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

Supporting information

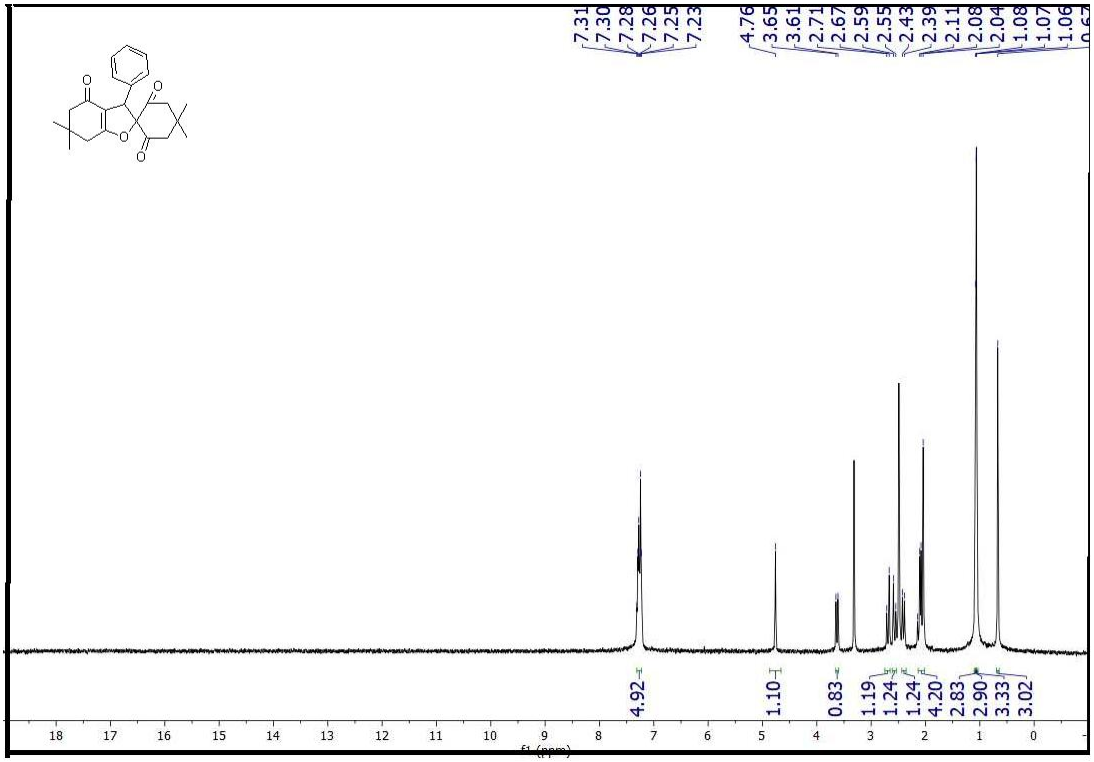
Design and preparation of hollow triple-shell $CaMgFe_2O_4$ nanospheres for green synthesis of spiro-dihydrofuranes under solvent free conditions

Somayeh Kazempour, Hossein Naeimi*

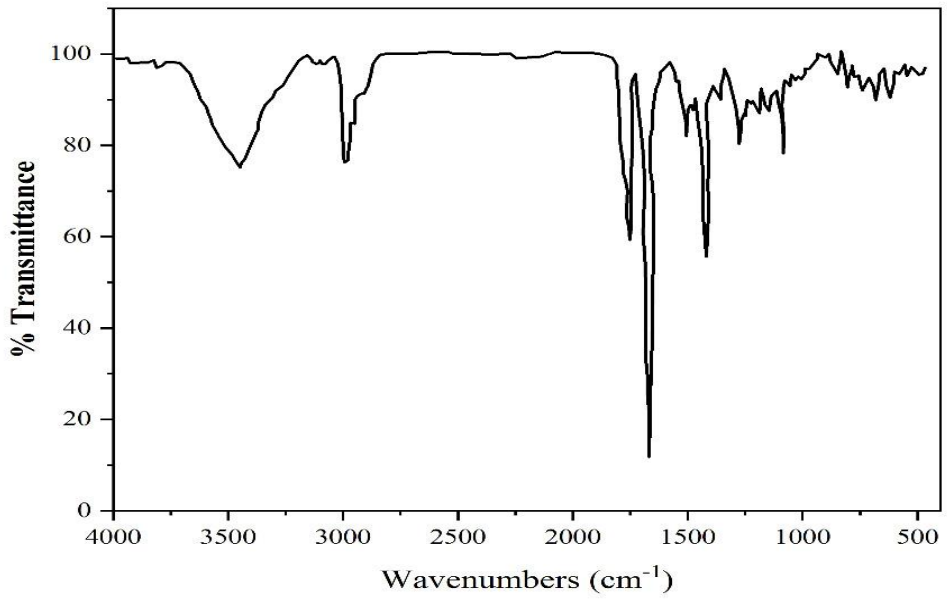
Department of Organic Chemistry, Faculty of Chemistry, University of Kashan, Kashan, 87317-51167, I.R. Iran; Tel: 98-31-55912388; Fax: 983155912397; E-mail: Naeimi@kashanu.ac.ir

General multicomponent procedure for synthesis of spiro-dihydrofurans

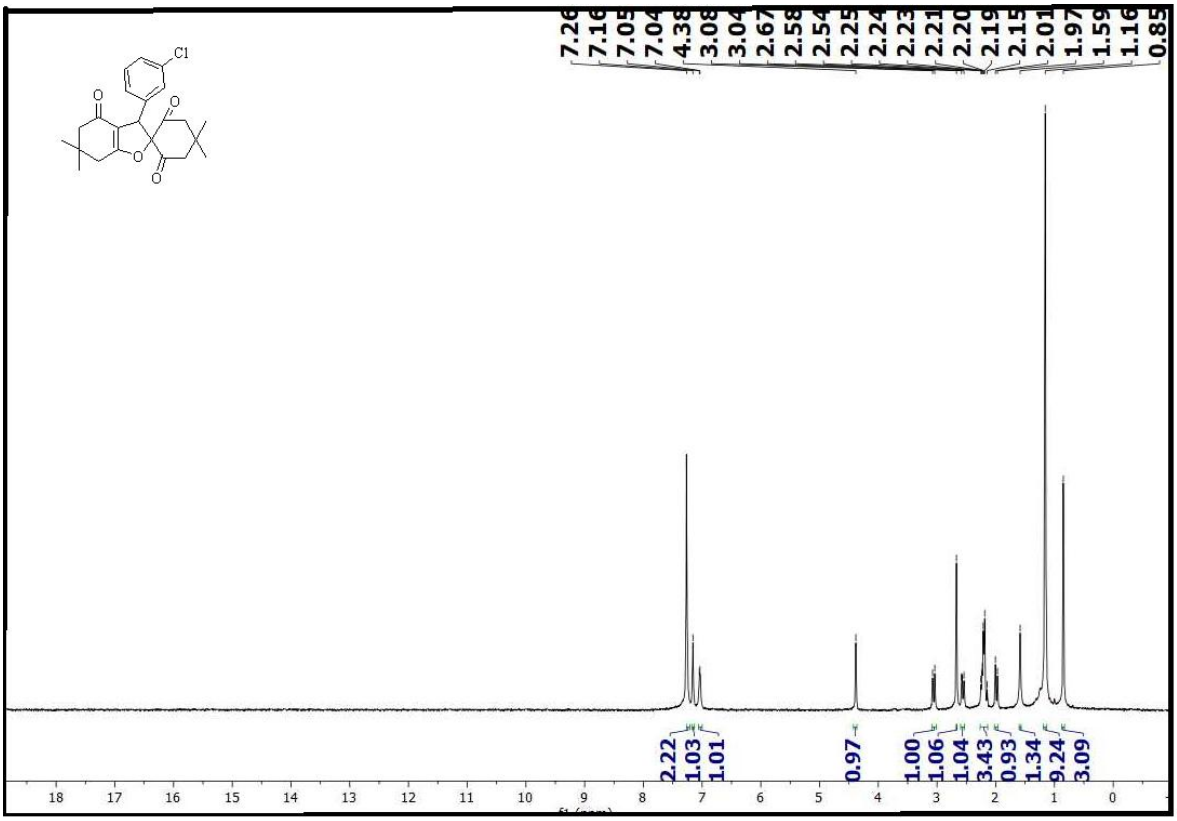
Spiro-dihydrofurans synthesized from the multi-component reaction. In this process, benzaldehyde (1 mmol), dimedone (2 mmol), iodine (1 mmol) and catalyst (0.01 mg, $CaMgFe_2O_4$) to make spiro-dihydrofurans derivatives mixed, and stirred in 50 ºC temperature for 85 min. the process followed with thin layer chromatography. After completion of the reaction, EtOH (5 ml) was added and the catalyst was separated by an external magnetic. The crude products were obtained by recrystallization in ethanol to give the pure product.



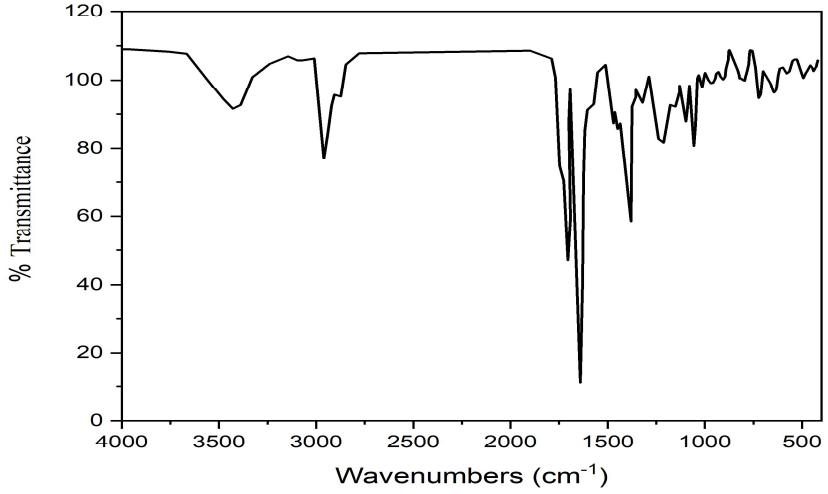
^{1}H NMR of **1a**



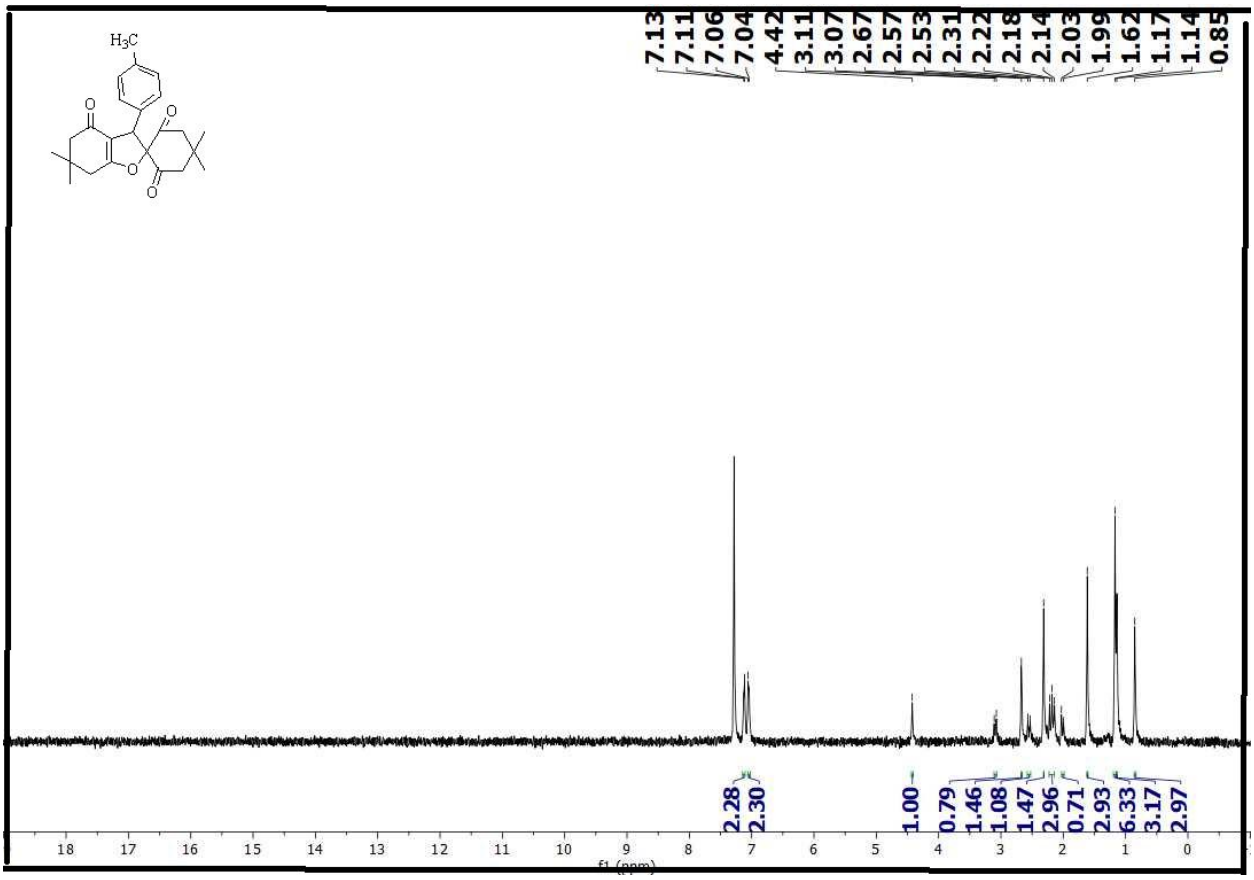
IR of **1a**



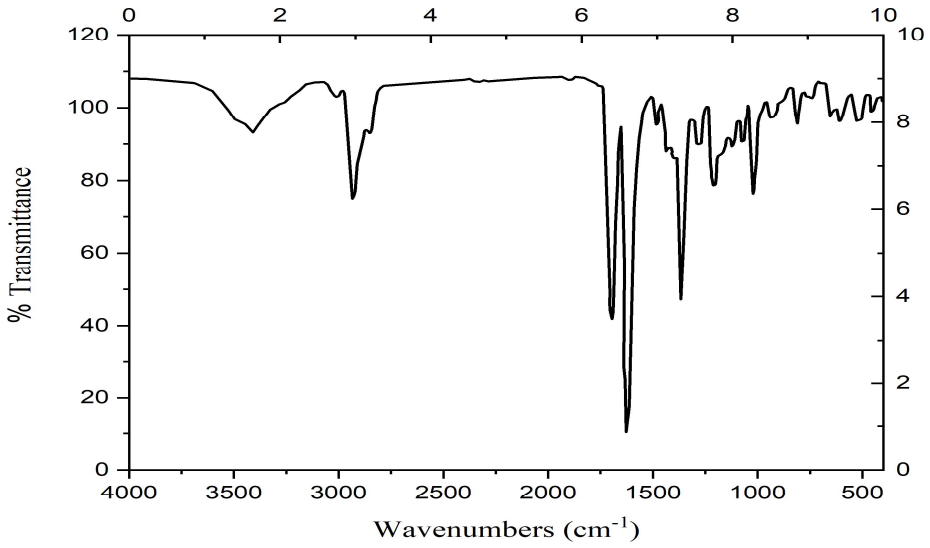
^{1}H NMR of **2a**



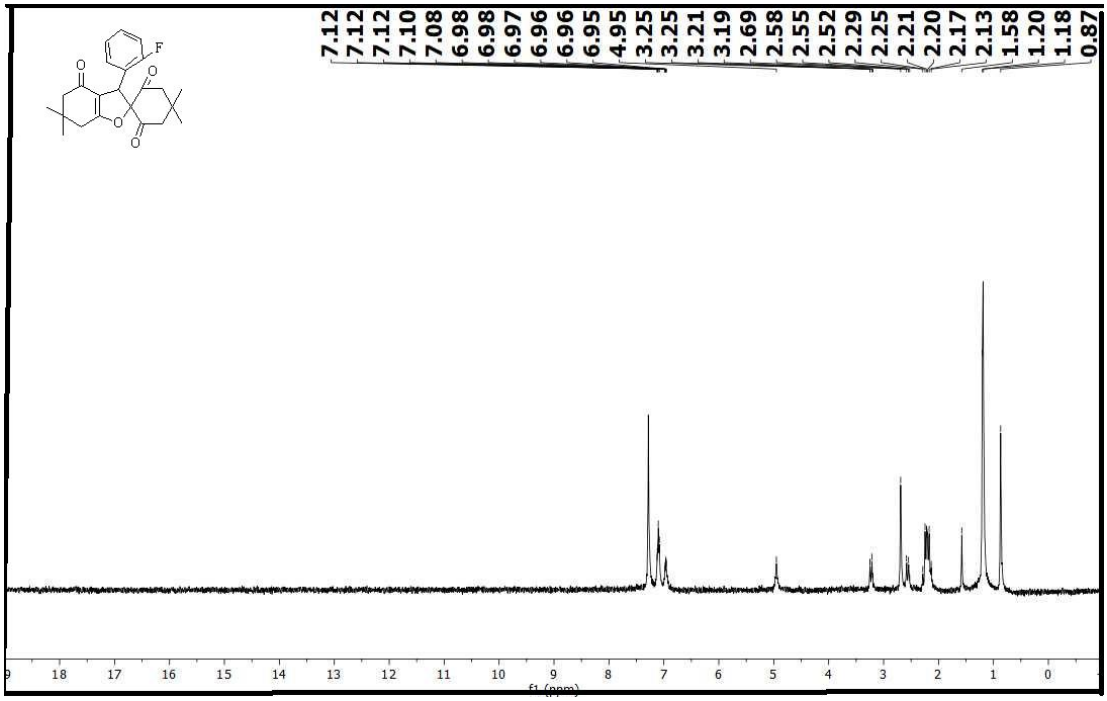
IR of **2a**



^{1}H NMR of **3a**



IR of **3a**



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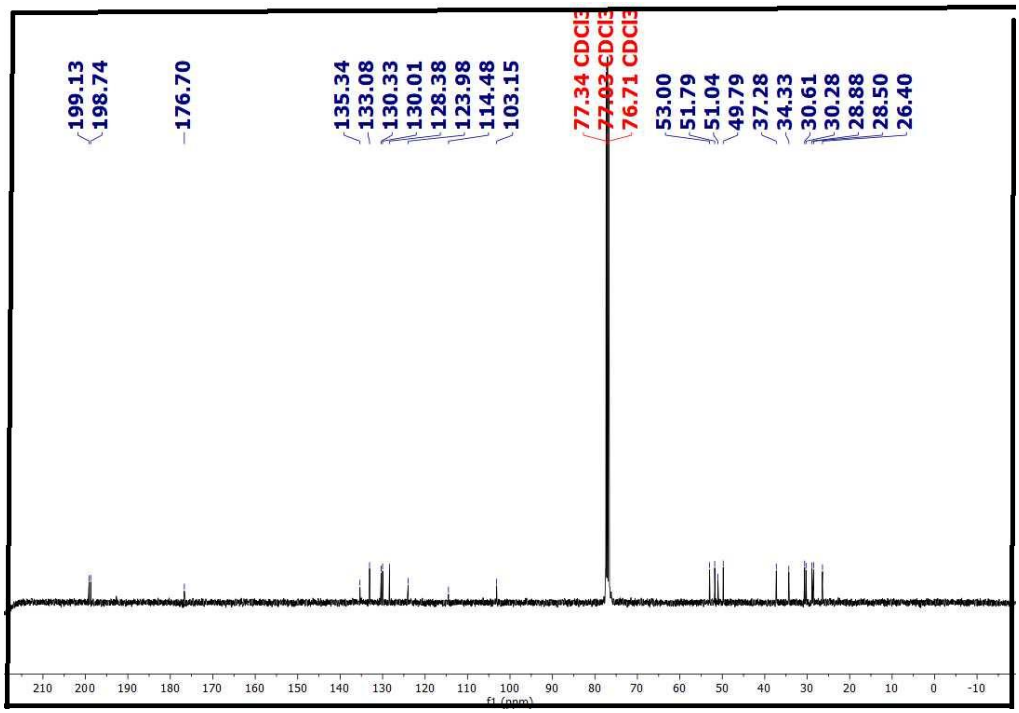
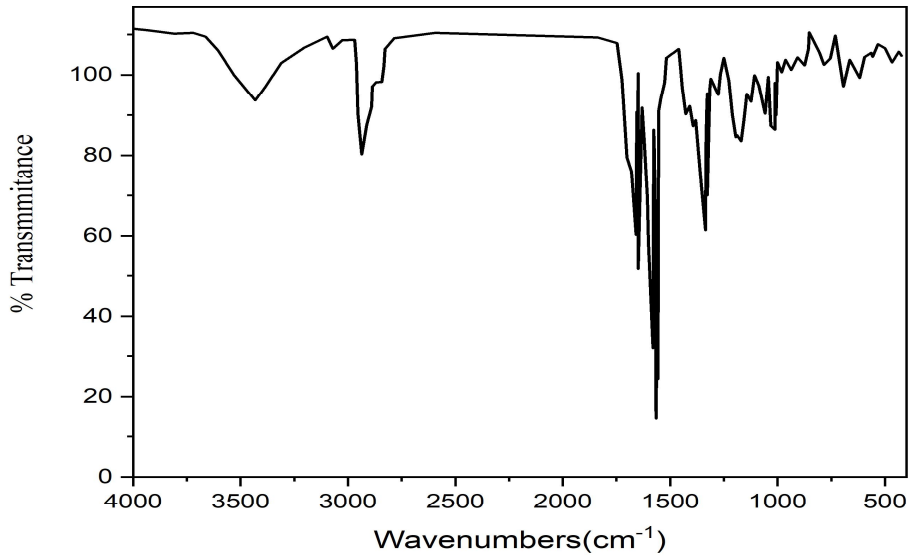
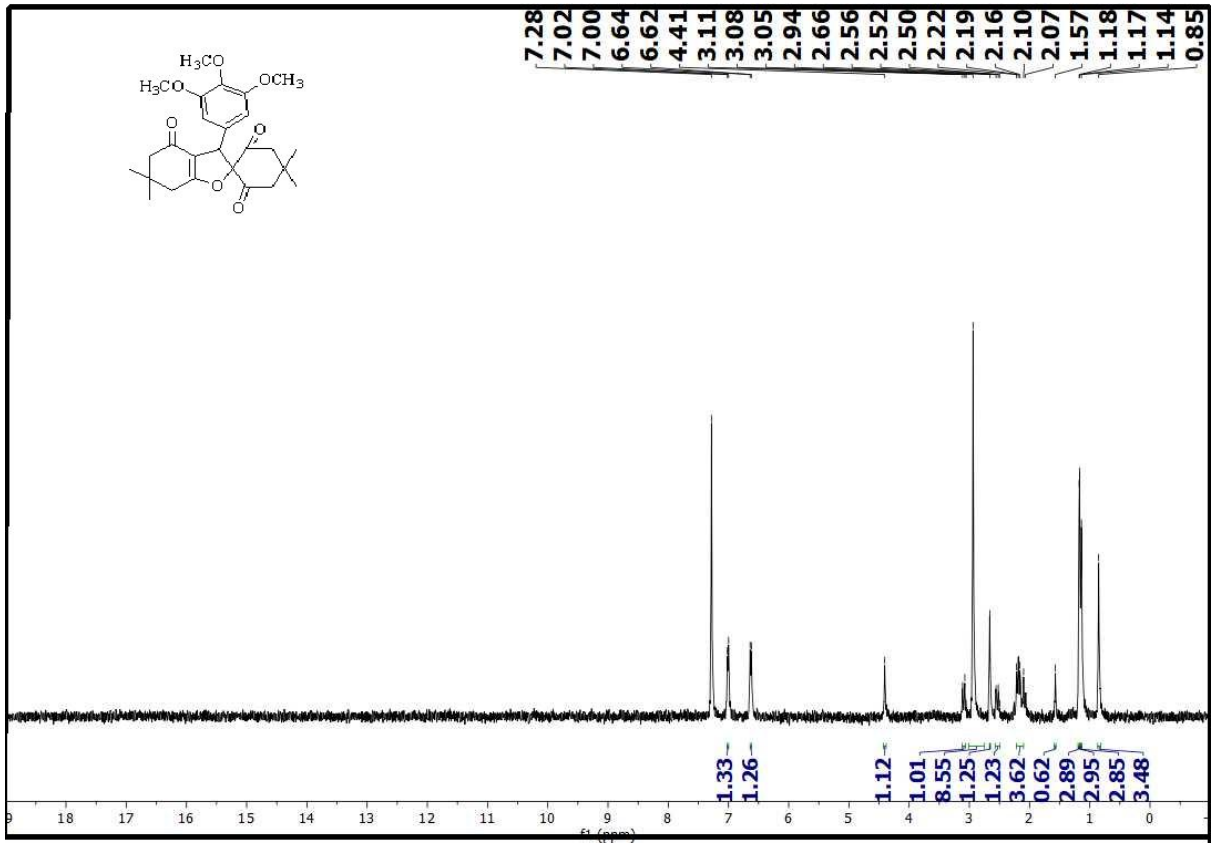


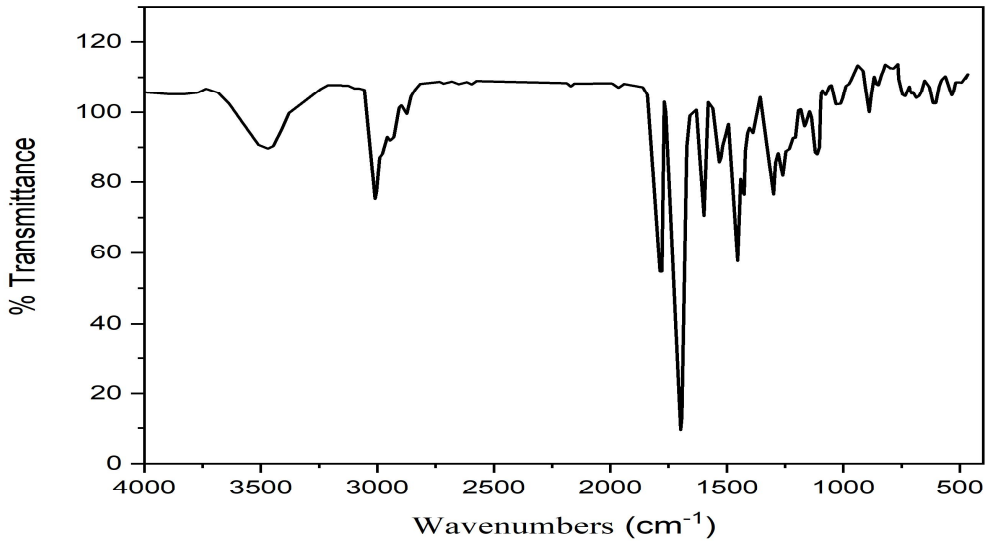
^{13}C NMR of **4a**



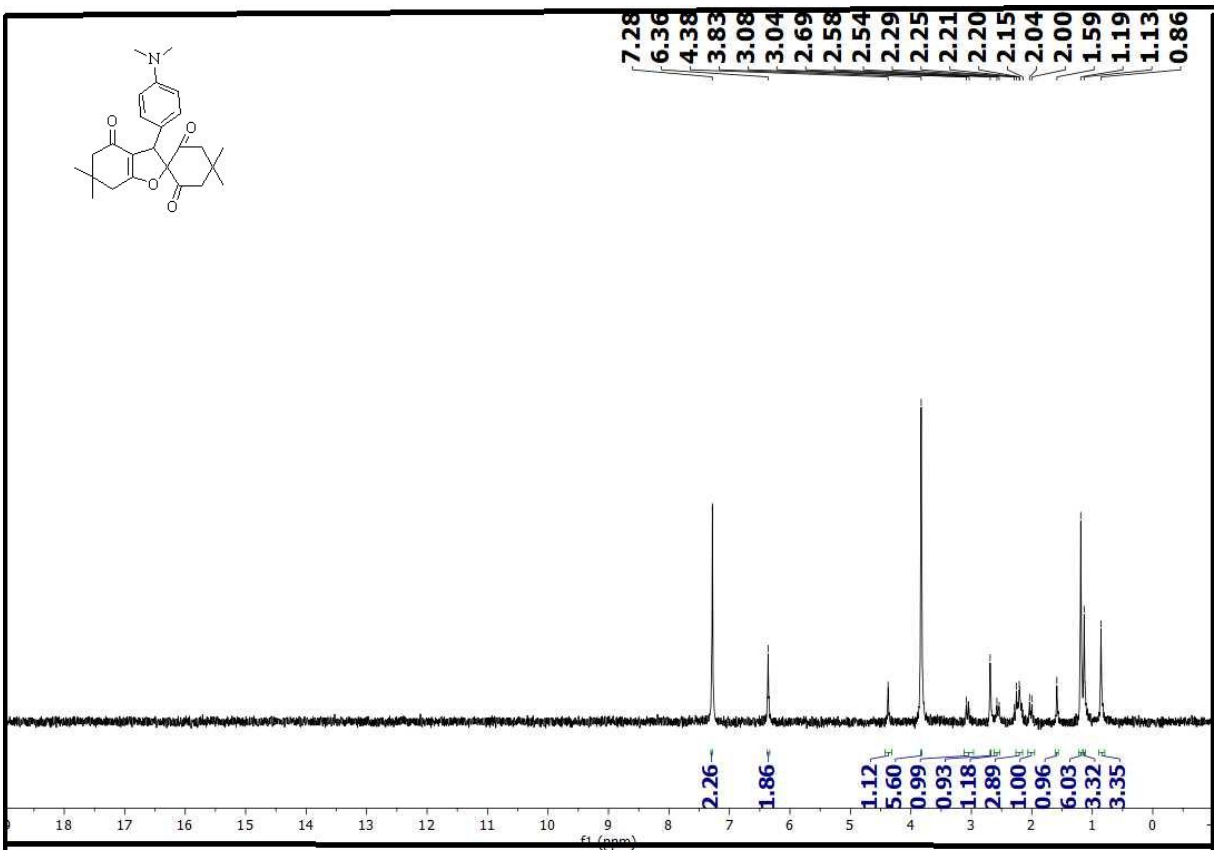
IR of **4a**



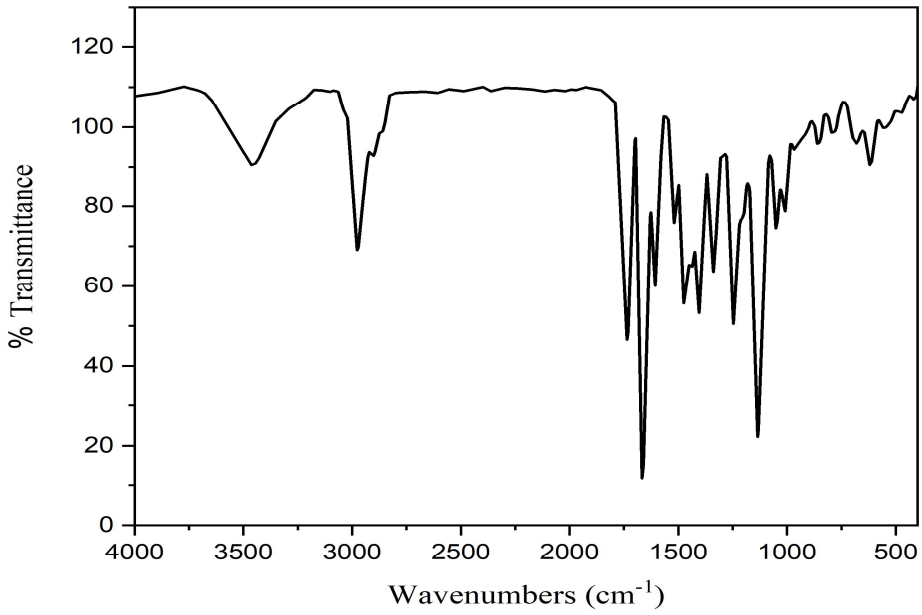
^{1}H NMR of **5a**



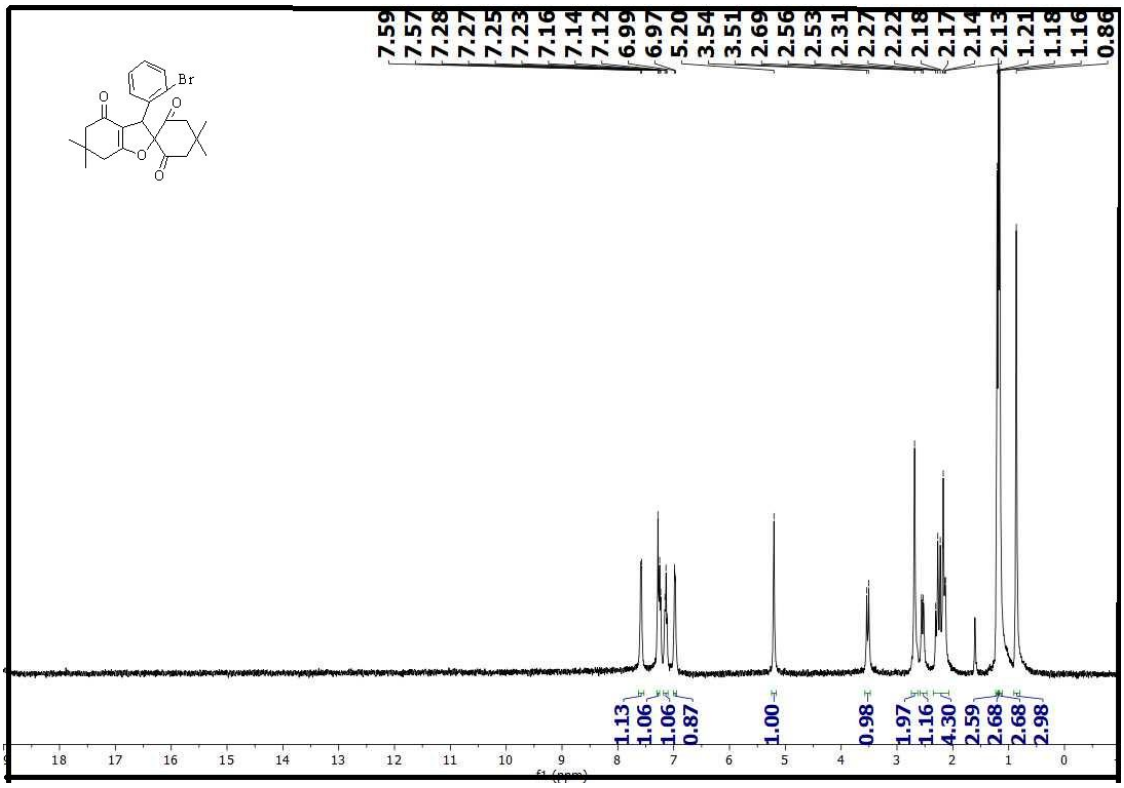
IR of **5a**



^{1}H NMR of **6a**



IR of **6a**



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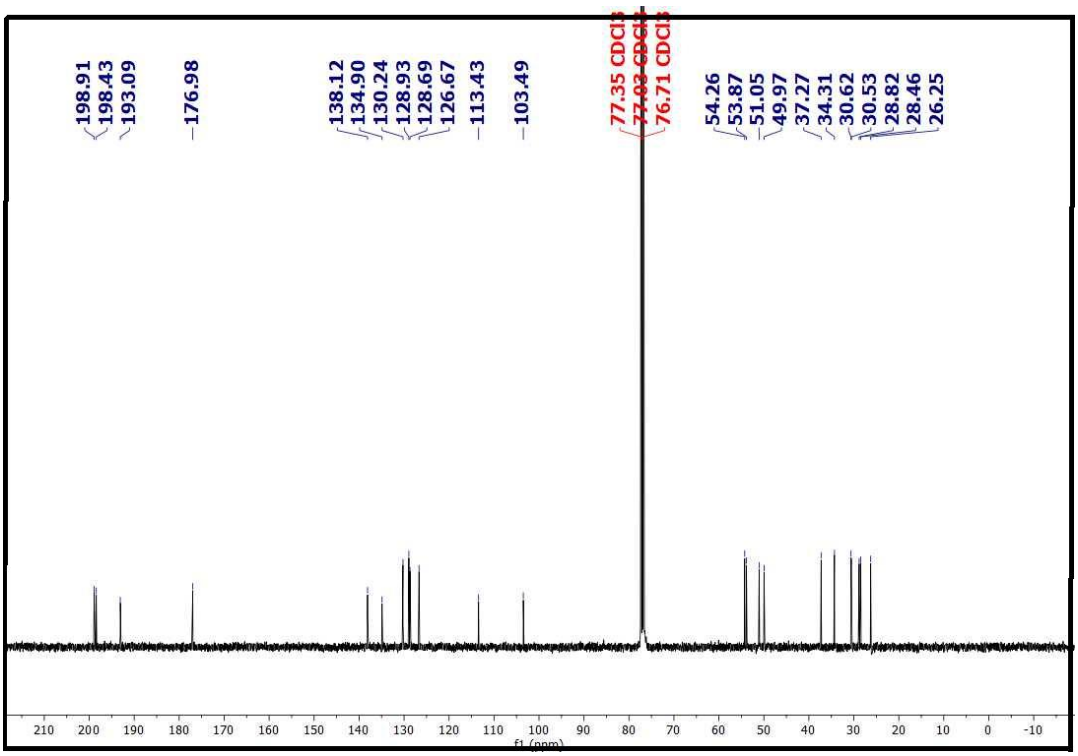
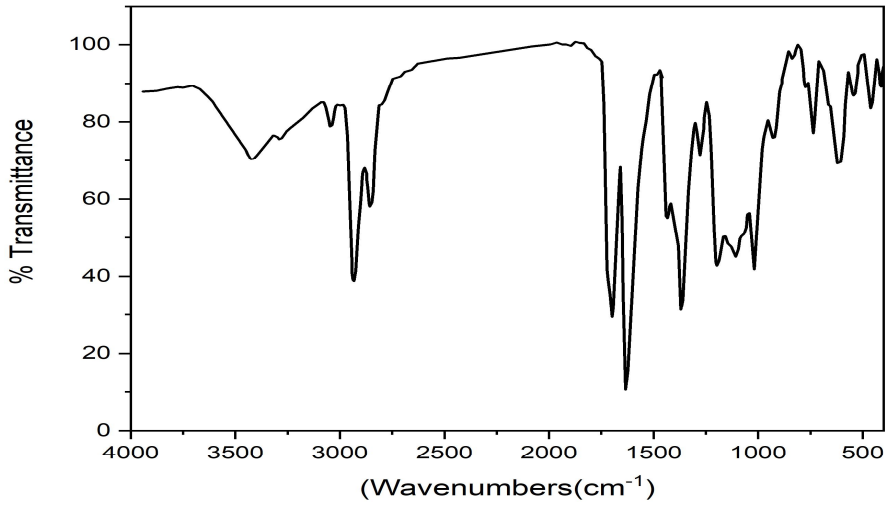
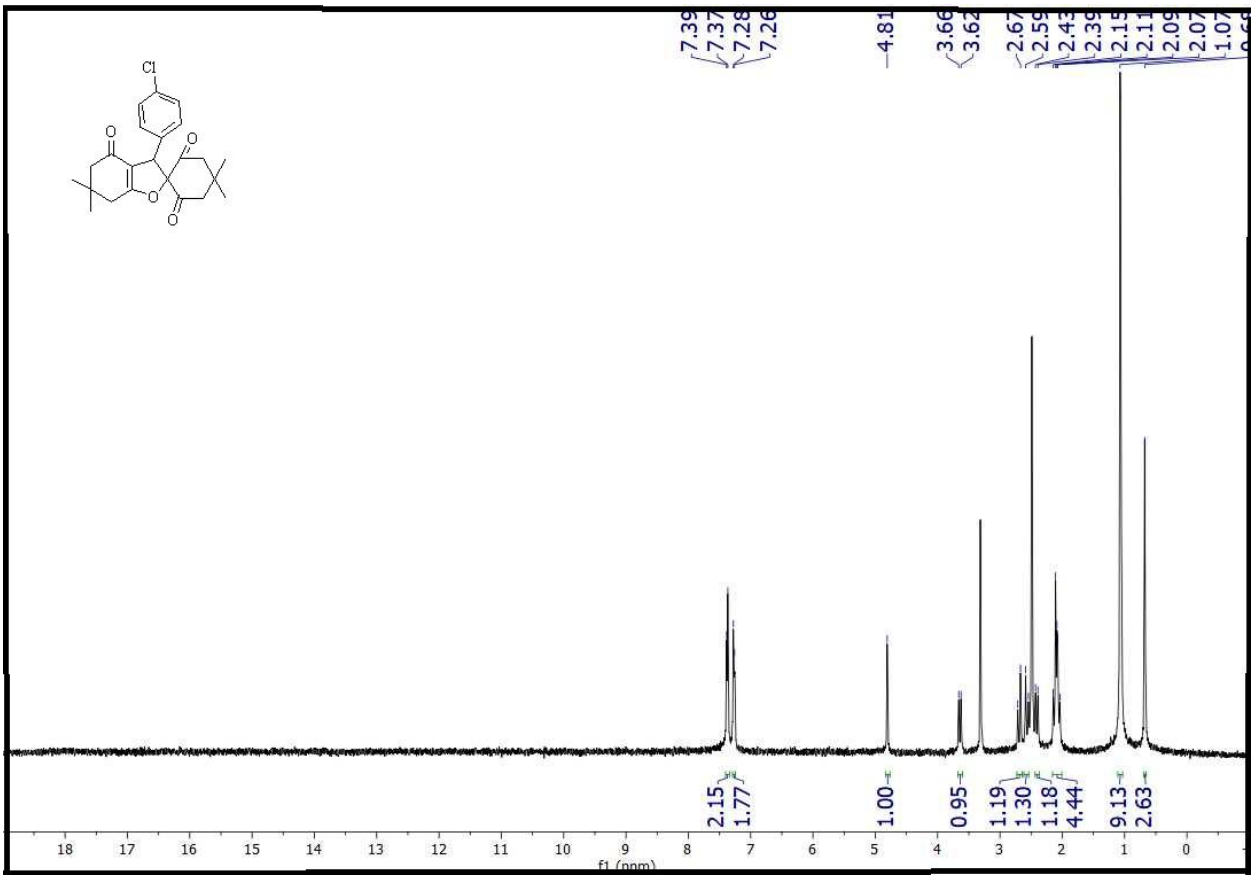


^{13}C NMR of **7a**



IR of **7a**



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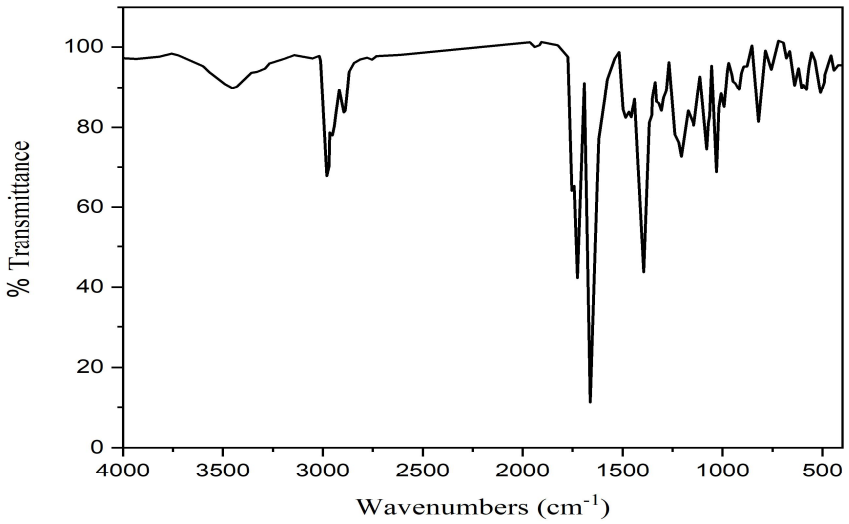
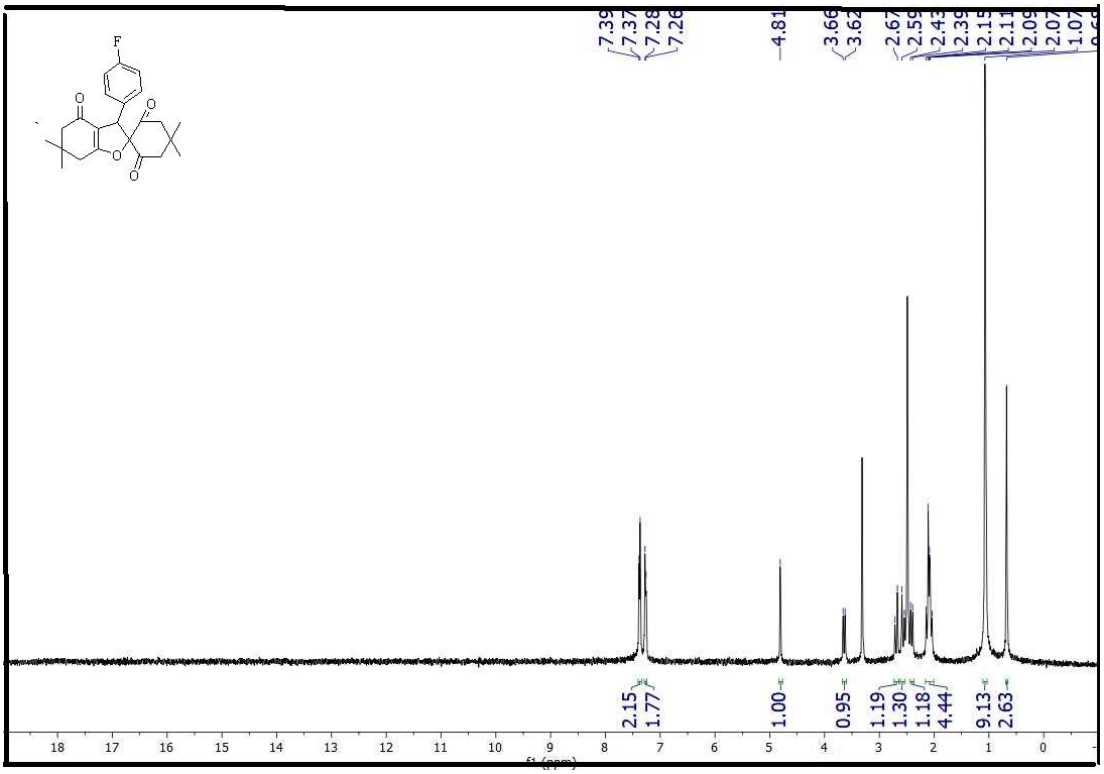


IR of **8a**



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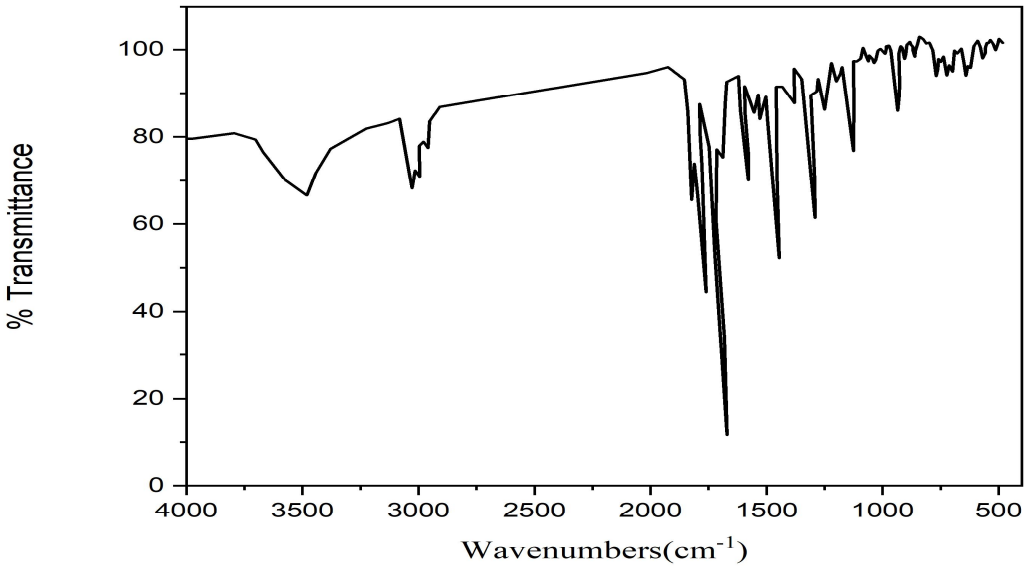
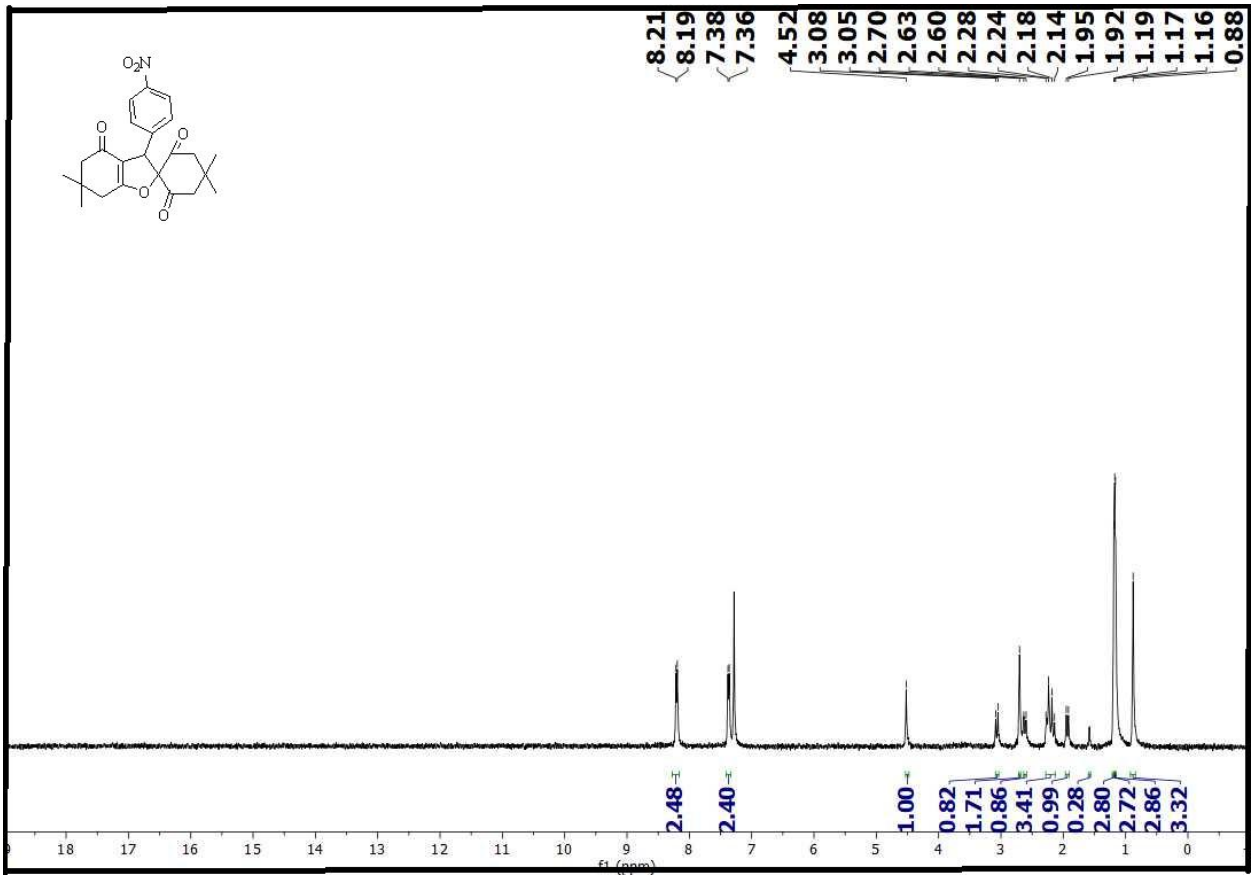
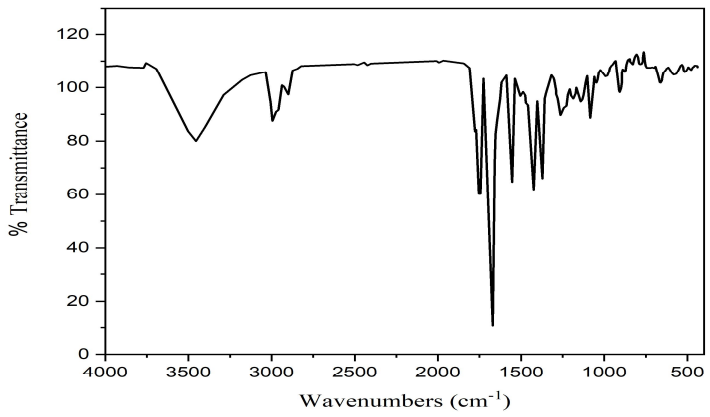


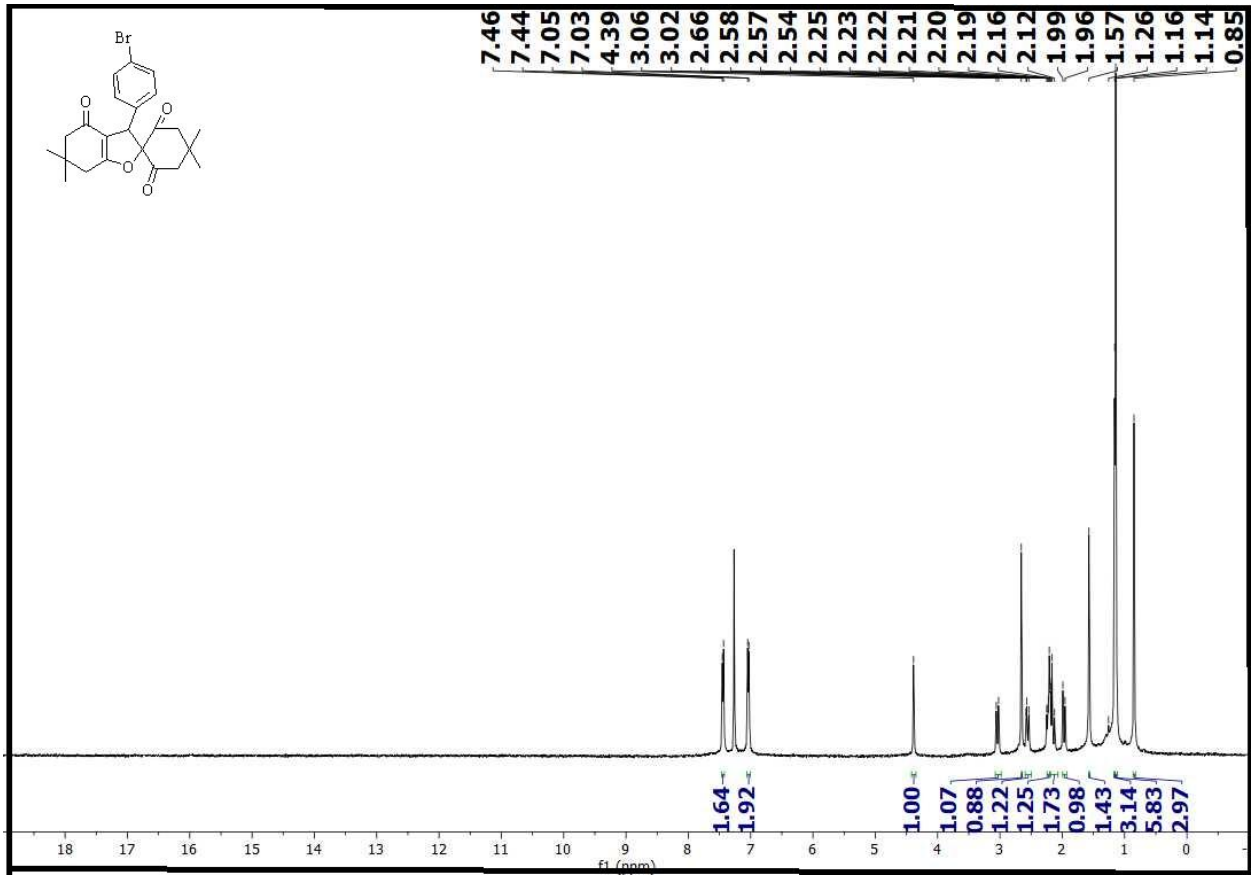
IR of **9a**



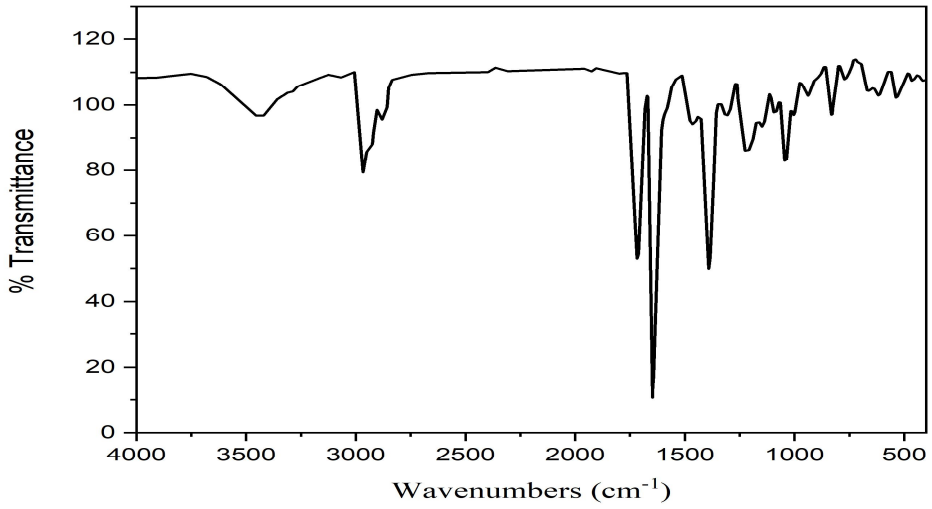
^{1}H NMR of **10a**



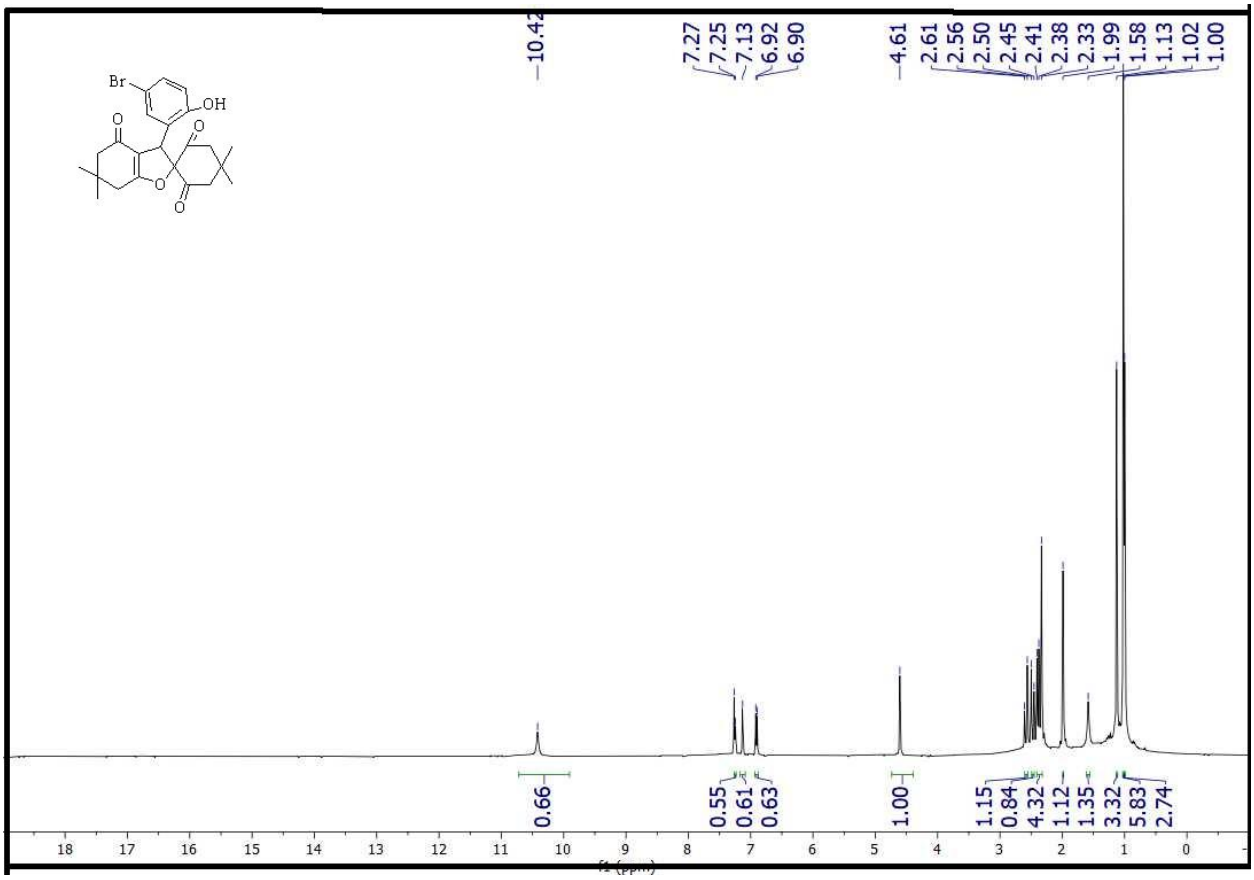
IR of **10a**



^{1}H NMR of **11a**



IR of **11a**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2.45
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2.38
2.33
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1.13
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1.00
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0.84
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1.12
1.35
3.32
5.83
2.74
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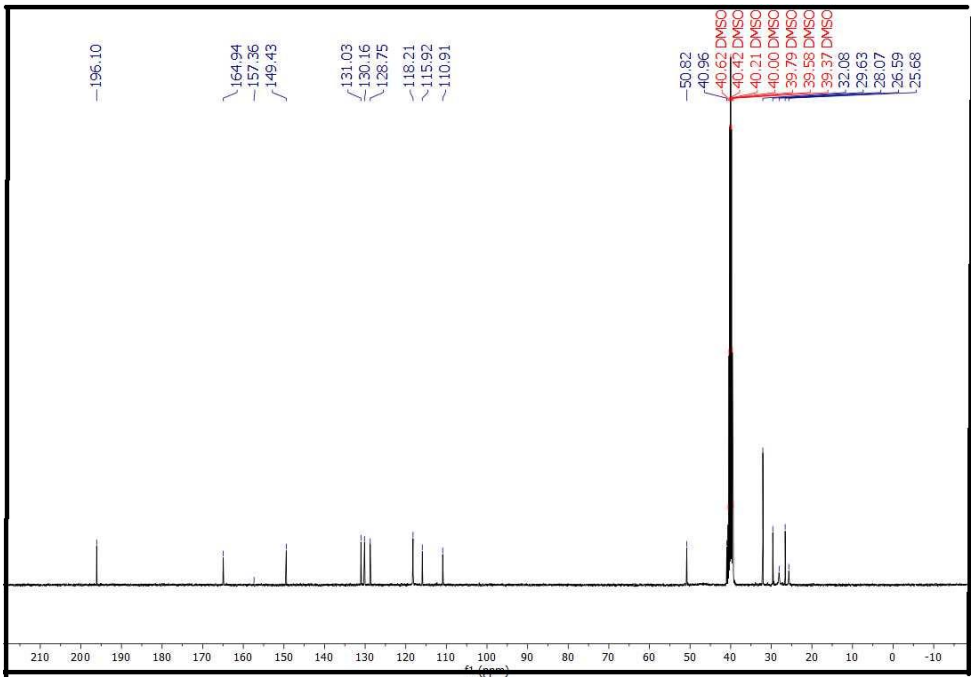
^{1}H NMR of **12a**



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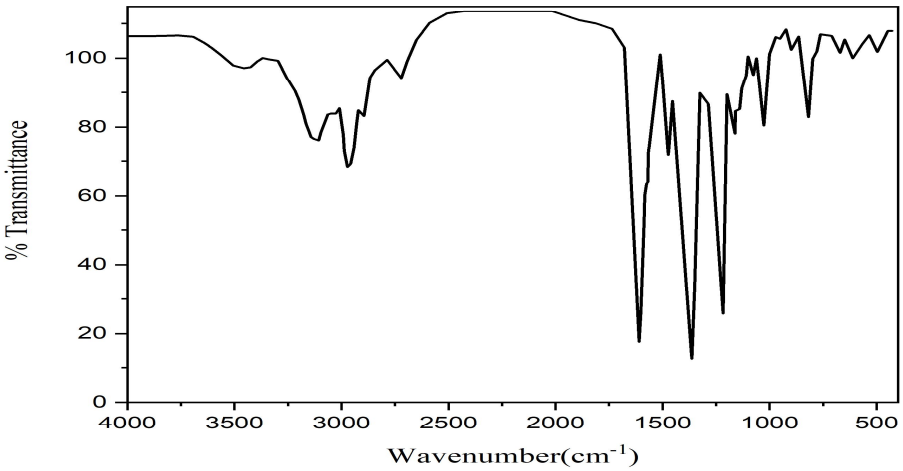

IR of **12a**