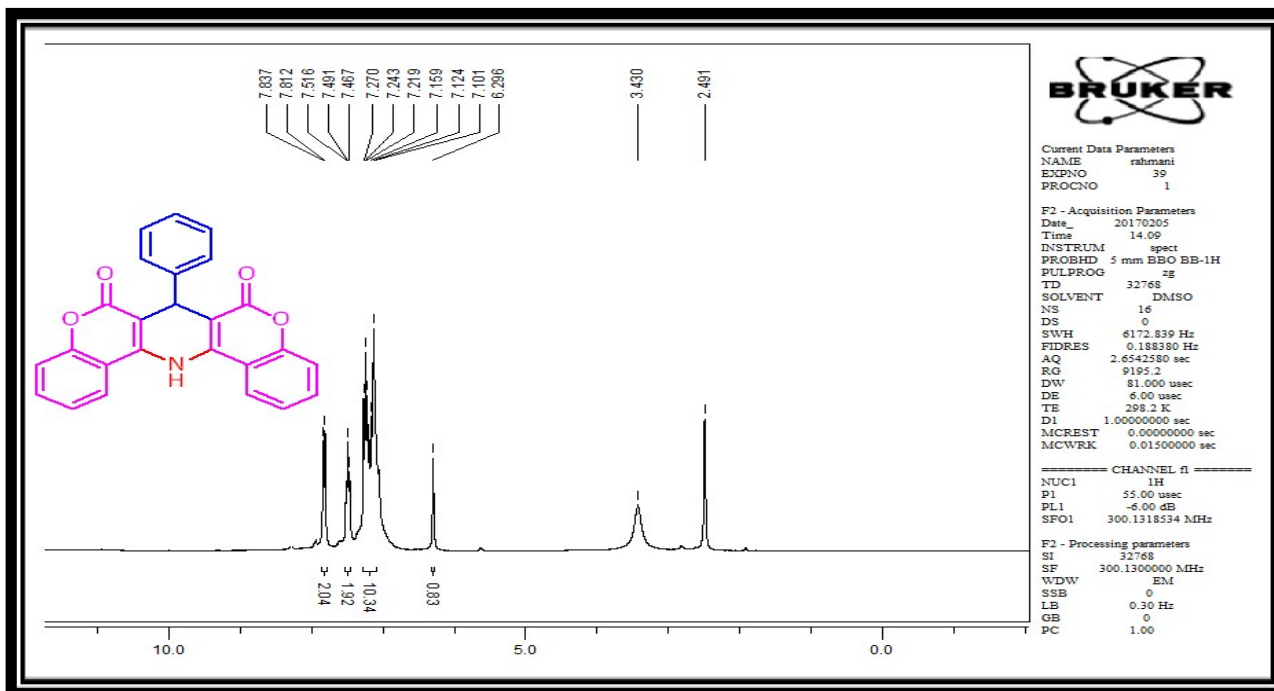


Sulfonyl-bridged (copper-immobilized nickel ferrite) with activated montmorillonite, [(NiFe₂O₄@Cu)SO₂(MMT)]: a new class of magnetically separable clay nanocomposite systems towards Hantzsch synthesis of coumarin-based 1,4-dihydropyridines

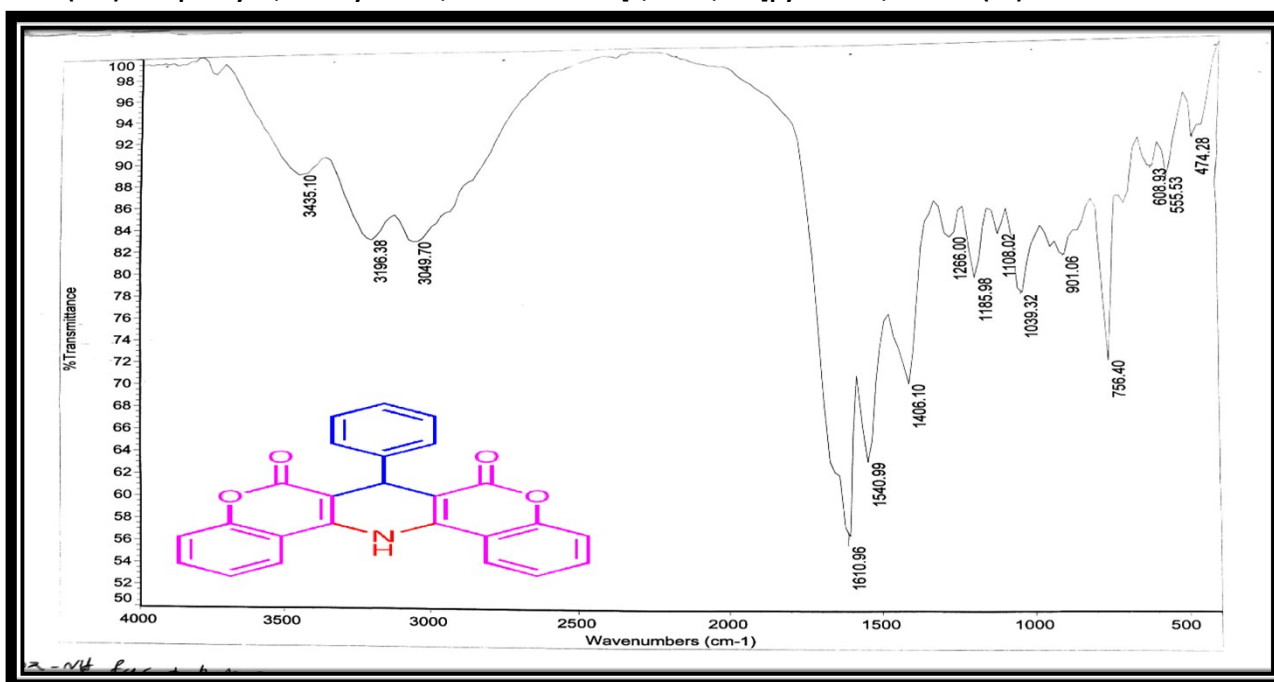
Behzad Zeynizadeh and Soleiman Rahmani

Faculty of Chemistry, Urmia University, Urmia 5756151818, Iran
E-mail: s.rahmani@urmia.ac.ir

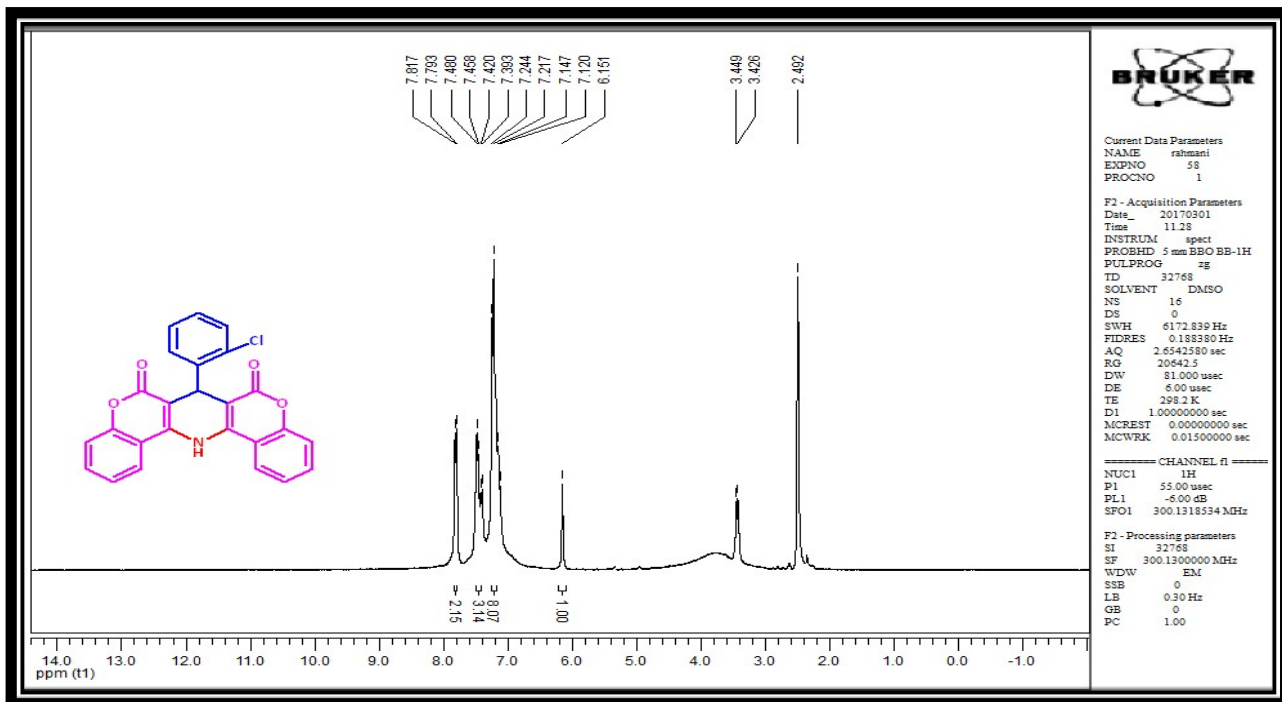
¹H NMR (300 MHz, DMSO-d₆) of 7-phenyl-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-di-one (4a)



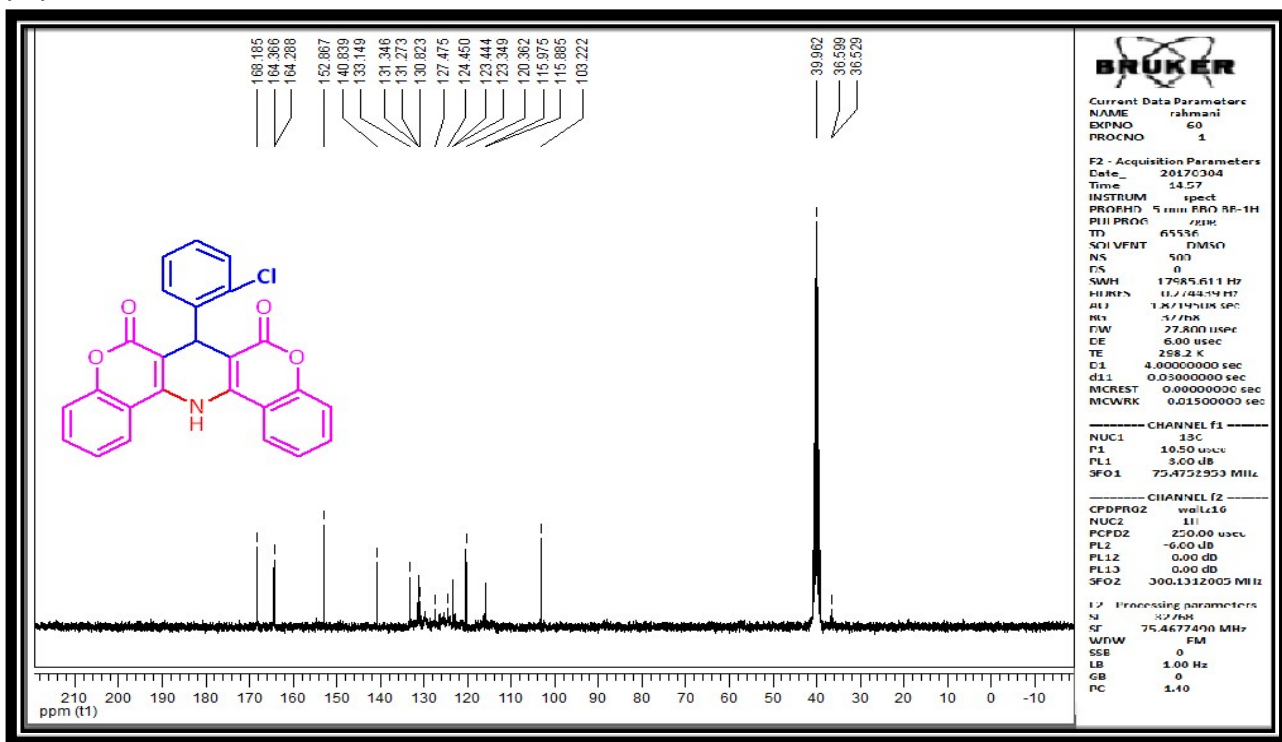
FT-IR (KBr) of 7-phenyl-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4a)



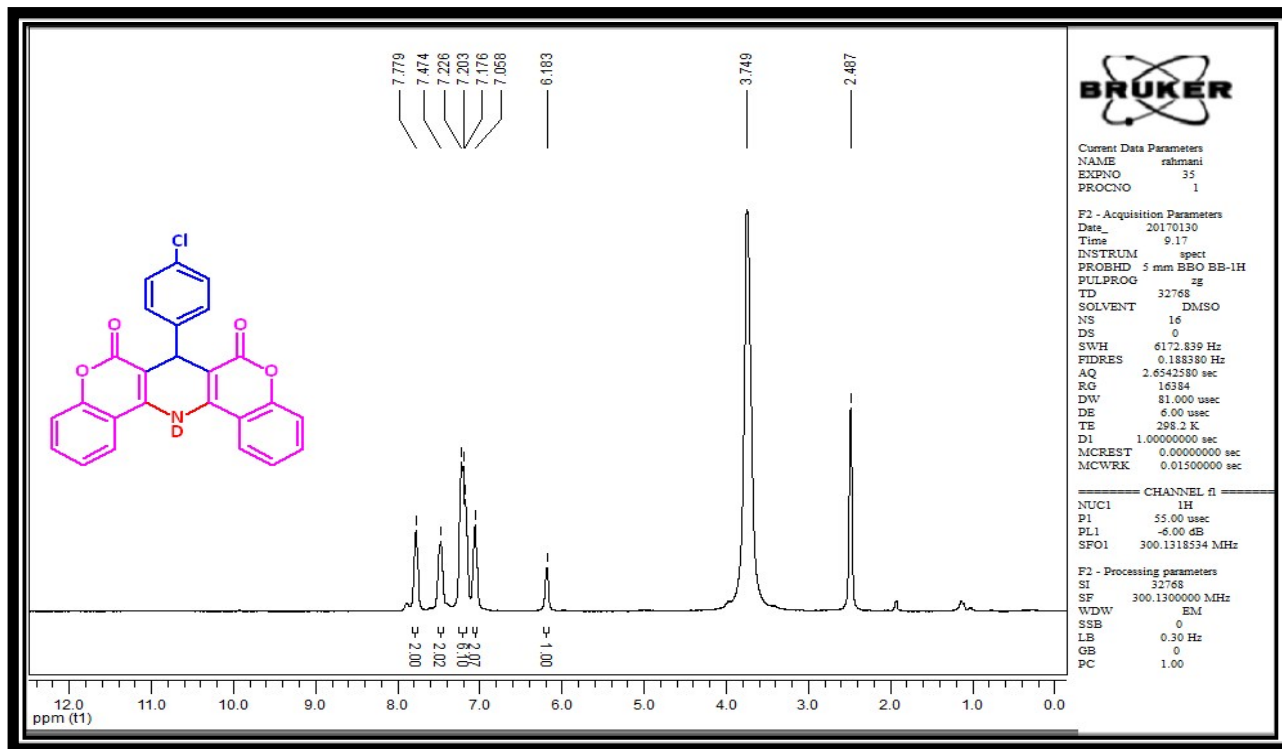
¹H NMR (300 MHz, DMSO-d₆) of 7-(2-chlorophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4b)



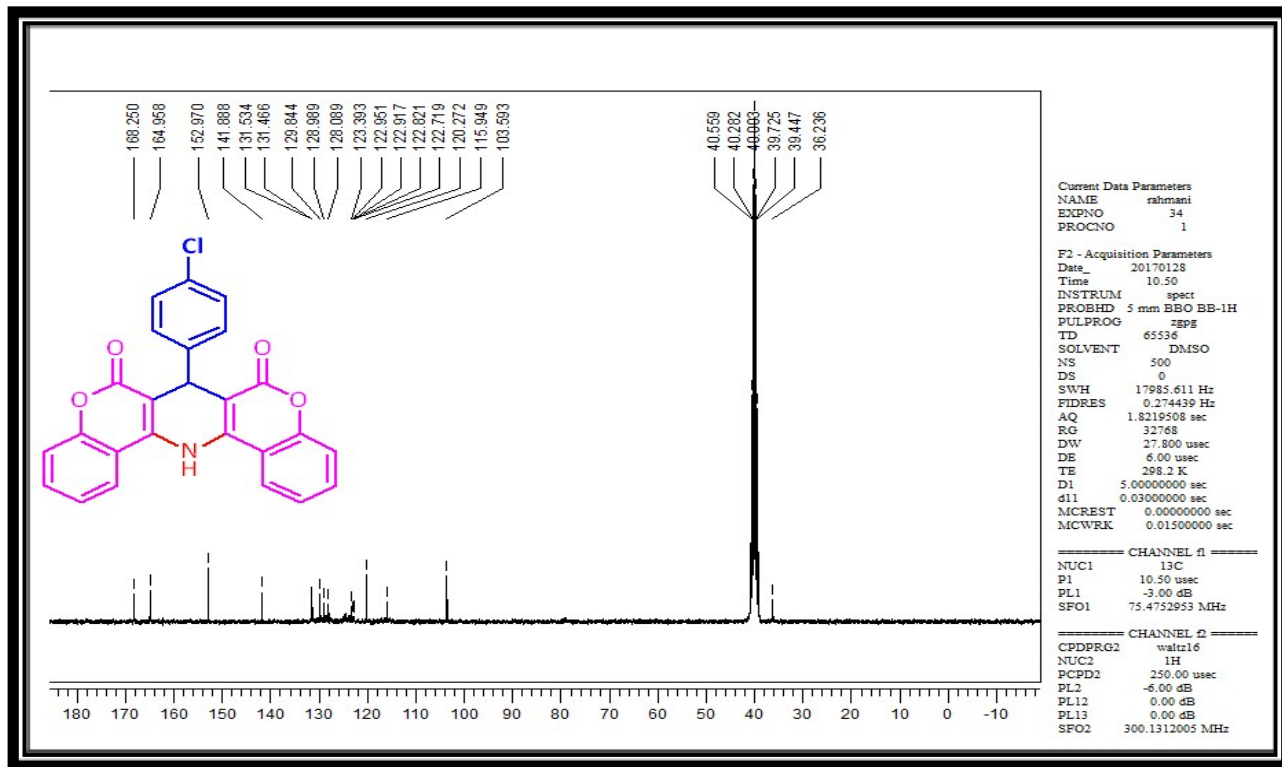
¹³C NMR (75 MHz, DMSO-d₆) of 7-(2-chlorophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4b)



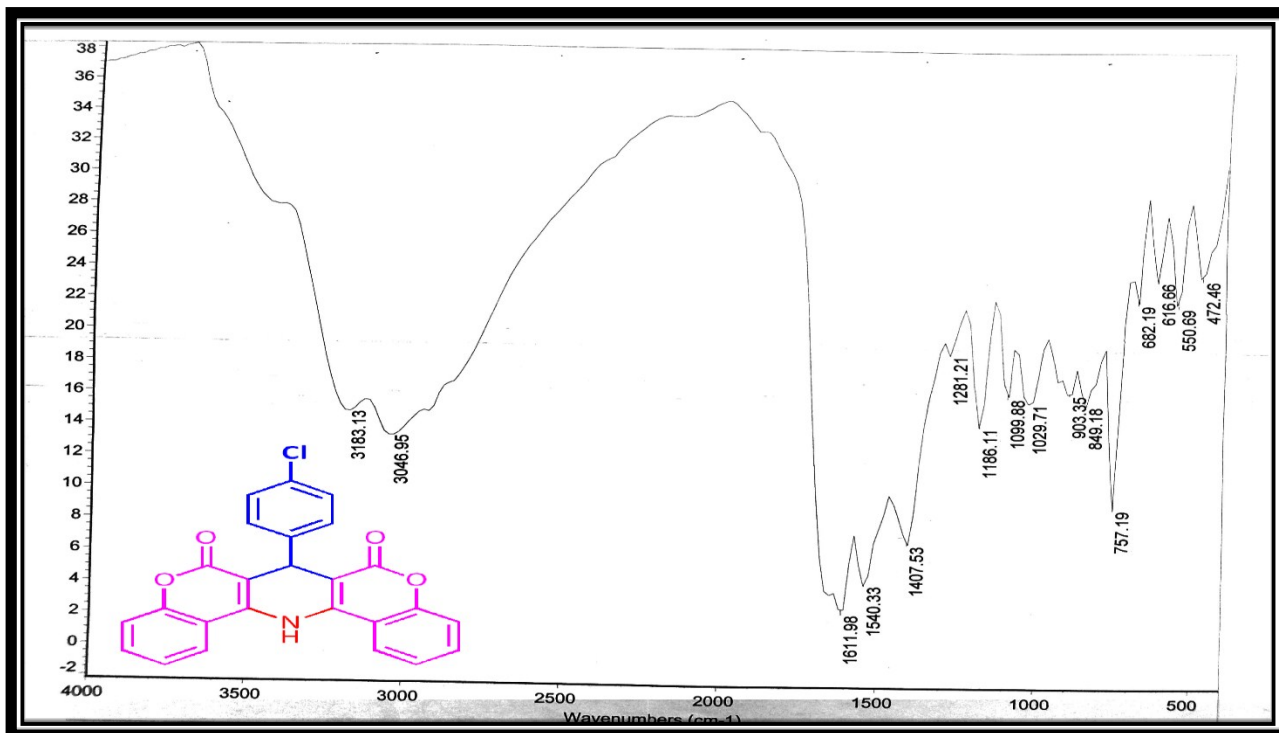
¹H NMR (300 MHz, DMSO-d₆) of 7-(4-chlorophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4c) (Deuterium exchanged)



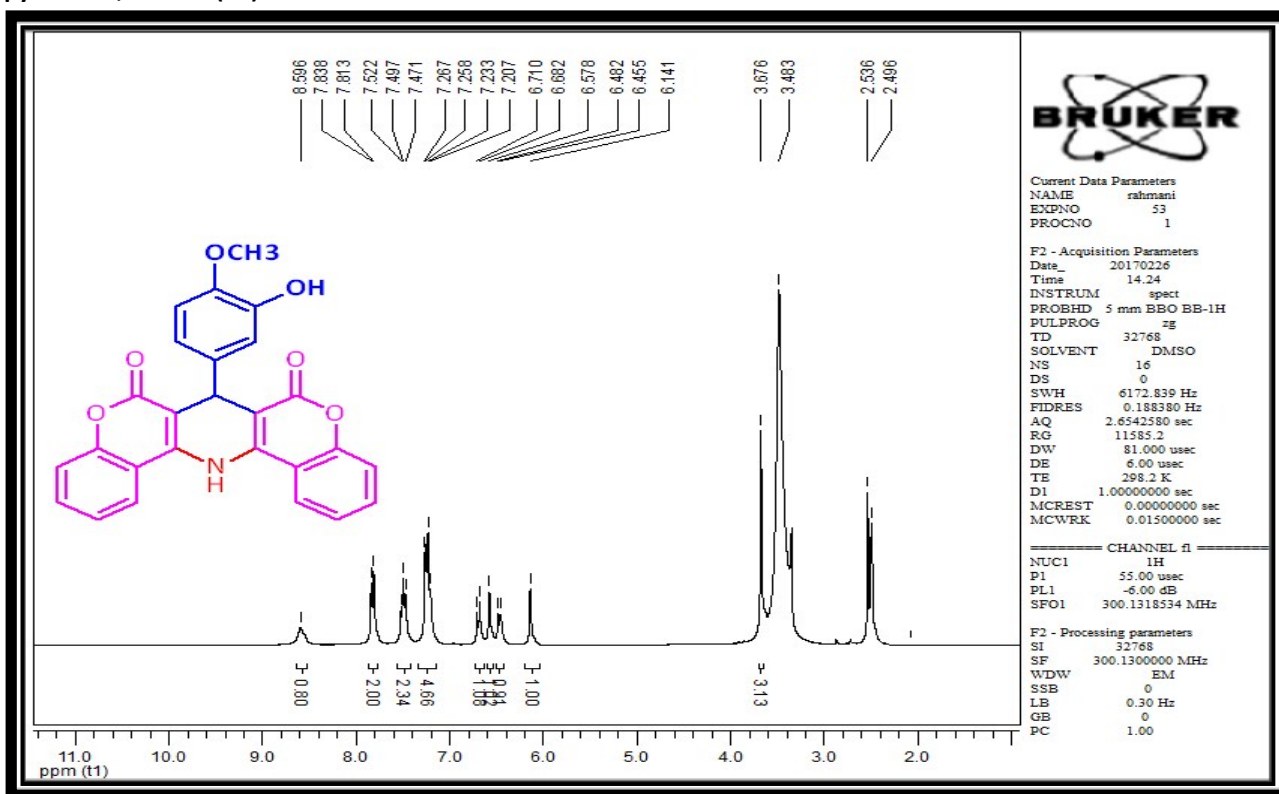
¹³C NMR (75 MHz, DMSO-d₆) of 7-(4-chlorophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4c)



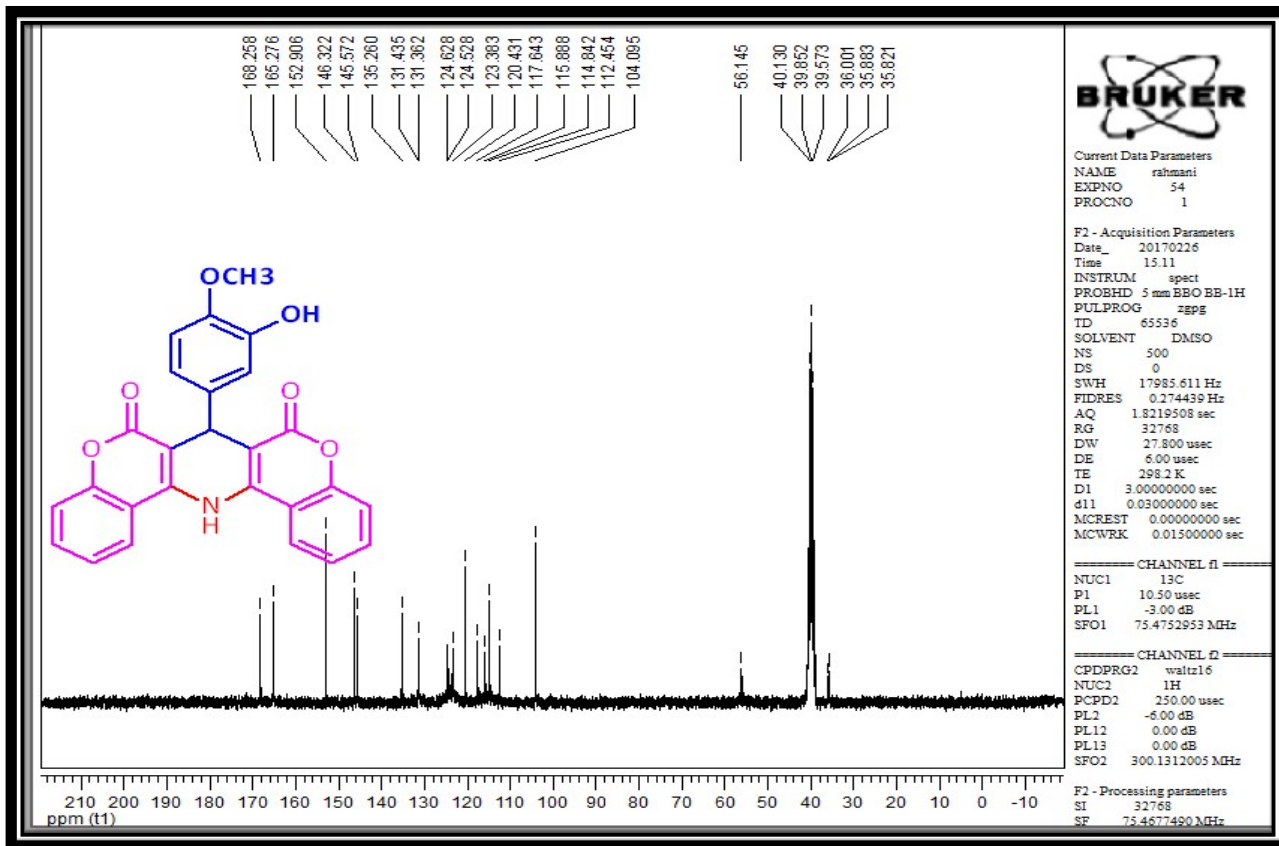
FT-IR (KBr) of 7-(4-chlorophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4c)



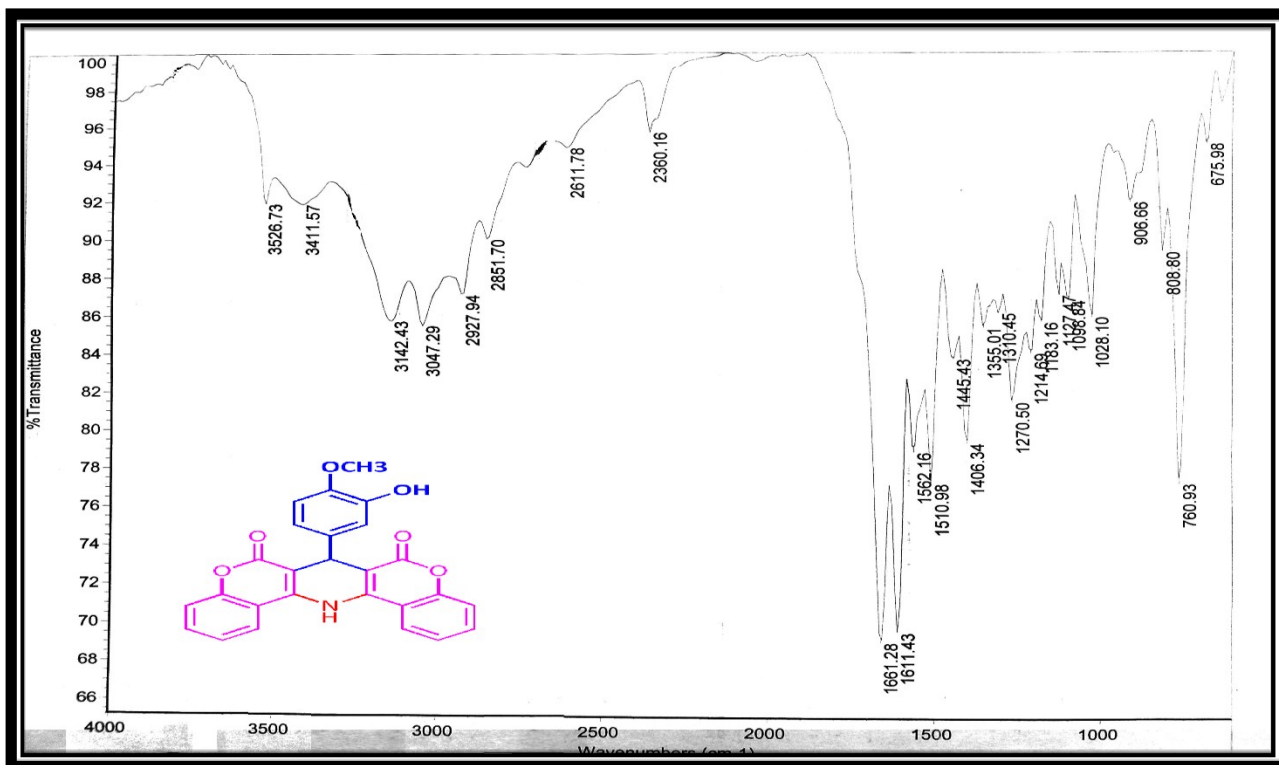
¹H NMR (300 MHz, DMSO-d₆) of 7-(3-hydroxy-4-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4d)



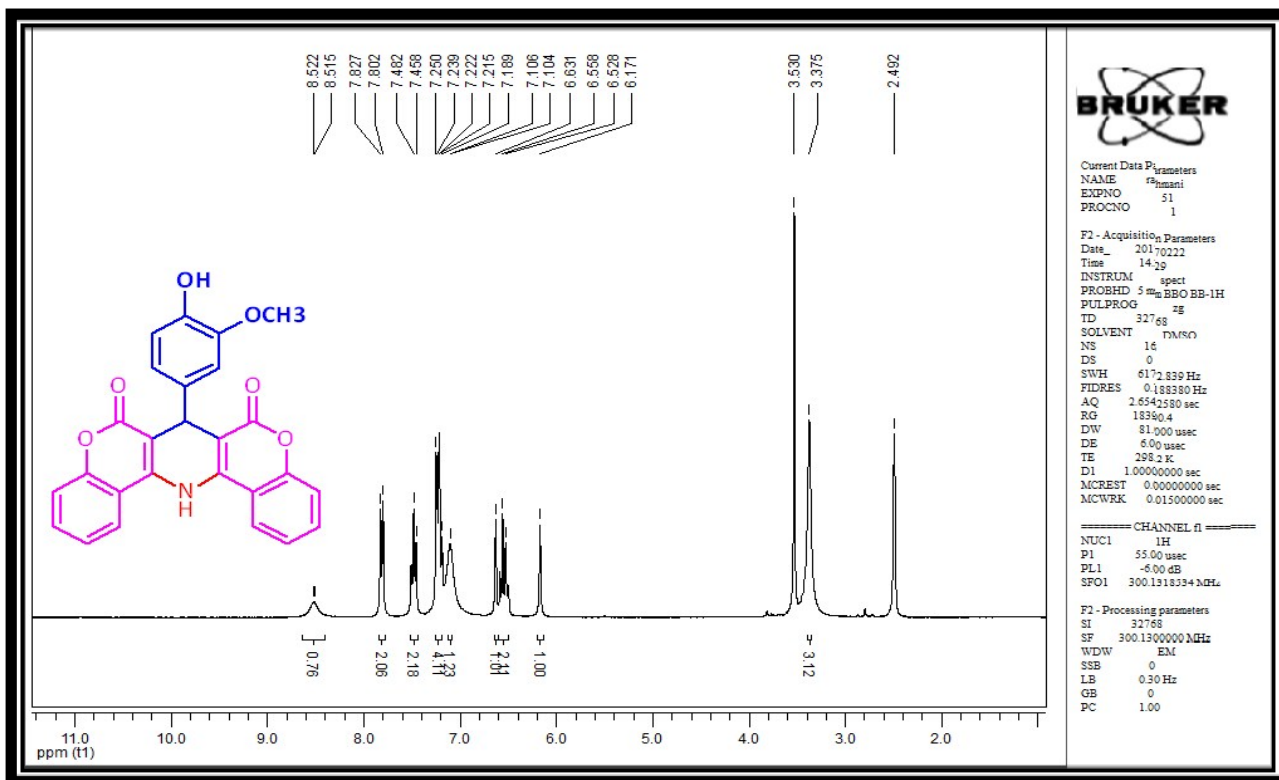
¹³C NMR (75 MHz, DMSO-d₆) of 7-(3-hydroxy-4-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e] pyridine-6,8-dione (4d)



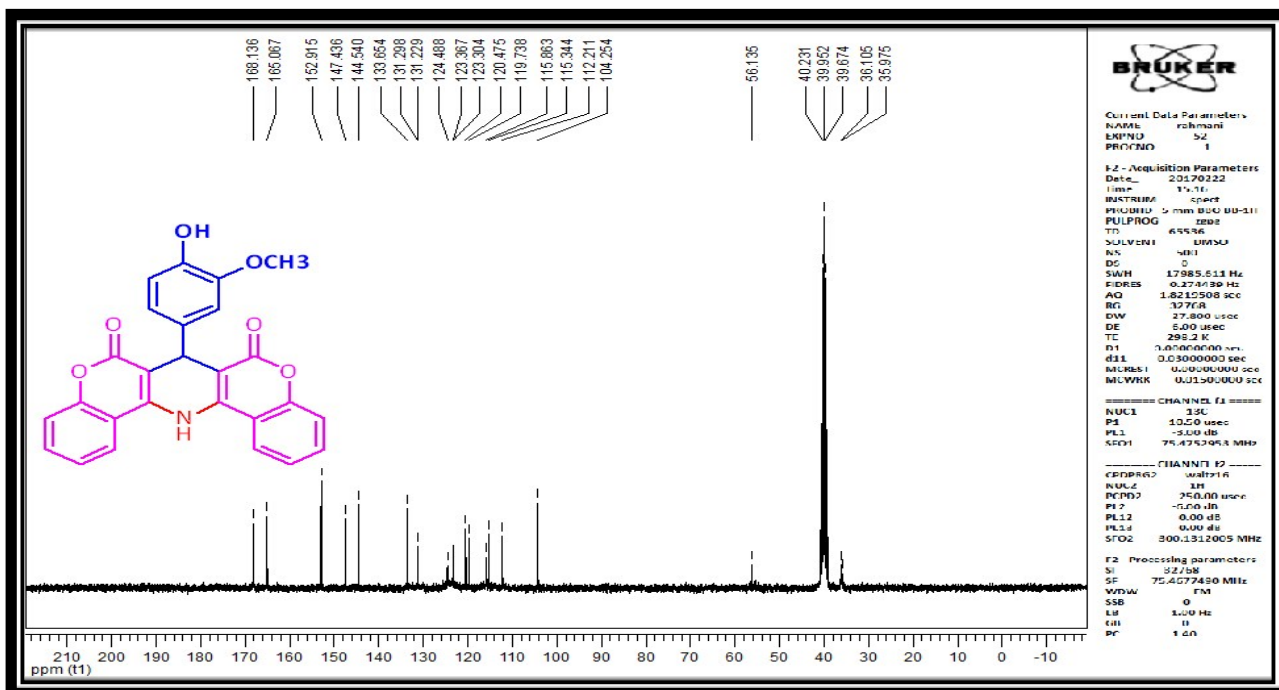
FT-IR (KBr) of 7-(3-hydroxy-4-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e] pyridine-6,8-dione (4d)



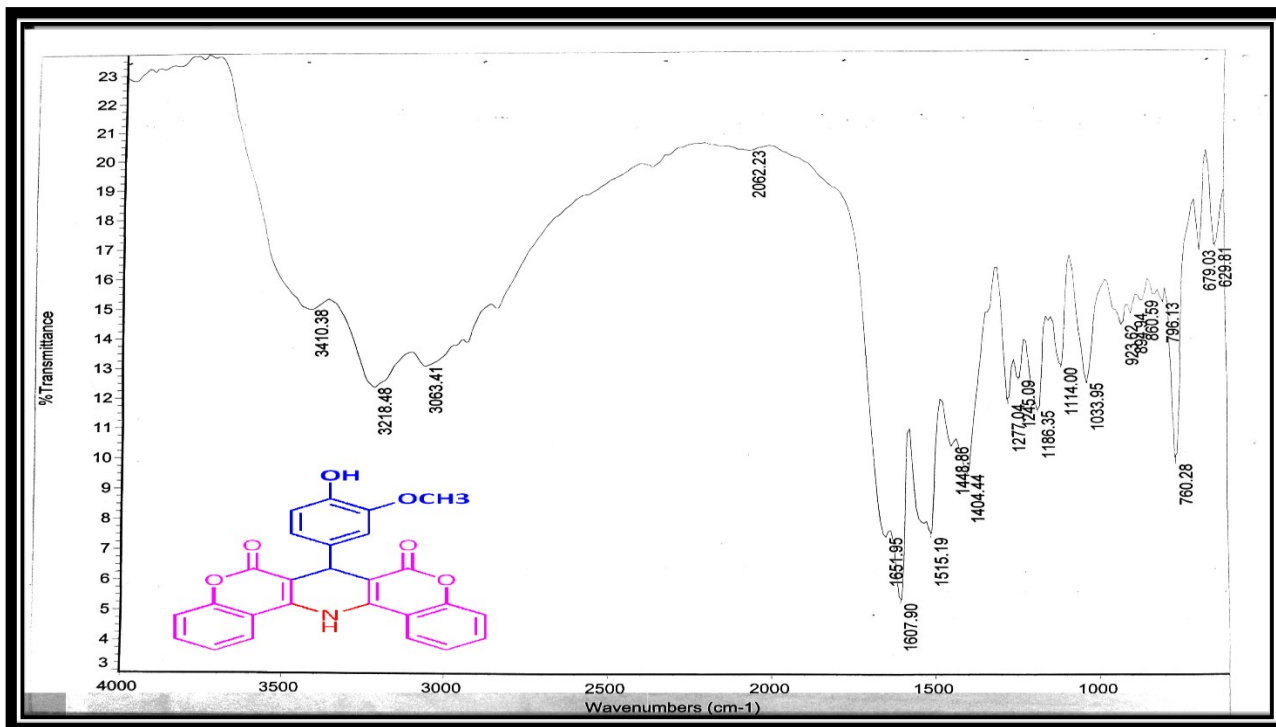
¹H NMR (300 MHz, DMSO-d₆) of (4-hydroxy-3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4e)



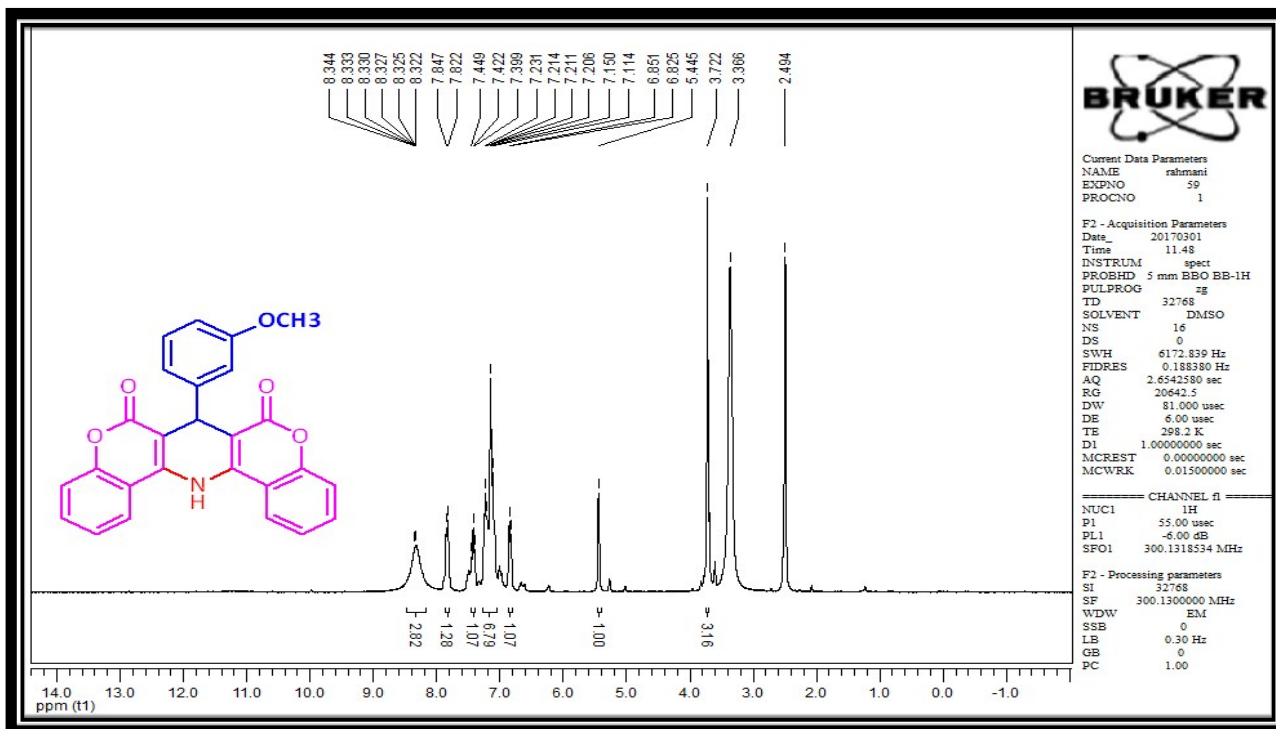
¹³C NMR (75 MHz, DMSO-d₆) of (4-hydroxy-3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4e)



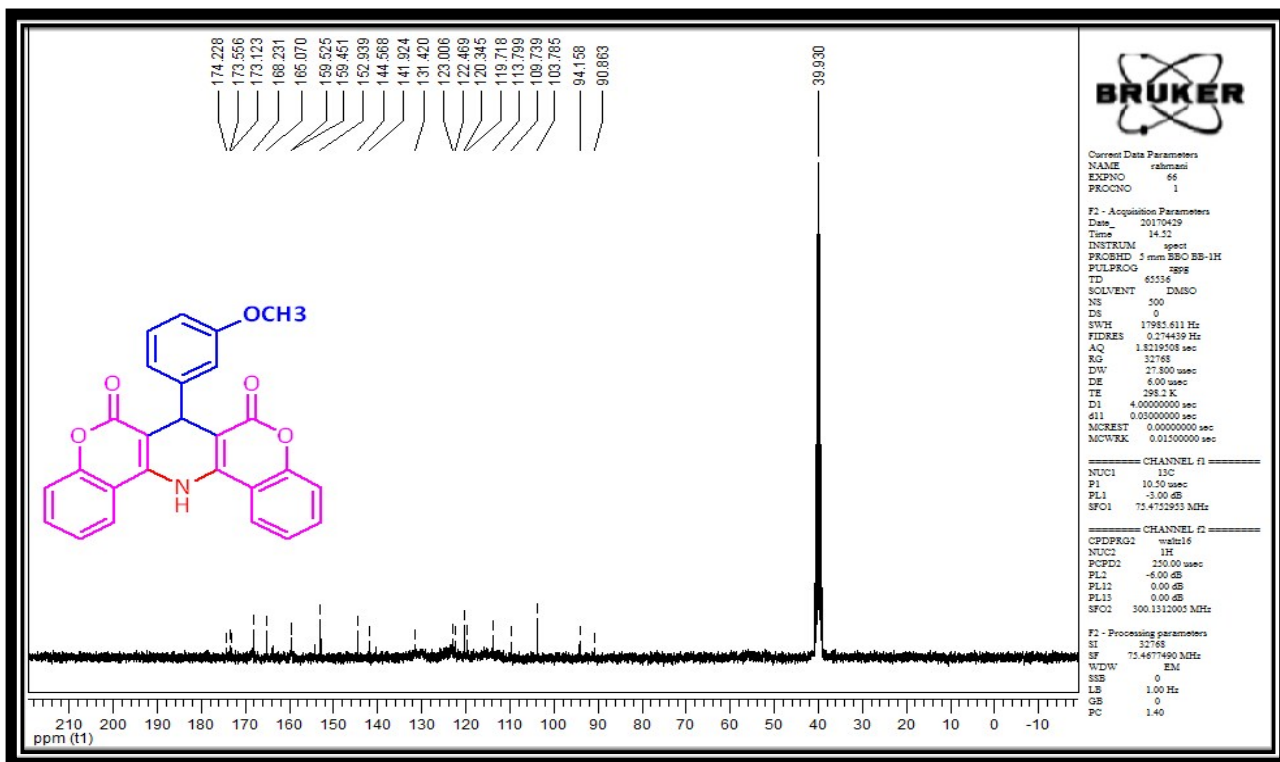
FT-IR (KBr) of 7-(4-hydroxy-3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4e)



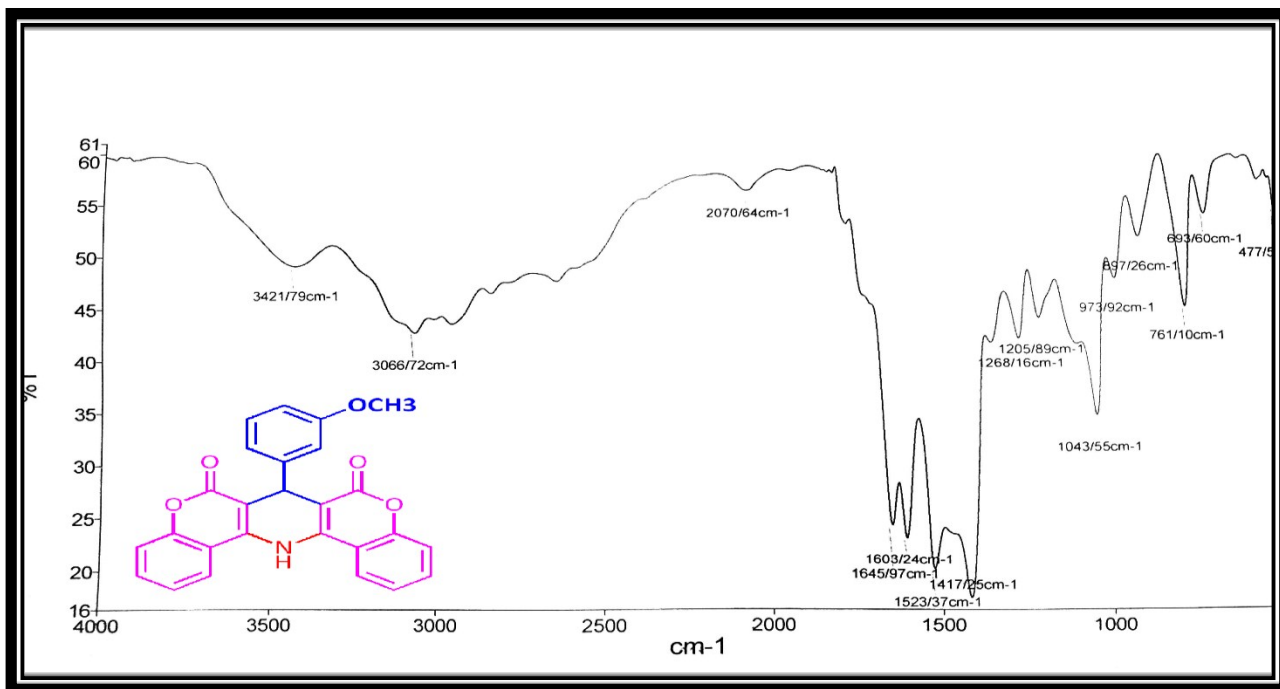
¹H NMR (300 MHz, DMSO-d₆) of 7-(3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4f)



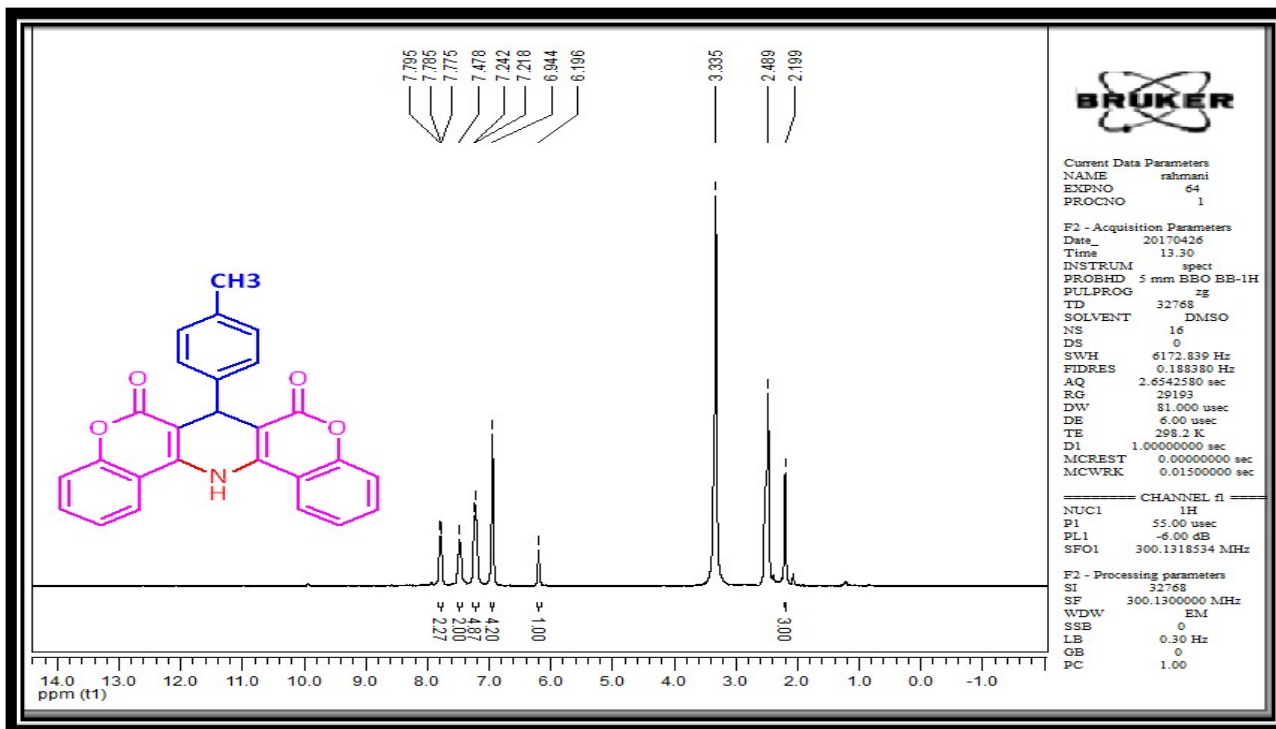
¹³C NMR (75 MHz, DMSO-d₆) of 7-(3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4f)



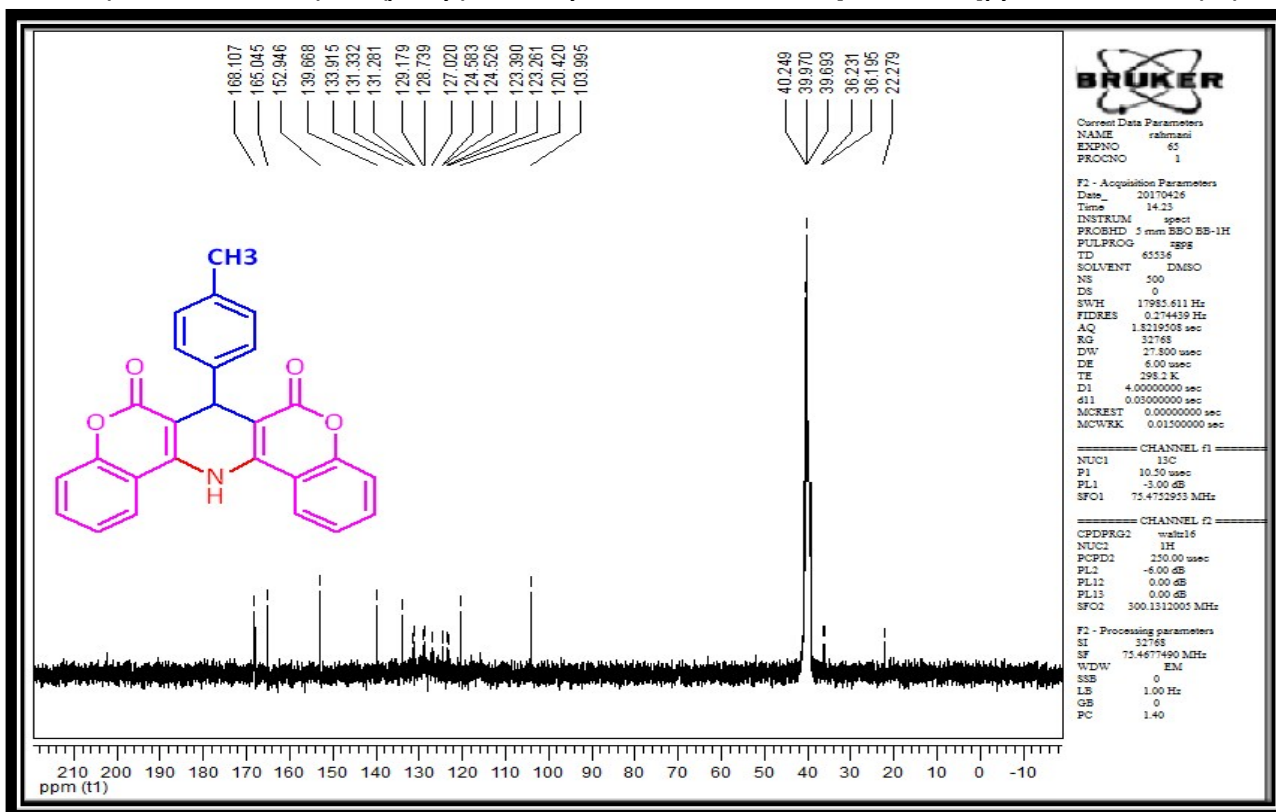
FT-IR (KBr) of 7-(3-methoxyphenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4f)



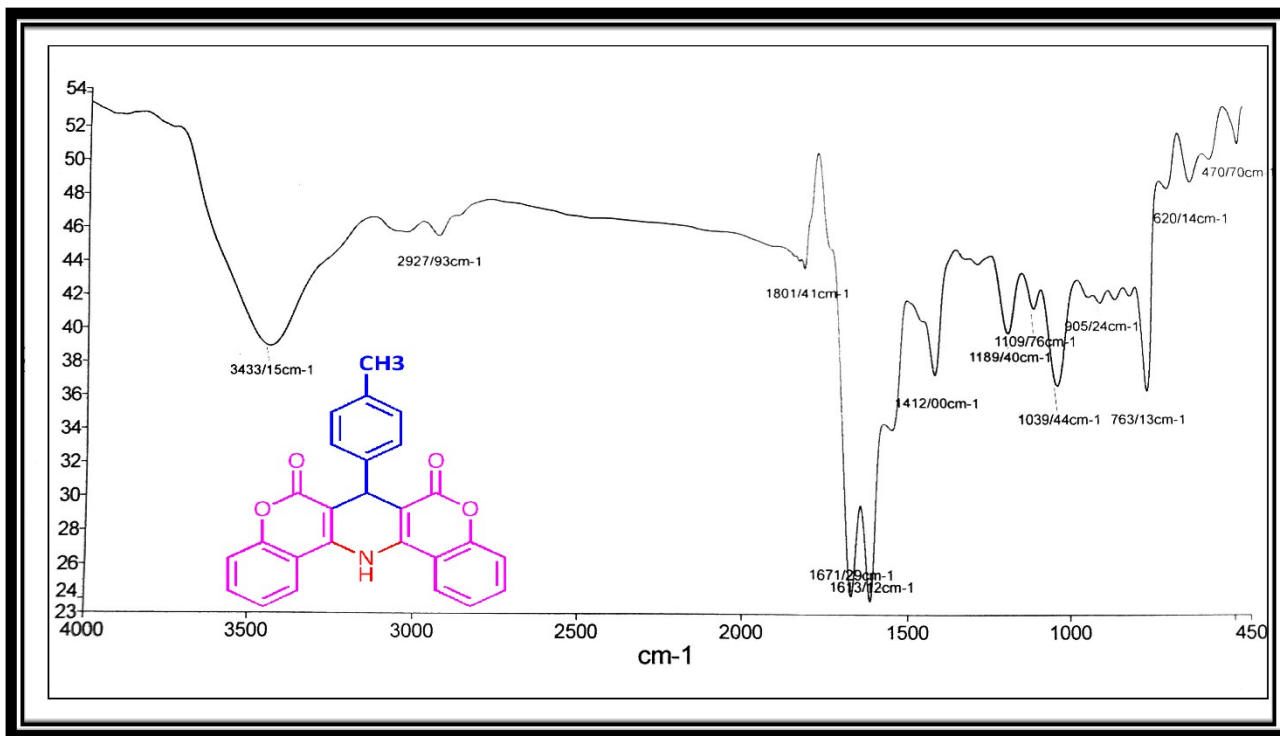
¹H NMR (300 MHz, DMSO-d₆) of 7-(*p*-tolyl)-7,14-dihydro-6H,8H-dichromeno[4,3-*b*:3',4'-*e*]pyridine-6,8-dione (4h)



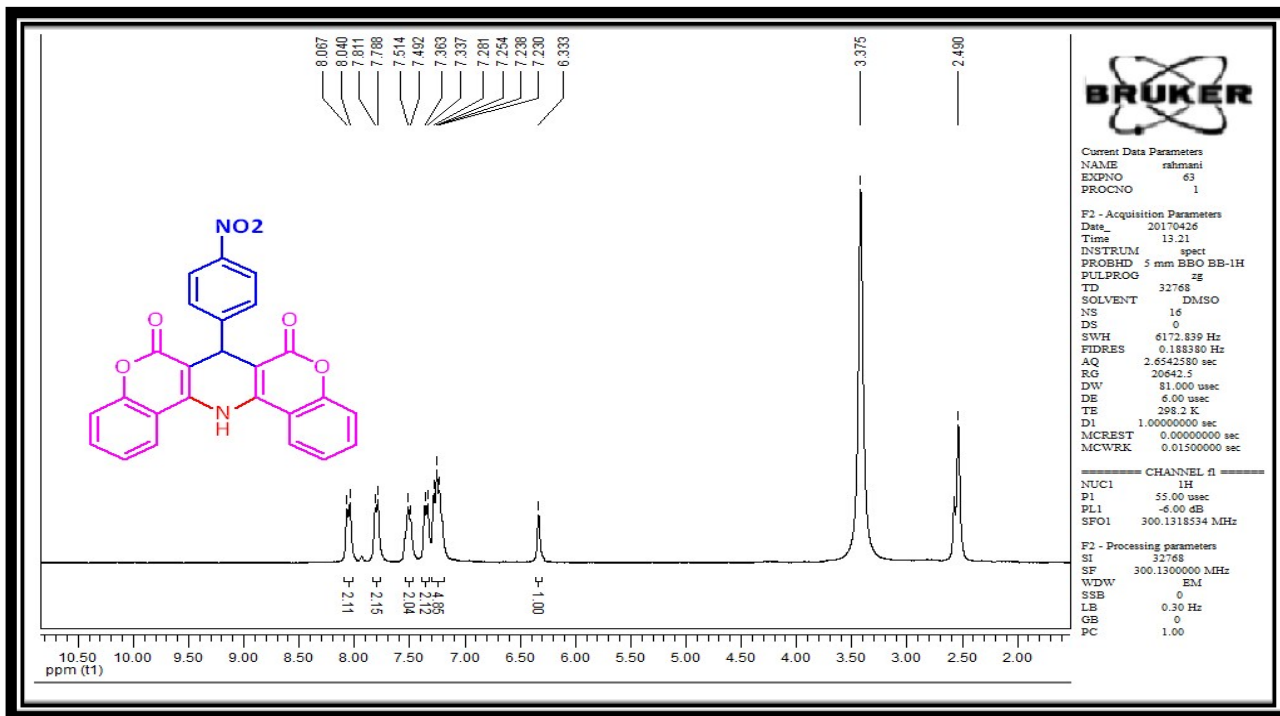
¹³C NMR (75 MHz, DMSO-d₆) of 7-(*p*-tolyl)-7,14-dihydro-6H,8H-dichromeno[4,3-*b*:3',4'-*e*]pyridine-6,8-dione (4h)



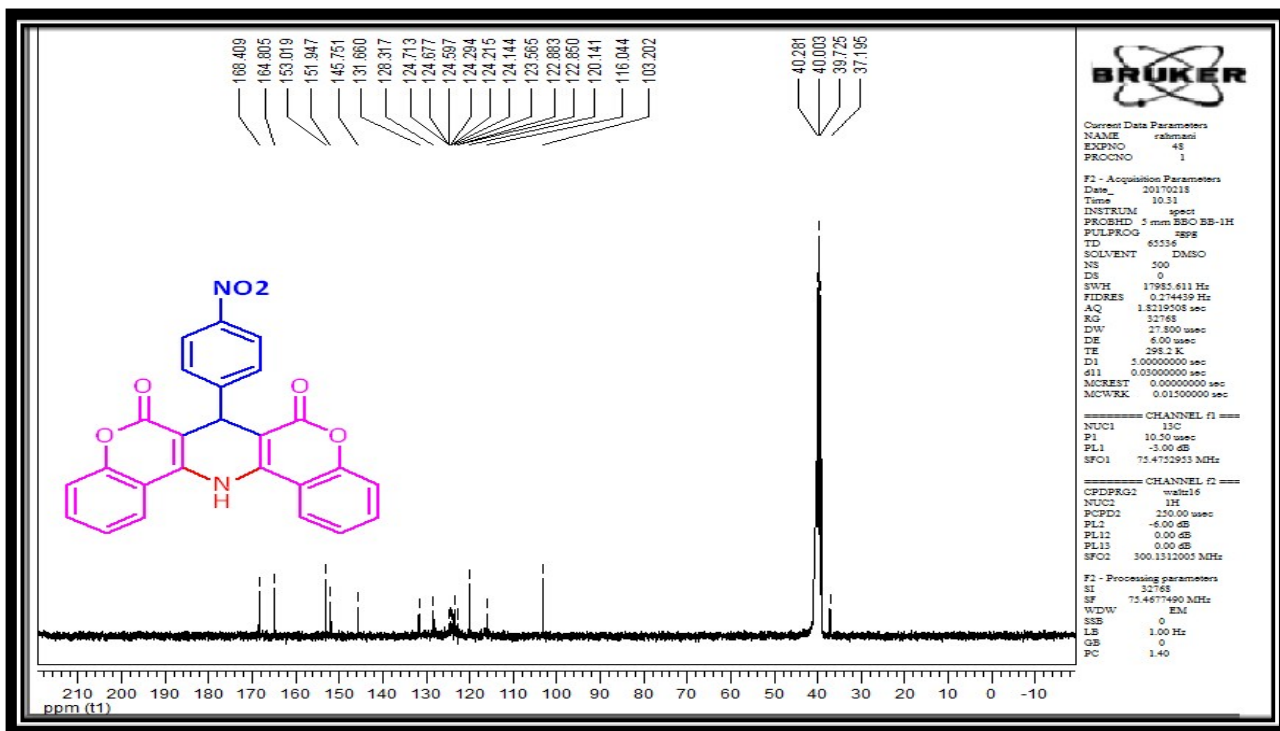
FT-IR (KBr) of 7-(*p*-tolyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4h)



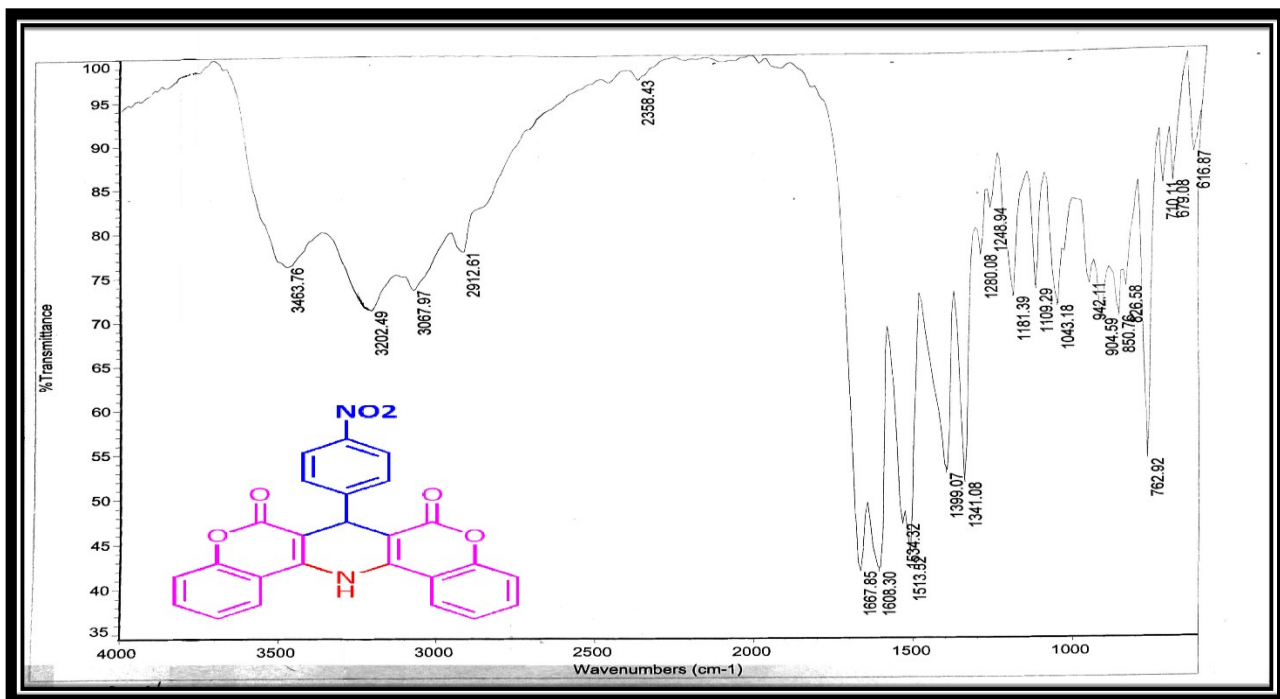
¹H NMR (300 MHz, DMSO-d₆) of 7-(4-nitrophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4j)



¹³C NMR (75 MHz, DMSO-d₆) of 7-(4-nitrophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4j)



FT-IR (KBr) of 7-(4-nitrophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4j)



FT-IR (KBr) of 7-(4-chloro-3-nitrophenyl)-7,14-dihydro-6H,8H-dichromeno[4,3-b:3',4'-e]pyridine-6,8-dione (4I)

