SUPPORTING INFORMATION TO

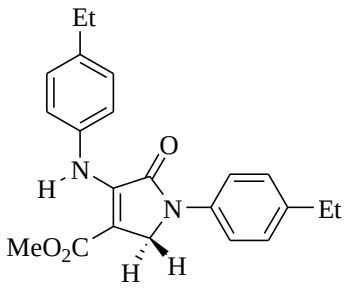
Glutamic acid as a green and bio-based *α*-amino acid catalyst promoted one-pot access to polyfunctionalized dihydro-2-oxypyrroles *via* imin-based four condensation domino reaction of amines, dialkyl acetylenedicarboxylaes and formaldehyde at room temperature

FARZANEH MOHAMADPOUR [a,*]

[a] *Young Researchers and Elite Club, Shiraz Branch, Islamic Azad University, Shiraz, Iran*

* *Corresponding author. mohamadpour.f.7@gmail.com*

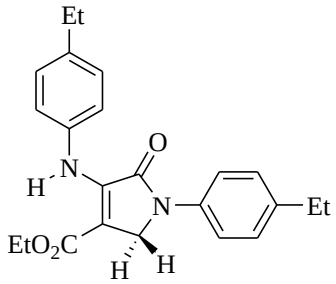
*Methyl4-(4-ethylphenylamino)-1-(4-ethylphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5f**) (Table II, entry 6)*



5f

Yield: 86%; M.p. 125-127 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 1.26 (6H, t, *J*=2.4 Hz, $2CH_2\underline{CH_3}$), 2.67 (4H, q, *J*=7.2 Hz, $2\underline{CH_2}CH_3$), 3.76 (3H, s, $2OCH_3$), 4.53 (2H, s, $C\underline{H_2}$-N),7.09 (2H, d, *J*=8.4 Hz, ArH), 7.17 (2H, d, *J*=8.4 Hz, ArH), 7.24 (2H, d, *J*=8.8 Hz, ArH),7.70 (2H, d, *J*=8.8 Hz, ArH), 8.05(1H, s, NH) ppm.

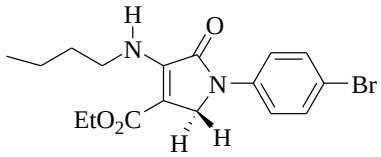
*Ethyl4-(4-ethylphenylamino)-1-(4-ethylphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5g**) (Table II, entry 7)*



5g

Yield: 87%; M.p. 102-104 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 1.24 (9H, m, 3 $CH_2\underline{CH_3}$), 2.67 (4H, q, *J*=7.2 Hz, 2$\underline{CH_2}CH_3$), 4.22 (2H, q, *J*=7.2 Hz, $\underline{CH_2}CH_3$), 4.54 (2H, s, C$\underline{H_2}$-N), 7.09 (2H, d, *J*=8.4 Hz, ArH), 7.16 (2H, d, *J*=8.4 Hz, ArH), 7.24 (2H, d, *J*=8.4 Hz, ArH), 7.71 (2H, d, *J*=8.8 Hz, ArH), 8.01 (1H, s, NH) ppm.

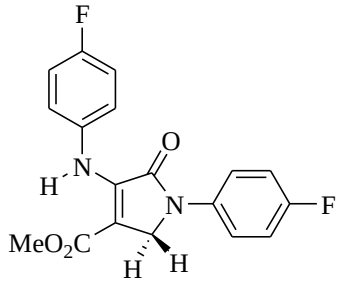
*Ethyl 1-(4-bromophenyl)-3-(butylamino)-2,5-dihydro-2-oxo-1H-pyrrole-4-carboxylate (**5k**) (Table II, entry 11**)*



5k

Yield: 85%; M.p. 96-98 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 0.97 (3H, t, *J* = 7.2 Hz, CH_3), 1.35 (3H, t, *J* = 7.2 Hz, $OCH_2\underline{CH_3}$), 1.43 (2H, sextet, *J* = 7.6 Hz, CH_2), 1.61 (2H, quintet, *J* = 7.6 Hz, CH_2), 3.87 (2H, t, *J* = 7.2 Hz, $\underline{CH_2}$-NH), 4.28 (2H, q, *J* = 7.2 Hz, $O\underline{CH_2}CH_3$), 4.40 (2H, s, $\underline{CH_2}$-N), 6.72 (1H, br s, NH), 7.52 (2H, d, *J* = 8.8 Hz, ArH), 7.70 (2H, d, *J* = 8.8 Hz, ArH).

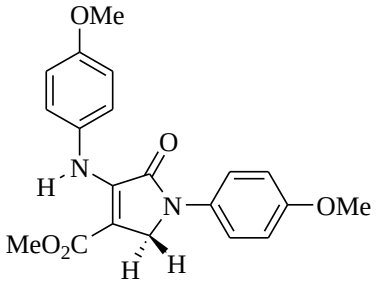
*Methyl4-(4-fluoroyphenylamino)-1-(4-fluorophenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5l**) (Table II, entry 12)*



5l

Yield: 94%; M.p. 161-163 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 3.79 (3H, s, OCH_3), 4.52 (2H, s, $C\underline{H_2}$-N), 7.04 (2H, t, *J*=8.4 Hz, ArH), 7.08-7.16 (4H, m, ArH), 7.73-7.76 (2H, m, ArH), 8.05 (1H, s, NH).

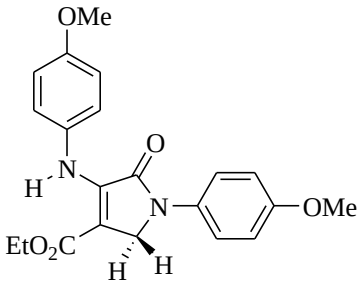
*Methyl4-(4-methoxyphenylamino)-1-(4-methoxyphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5o**) (Table II, entry 15)*



5o

Yield: 87%; M.p. 171-173 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 3.77 (3H, s, CH_3), 3.83 (6H, s, $2OCH_3$), 4.50 (2H, s, $C\underline{H}_2$-N), 6.89 (4H, d, *J*=17.6 Hz, ArH), 7.13 (1H, s, ArH) ,7.68 (1H, s, ArH), 8.03 (1H, s, NH).

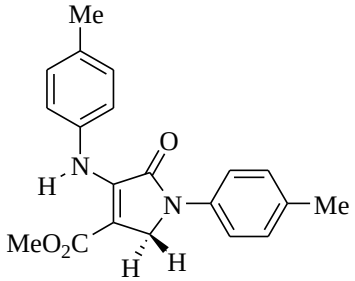
*Ethyl4-(4-methoxyphenylamino)-1-(4-methoxyphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5p**) (Table II, entry 16)*



5p

Yield: 86%; M.p. 153-155 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 1.26 (3H, t, *J*=7.2Hz, $CH_2\underline{CH_3}$), 3.83 (6H, s, $2OCH_3$), 4.23 (2H, q, *J*=7.2 Hz, $\underline{CH_2}CH_3$), 4.50 (2H, s, $C\underline{H_2}$-N), 6.87 (2H, d, *J*=8.8 Hz, ArH), 6.93 (2H, d, *J*=8.8 Hz, ArH), 7.12 (2H, d, *J*=8.8 Hz, ArH), 7.69 (2H, d, *J*=8.8 Hz, ArH), 8.02 (1H, s, NH).

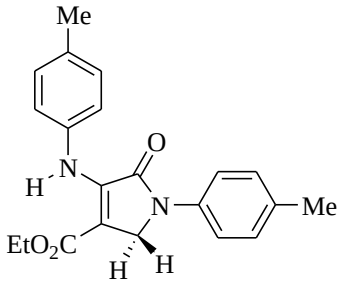
*Methyl4-(4-methylphenylamino)-1-(4-methylphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5r**) (Table II, entry 18)*



5r

Yield: 90%; M.p. 175-176 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 2.36 (6H, s, $2CH_3$), 3.77 (3H, s, OCH_3), 4.52(2H, s, $C\underline{H_2}$-N), 7.06 (2H, d, *J*=8.4 Hz, ArH), 7.14 (2H, d, *J*=8.4 Hz, ArH), 7.21(2H, d, *J*=8.4 Hz, ArH), 7.68 (2H, d, *J*=8.8 Hz, ArH), 8.03 (1H, s, NH).

*Ethyl4-(4-methylphenylamino)-1-(4-methylphenyl)-2,5-dihydro-5-oxo-1H-pyrrole-3-carboxylate (**5s**) (Table II, entry 19)*



5s

Yield: 88%; M.p. 131-133 °C; ^{1}H NMR (400 MHz, $CDCl_3$): 1.25 (3H, t, *J*=7.2 Hz, $CH_2\underline{CH_3}$), 2.37 (6H, s, $2CH_3$), 4.23 (2H, q, *J*=7.2 Hz, $2\underline{CH_2}CH_3$), 4.53 (2H, s, $C\underline{H_2}$-N),7.06 (2H, d, *J*=8.4 Hz, ArH), 7.14 (2H, d, *J*=8.4 Hz, ArH), 7.21 (2H, d, *J*=8.4 Hz, ArH), 7.68 (2H, d, *J*=8.4 Hz, ArH), 8.01 (1H, s, NH).

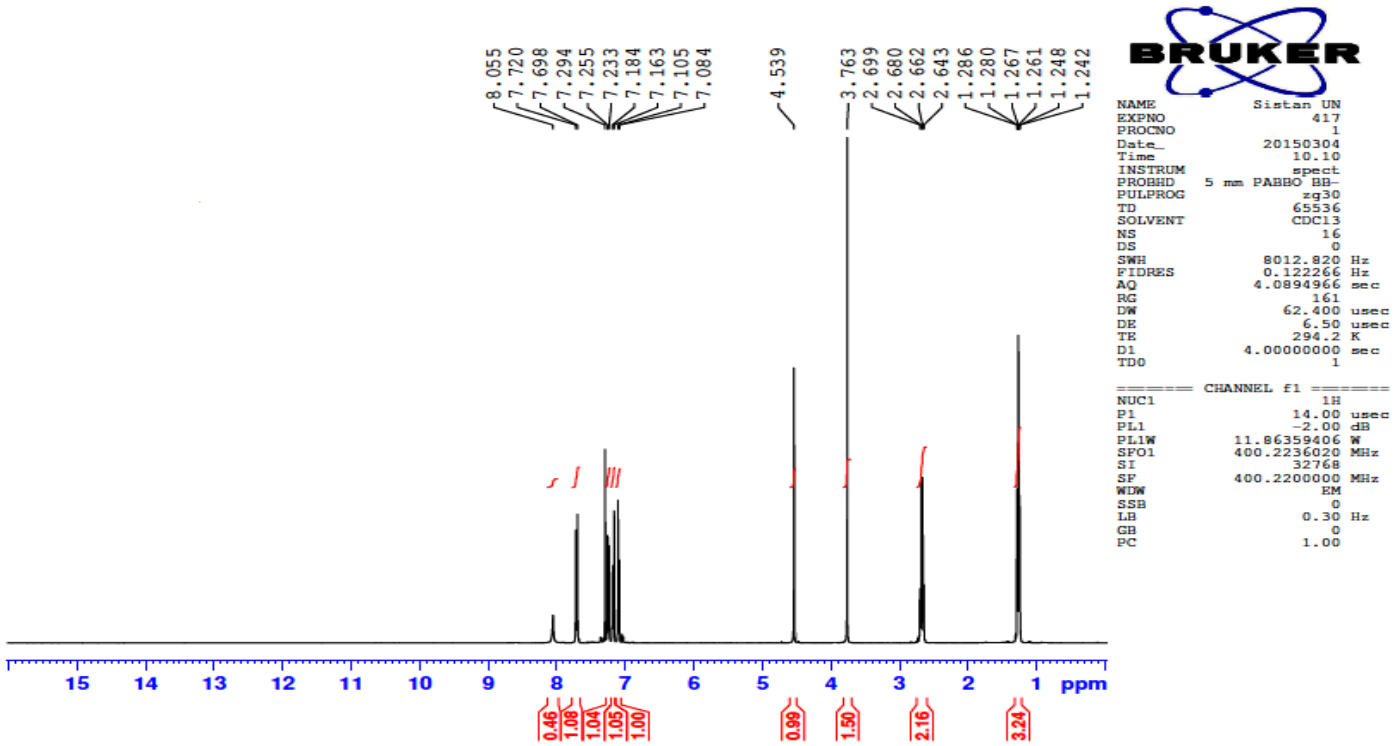


Fig. S-1.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5f**

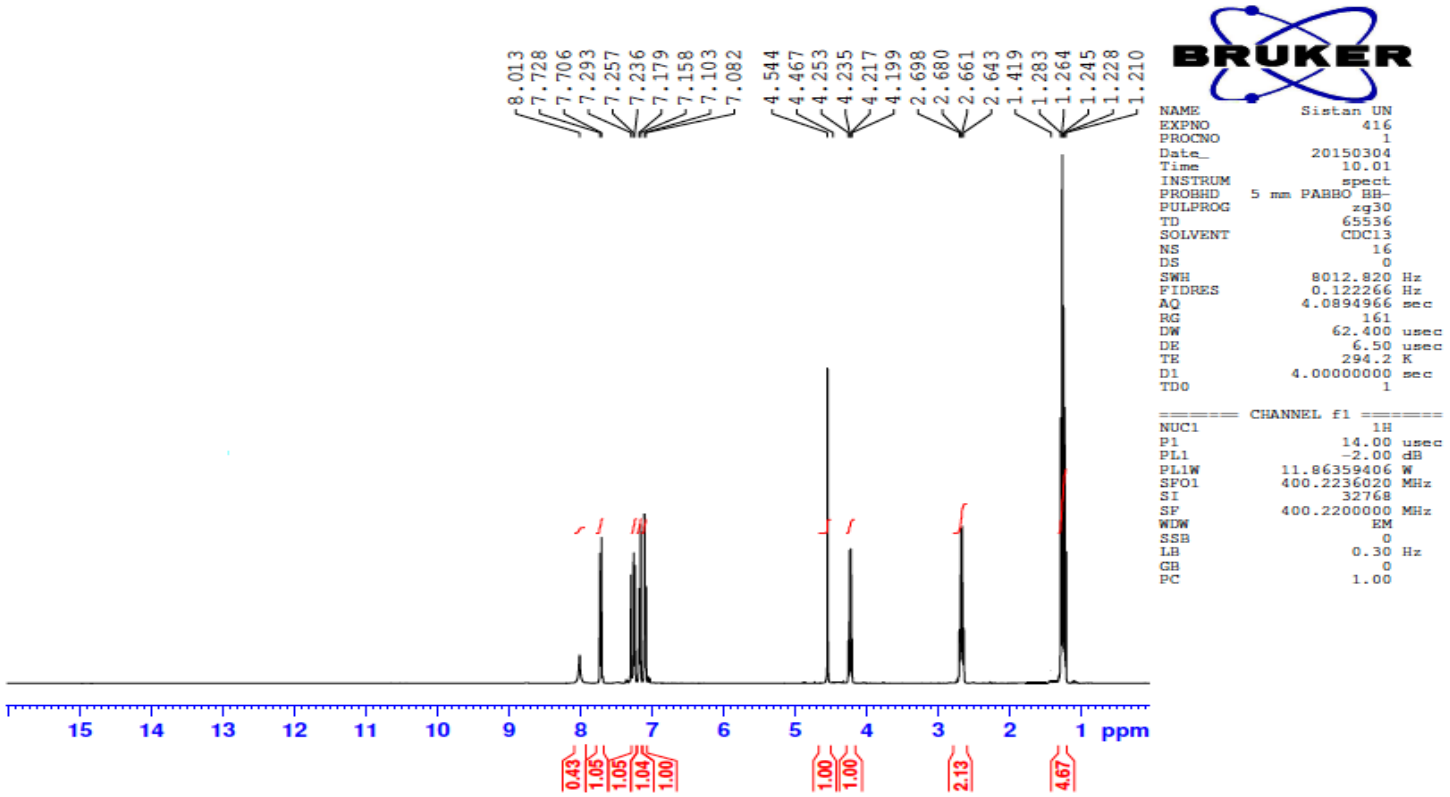


Fig. S-2.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5g**

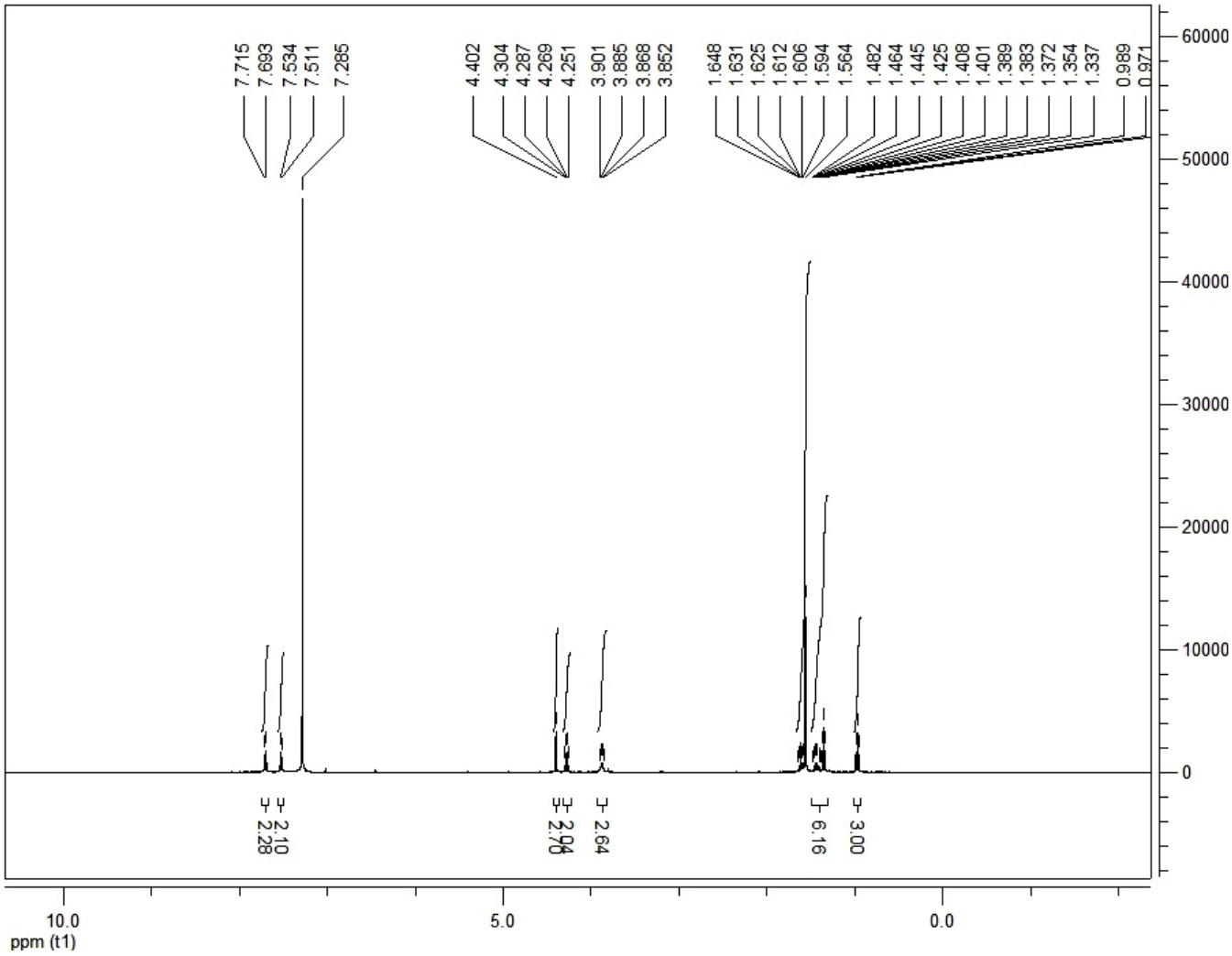


Fig. S-3.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5k**

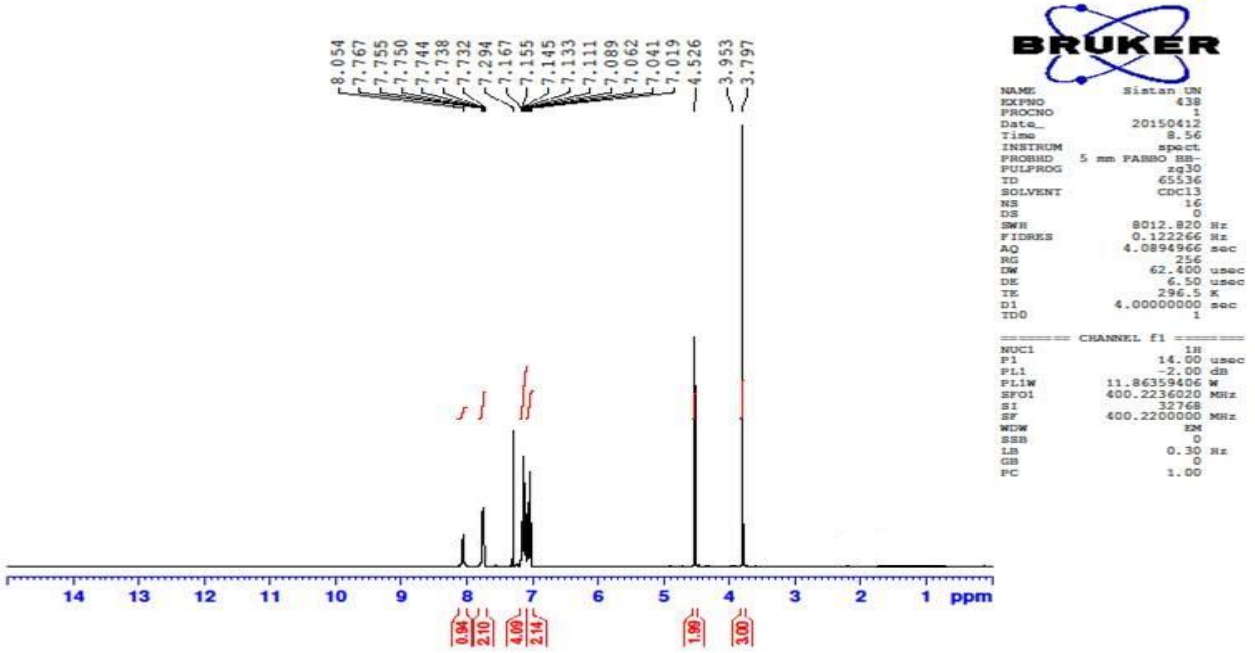


Fig. S-4.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5l**

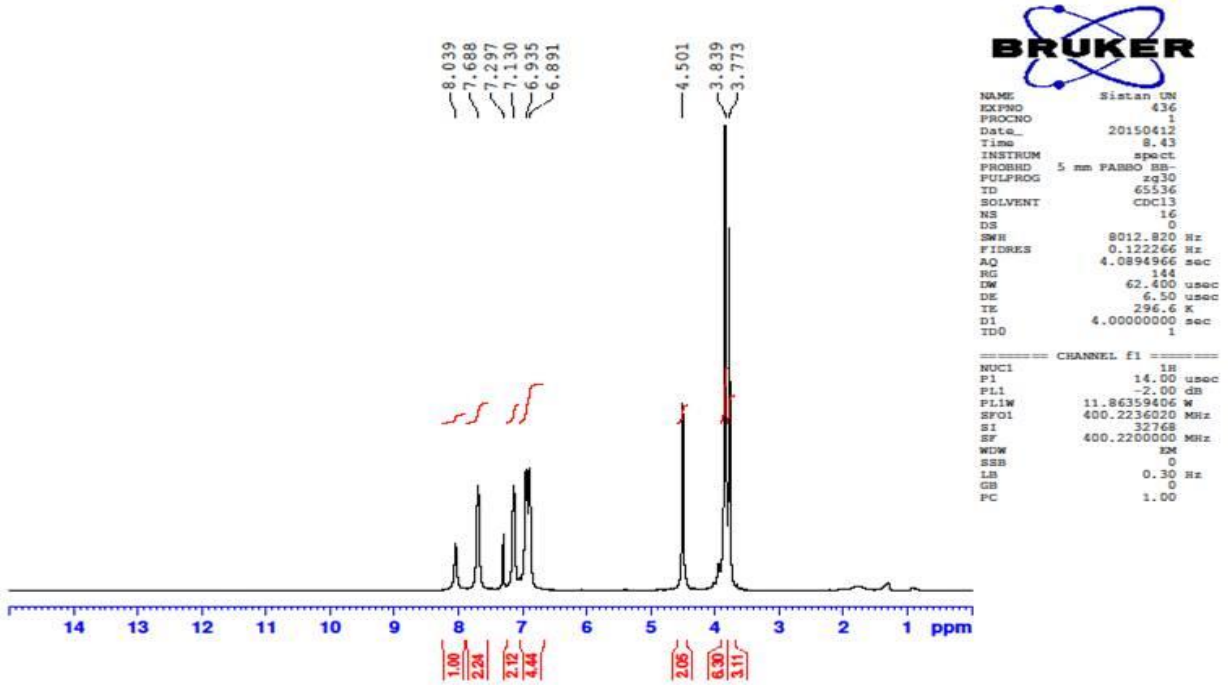


Fig. S-5.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5o**

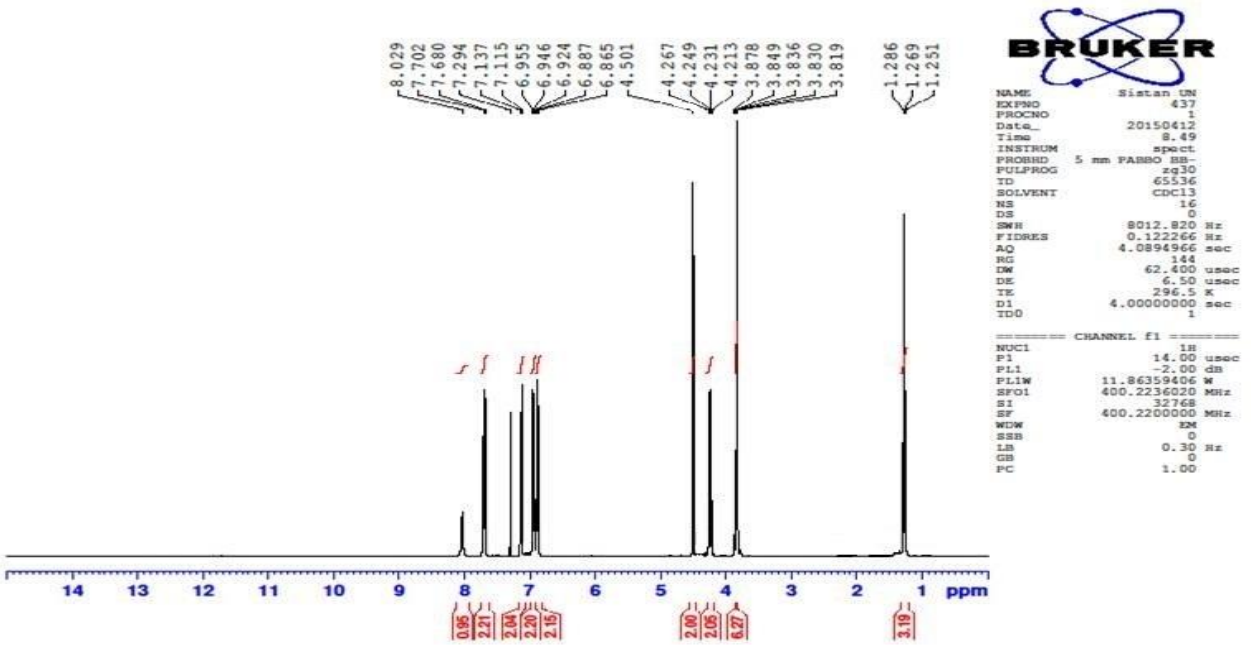


Fig. S-6.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5p**

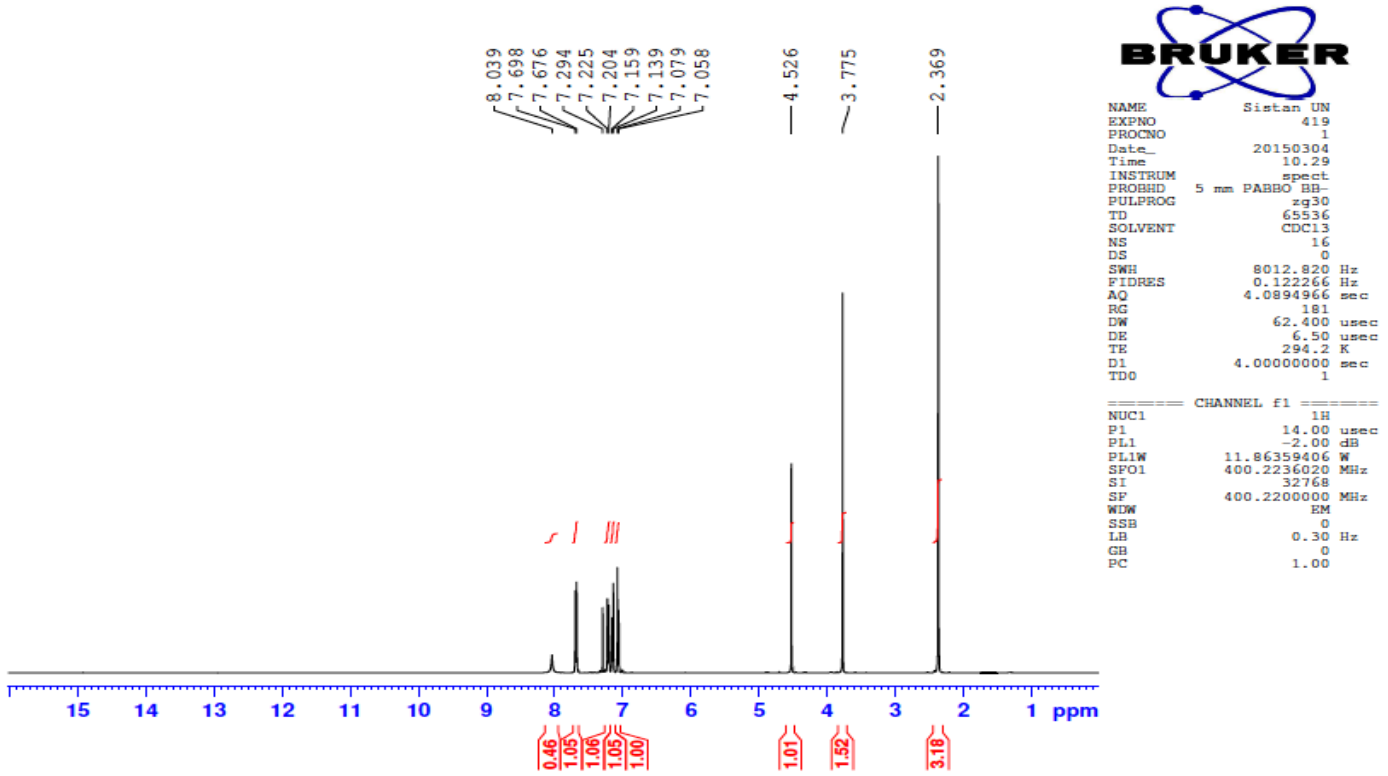


Fig. S-7.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5r**

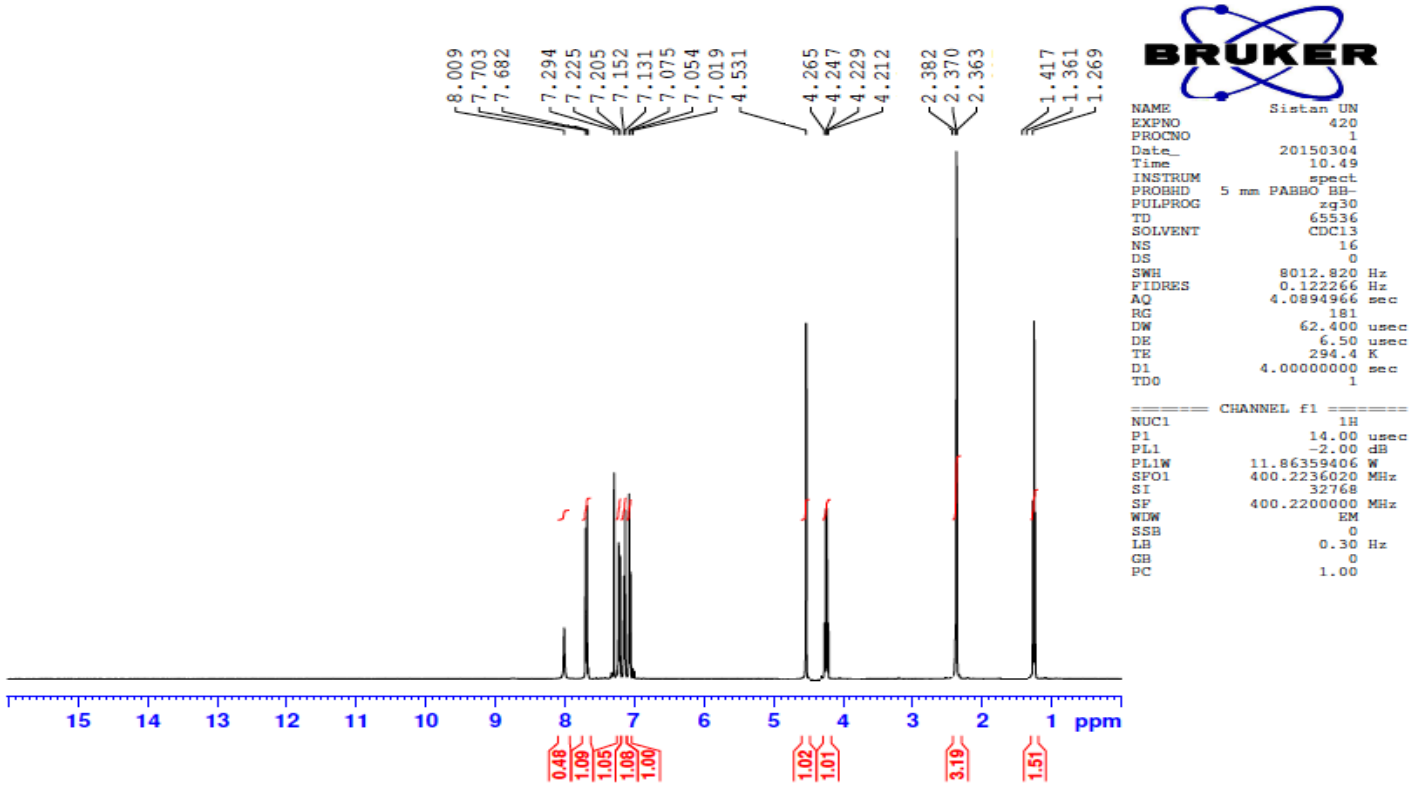


Fig. S-8.^{1}H NMR Spectrum of compound (400 MHz, $CDCl_3$) of **5s**