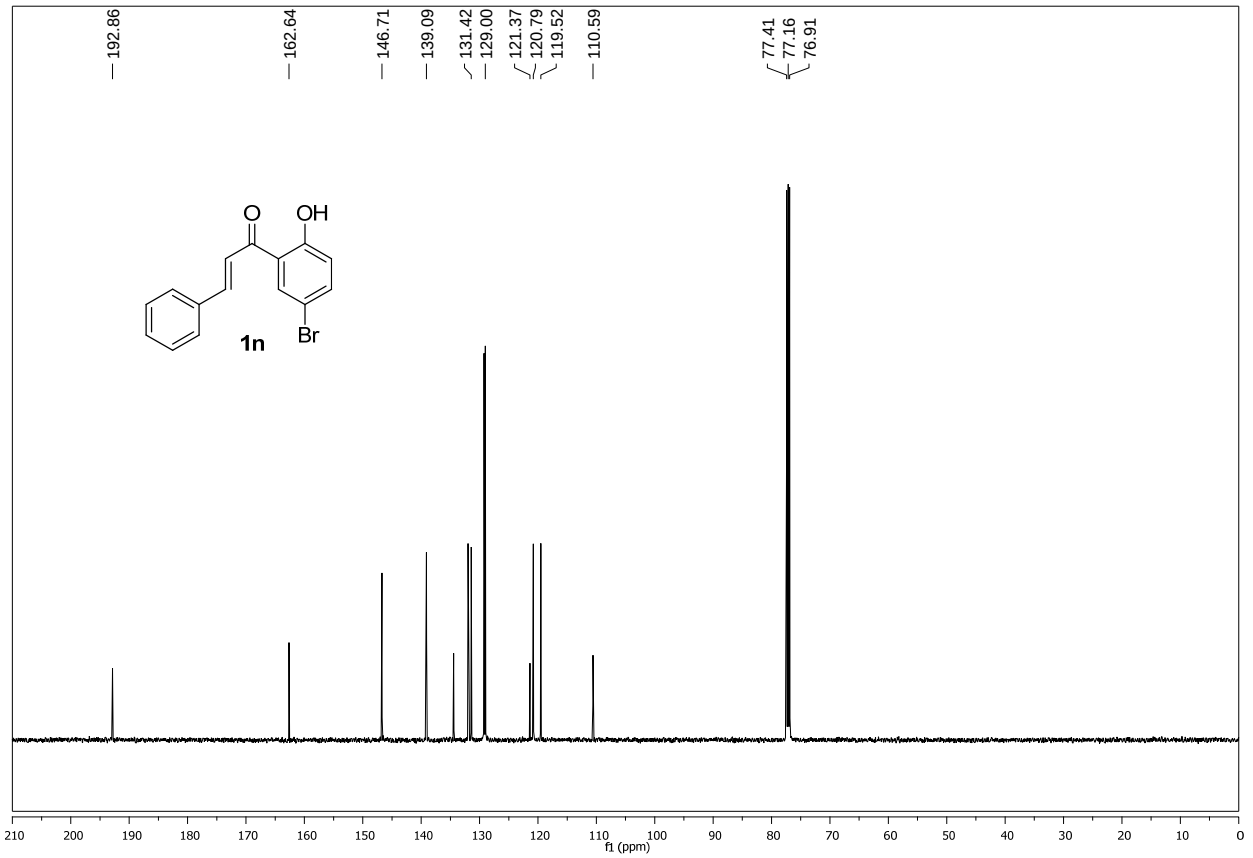
(2*E*,4*E*)-1-(2-Hydroxyphenyl)-5-phenylpenta-2,4-dien-1-one (1m)



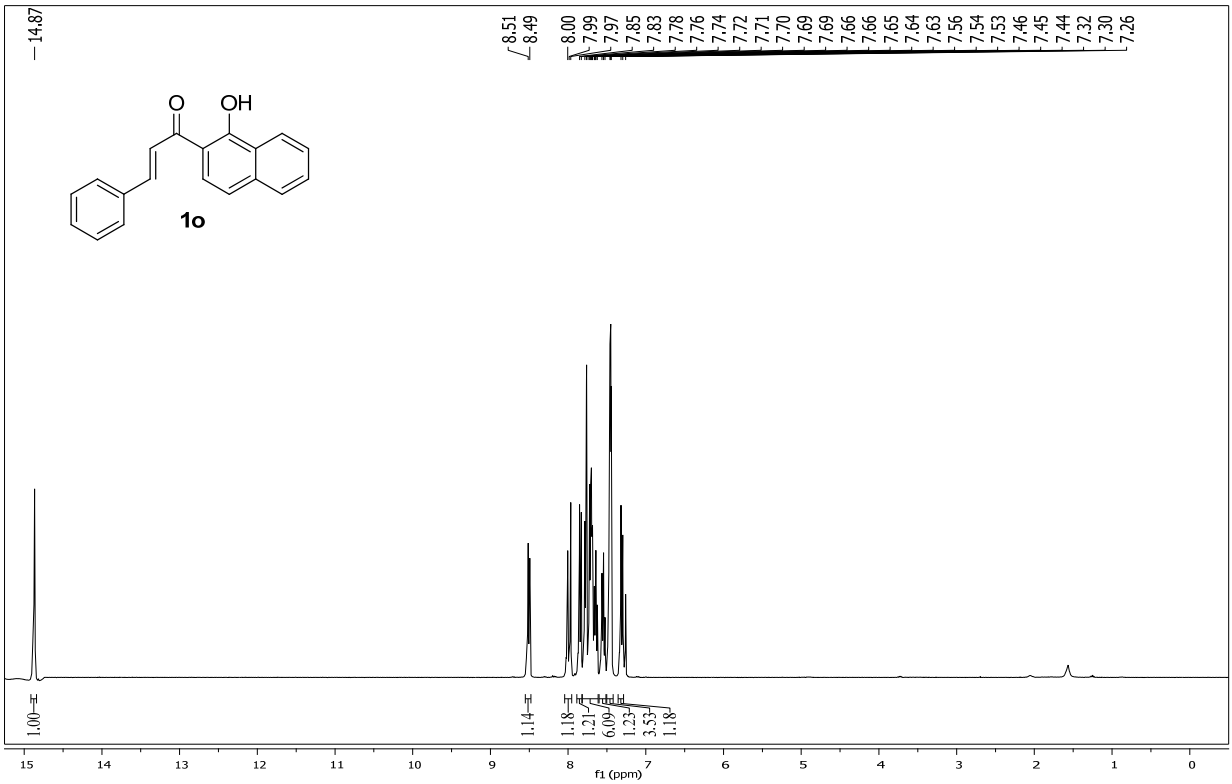


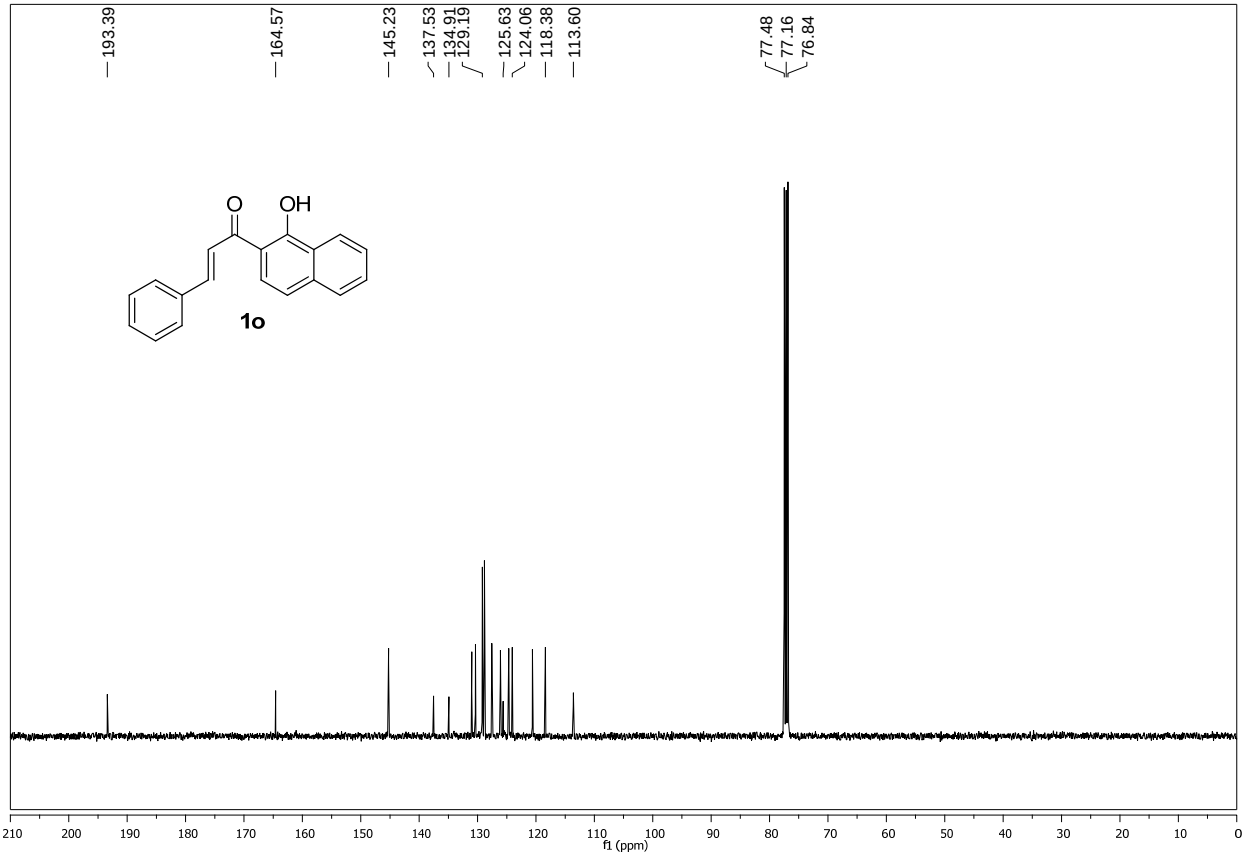
(*E*)-1-(5-Bromo-2-hydroxyphenyl)-3-phenylprop-2-en-1-one (1n)



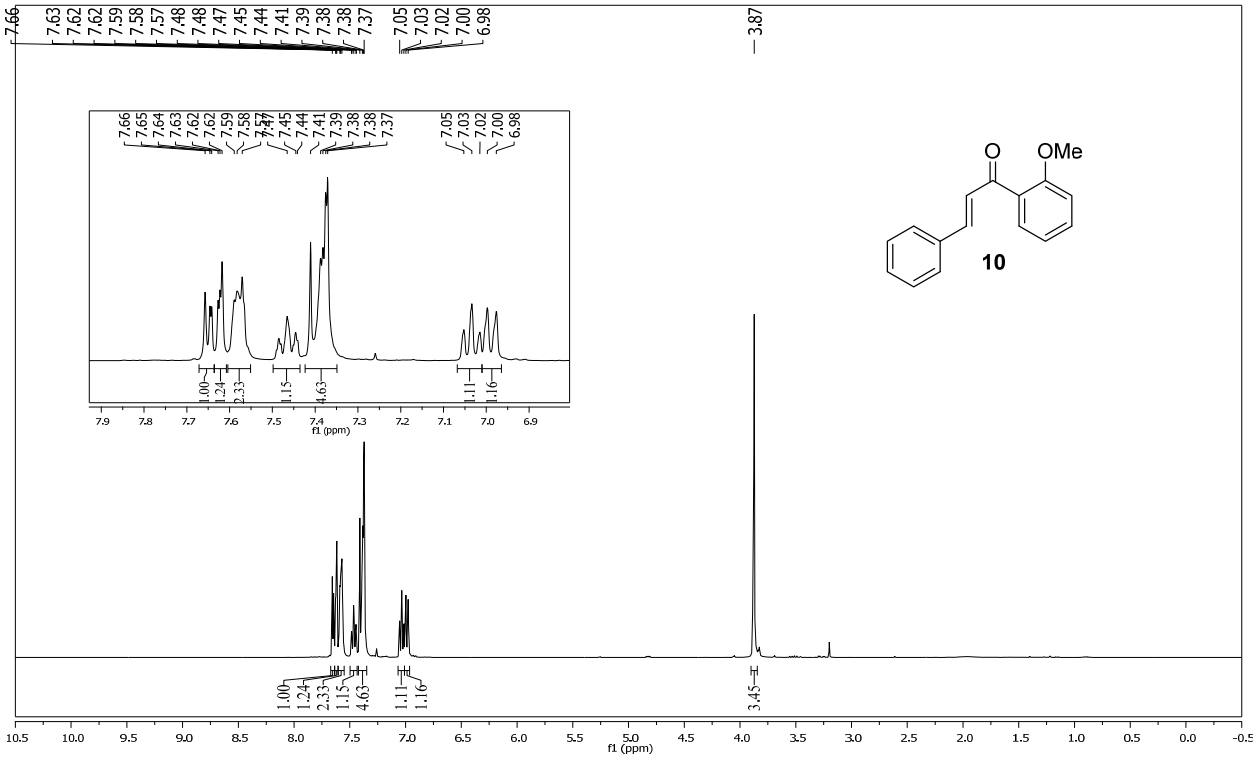


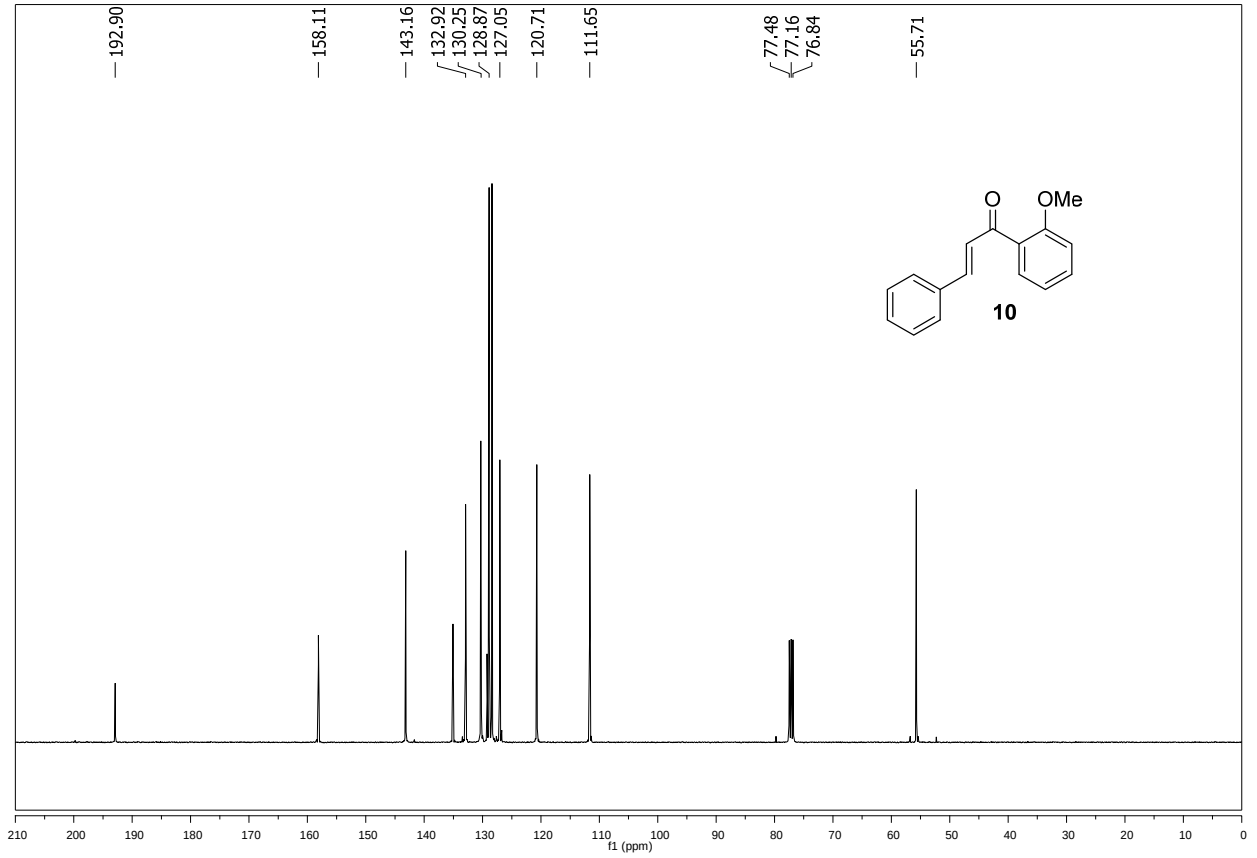
(*E*)-1-(1-Hydroxynaphthalen-2-yl)-3-phenylprop-2-en-1-one (1o)





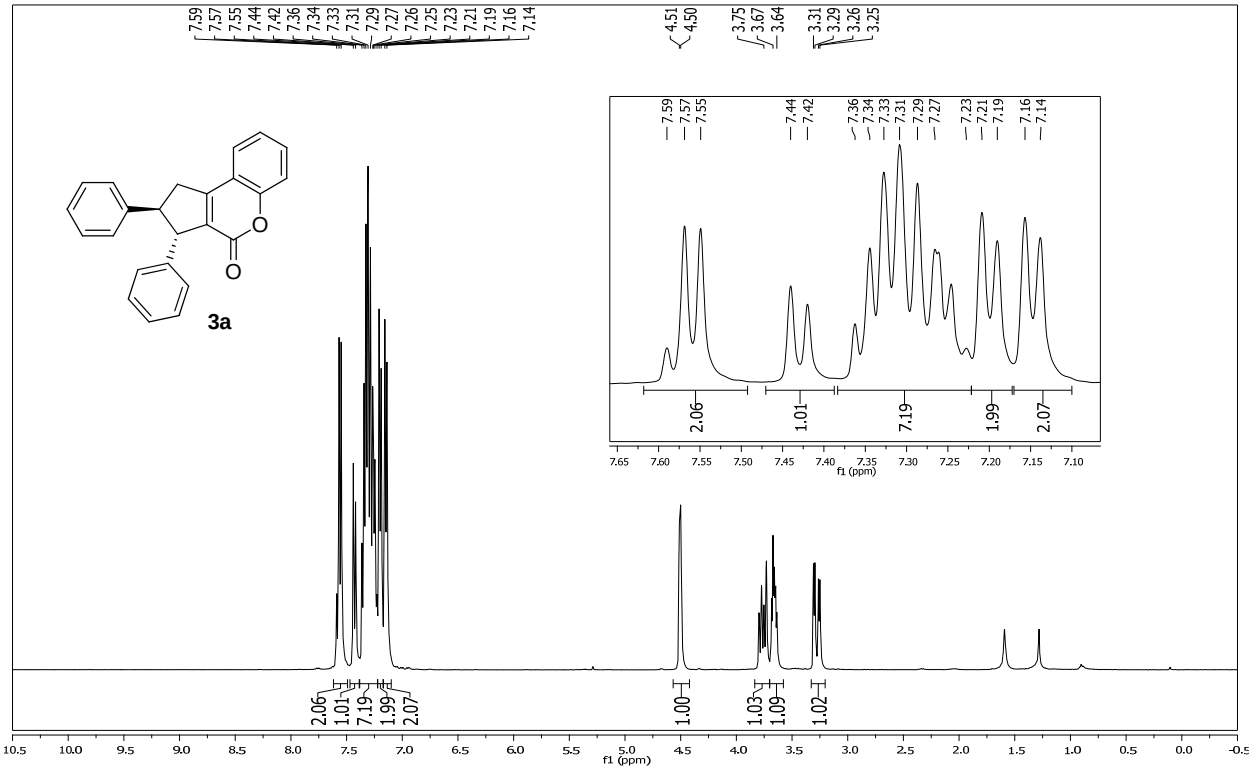
(*E*)-1-(2-Methoxyphenyl)-3-phenylprop-2-en-1-one (10)

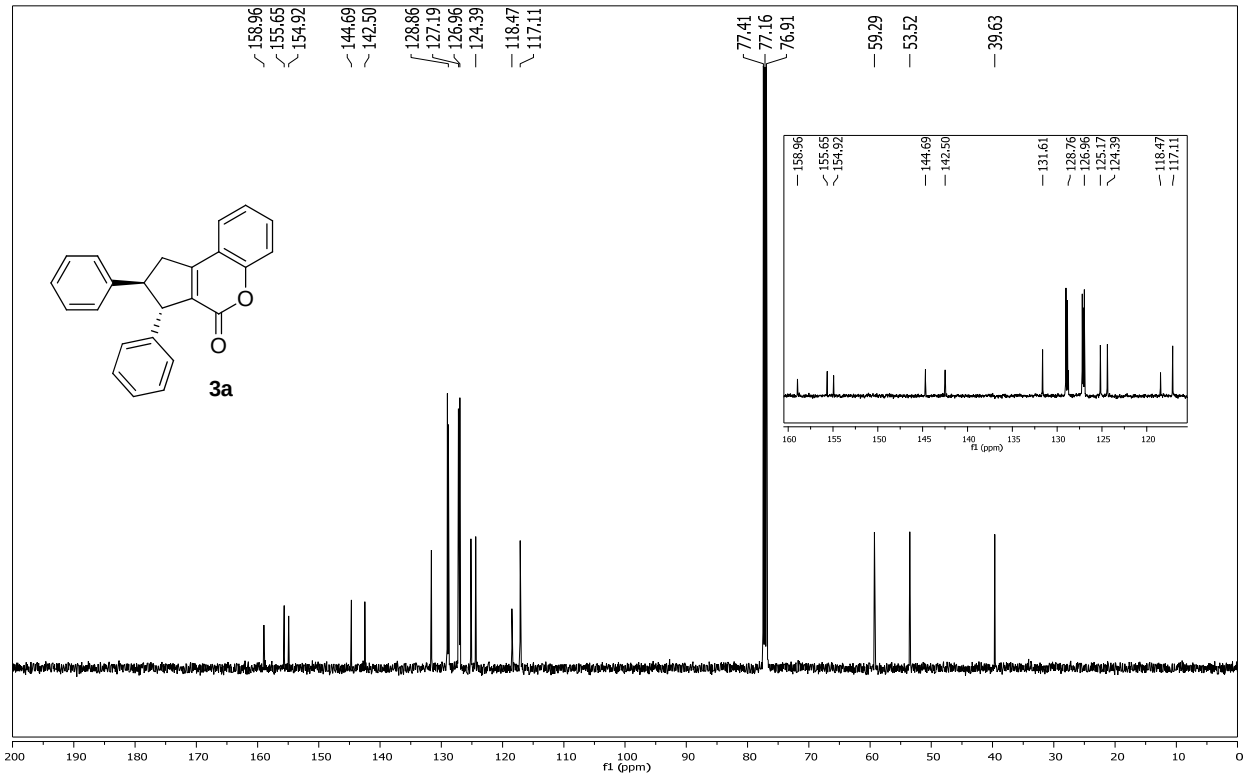




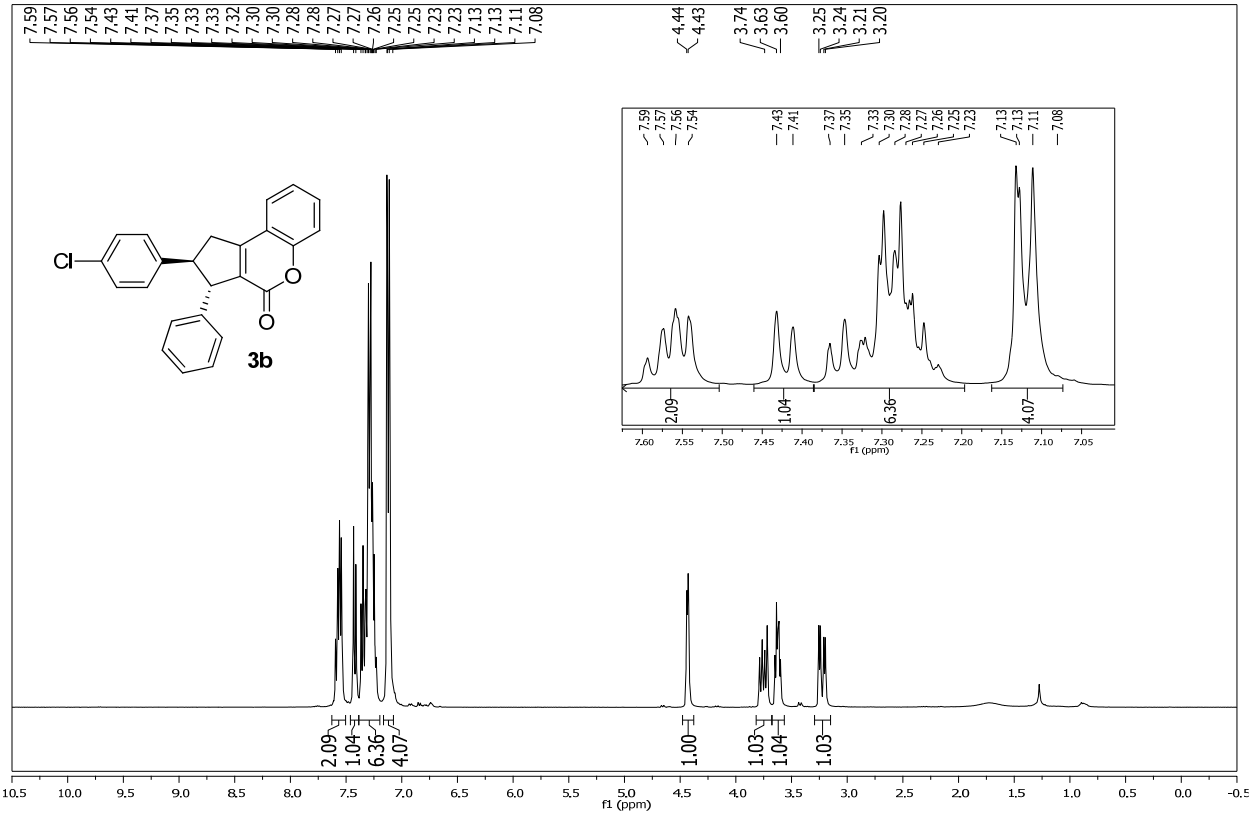
9. ^{1}H and ^{13}C NMR Spectra Functionalized Coumarins

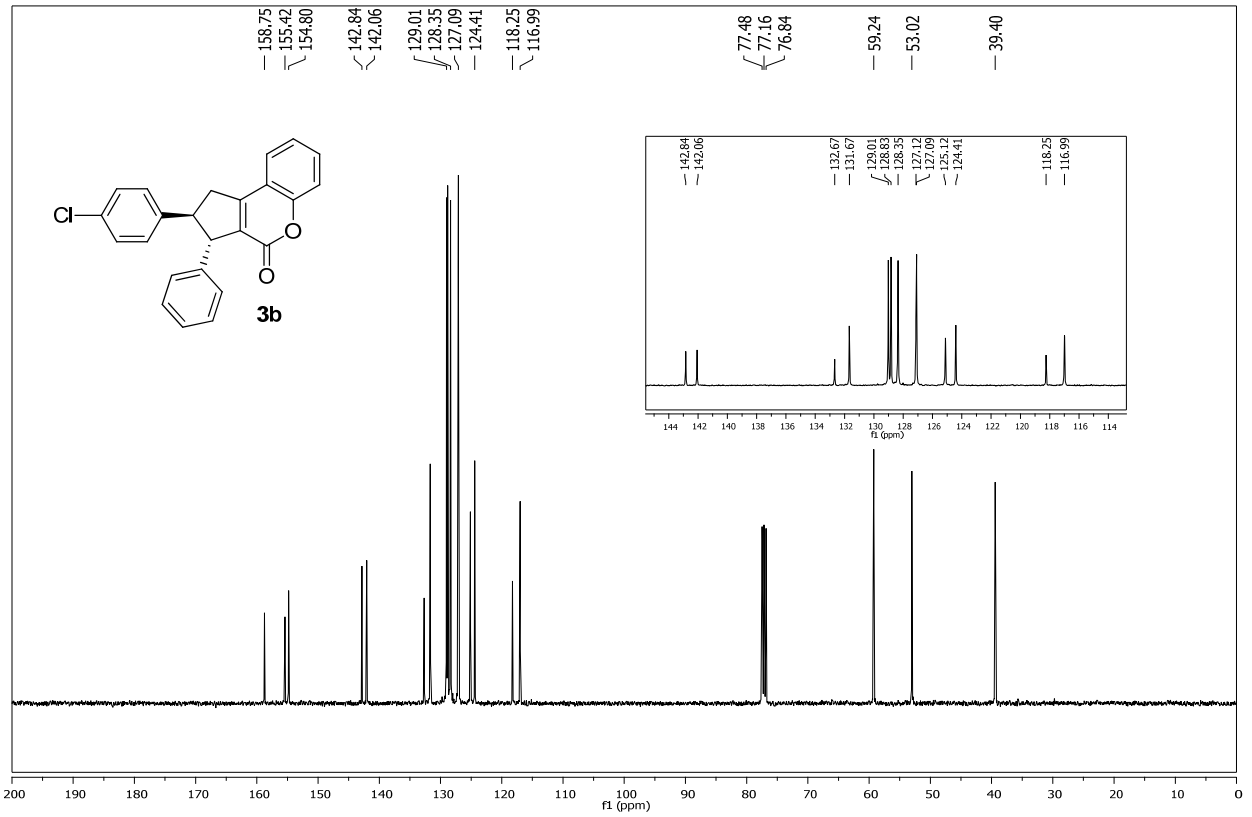
2,3-Diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3a)



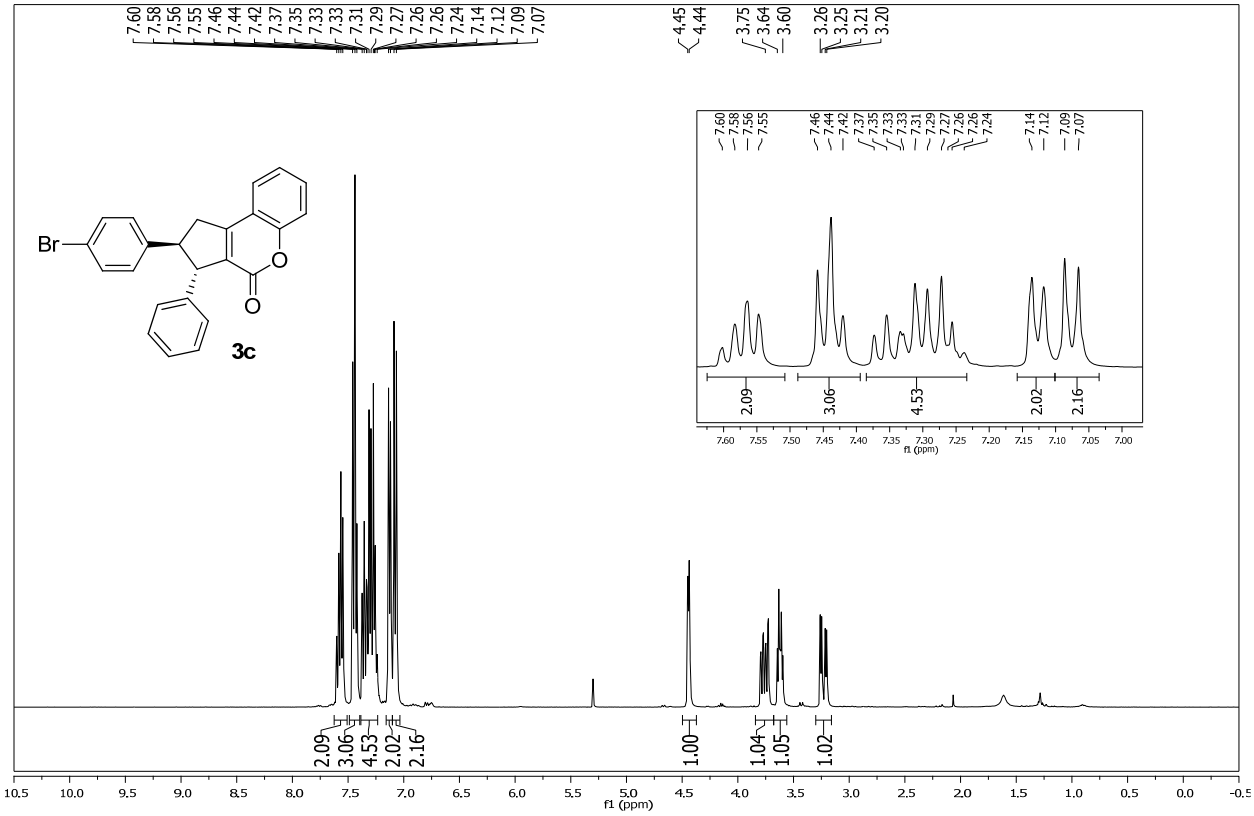


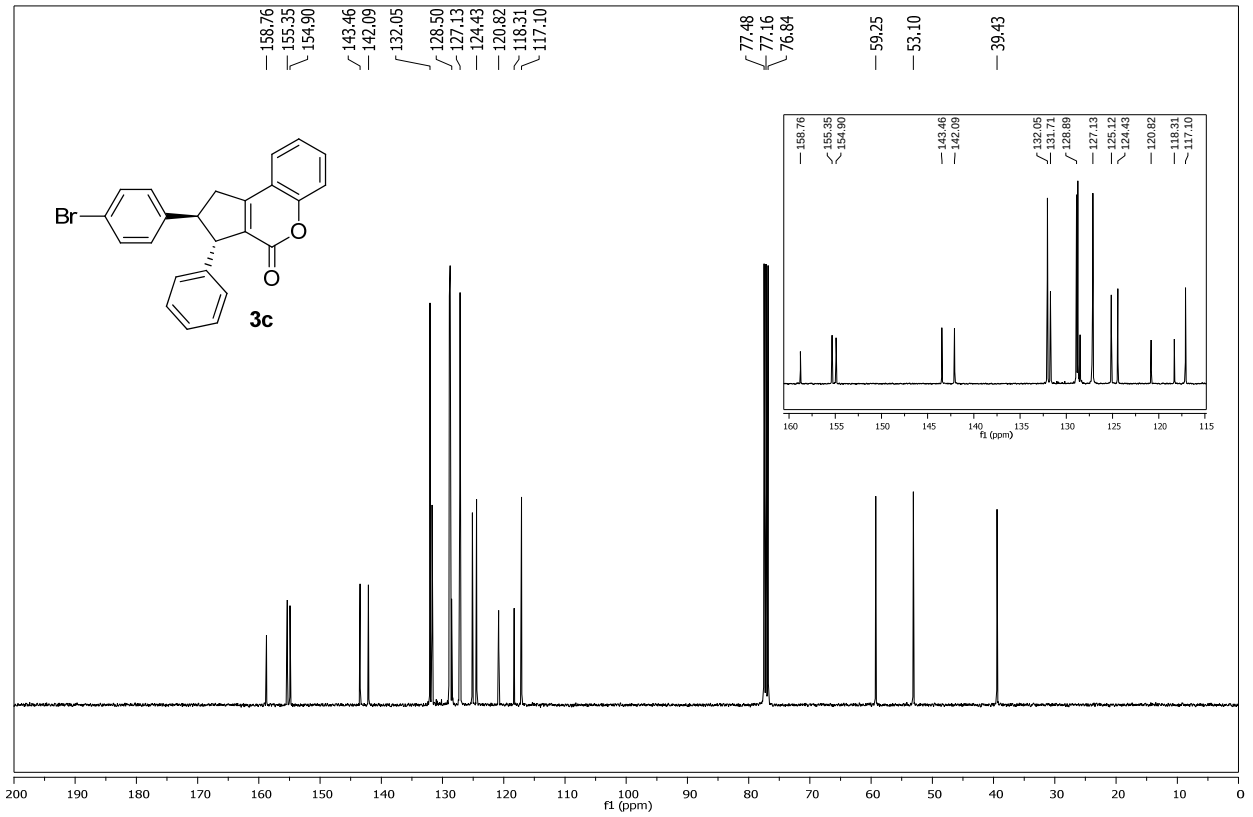
2-(4-Chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3b)



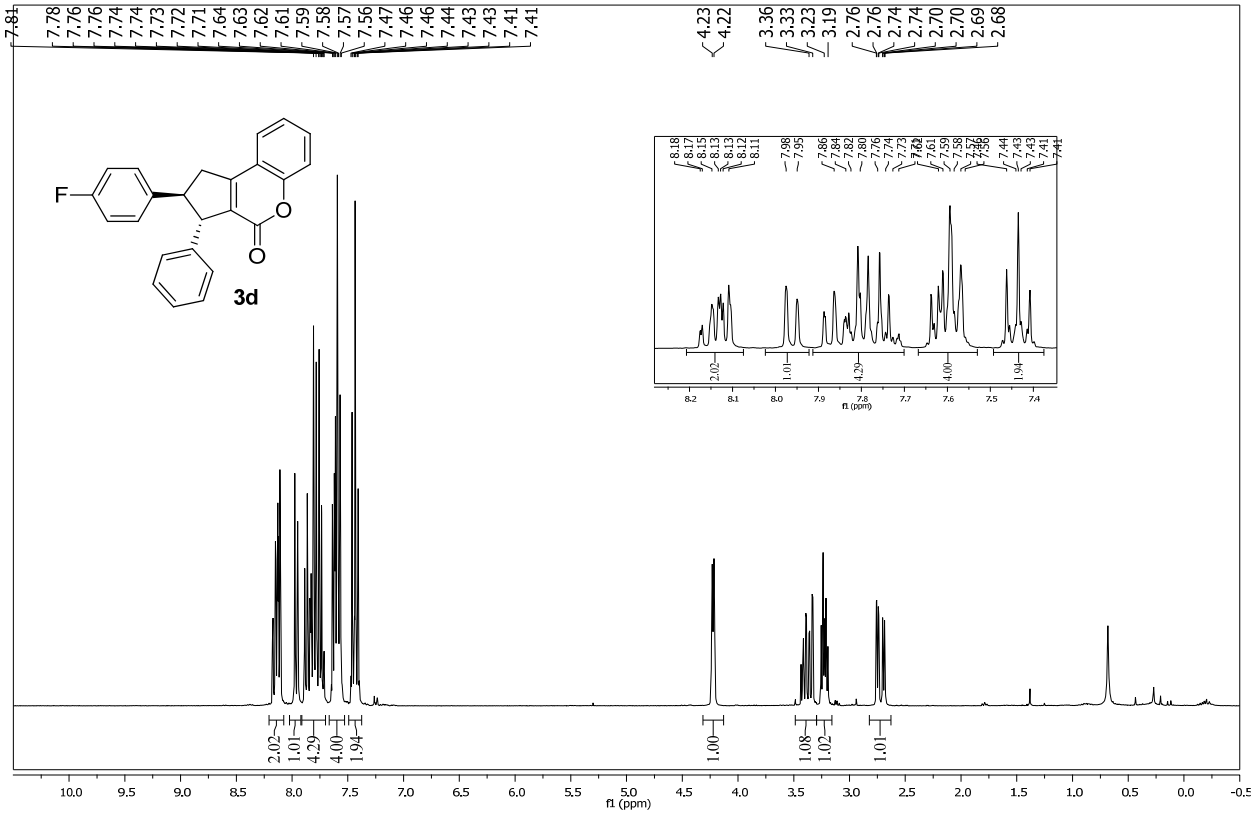


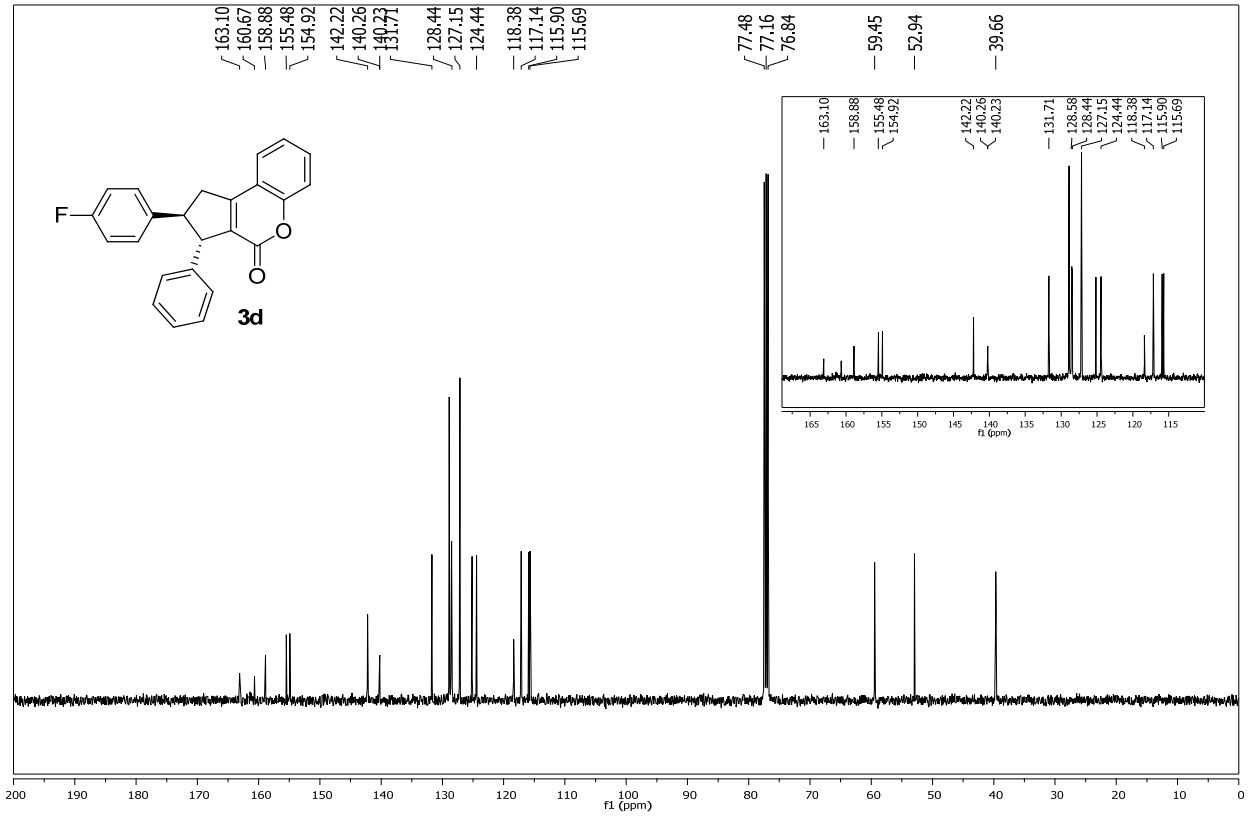
2-(4-Bromophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3c)



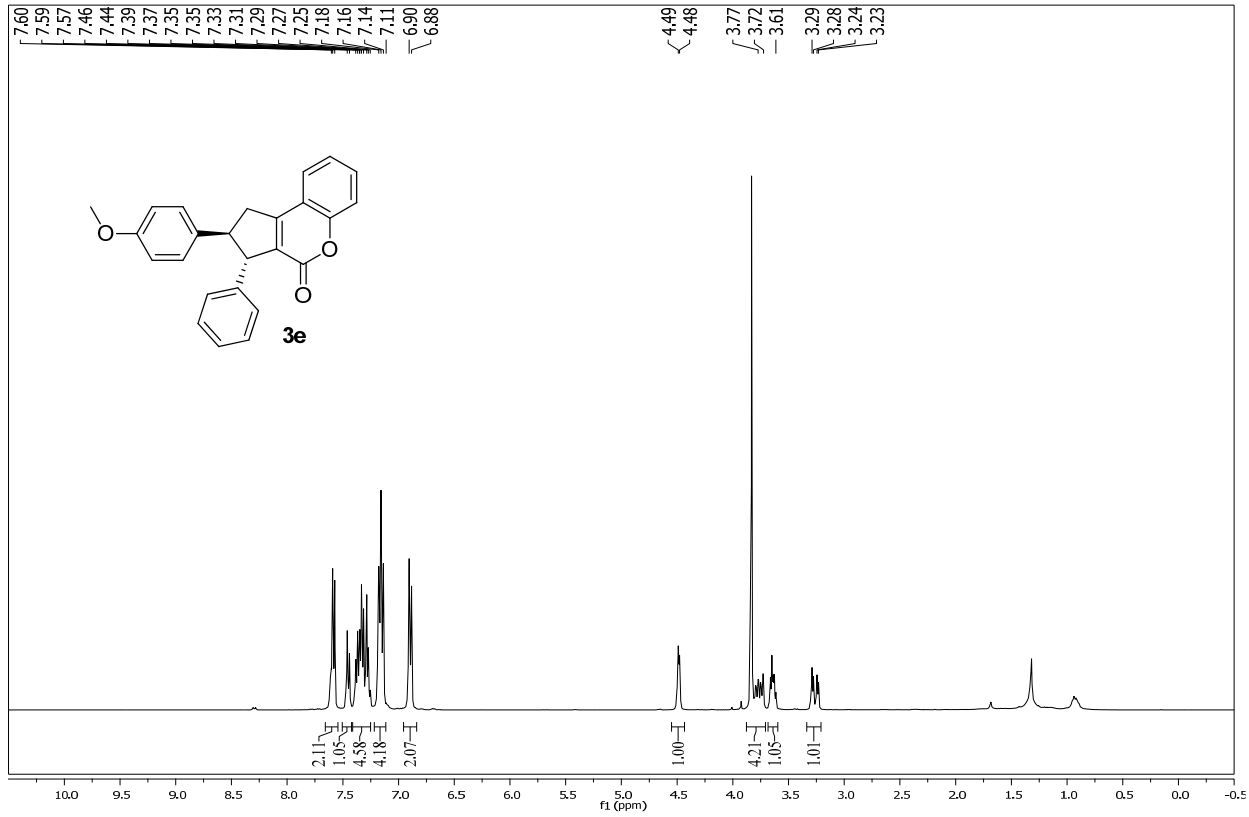


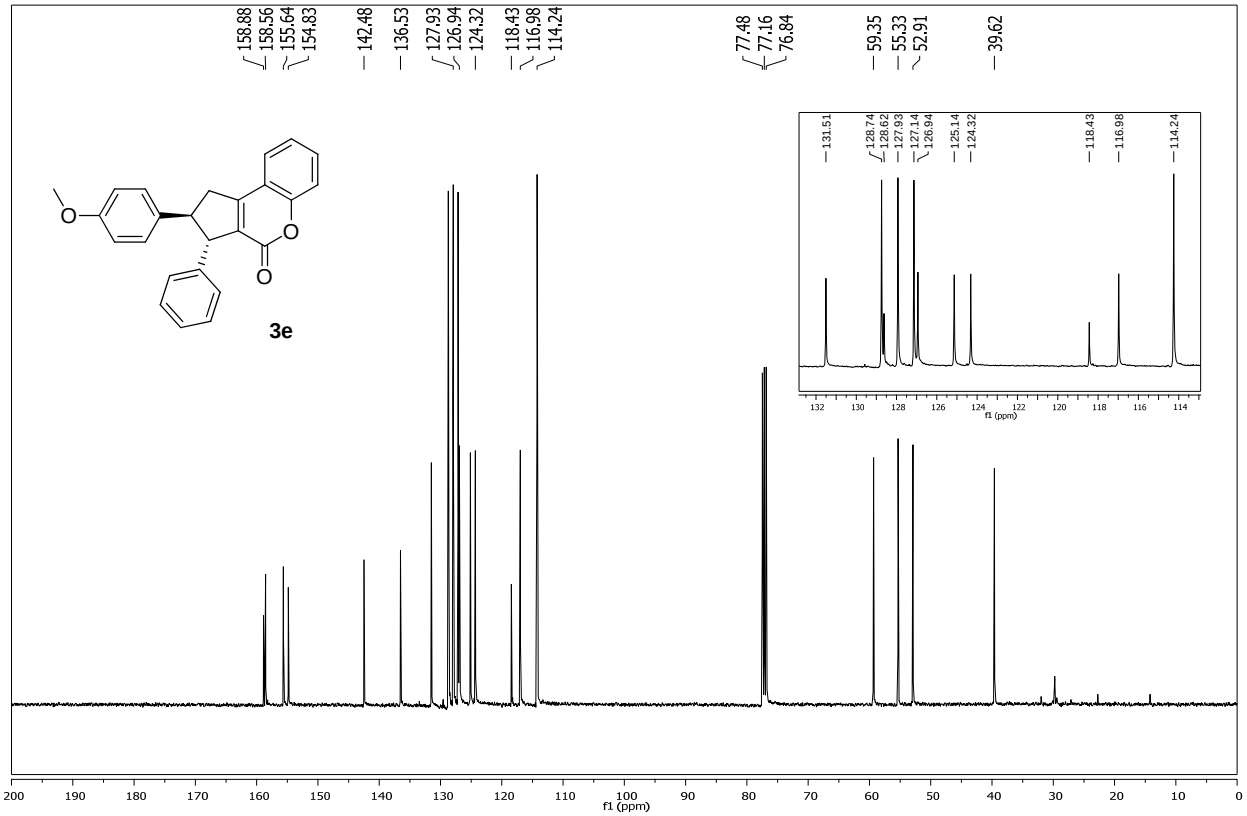
2-(4-Fluorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3d)



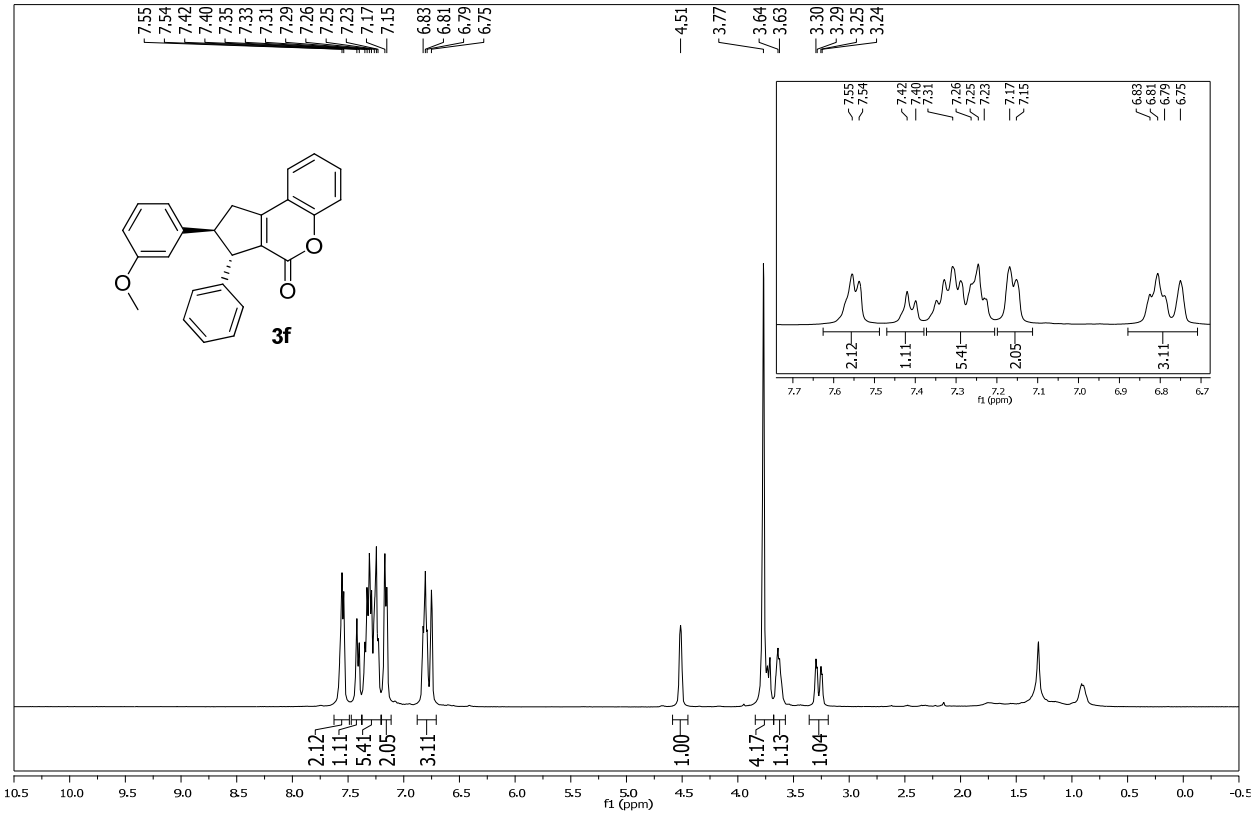


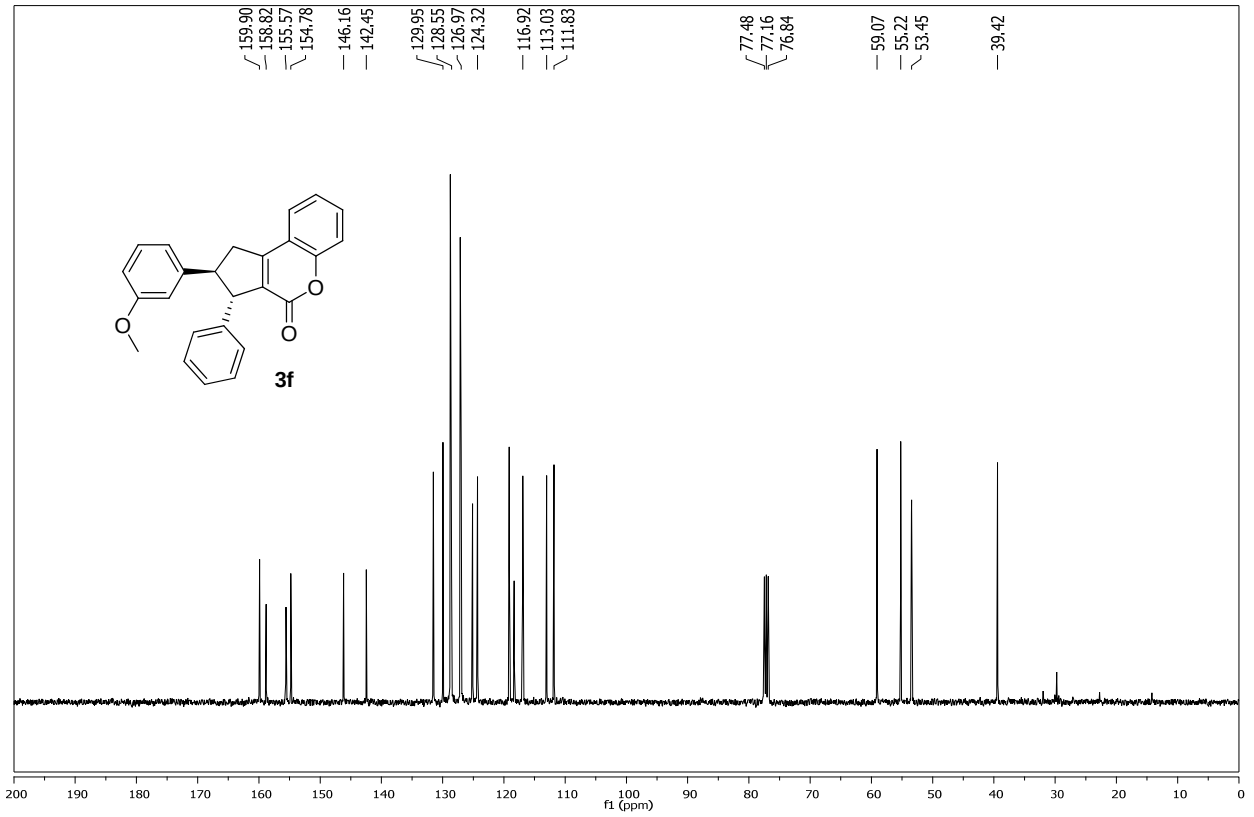
2-(4-Methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3e)



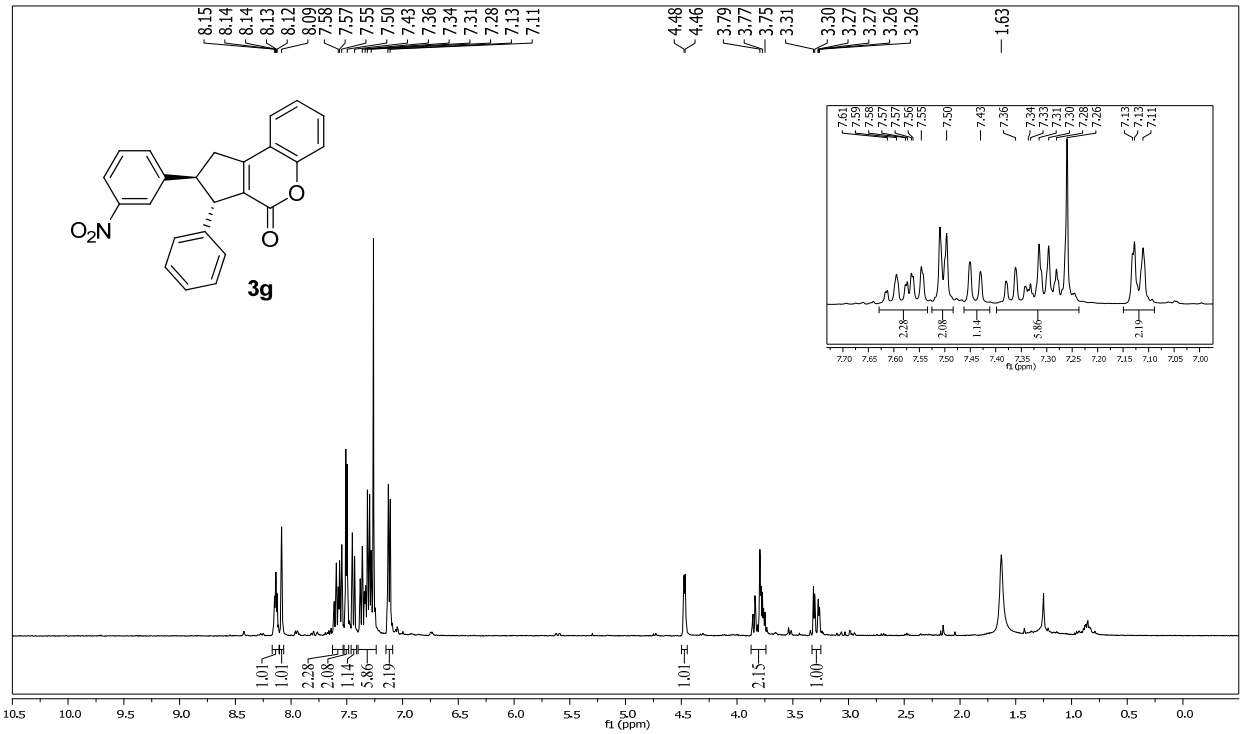


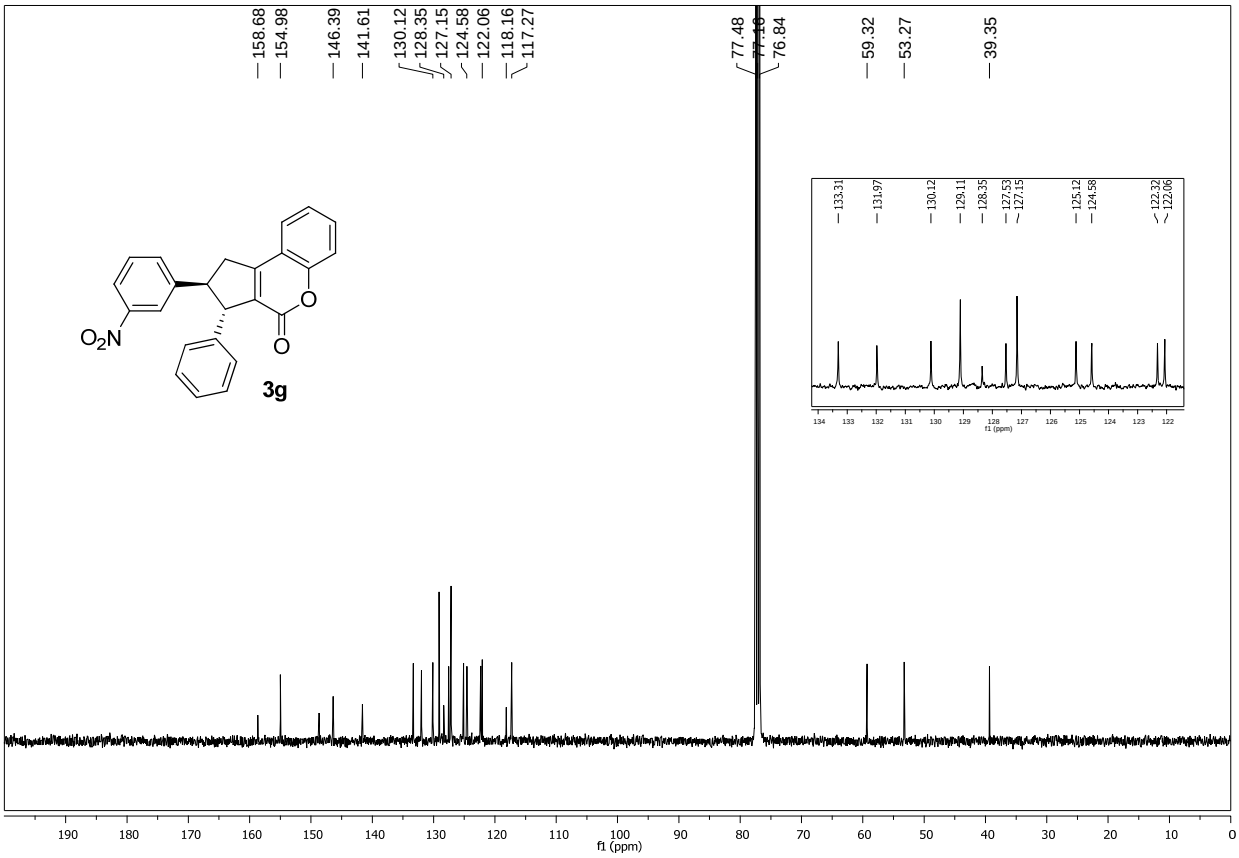
2-(3-Methoxyphenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3f)



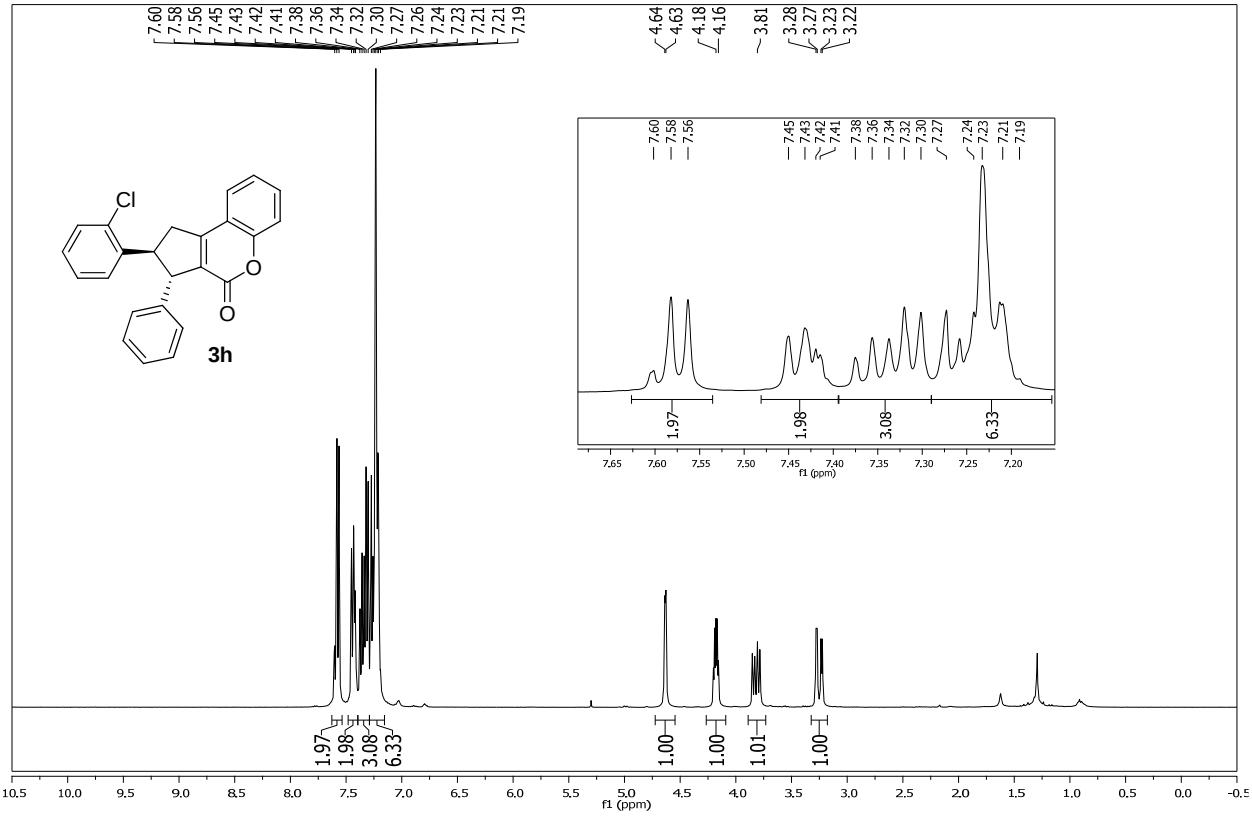


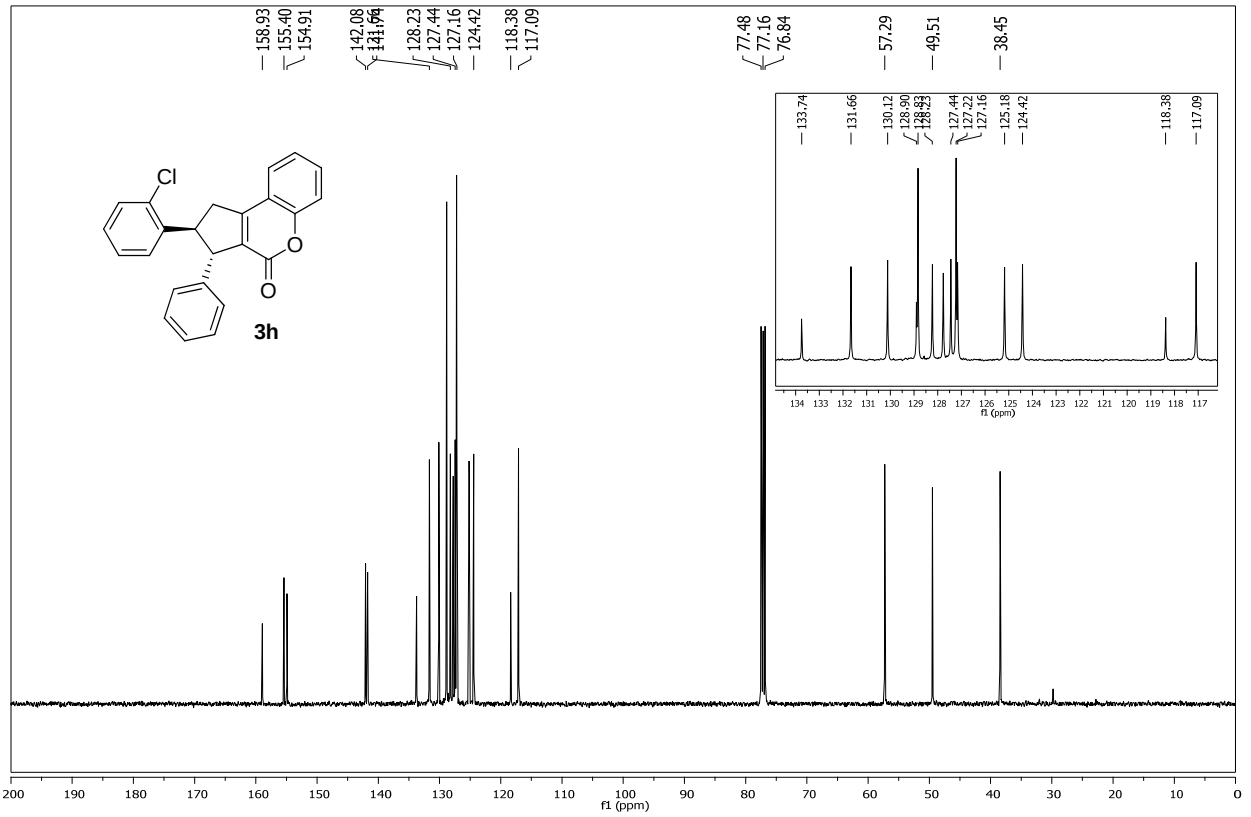
2-(3-Nitrophenyl)-3-phenyl-2,3-dihydrocyclopenta[c]chromen-4(1H)-one (3g)



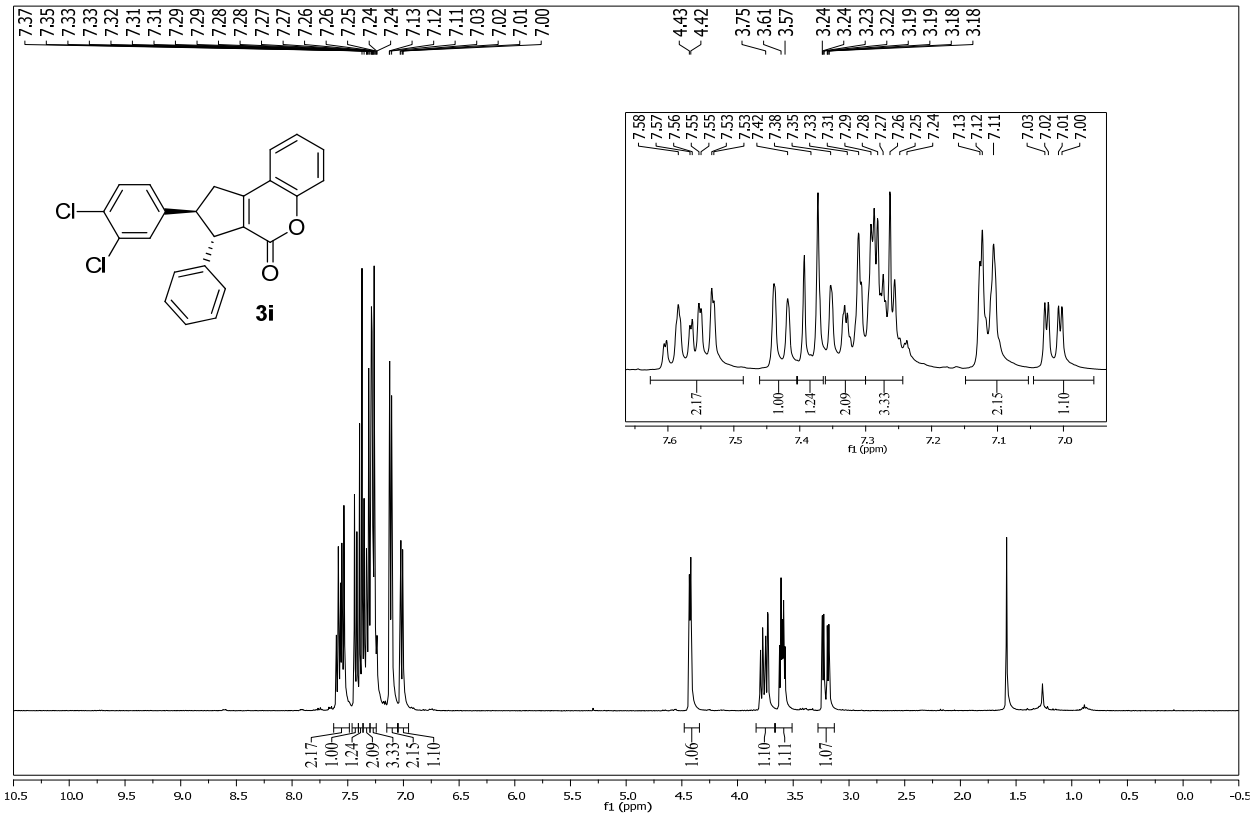


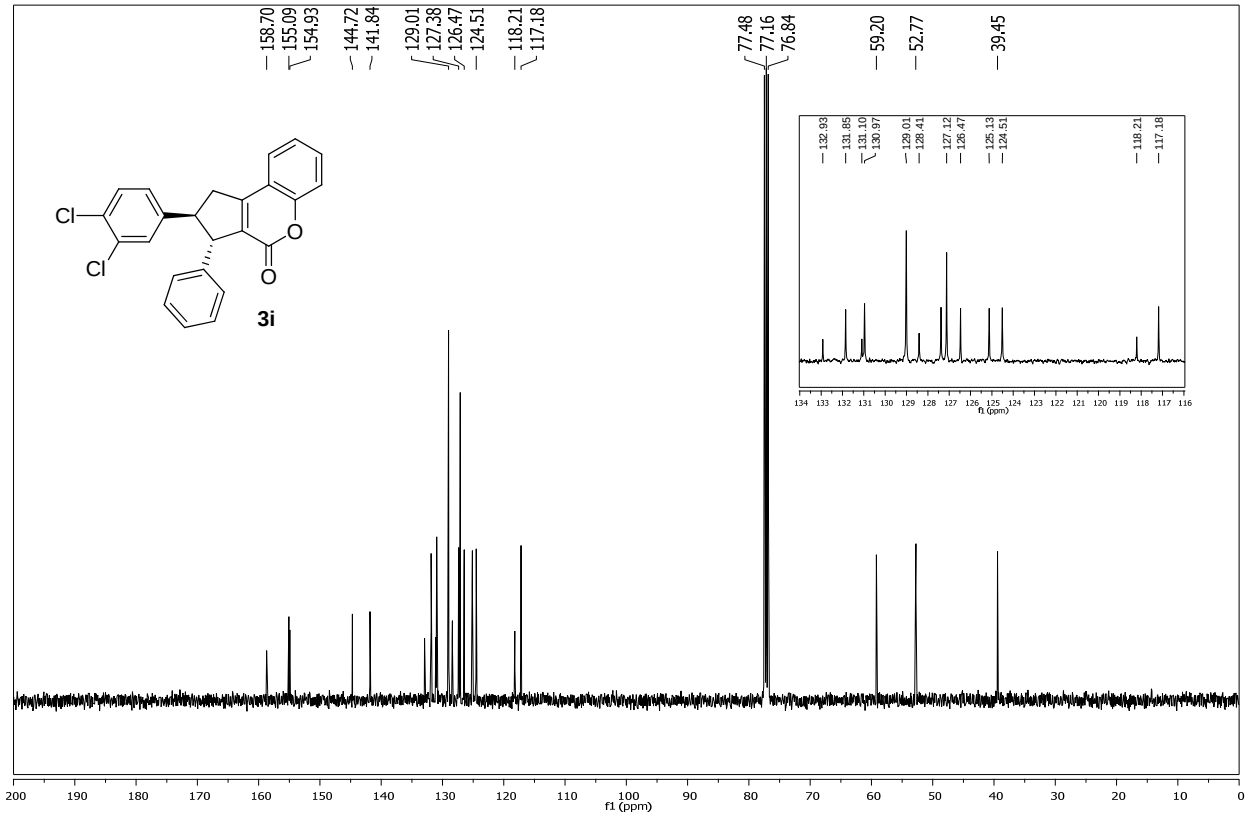
2-(2-chlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3h)



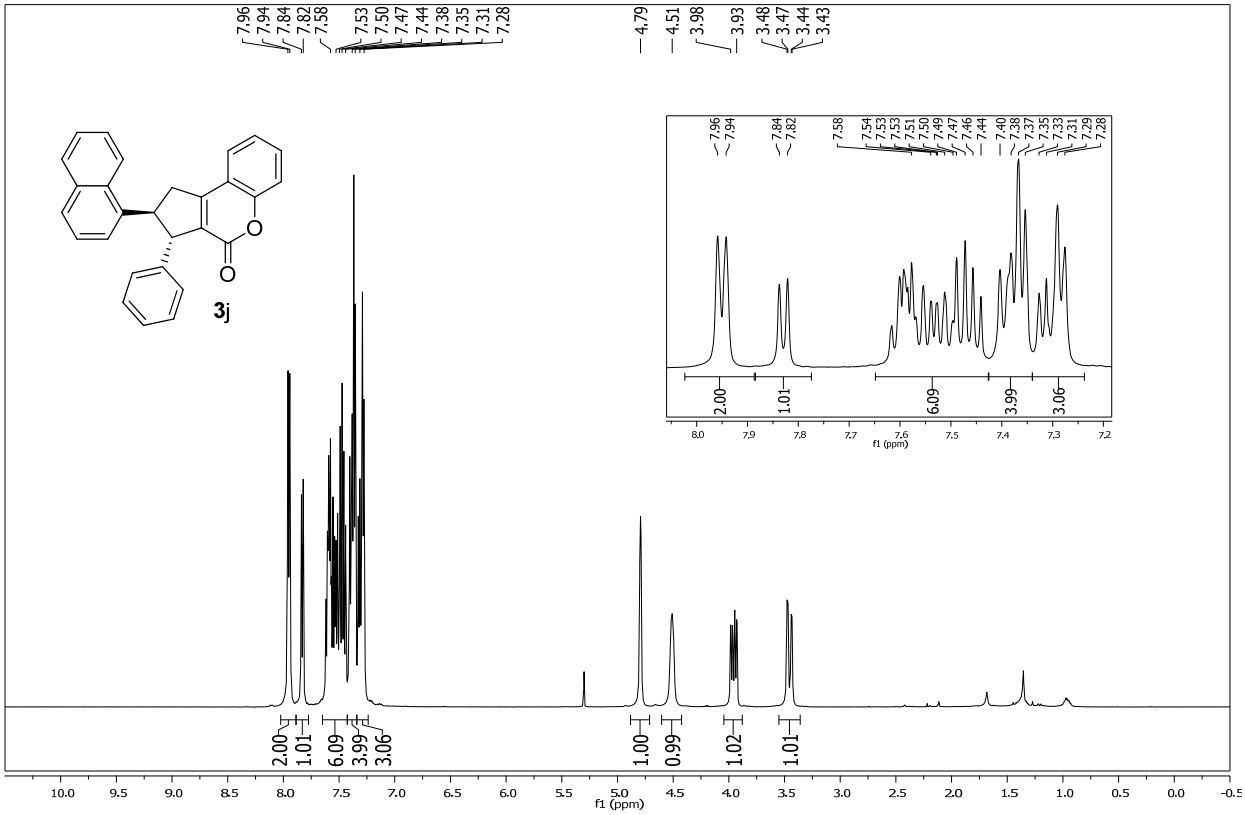


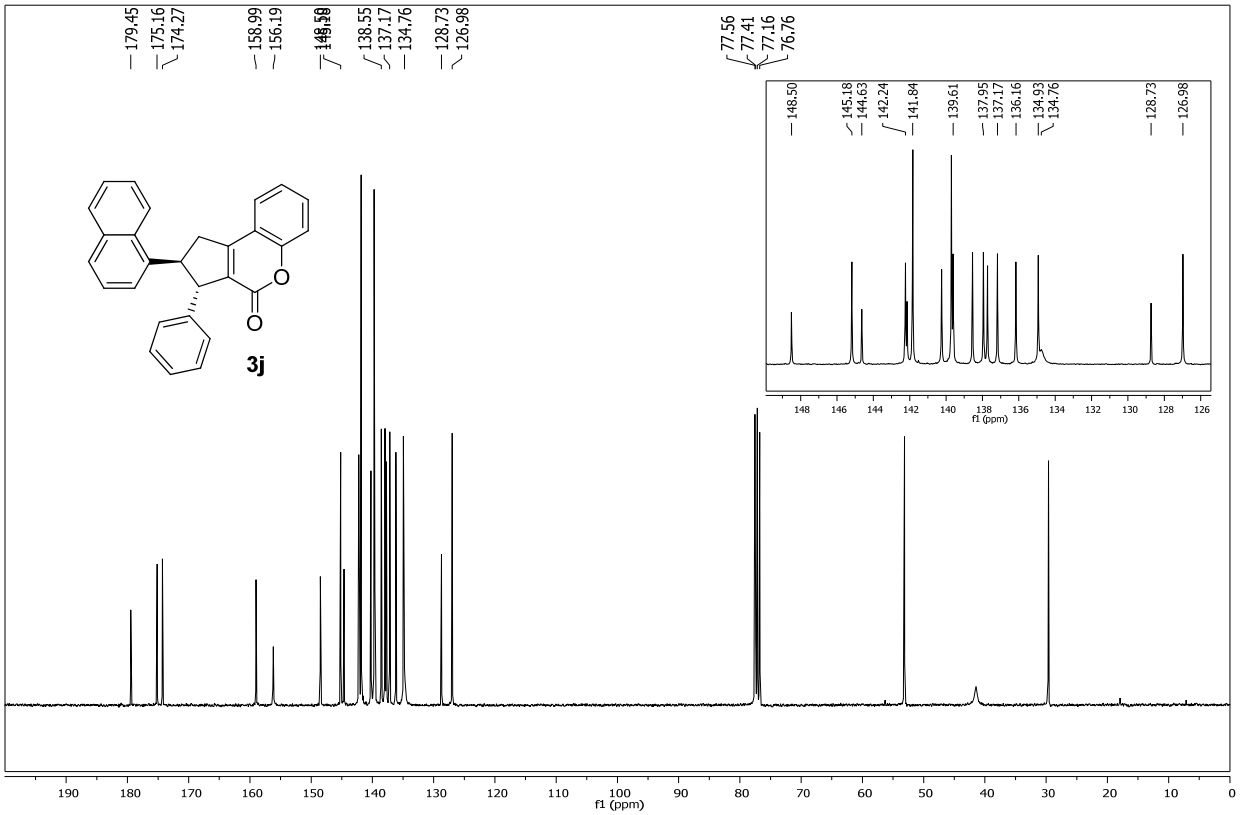
3,4-(Dichlorophenyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3i)



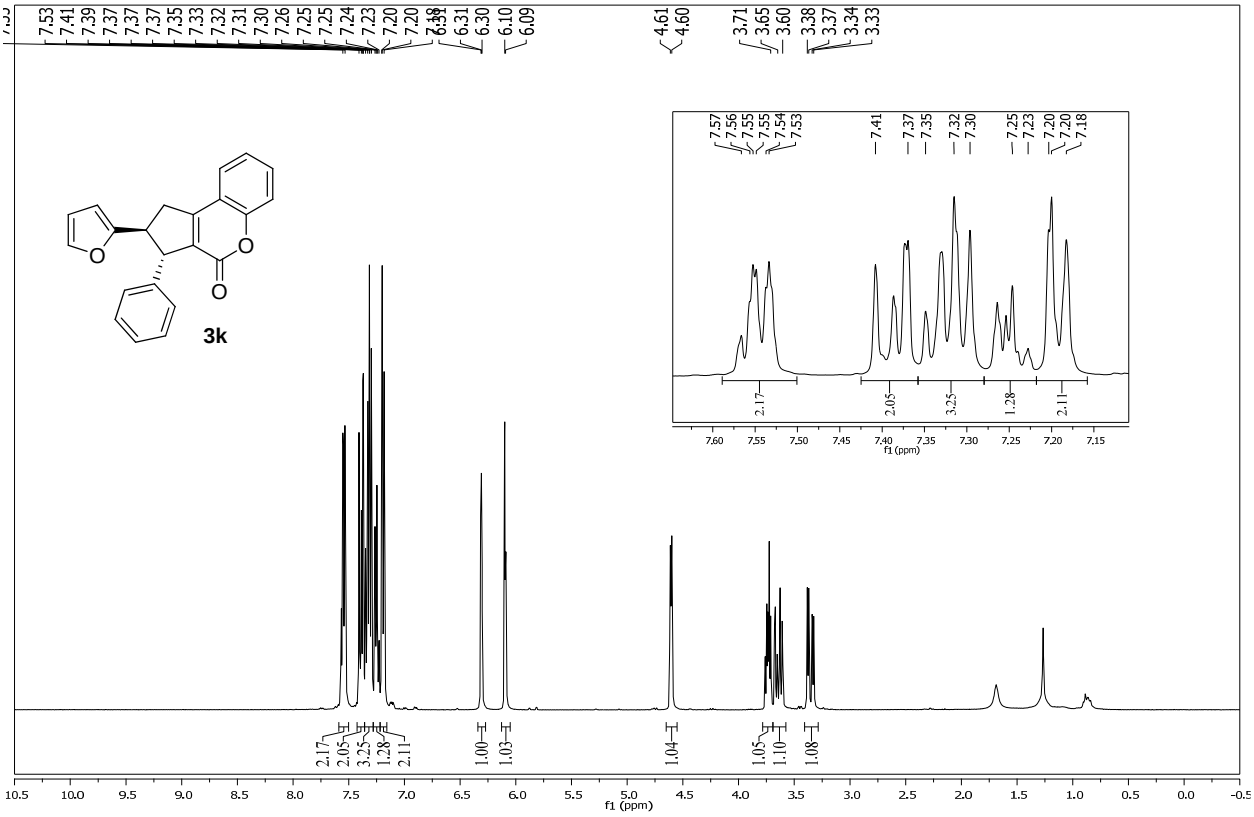


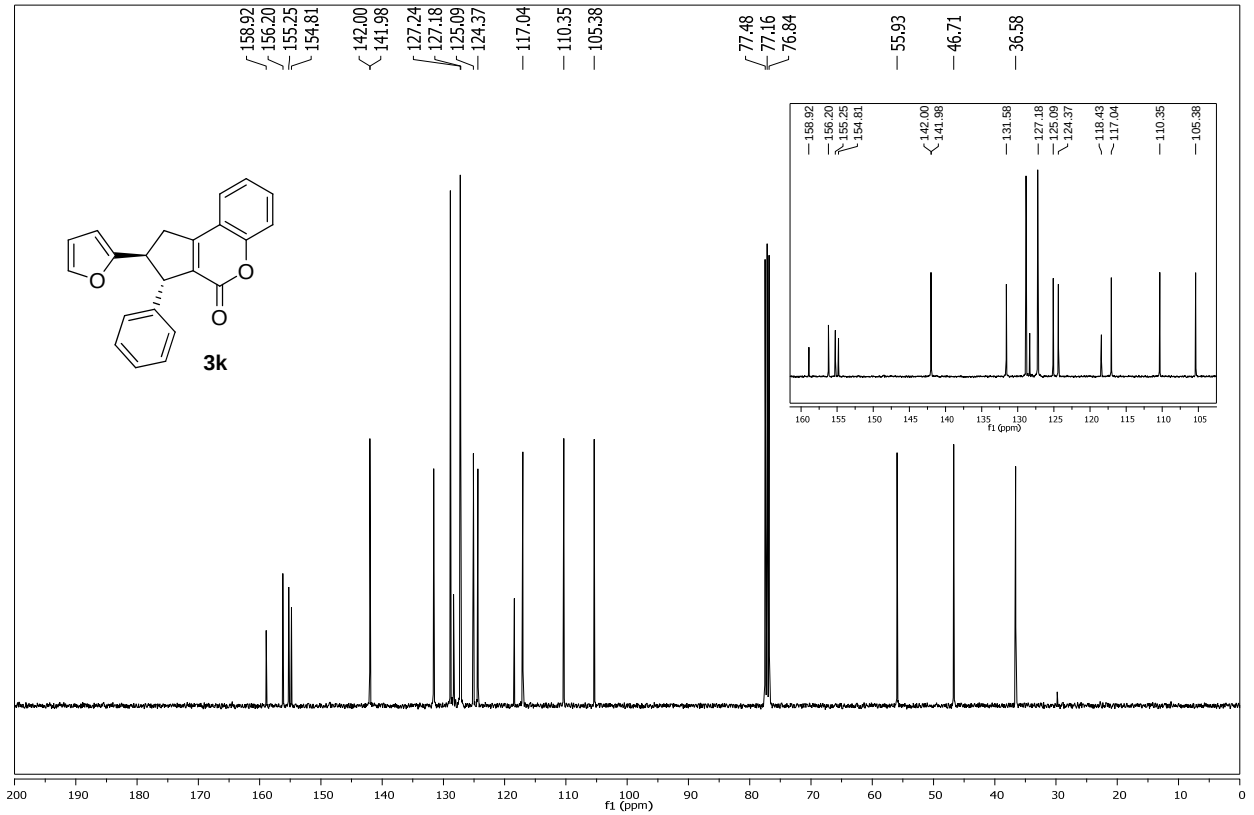
2-(naphthalen-1-yl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3j)



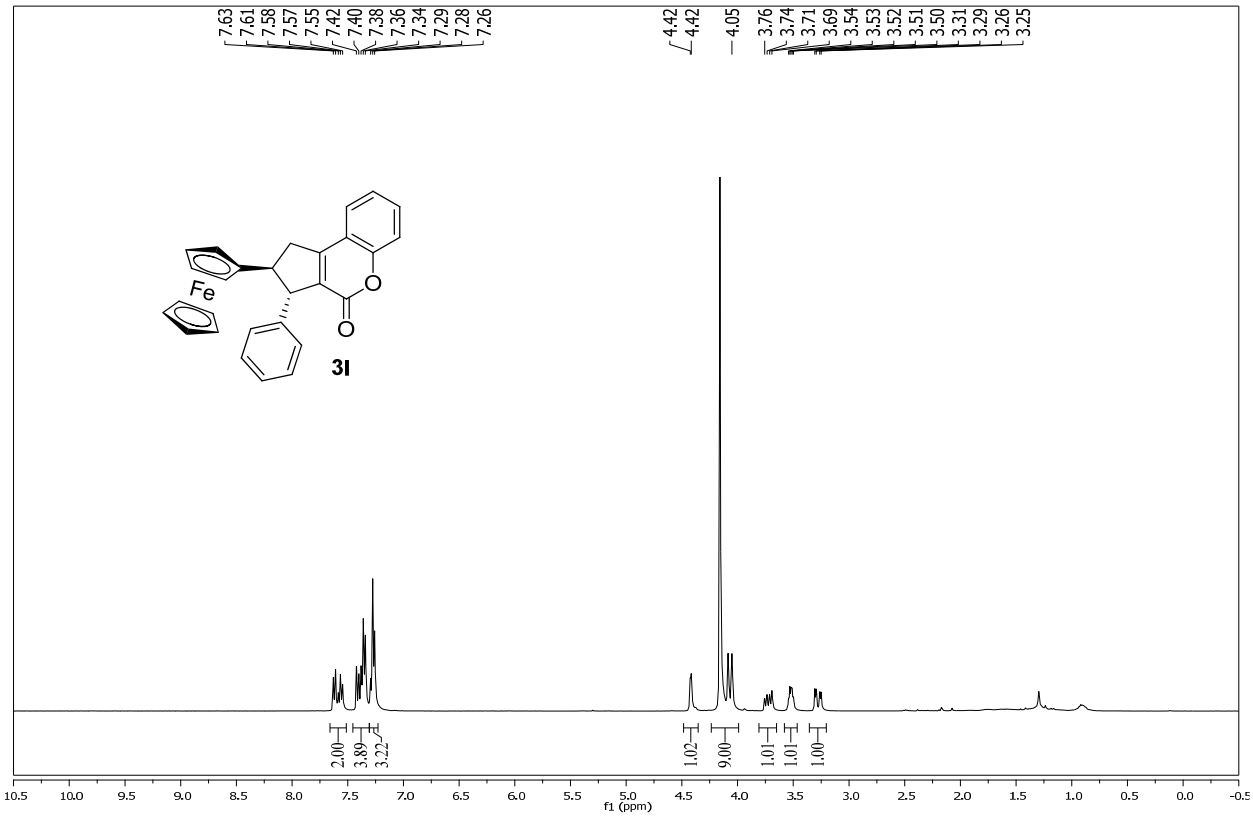


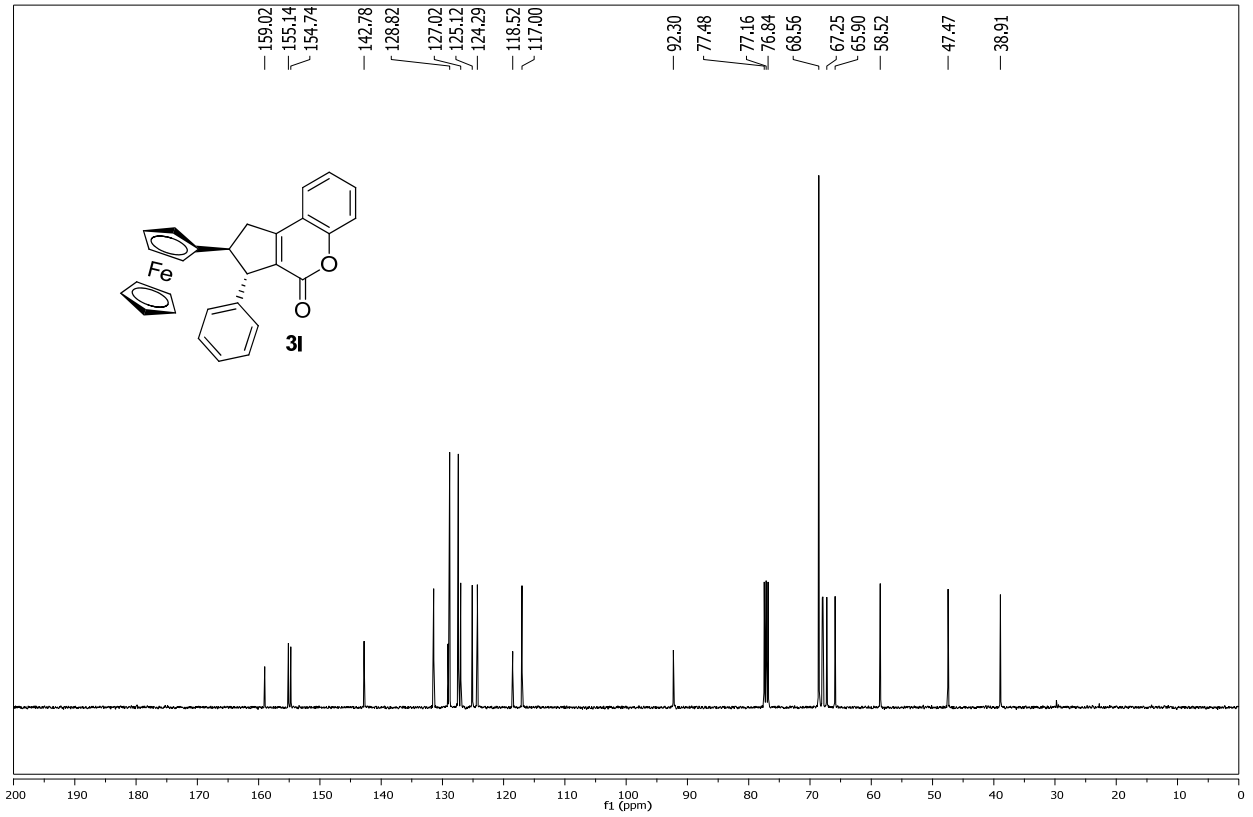
2-(Furan-2-yl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3k)



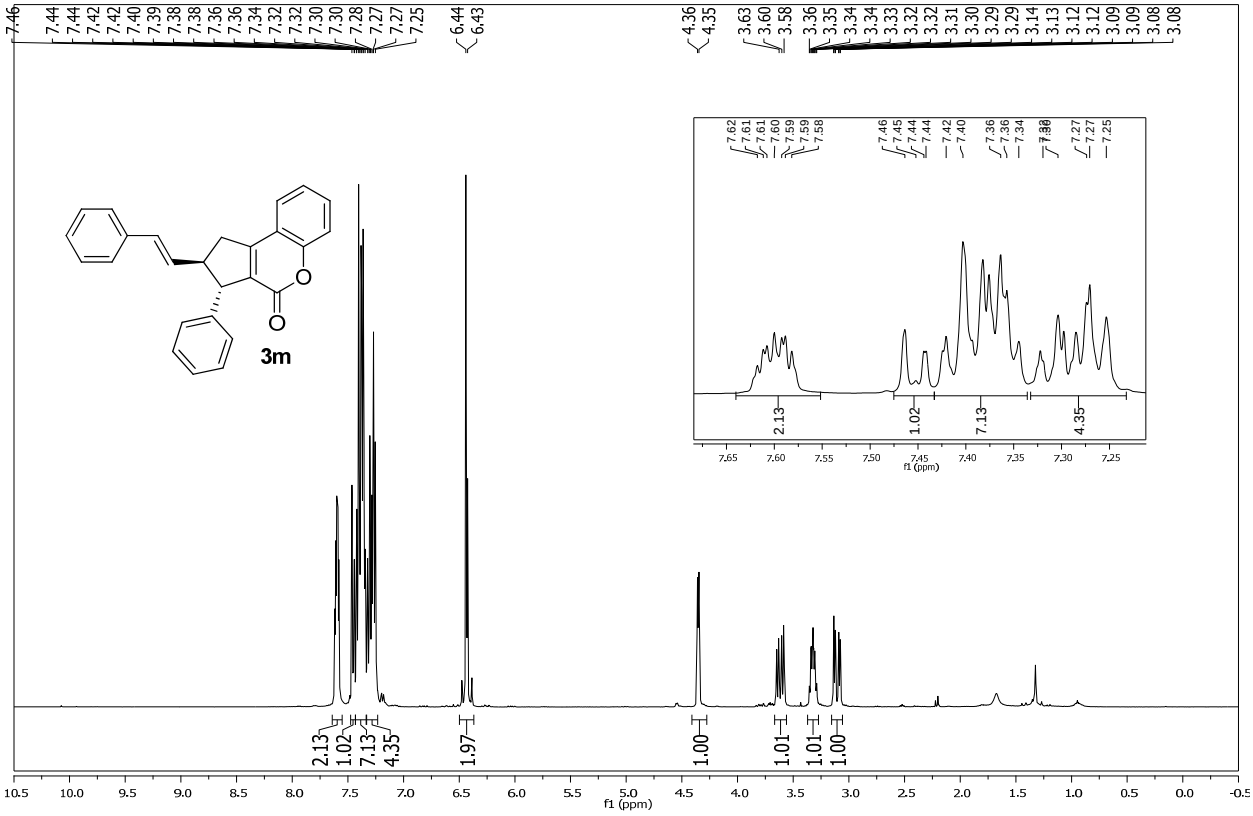


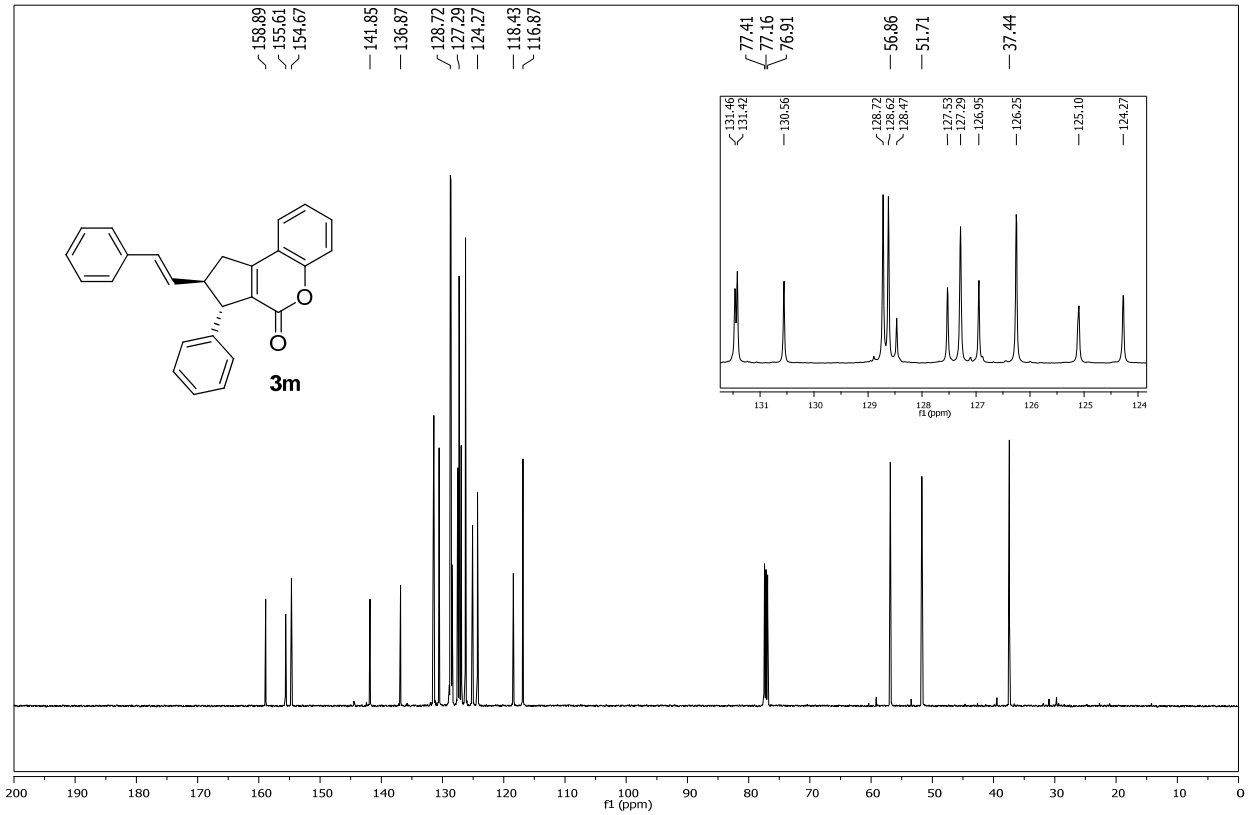
2-(Ferroceniyl)-3-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3l)



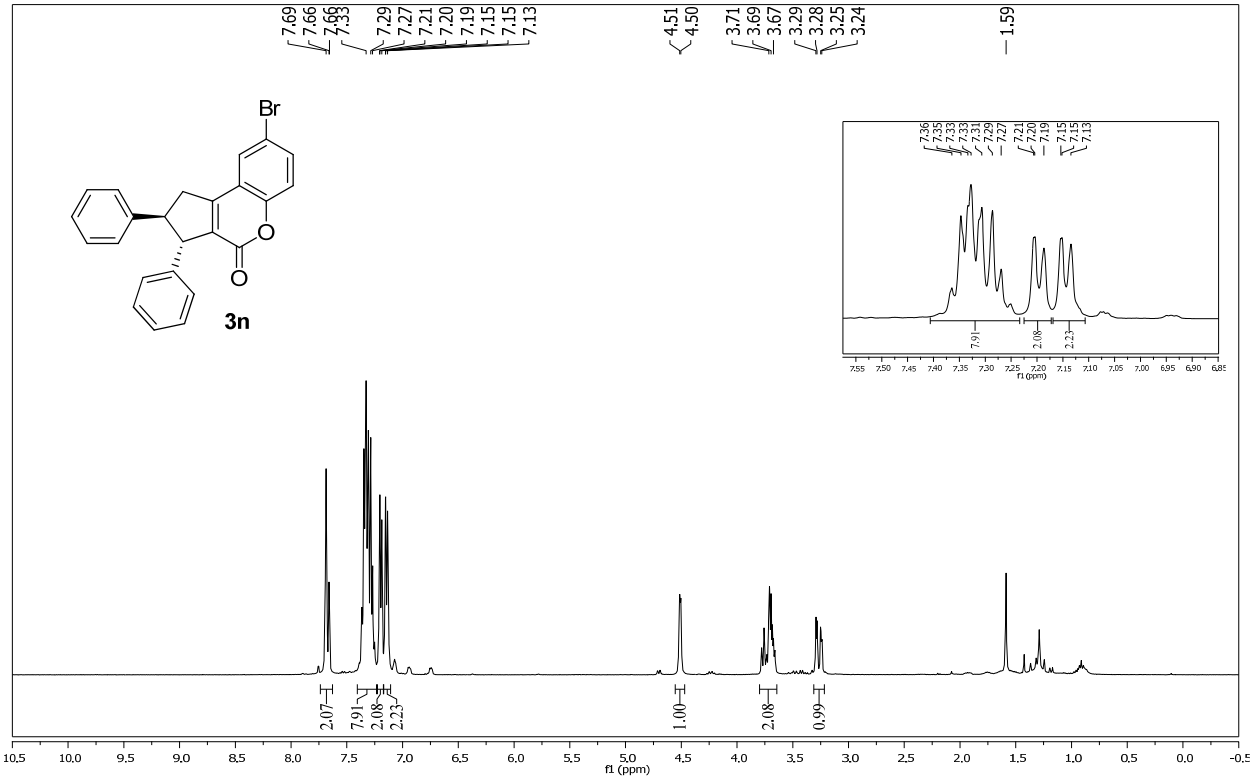


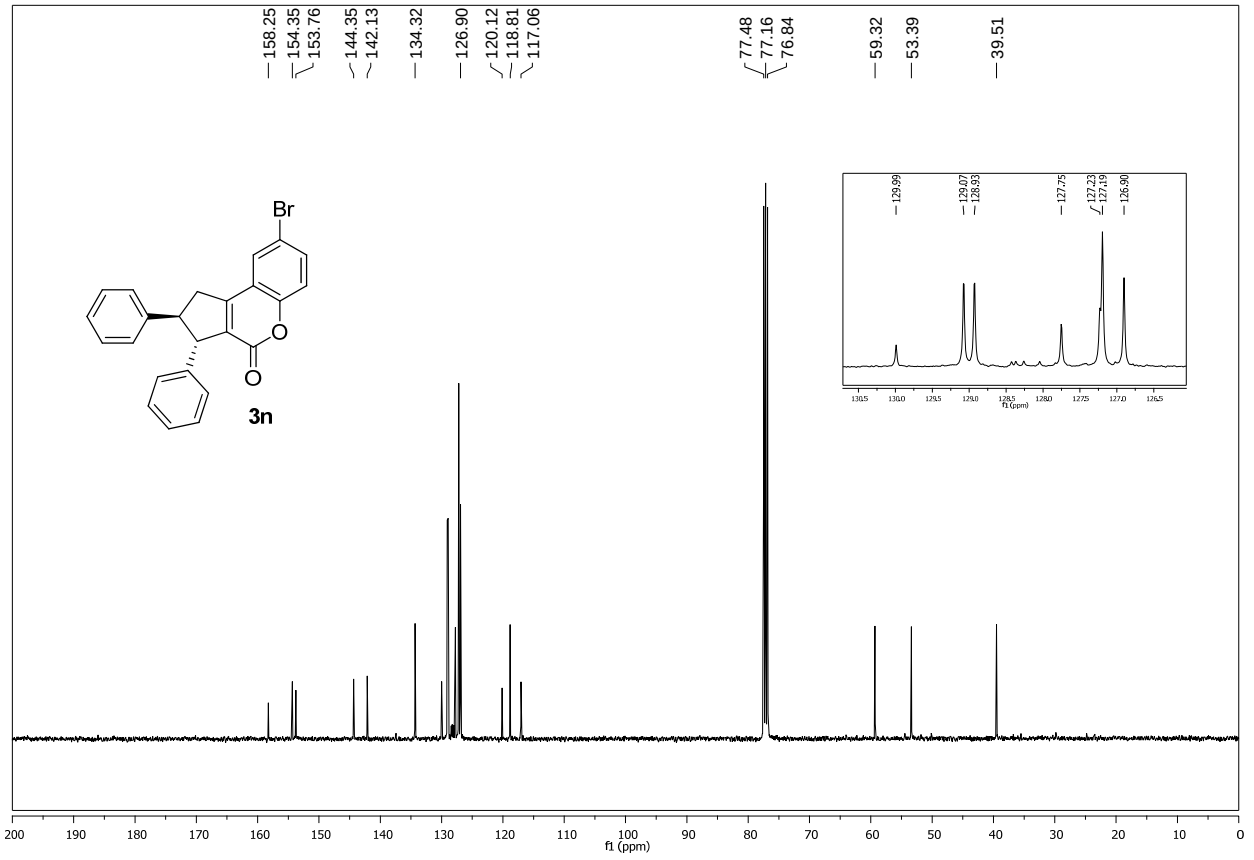
3-Phenyl-2-((*E*)-styryl)-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3m)



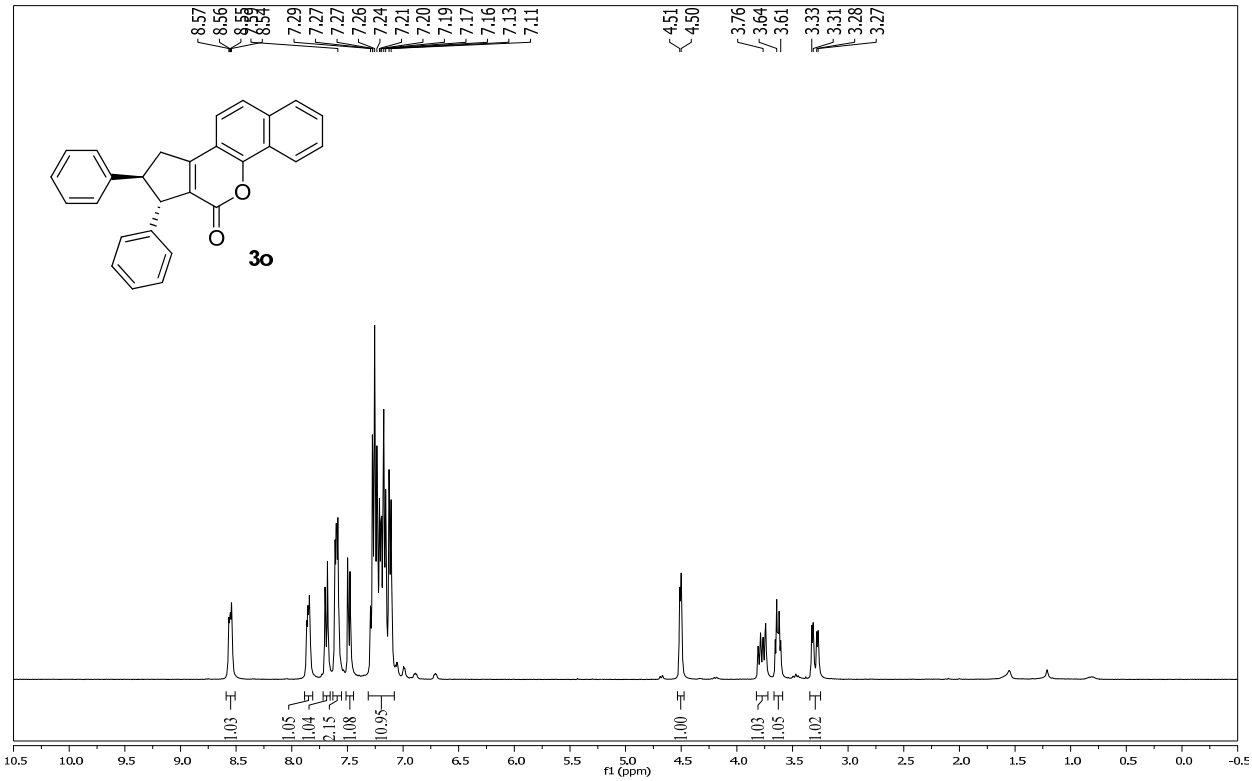


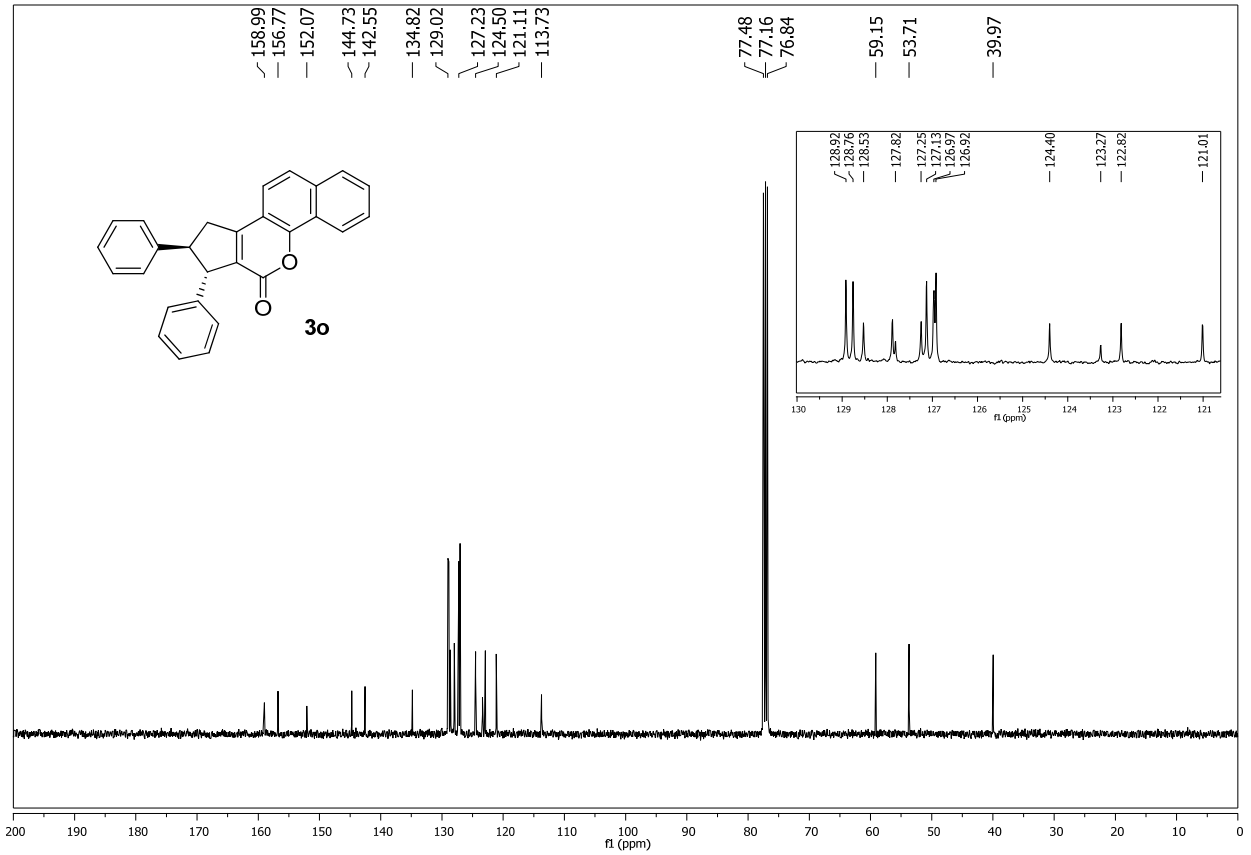
8-bromo-2,3-diphenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3n)



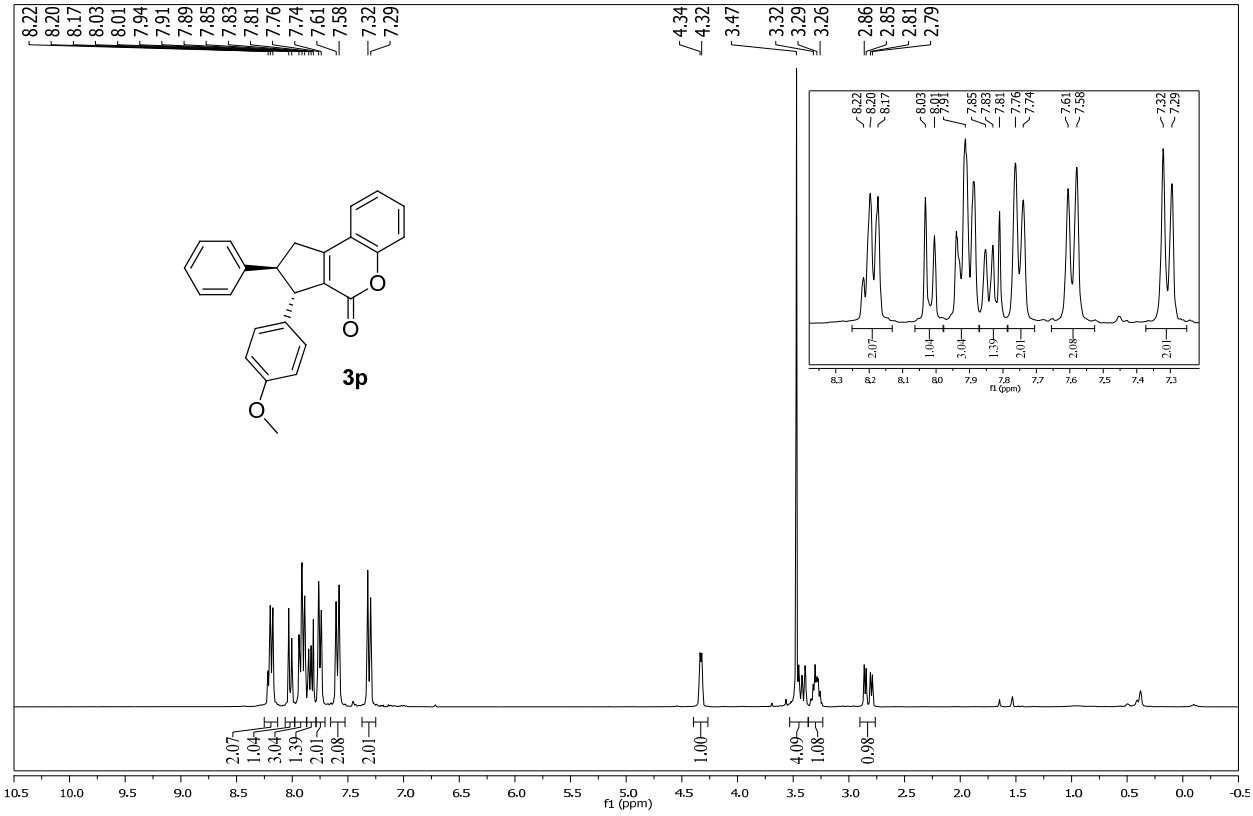


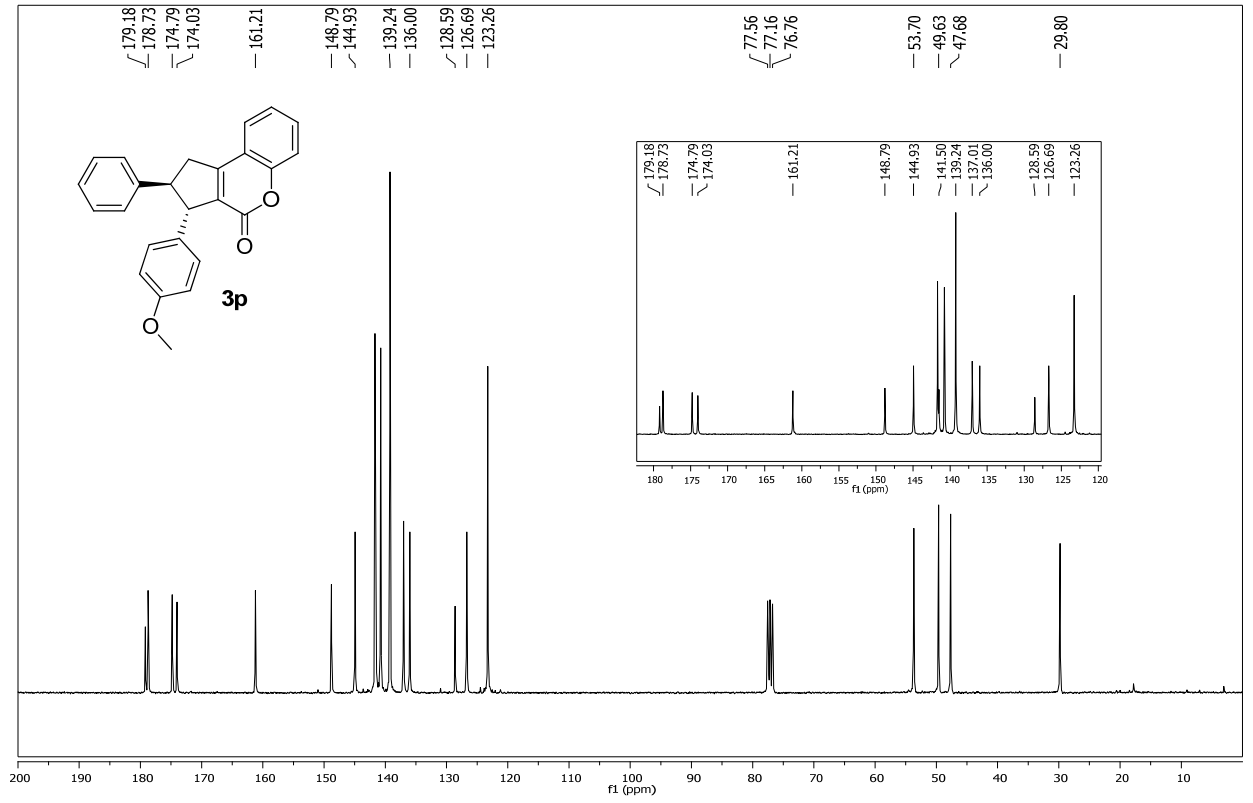
7,8-Diphenyl-8,9-dihydrobenzo[h]cyclopenta[*c*]chromen-6(7*H*)-one (3o)



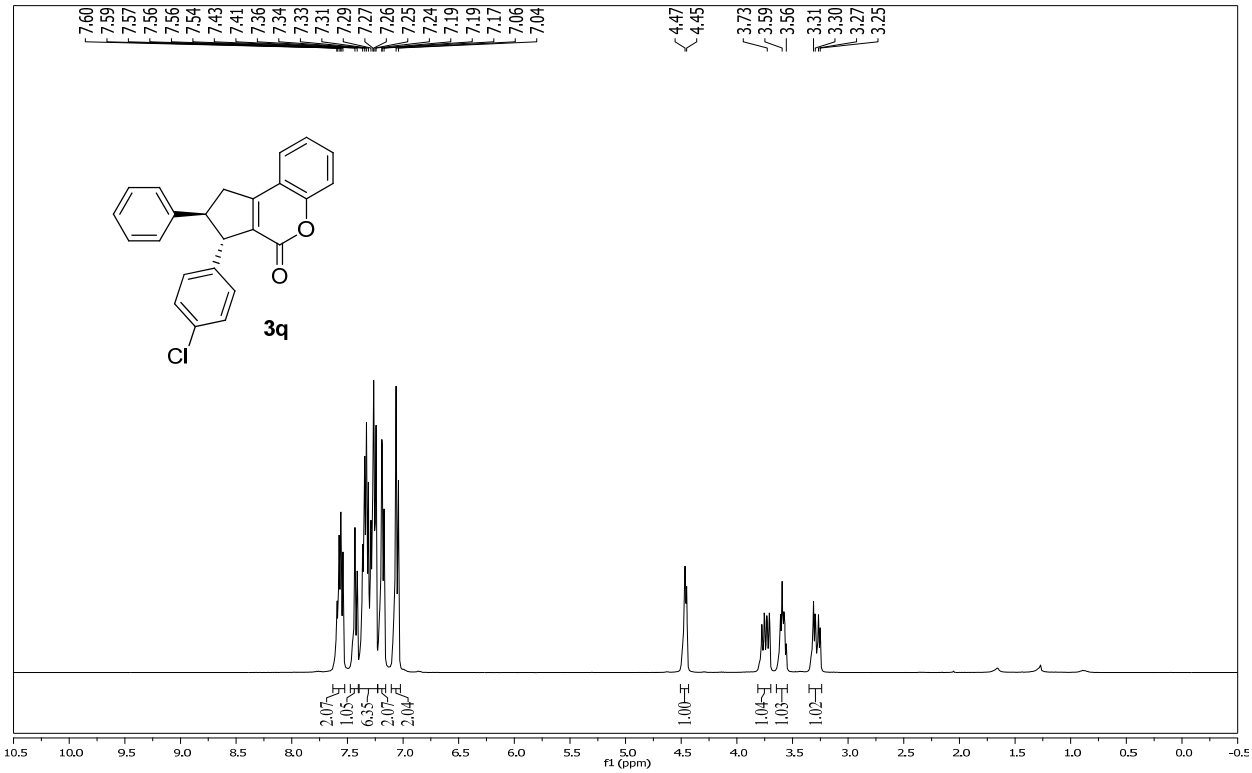


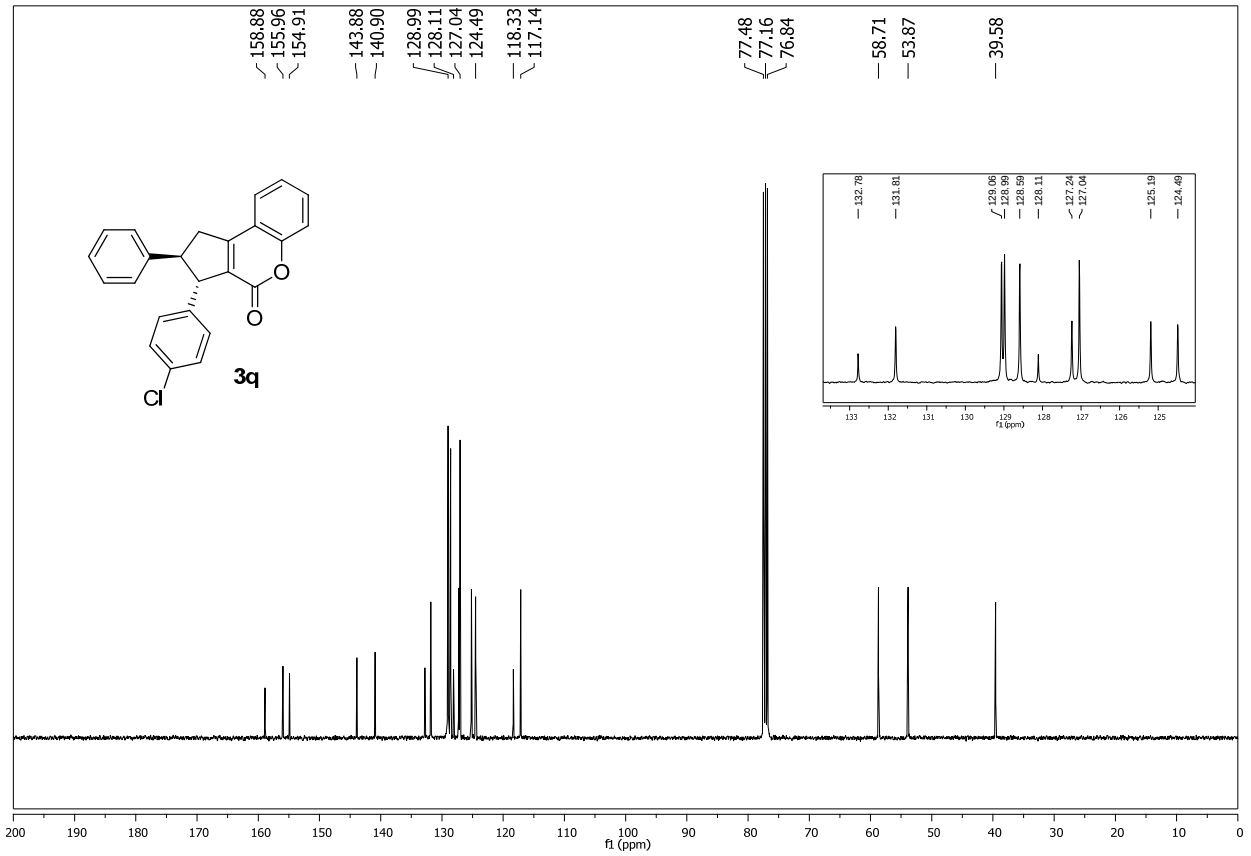
3-(4-methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3p)



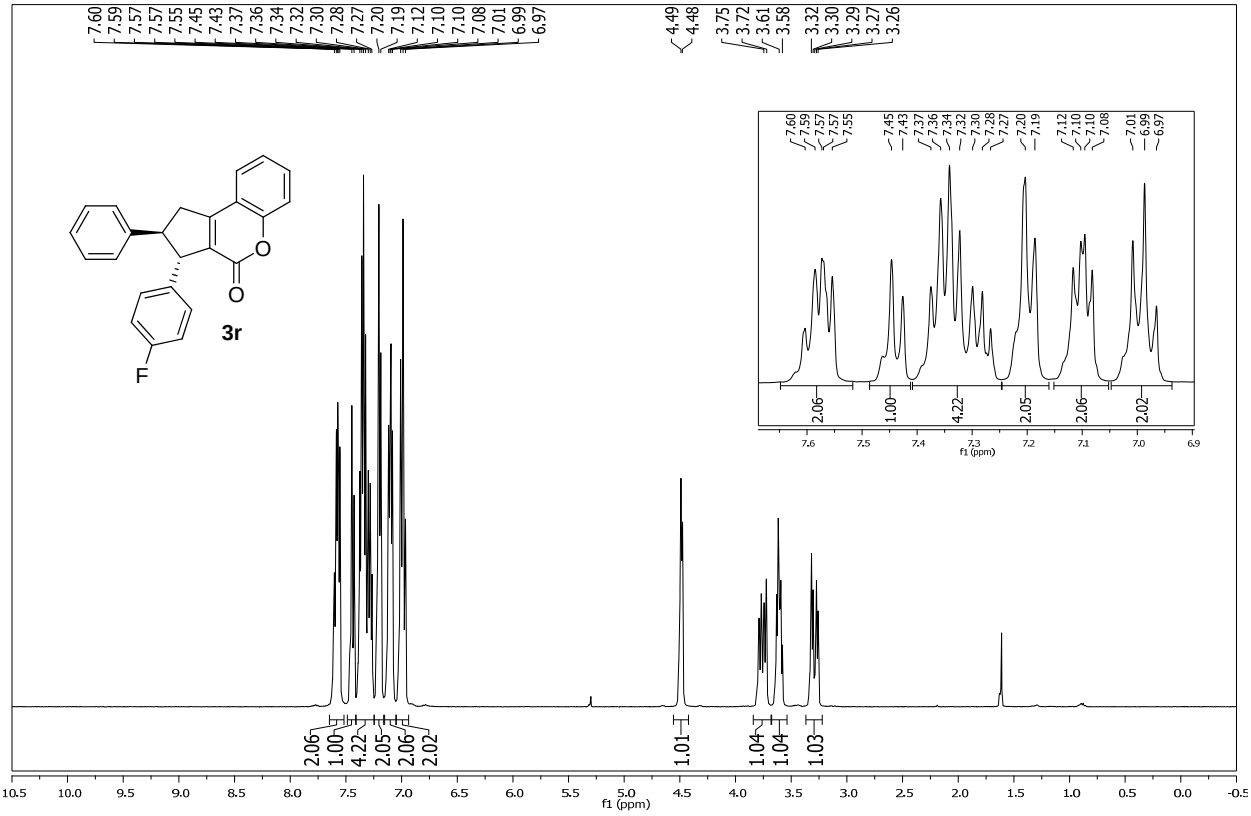


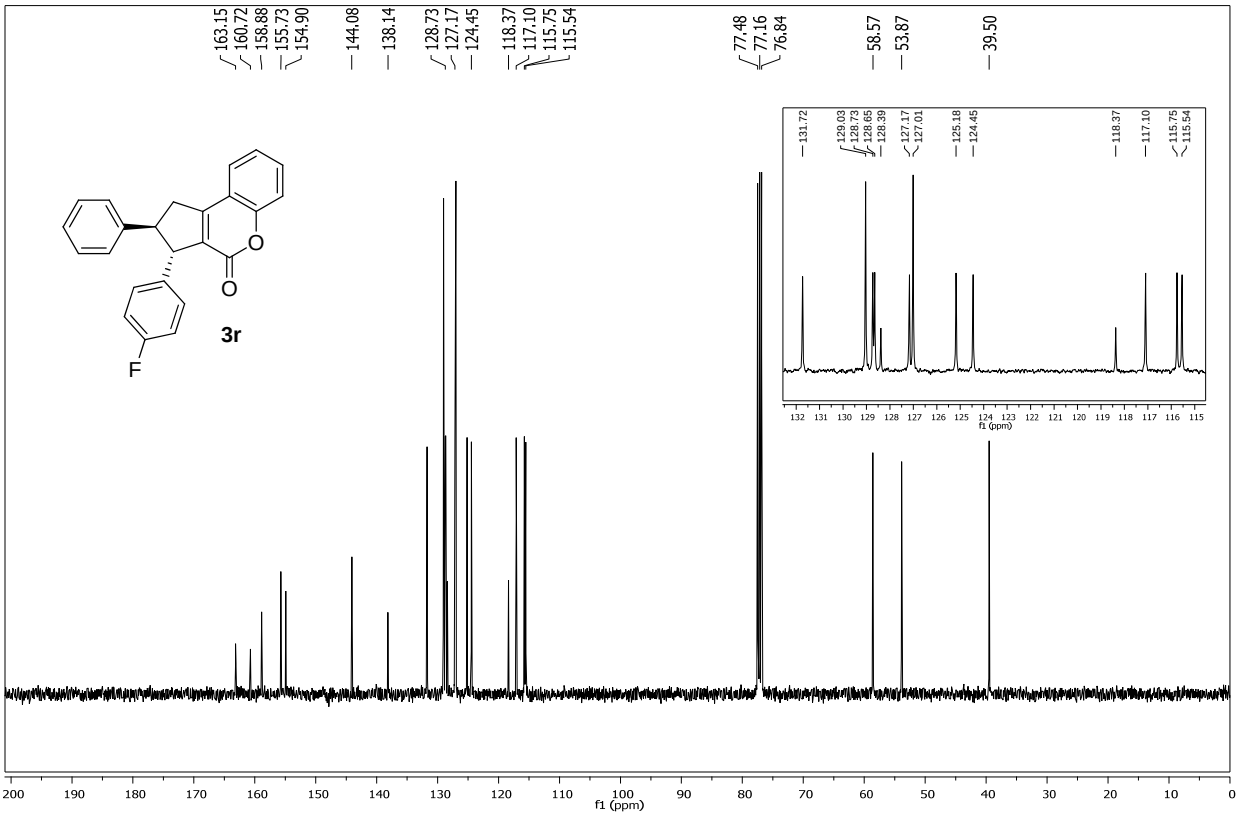
3-(4-Chlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3q)



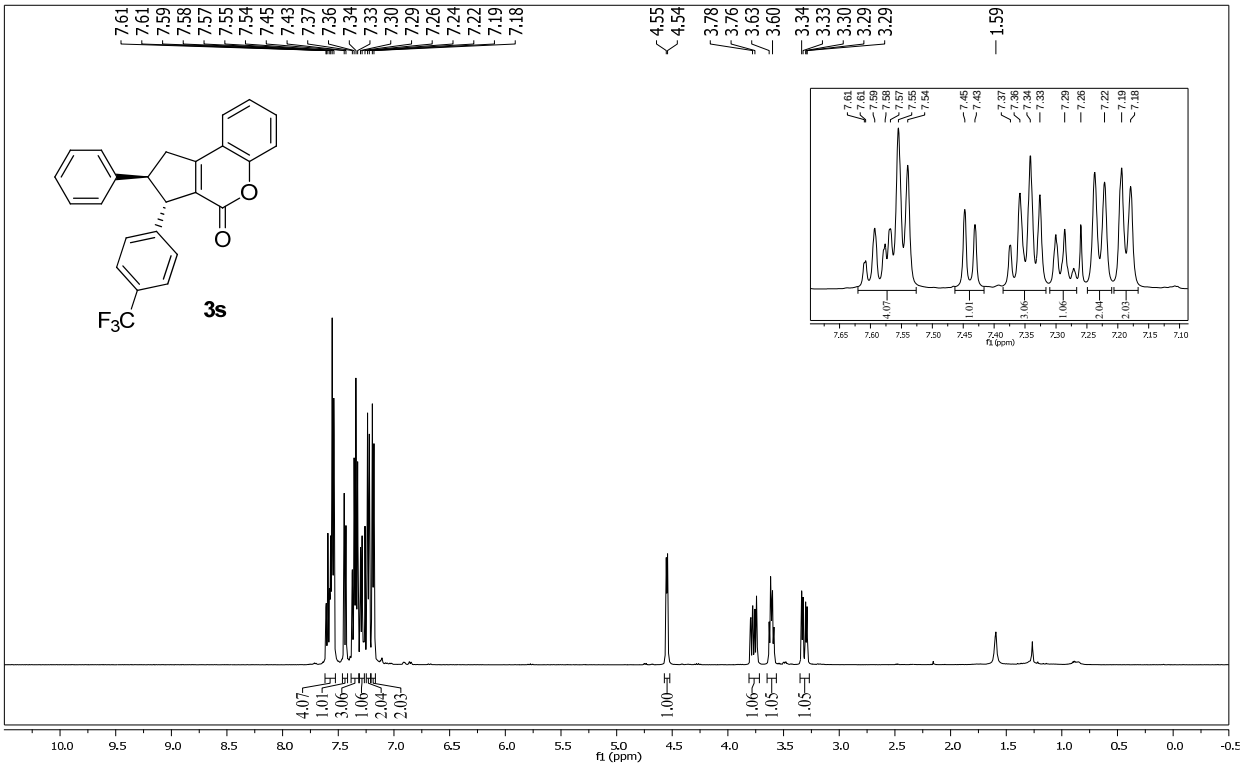


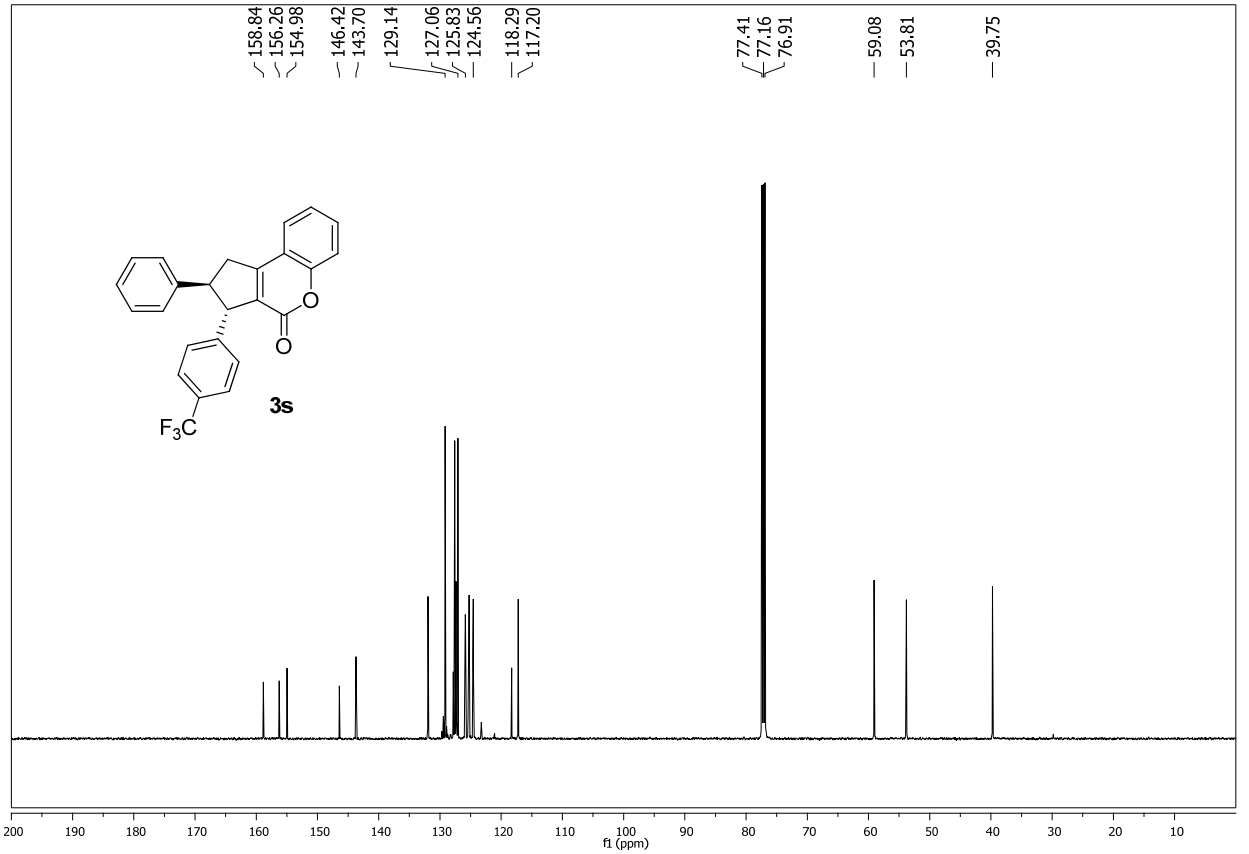
3-(4-Fluorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3r)



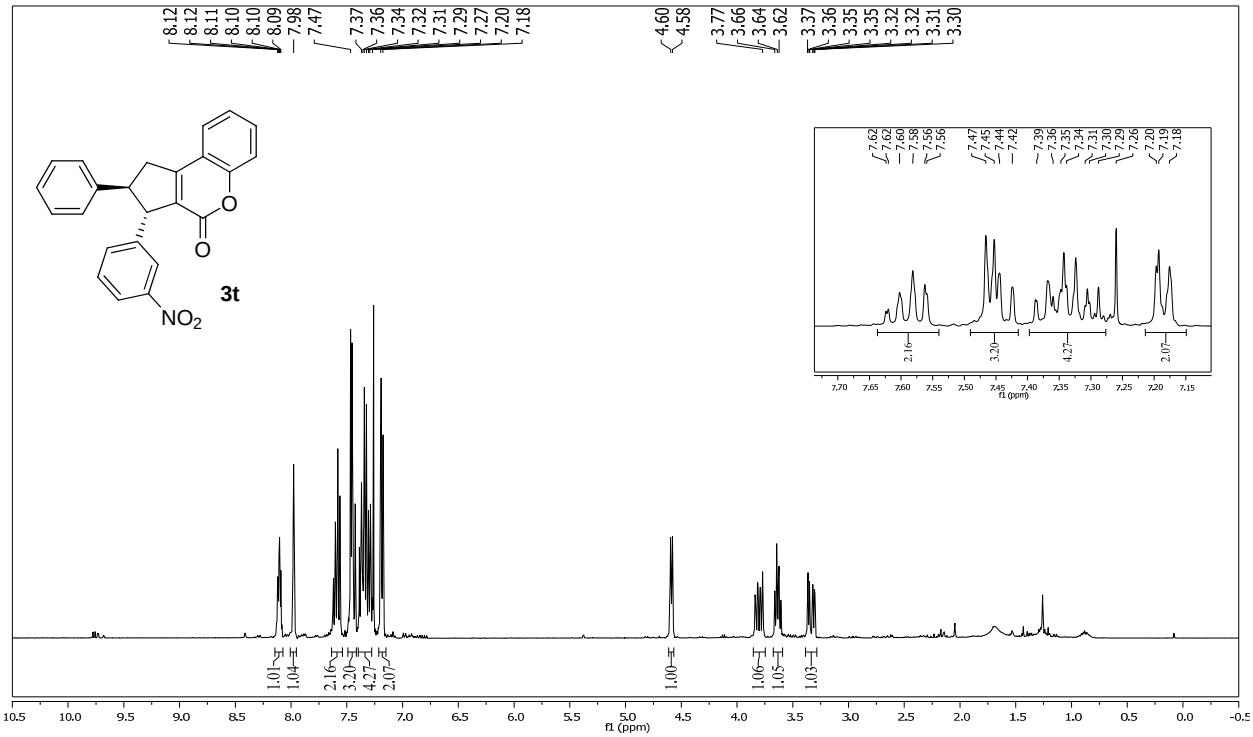


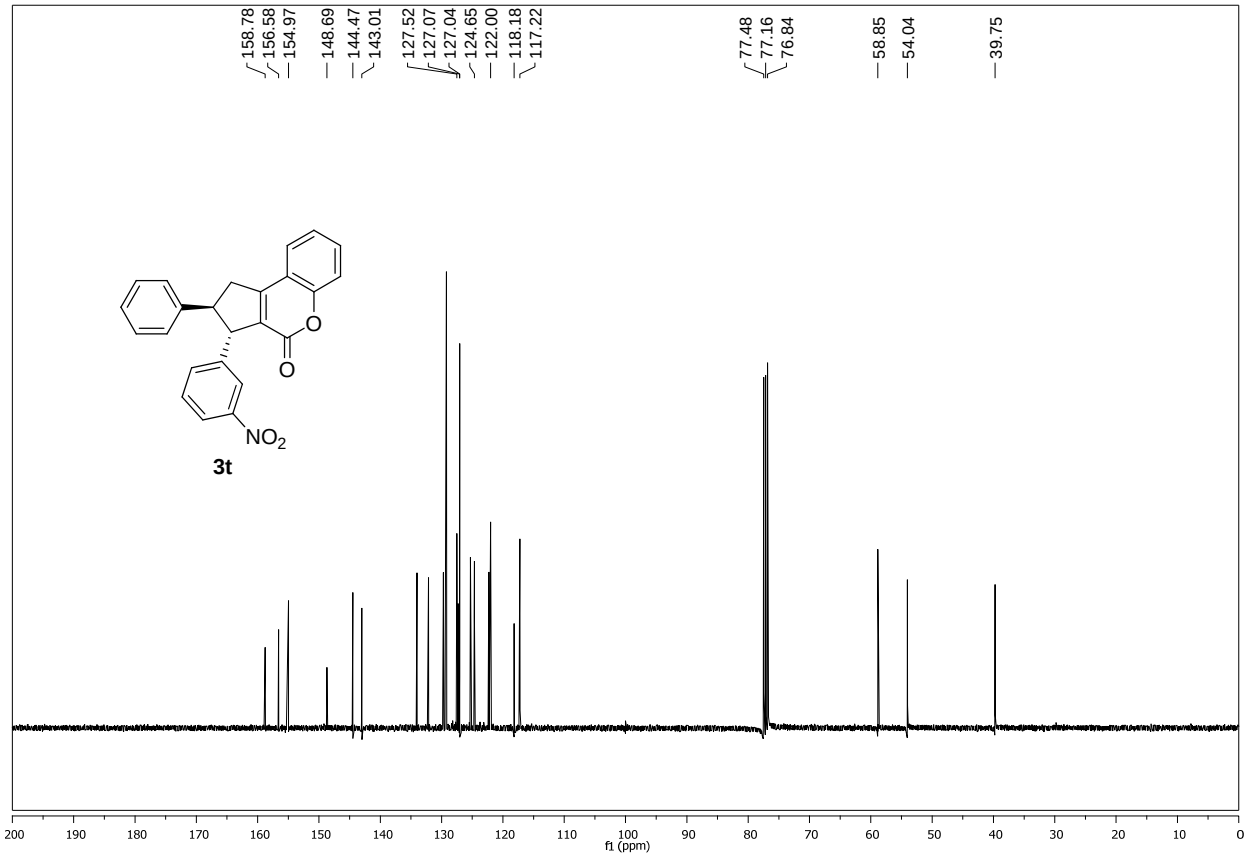
(4-(Trifluromethyl)phenyl)-2,3-dihydro-2-phenylcyclopenta[*c*]chromen-4(1*H*)-one (3s)



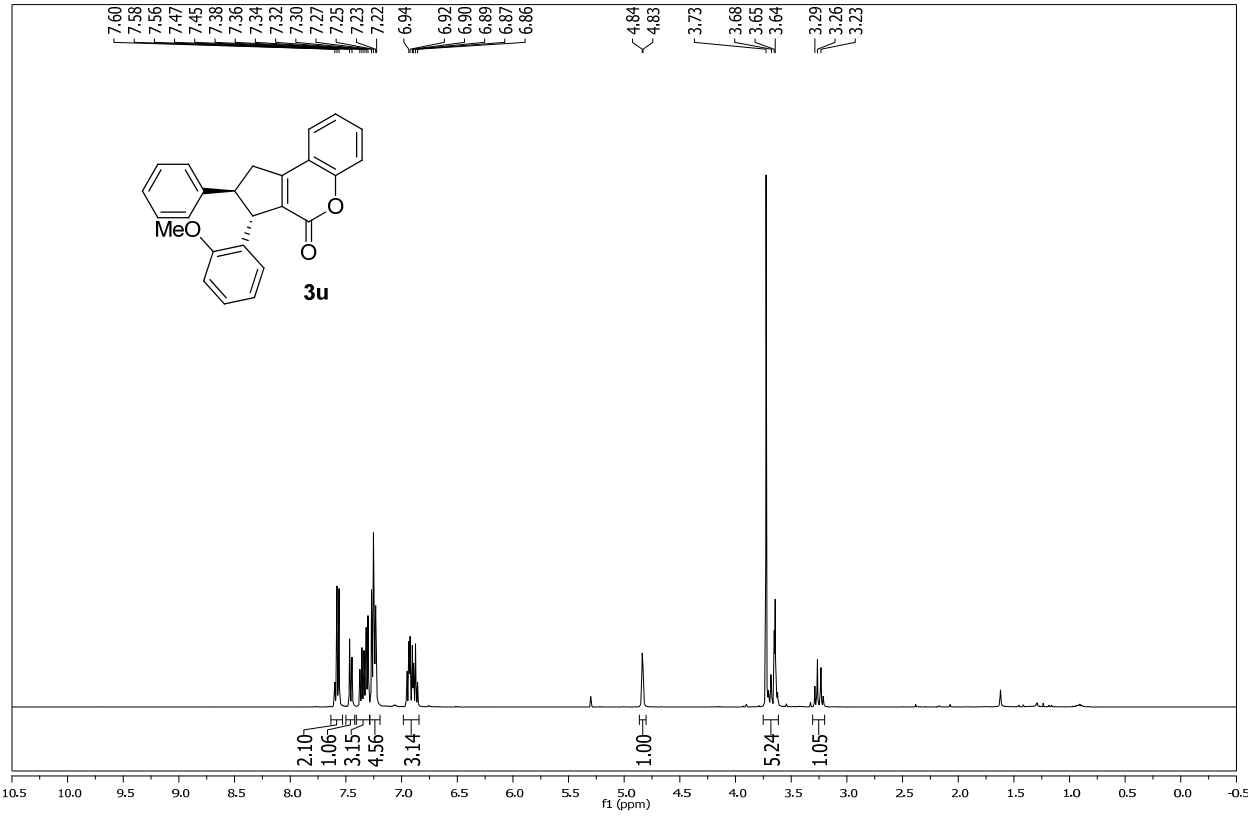


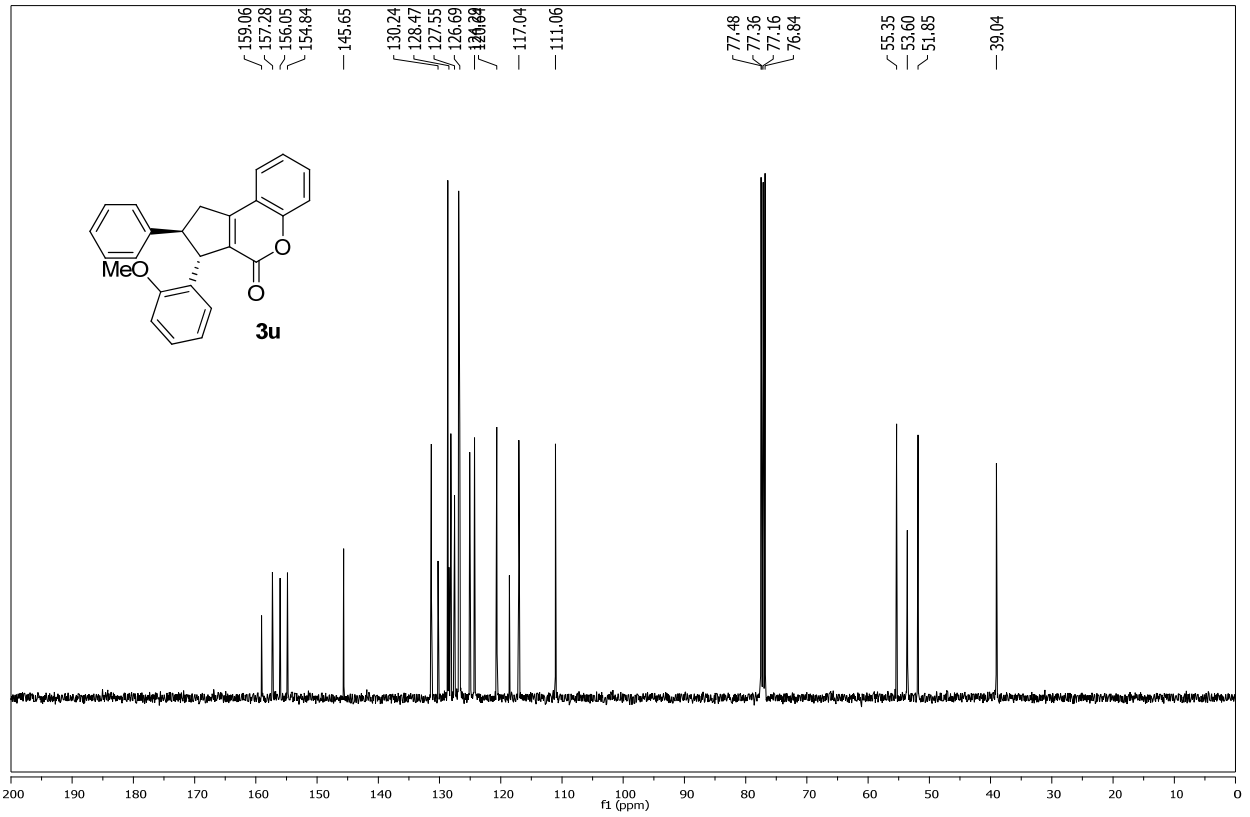
3-(3-Nitrophenyl)-2-phenyl-2,3-dihydrocyclopenta[c]chromen-4(1H)-one (3t)



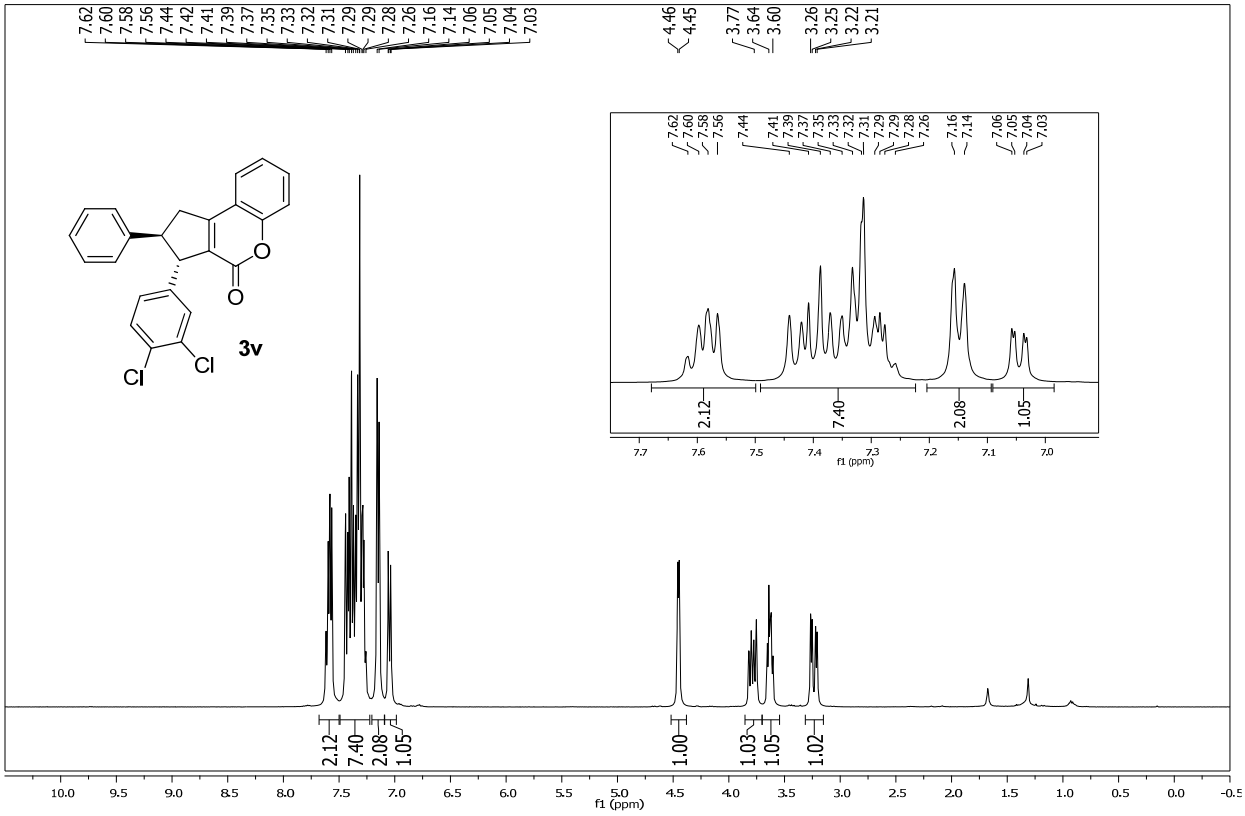


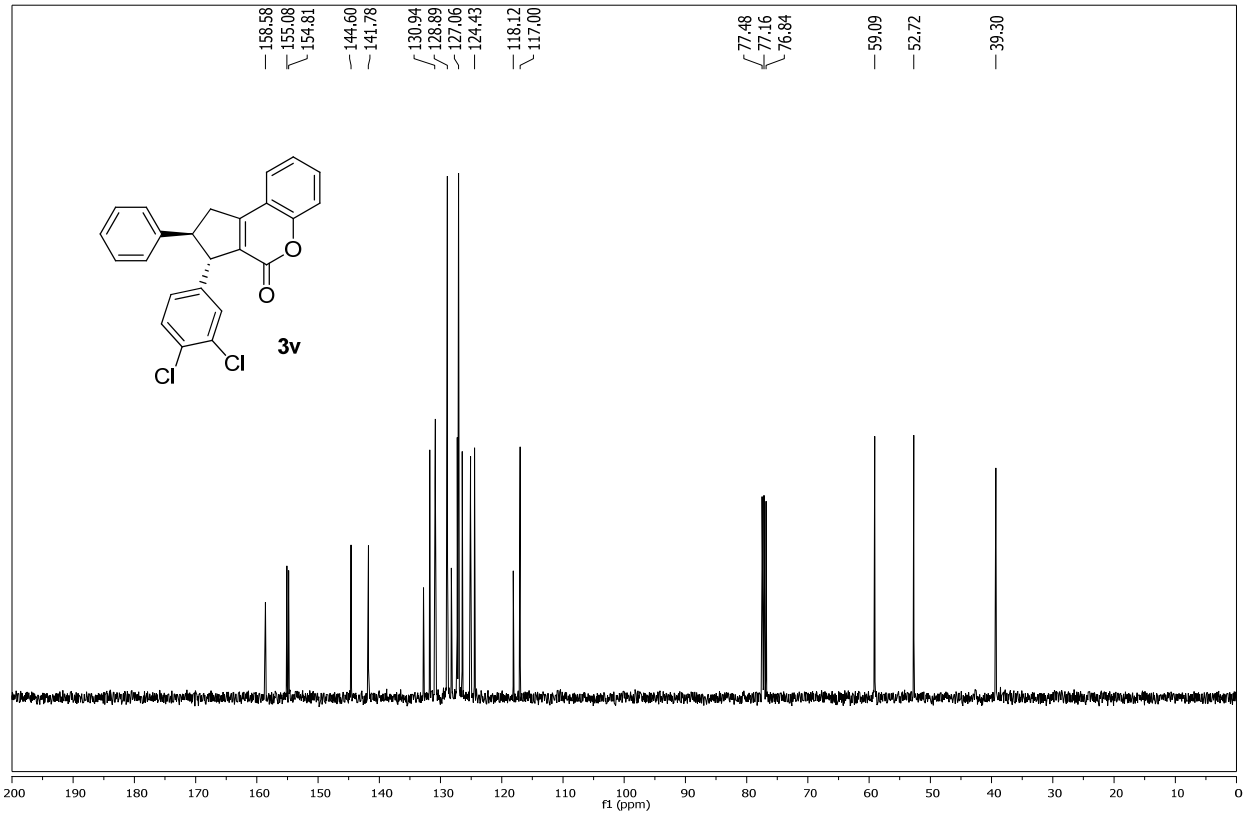
3-(2-Methoxyphenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3u)



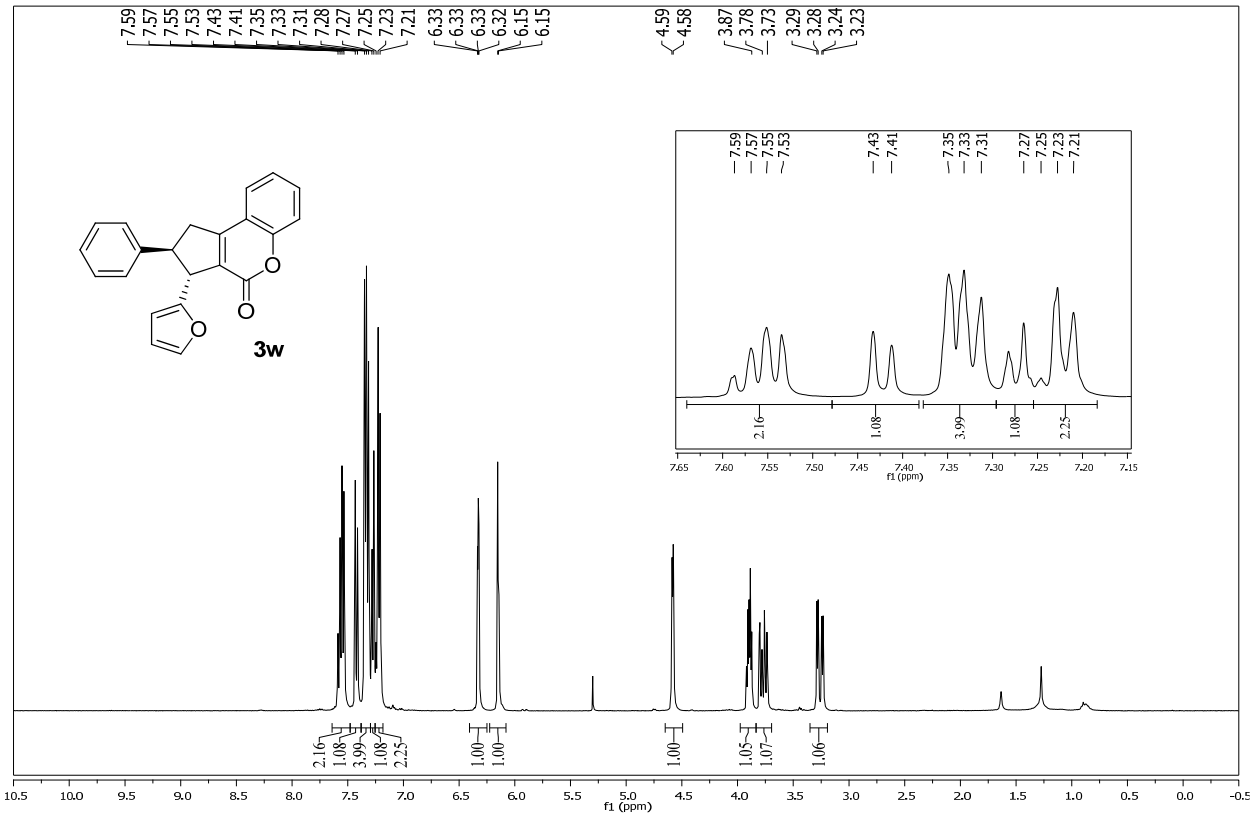


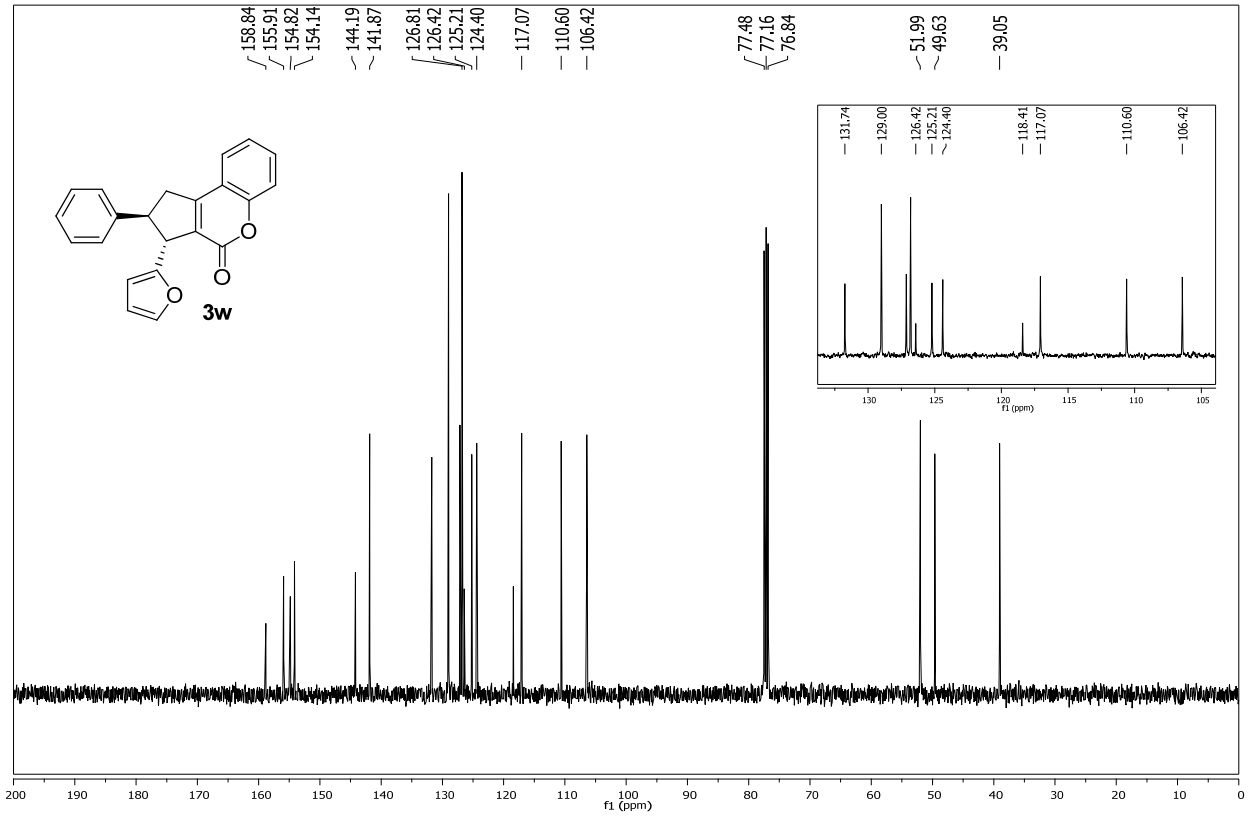
3-(3,4-Dichlorophenyl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3v)



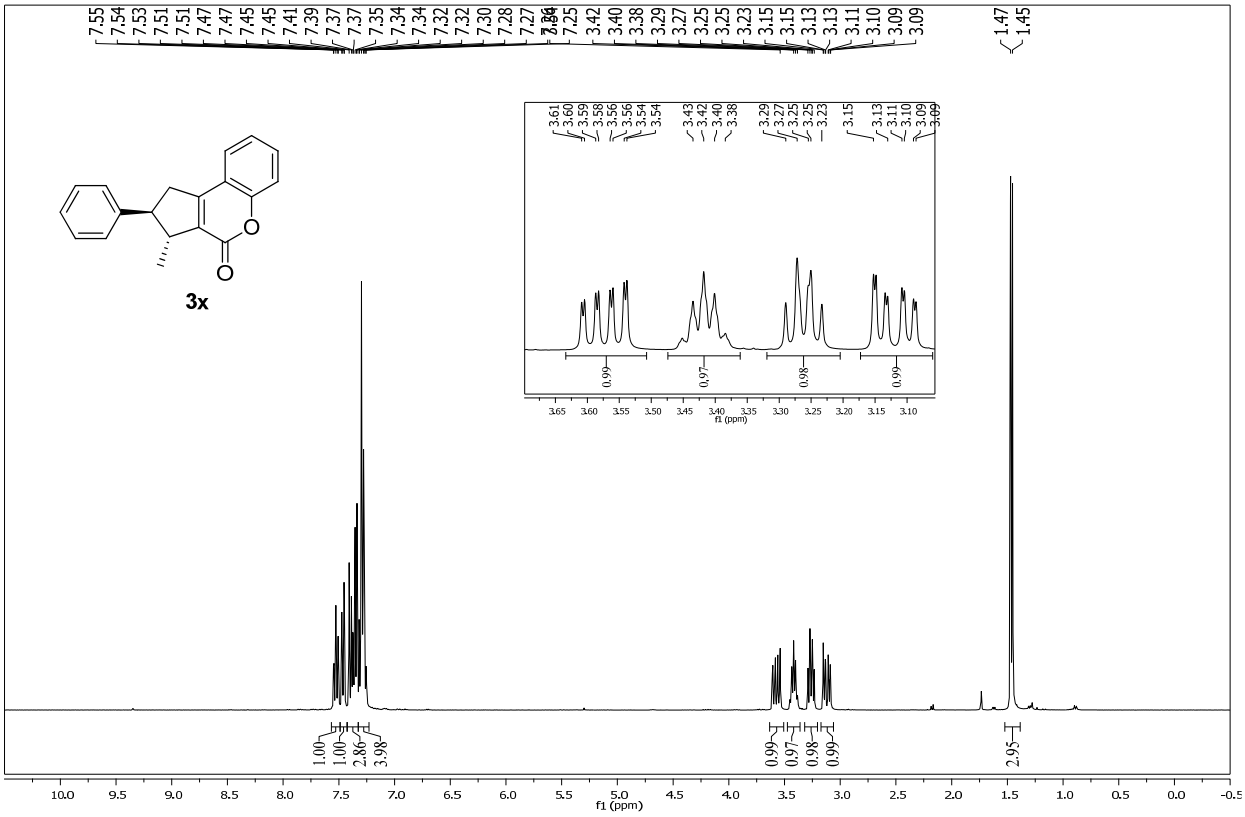


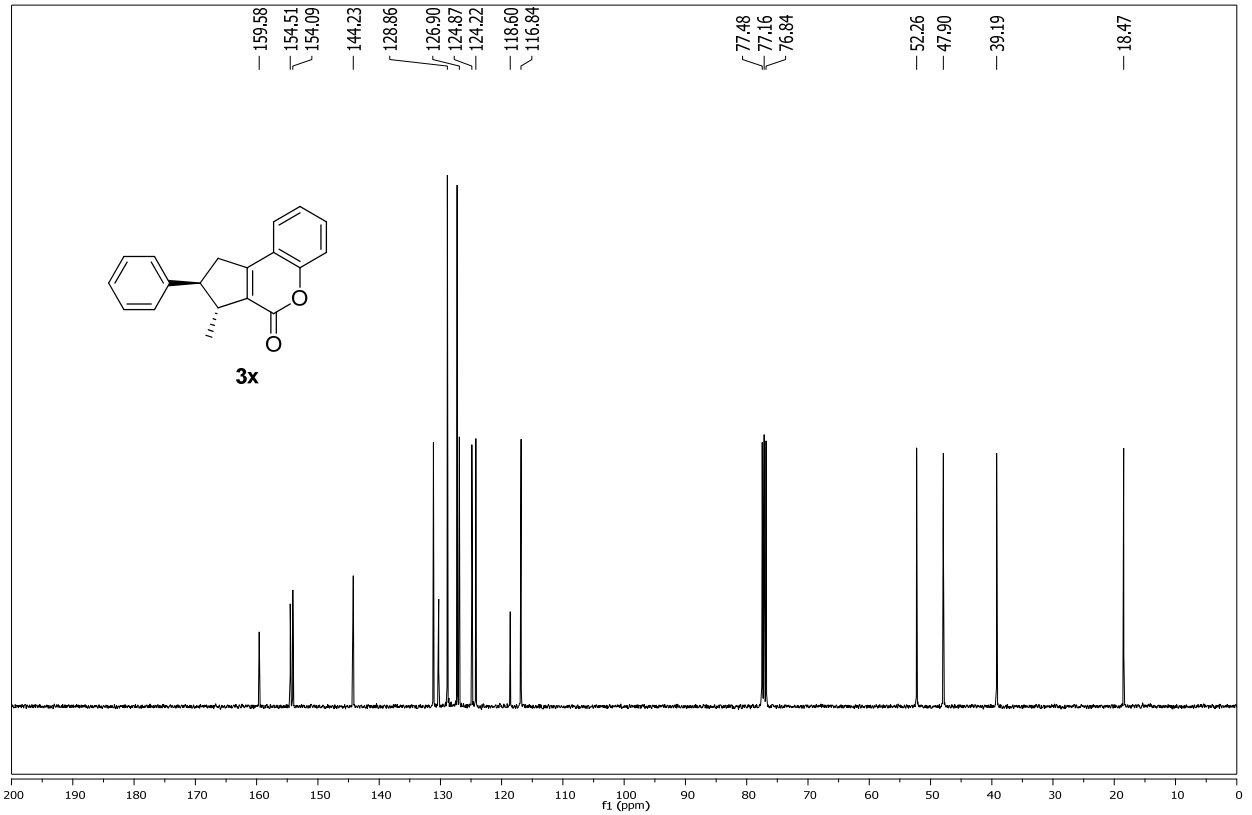
3-(Furan-2-yl)-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3w)



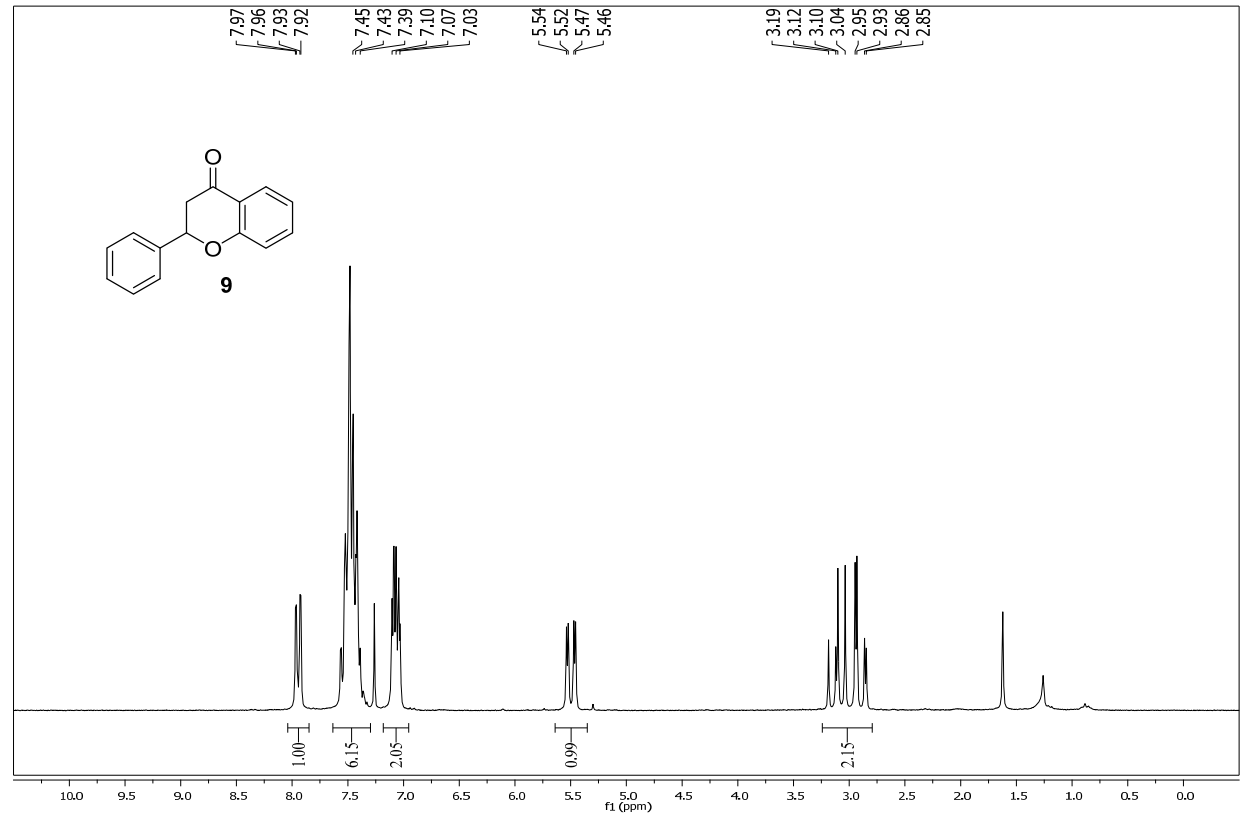


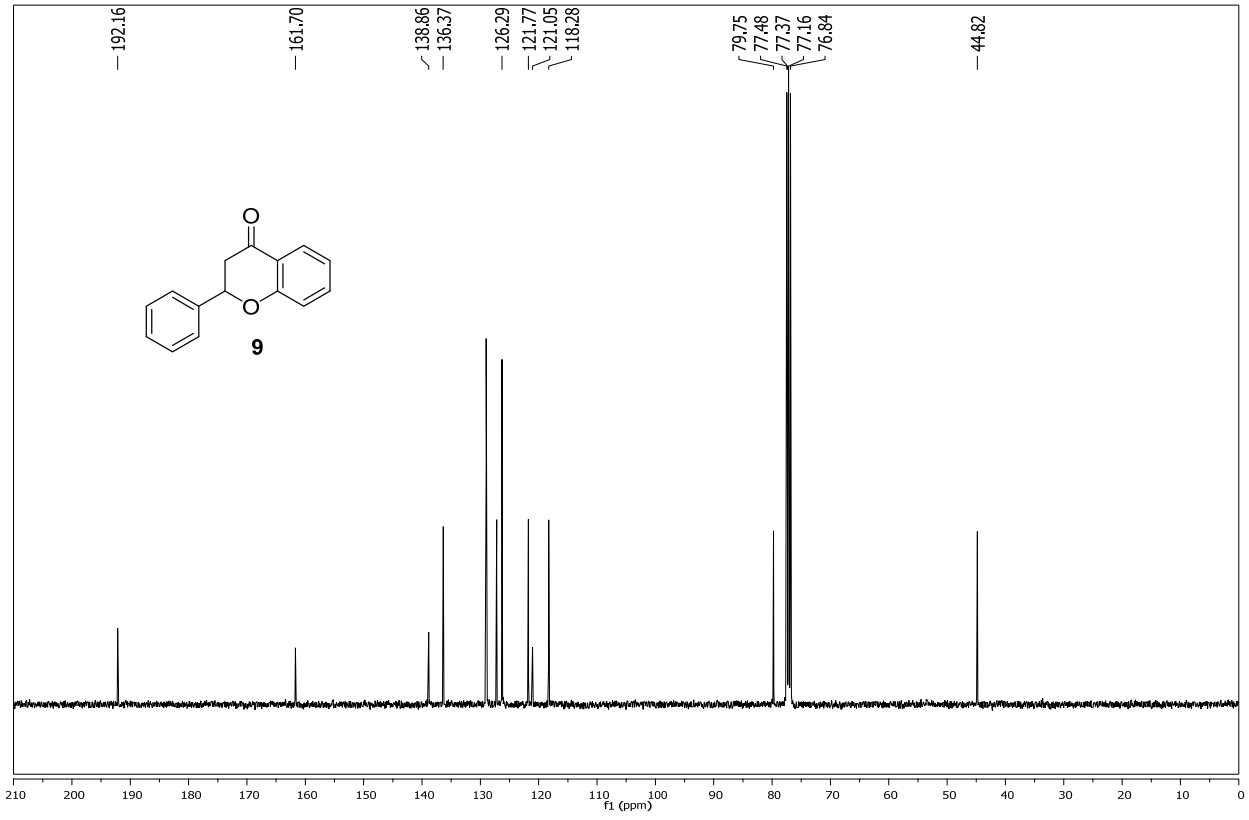
3-Methyl-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3x)





2-Phenylchroman-4-one (9)





3-Ethyl-2-phenyl-2,3-dihydrocyclopenta[*c*]chromen-4(1*H*)-one (3y)