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Synthesis and characterization of molybdic acid immobilized on modified magnetic nanoparticles as a new and recyclable catalyst for the synthesis of chromeno[4,3-*b*]chromenes

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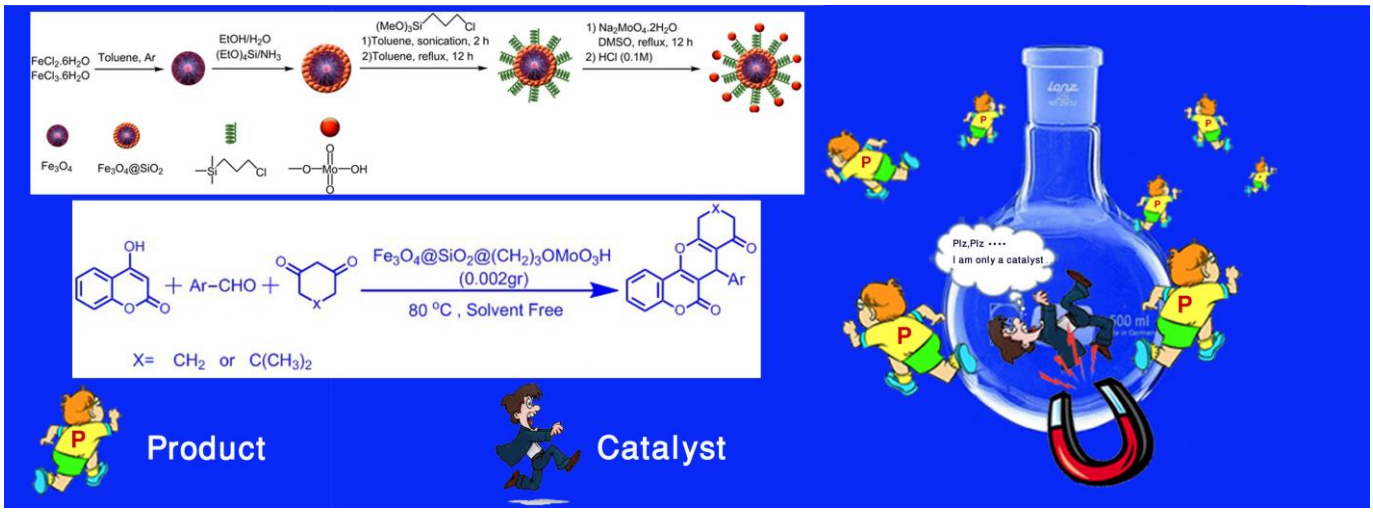
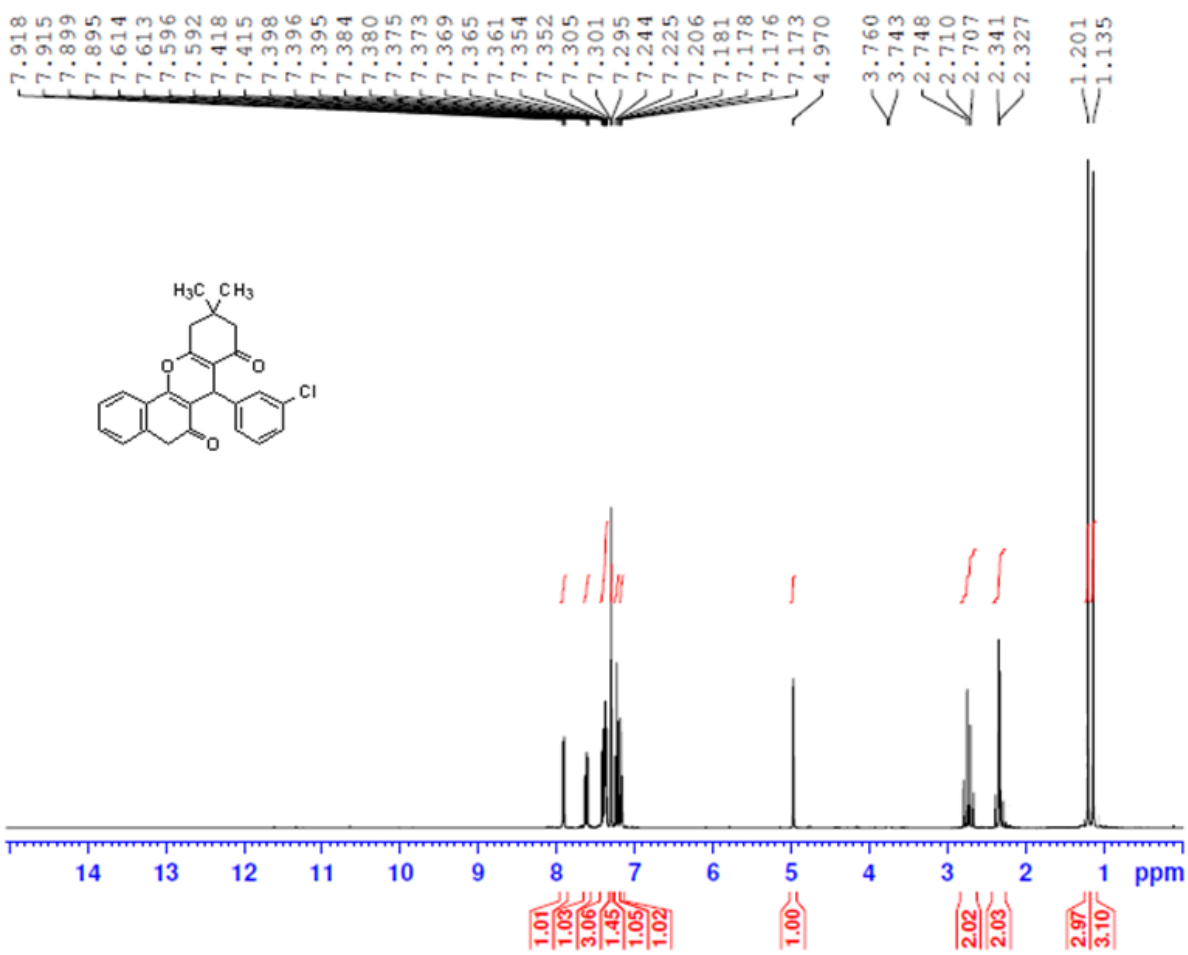
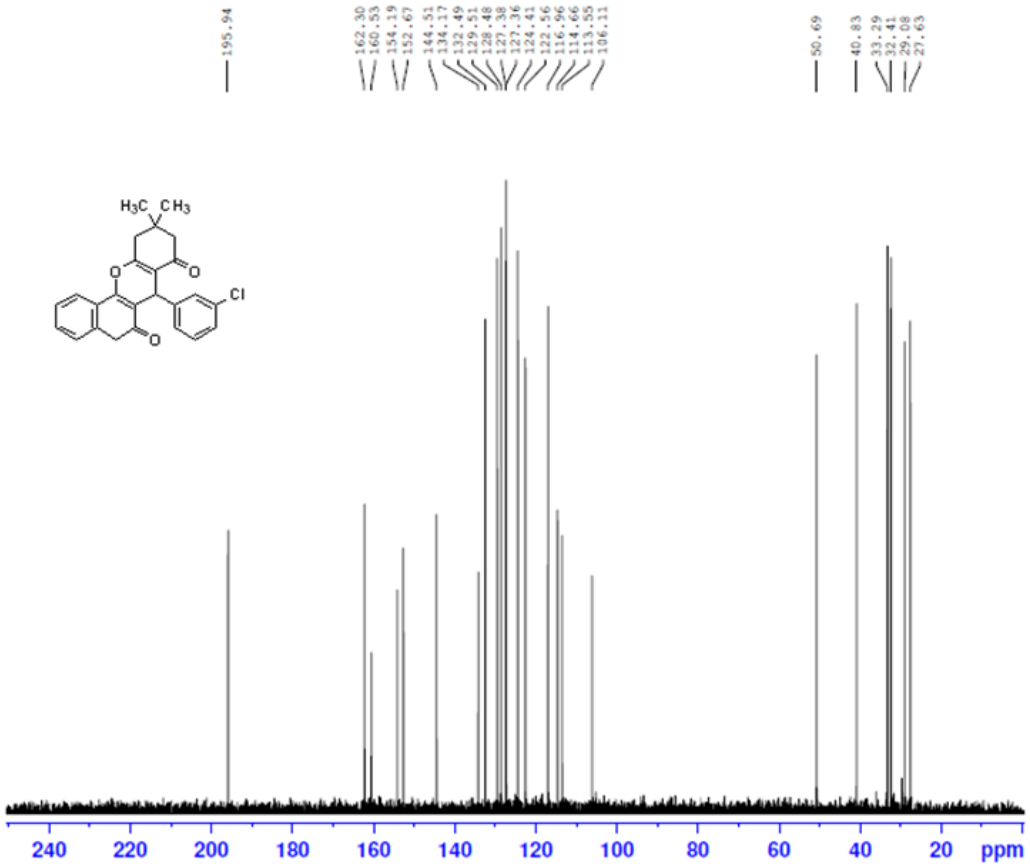


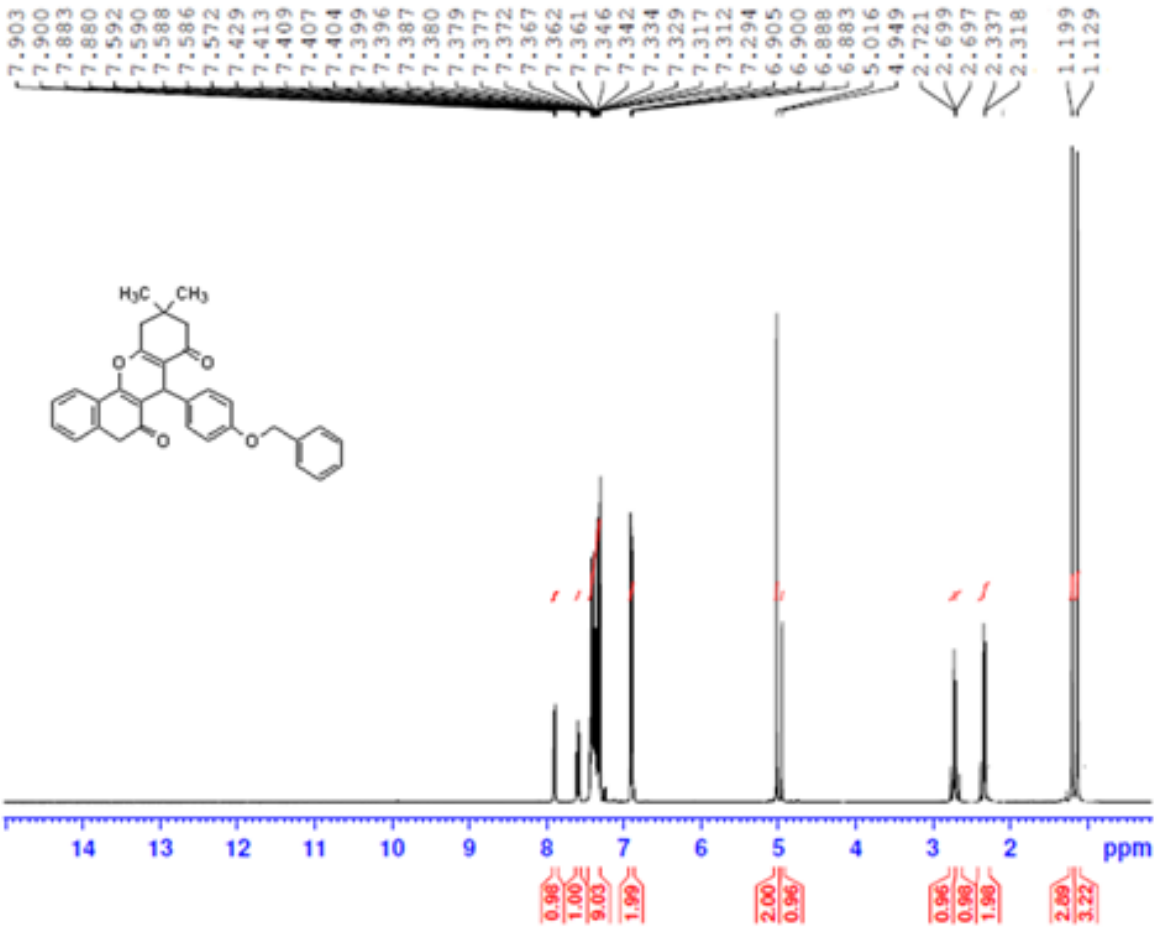
^{1}H NMR spectra- Compound 10,10-dimethyl-7-(3-chlorophenyl)-7,9,10,11-tetrahydro-6*H*,8*H*-chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



^{13}C NMR spectra- Compound 10,10-dimethyl-7-(3-chlorophenyl)-7,9,10,11-tetrahydro-6H,8H-chromeno[4,3-b]chromene-6,8-dione ($CDCl_3$ solvent)



^{1}H NMR spectra- Compound10,10-dimethyl-7-(4-(benzyloxy)phenyl)-7,9,10,11-tetrahydro-6*H*,8*H*-chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



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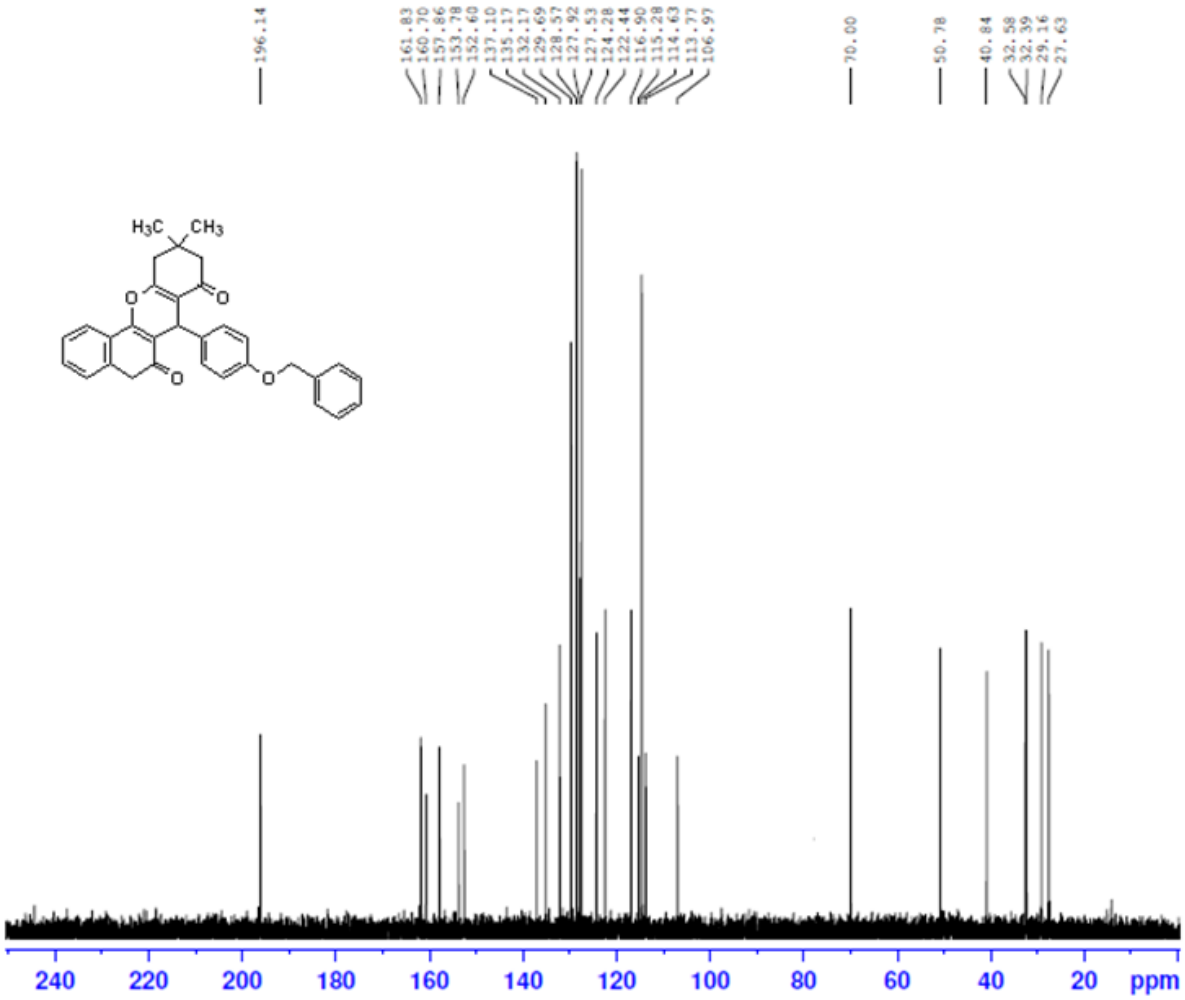
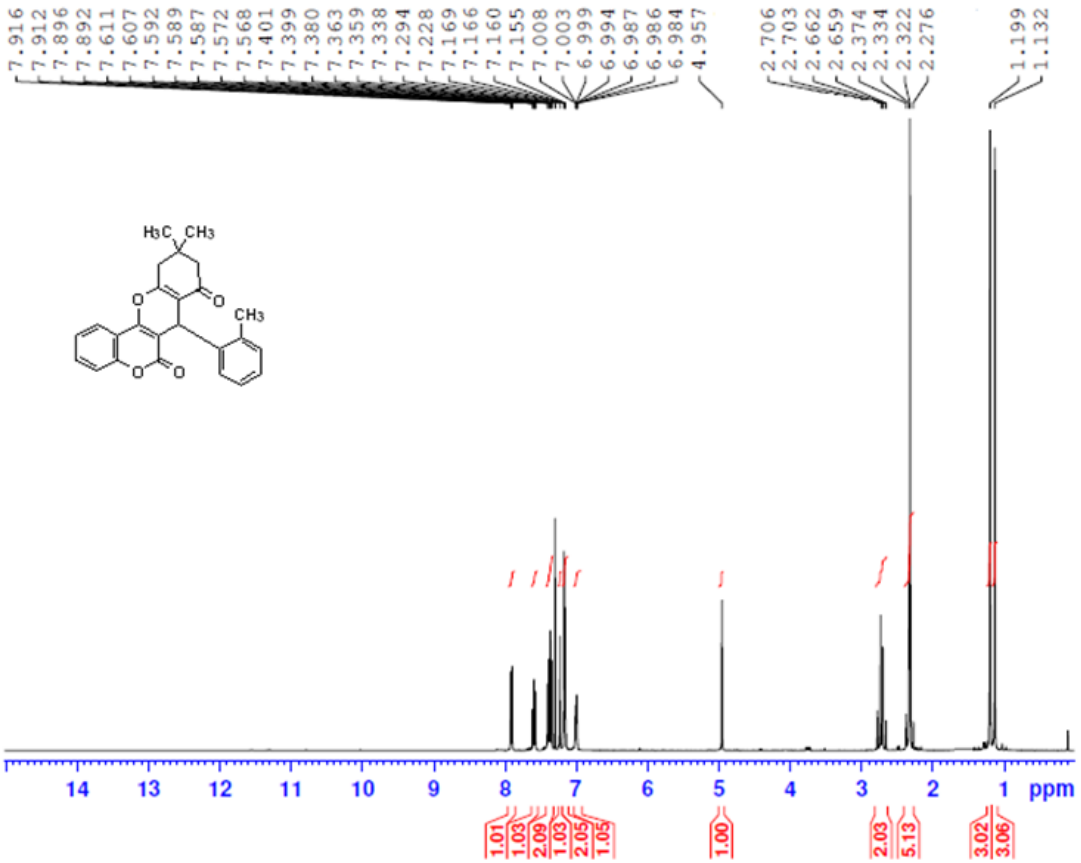
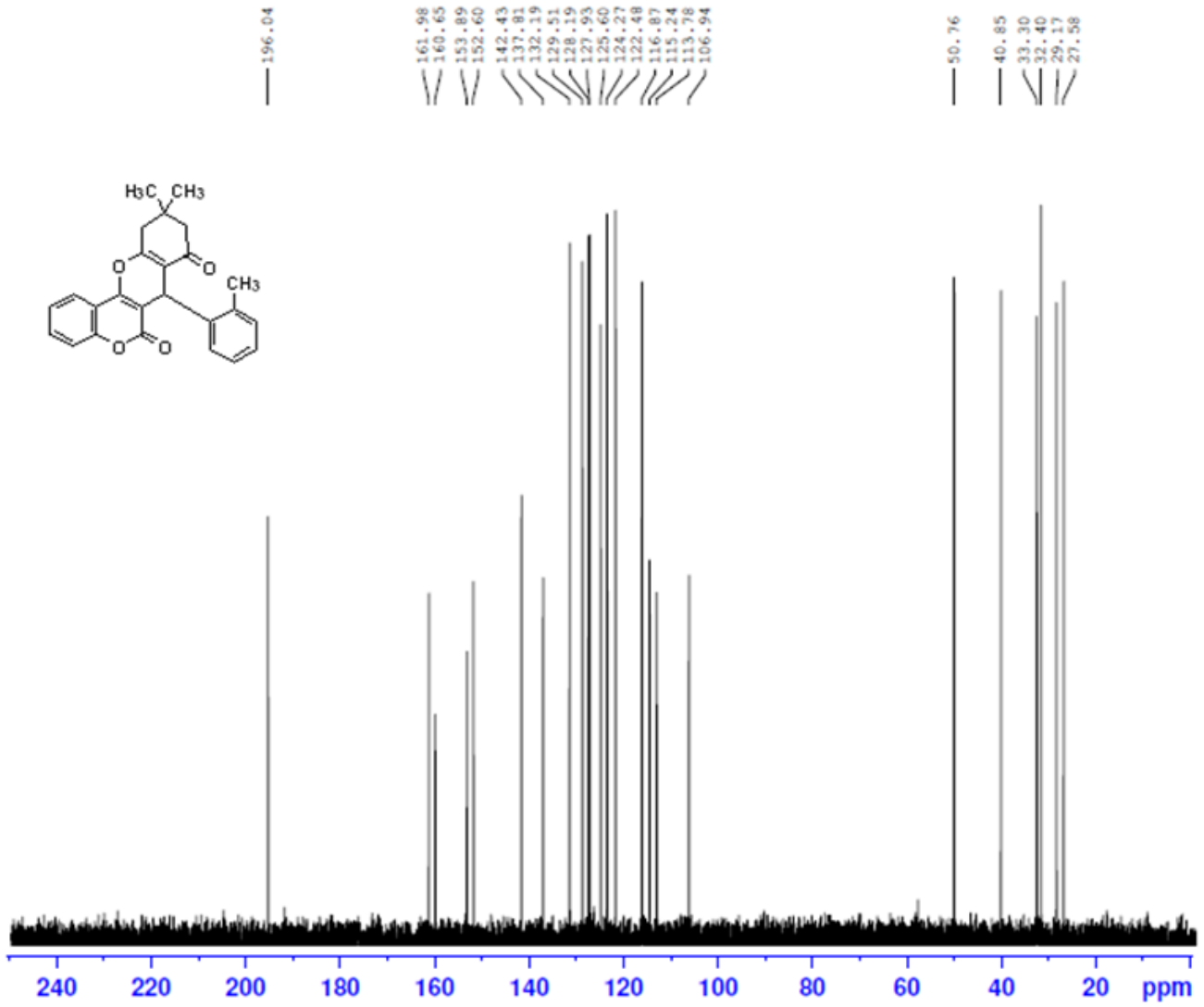


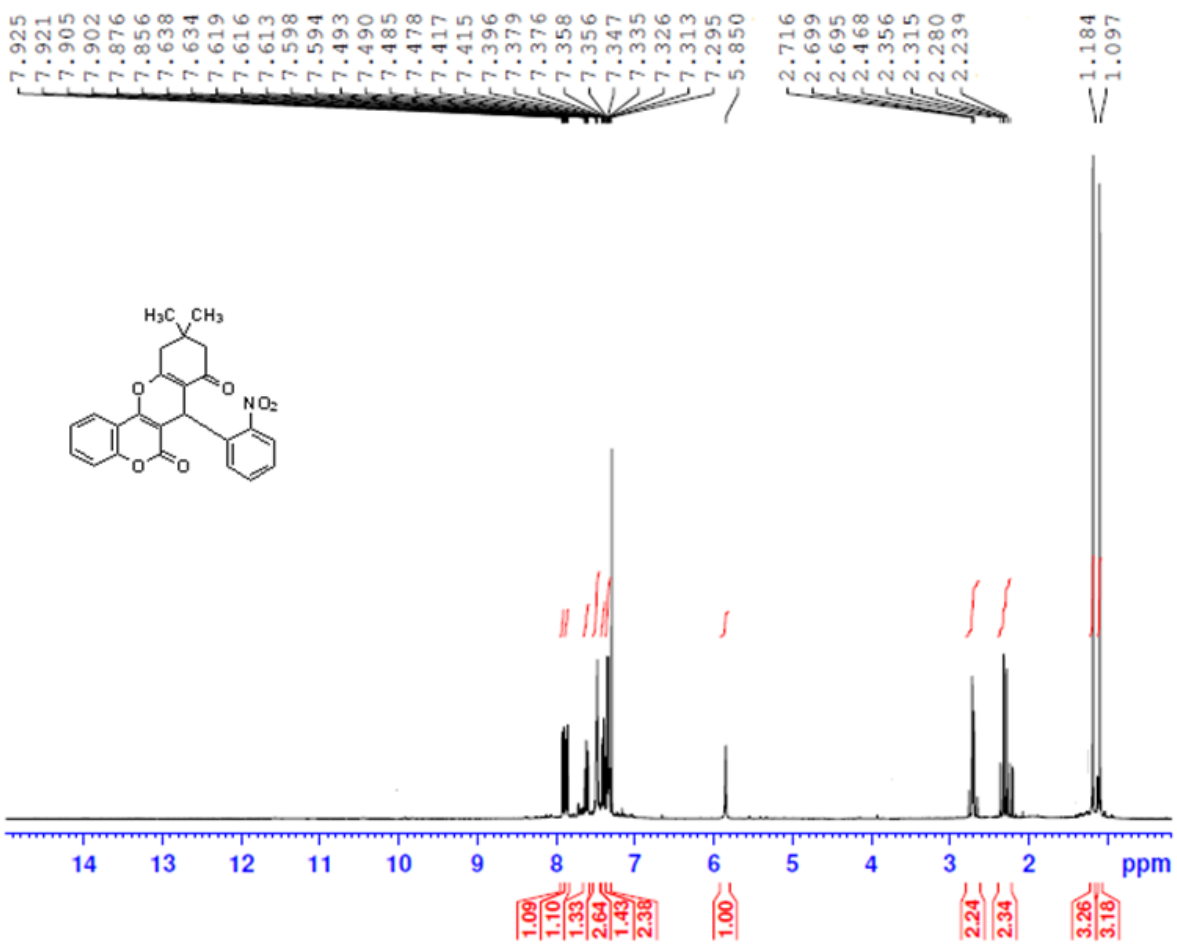
^{1}H NMR spectra- Compound 10,10-dimethyl-7-(o-tolyl)-7,9,10,11-tetrahydro-6*H*,8*H* -chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



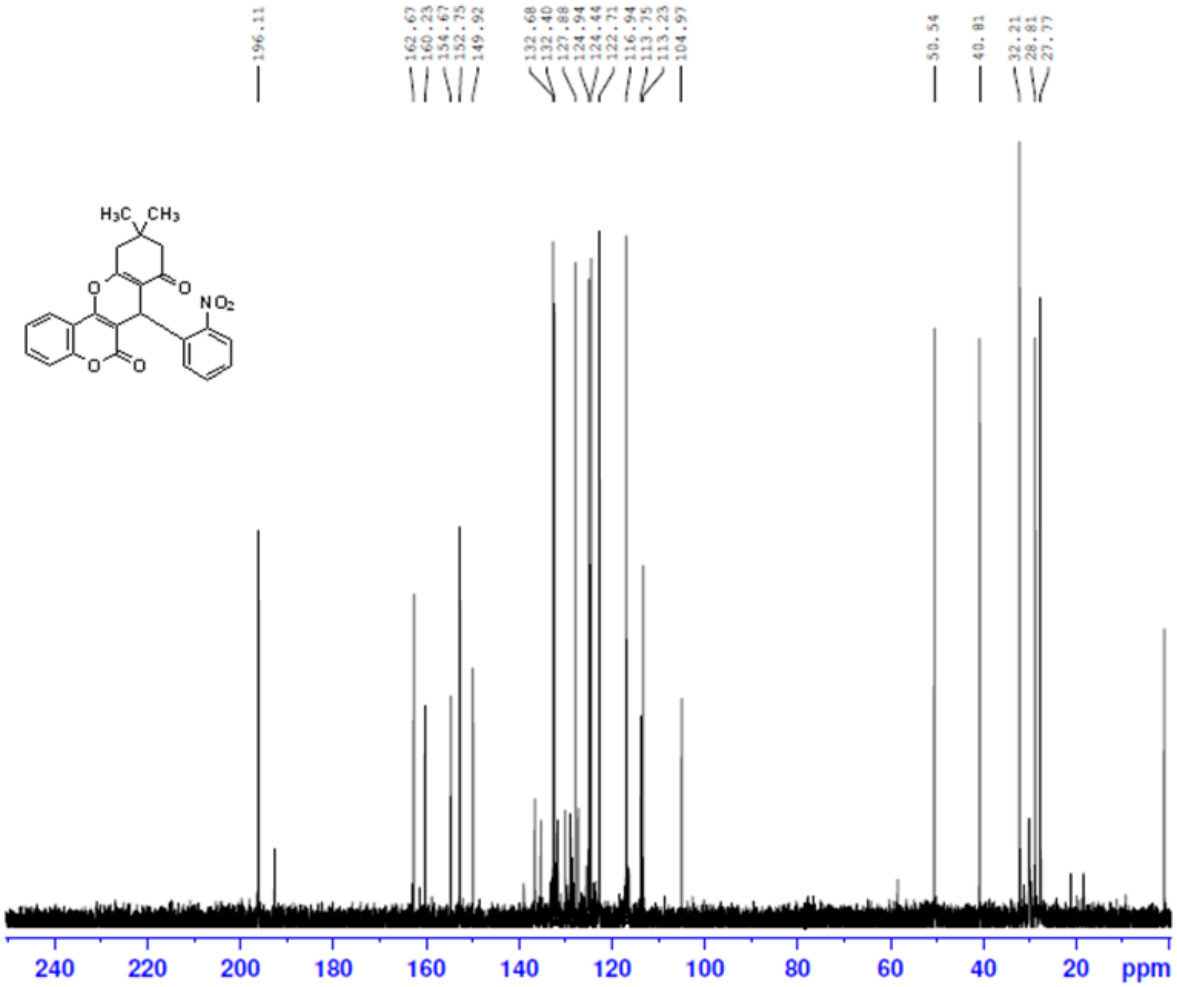
^{13}CNMR spectra- 10,10-dimethyl-7-(o-tolyl)-7,9,10,11-tetrahydro-6*H*,8*H* -chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



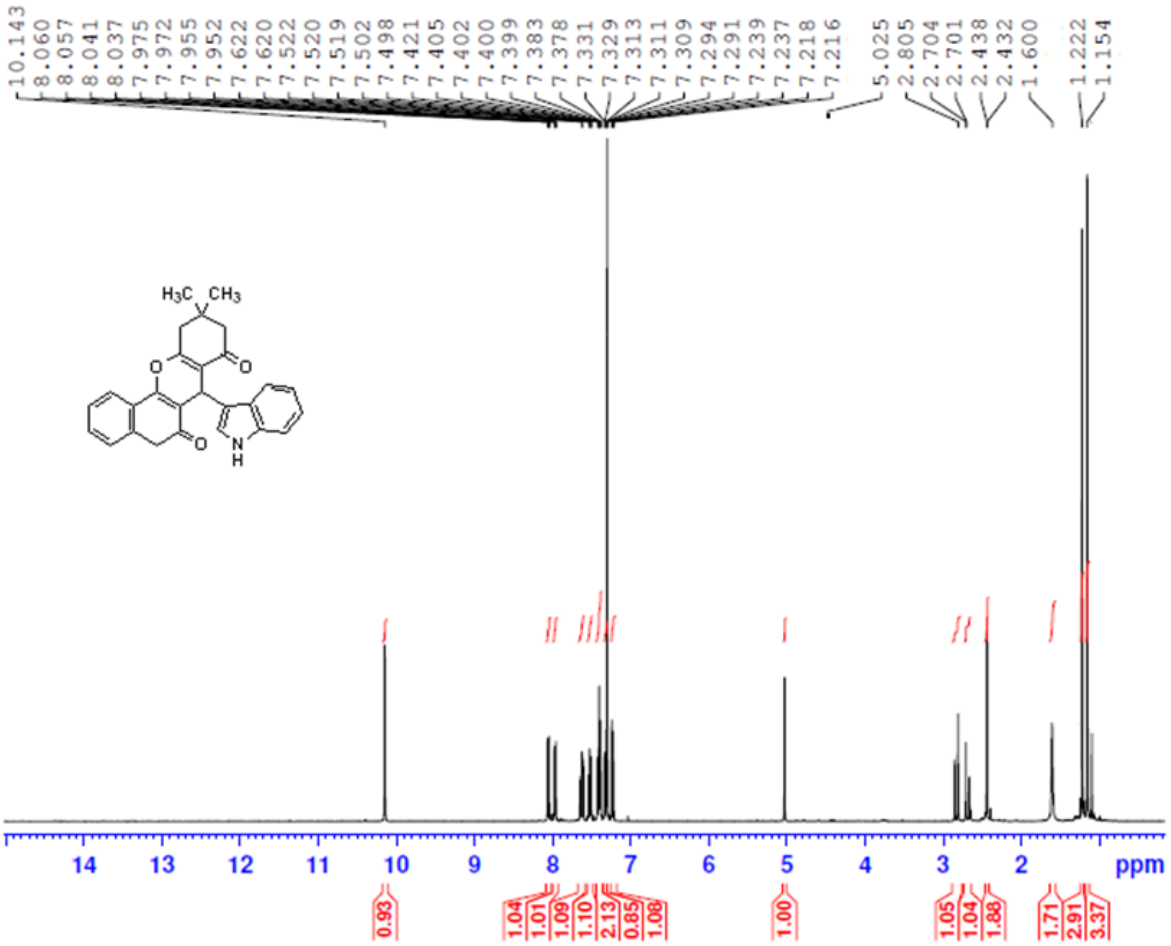
^{1}H NMR spectra- Compound10,10-dimethyl-7-(2-nitrophenyl)-7,9,10,11-tetrahydro -6*H*,8*H*-chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



^{13}C NMR spectra- Compound10,10-dimethyl-7-(2-nitrophenyl)-7,9,10,11-tetrahydro -6*H*,8*H*-chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



^{1}H NMR spectra- Compound 10,10-Dimethyl-7-(1*H*-indol-3-yl)-7,9,10,11-tetrahydro -6*H*,8*H*-chromeno[4,3-*b*]chromene-6,8-dione ($CDCl_3$ solvent)



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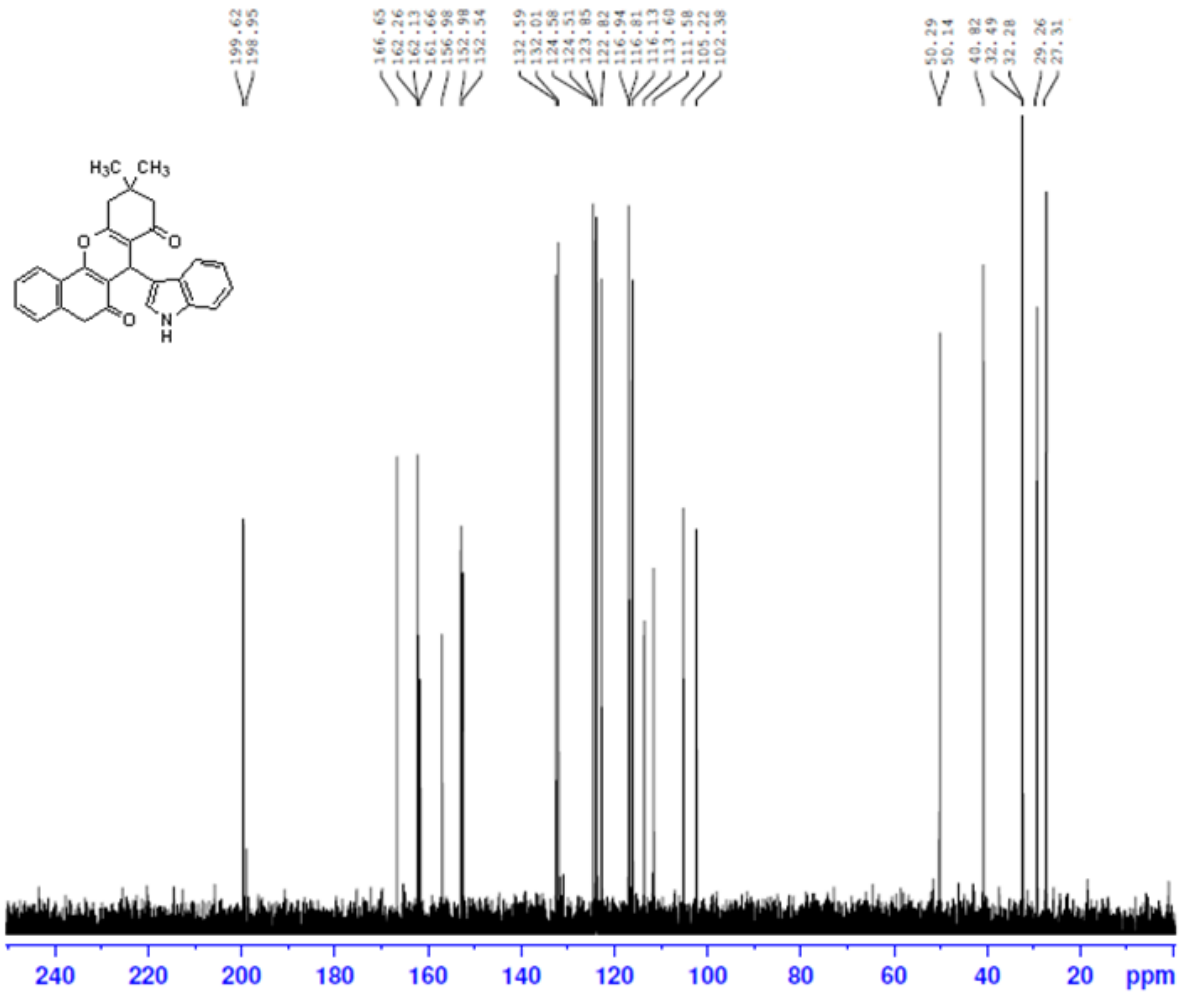
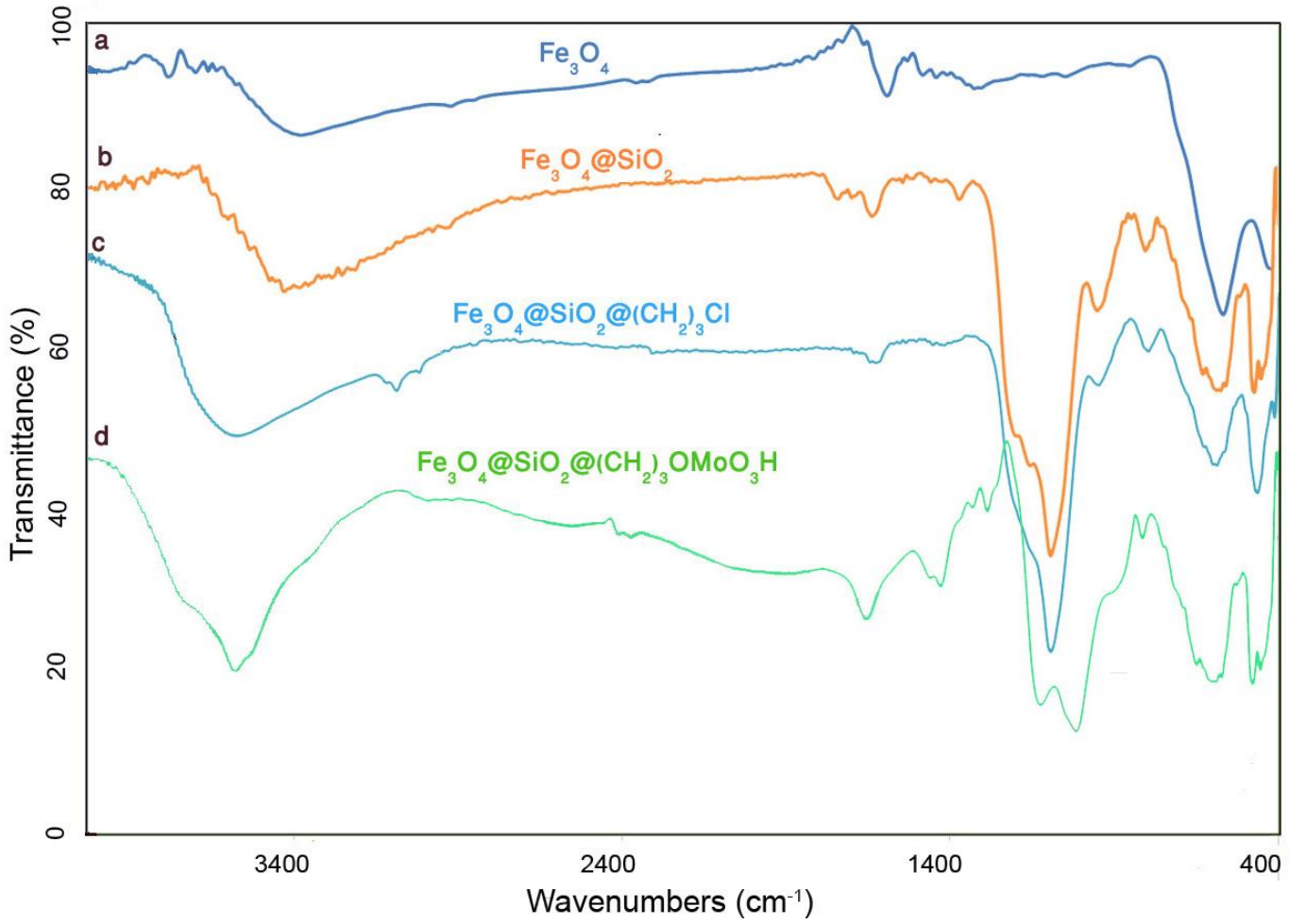
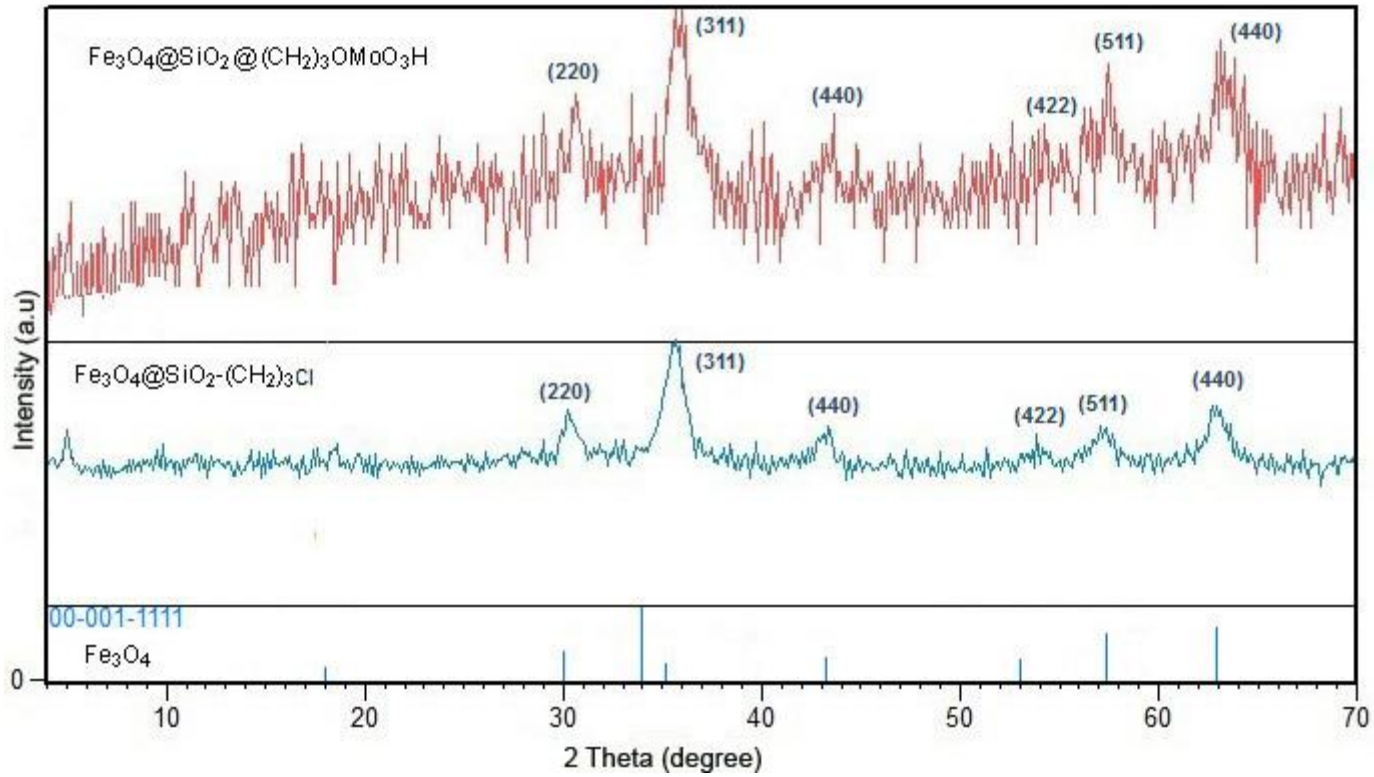


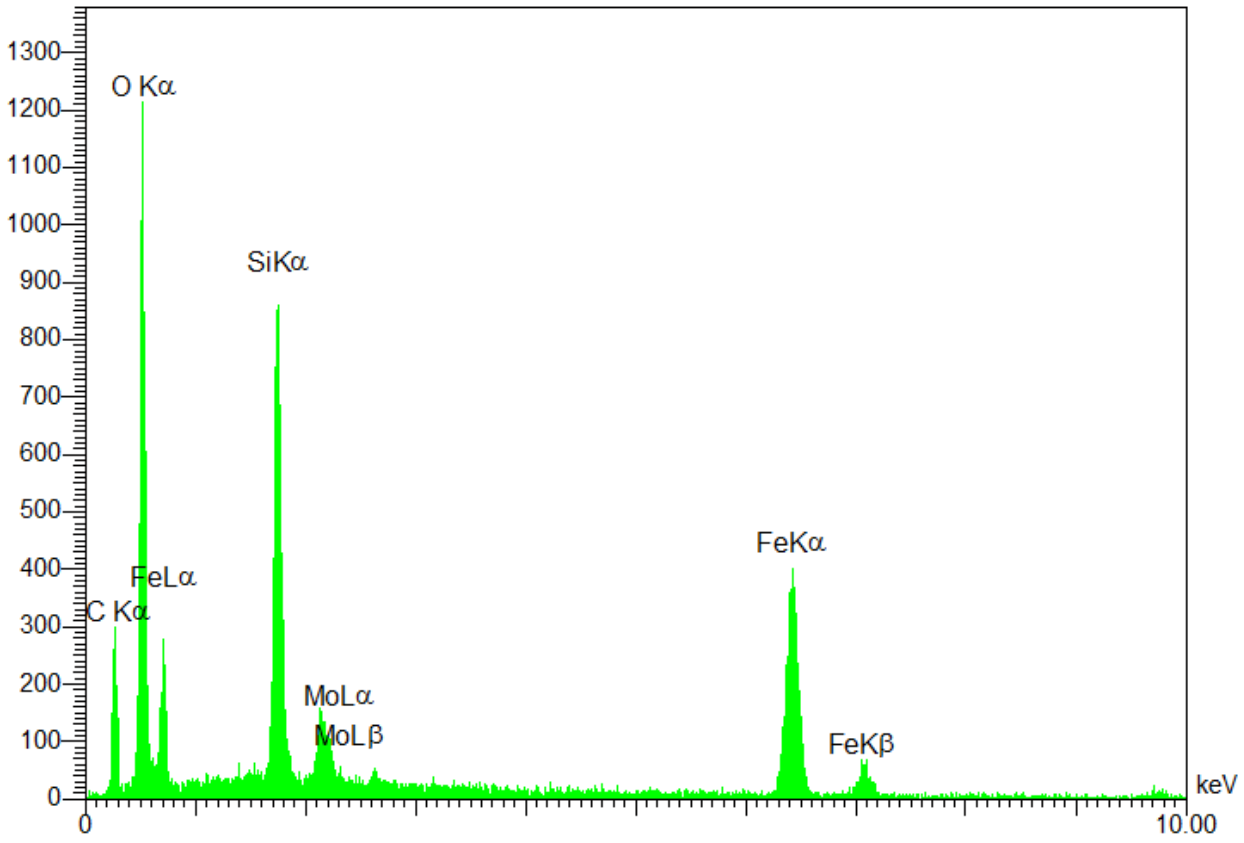
The FT-IR spectra of a) Fe_3O_4, b) $Fe_3O_4@SiO_2$, c) $Fe_3O_4@SiO_2@(CH_2)_3Cl$, and d) $Fe_3O_4@SiO_2@(CH_2)_3OMoO_3H$



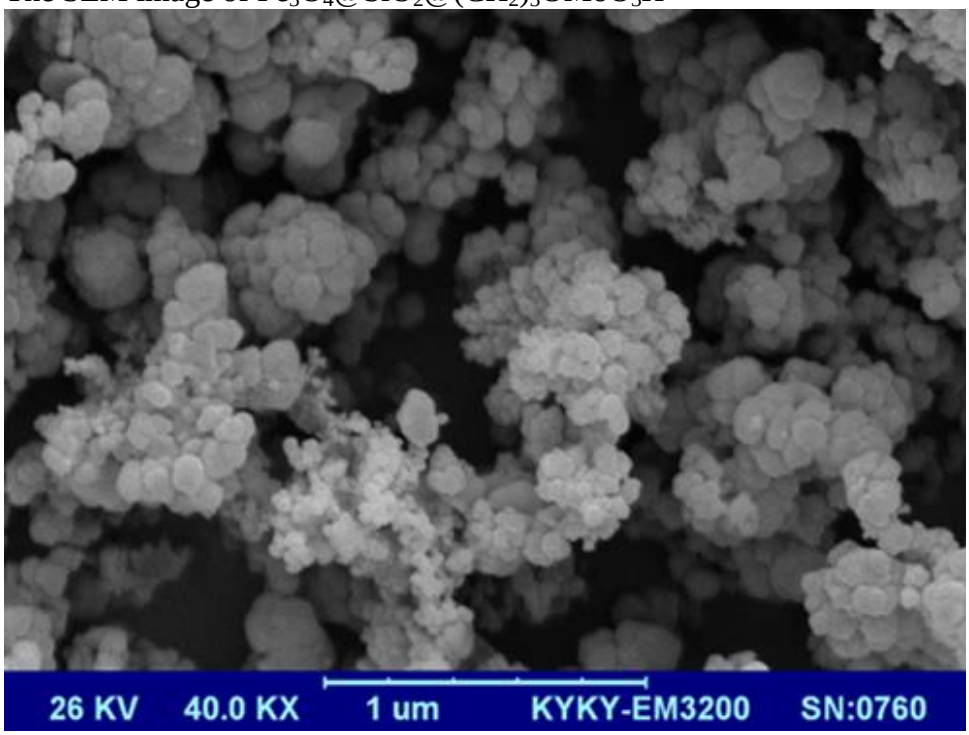
XRD patterns of Fe_3O_4, $Fe_3O_4@SiO_2@(CH_2)_3Cl$, and $Fe_3O_4@SiO_2@(CH_2)_3OMoO_3H$



Energy-dispersive X-ray spectroscopy (EDS) spectra of $Fe_3O_4@SiO_2@(CH_2)_3OMoO_3H$



The SEM image of $Fe_3O_4@SiO_2@(CH_2)_3OMoO_3H$



Room-temperature magnetization curves of a) Fe_3O_4 b) $Fe_3O_4@SiO_2@(CH_2)_3Cl$ c) $Fe_3O_4@SiO_2@(CH_2)_3OMoO_3H$