

Synthesis of new Schiff base ligands from quinoline and benzo[*h*]quinoline

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(Received: October 09, 2010; Accepted: November 12, 2010)

ABSTRACT

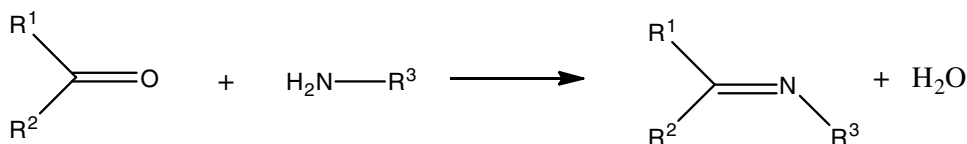
The one-pot synthesis of Schiff base ligands that derived from condensation of 4, 4'- diamino diphenylsulfone (dapsone) and 4,4'- dinitrobenzyl and aromatic aldehydes is reported. These compounds can be used to bind various transition metals. The products have been characterized by their IR and ¹H NMR spectra.

Key words: Schiff base ligands, dapsone, aromatic aldehydes, 4,4'- dinitrobenzyl, imine.

INTRODUCTION

A Schiff base is a functional group that contains a carbon- nitrogen double bond between

amines nitrogen and carbon of carbonyl group. It is usually formed by condensation of an aldehyde or ketone with primary amine (Scheme 1).



$\text{R}^1, \text{R}^2, \text{R}^3 = \text{H}, \text{alkyl or aryl}$

If the imine contains a hydrogen atom ($\text{R}^3 = \text{H}$, therefore the starting material is ammonia), it is unstable and usually cannot be isolated. However, when the imine contains an aromatic (aryl) group on the nitrogen (than the starting amine is aromatic), the resulting imine is stable and can be isolated. The products are called Schiff bases. Carbonyl compounds differ in their reactivity towards amines. Some react in a short time to give imines in good to excellent yields (reaction equilibrium is to the right). Others react only after a prolonged time and the reaction equilibrium may not be favourable (it may be necessary to remove the formed water to shift the equilibrium towards the imine¹⁻⁶).

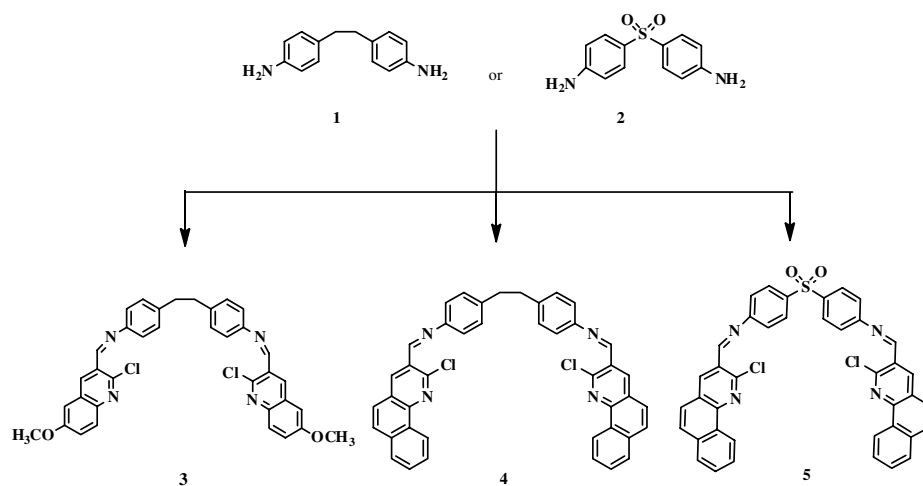
Schiff bases possessing antibacterial, antifungal, antimicrobial, anti HIV, anti inflammatory and antitumor activities. Also, a Schiff base compound has attracted a lot of interest in the fields of coordination chemistry and material sciences. The presence of ion pair on the nitrogen atom of the imino group enables the coordination of numerous metal cations. Schiff base ligands have been extensively studied in coordination chemistry mainly due to their facile syntheses, easily tunable steric, electronic properties and good solubility in common solvents⁷⁻⁹. Dapsone (4, 4'- diamino diphenyl sulfone), is yellowish-white odourless crystalline powder whose chemical formula is

$C_{12}H_{12}N_2O_2S$ ¹⁰. Dapsone has been clinically used for the treatment of leprosy and dermatitis herpetiformis. Recent reports have shown that dapsone is also effective against rheumatoid arthritis¹¹, systemic lupus erythematosus (SLE)¹², thrombocytopenia and dementia¹³. Dapsone is almost completely absorbed from the gastro-intestinal tract with a peak plasma concentration occurring from 1 to 8 h after dose administration^{14,15}. In this study 4,4'-dinitrobenzyl was prepared from *p*-nitrotoluene in presence of methanolic potassium hydroxide then reduced to corresponding diamines. Reaction of 4,4'-diaminobenzyl or 4, 4'- diamino

diphenylsulfone with various aldehydes lead to the preparation of several Schiff bases.

RESULTS AND DISCUSSION

In the present study, synthesis of new Schiff base ligands were reported. Diamines such as 4,4'-diaminobenzyl 1 or 4, 4'- diamino diphenylsulfone 2 was chosen to synthesize Schiff base ligands 3-5 by the condensation with pre-mades aromatic aldehydes such as 2-chloro-6- methoxy quinoline 3- carbaldehyde and 2- chloro benzo [*h*] quinoline-3- carbaldehyde (Scheme 2).



Scheme 2: Structure of synthesised compounds from 4,4'-diaminobenzyl and 4, 4'- diamino diphenylsulfone

Compounds 3-5 was prepared by refluxing two equivalents of mention aldehydes with one equivalent of 4,4'-diaminobenzyl and 4, 4'- diamino diphenylsulfone in EtOAc. Condensation of primary amino groups is confirmed by the lack of N-H stretching bands in the 3150-3450 cm^{-1} IR region and the presence of strong C=N stretching bonds. The ¹H NMR and infrared data for compounds 3-5 are completely consistent with the formulation indicated in Scheme 2. These Schiff base ligands can be used to bind various transition metals. Dapsone don't reaction with most of aldehydes. This is because of SO_2 withdrawing function in dapsone structure.

EXPERIMENTAL

All the chemicals were purchased from Merck and Fluka. Melting points were measured on an Electro thermal 9100 apparatus and are uncorrected. ¹H NMR data were recorded in $CDCl_3$ or DMSO using a Bruker Avance 500-MHZ spectrometer. Chemical shifts are reported in ppm (δ) using deuterated solvents as internal references. The IR spectra were recorded on a Shimadzu IR-470 spectrophotometer. 2-chloro-6- methoxy quinoline 3- carbaldehyde and 2-chloro benzo[*h*]quinoline-3-carbaldehyde was prepared starting from acylated of aromatic amines in the

presence of acetic anhydride and glacial acetic acid refluxing for 2-3 h. followed by formylated with POCl_3 and DMF for 16-18 h at 70-80 °C. The general procedure for the synthesis of Schiff bases 3-5 is follows: a mixture of 4,4'-diaminobiphenyl or 4, 4'-diamino diphenylsulfone (5 mmol) and mention aldehydes (10 mmol) in EtOAc (40 ml) is refluxed for 1 days. Compounds 3-5 were recrystallized with ethyl acetate.

4- (4- ((2- chloro-6- methoxyquinoline-3- yl) methyleneamino) phenethyl)-N- ((2-chloro-6-methoxy quinoline-3- yl) methylene) benzenamine (3)

Yield 27%, M.P. 290-291 °C, yellow solid, ^1H NMR (500 MHz, CDCl_3 , ppm): δ 3.06 (s, 2H), 3.96 (s, 3H), 7.25 (s, 1H), 7.41 (d, J = 8.3 Hz, 2H), 7.49 (d, J = 9.1 Hz, 1H), 7.67 (d, J = 8.3 Hz, 2H), 7.99 (d, J = 9.2 Hz, 1H), 9.04 (s, 1H), 9.08 (s, 1H); IR (KBr, v/cm^{-1}); 3010, 2900, 1618, 1580, 1495, 1380, 1330, 1235, 1160, 1055, 1020, 960, 825. Calcd for $\text{C}_{36}\text{H}_{28}\text{Cl}_2\text{N}_4\text{O}_2$; C, 69.79; H, 4.56; N, 9.04; found C, 69.78; H, 4.55; N, 9.02.

4- (4- ((2- chlorobenzo [h] quinoline-3- yl) methyleneamino) phenethyl)-N- ((2- chloro benzo[h] quinoline-3- yl) methylene) benzenamine (4)

Yield 74%, M.P. 292-293°C, yellow solid, ^1H NMR (500 MHz, CDCl_3 , ppm): δ 3.08 (s, 2H), 7.33 (d, J = 8.2 Hz, 2H), 7.39 (d, J = 7.9 Hz, 2H), 7.80-7.82 (m, 2H), 7.86 (d, J = 8.6 Hz, 1H), 7.92 (d, J = 8.8 Hz, 1H), 7.96-7.98 (m, 1H), 9.13 (s, 1H), 9.22 (s, 1H), 9.27-9.31 (m, 1H); IR (KBr, v/cm^{-1}); 3050, 2900, 2850, 1617, 1600, 1580, 1500, 1400, 1350, 1330, 1160, 1110, 1060, 960, 820, 800, 740, 720, 560, 540. Anal. Calcd for $\text{C}_{42}\text{H}_{28}\text{Cl}_2\text{N}_4$; C, 76.48; H, 4.28; N, 8.49; found C, 76.46; H, 4.29; N, 8.47.

4- (4- ((2- chloro benzo [h] quinoline- 3- yl) methylene amino phenyle sulfonyle) - N- ((2-chlorobenzo [h] quinoline- 3- yl) methylene) (5)

Yield 67%, M.P. > 300 °C, green solid, ^1H NMR (500 MHz, CDCl_3 , ppm): δ 7.44 (d, J = 8.3 Hz, 2H), 7.81-7.84 (m, 3H), 7.93 (d, J = 8.5 Hz, 1H), 7.97-7.99 (m, 1H), 8.11 (d, J = 8.5 Hz, 2H), 8.04 (s, 1H), 9.09 (s, 1H), 9.27-9.29 (m, 1H); IR (KBr, $\text{v}/$

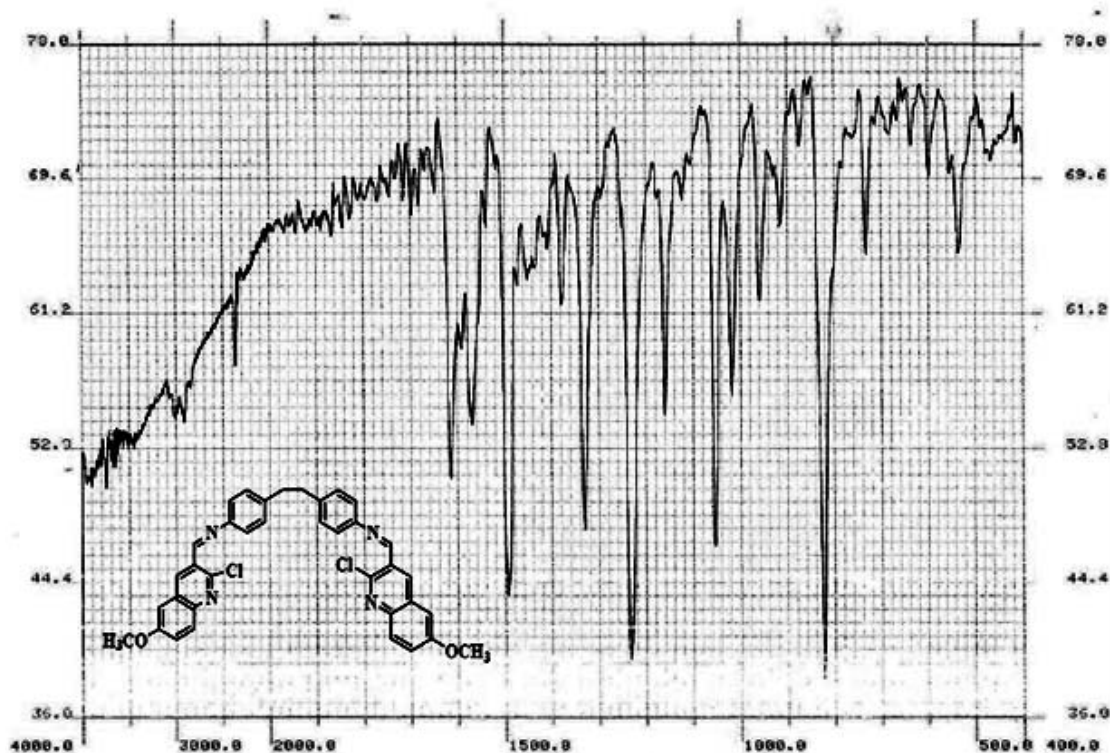
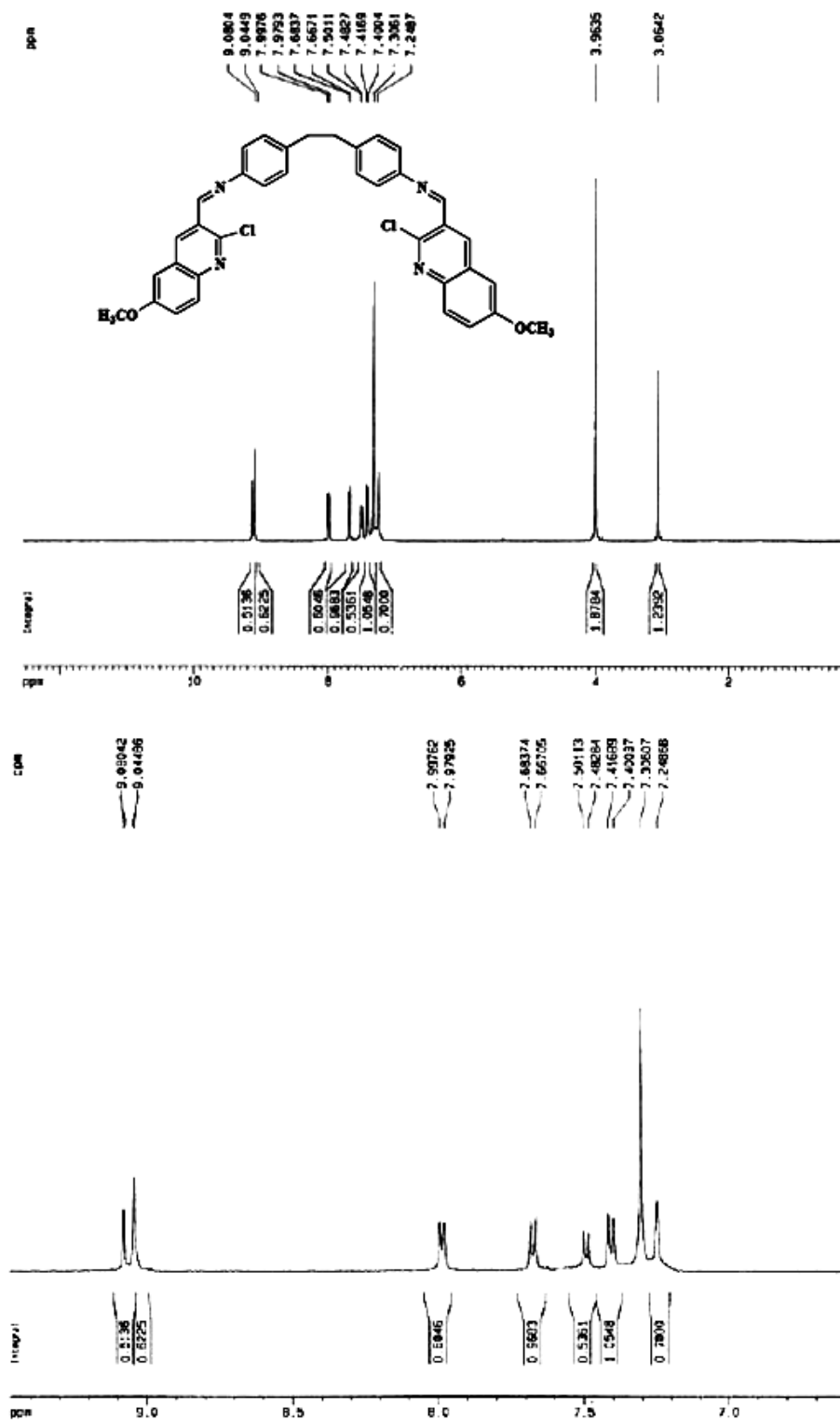


Fig. 1: IR spectrum of compound 3

Fig. 2: ¹H-NMR Spectrum of compound 3

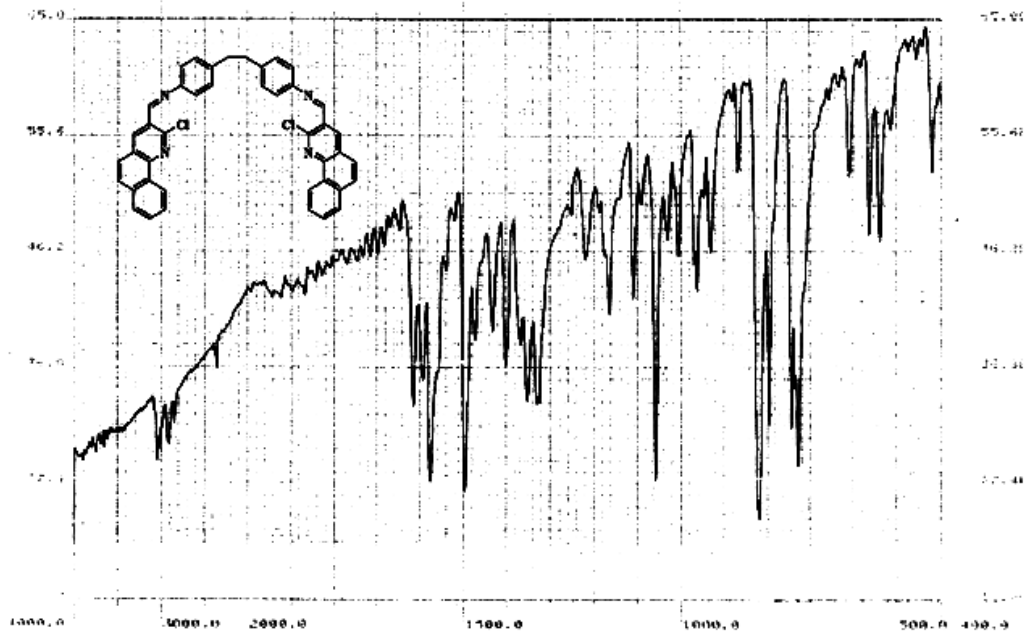
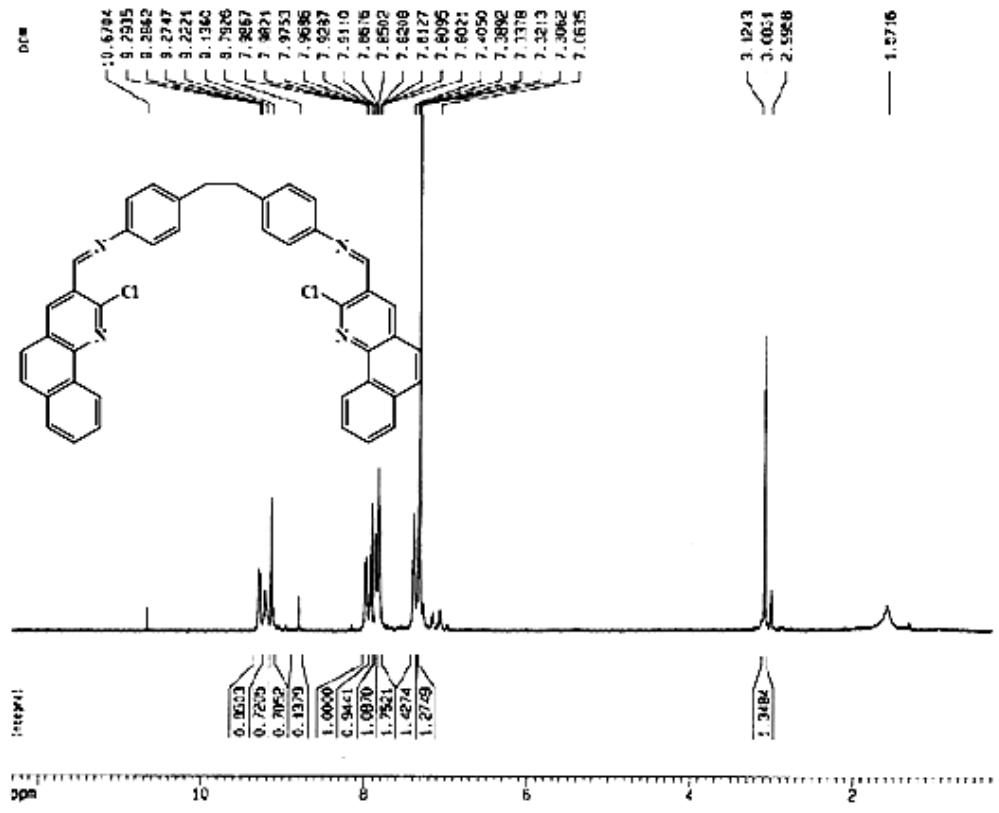


Fig. 3: IR spectrum of compound 4



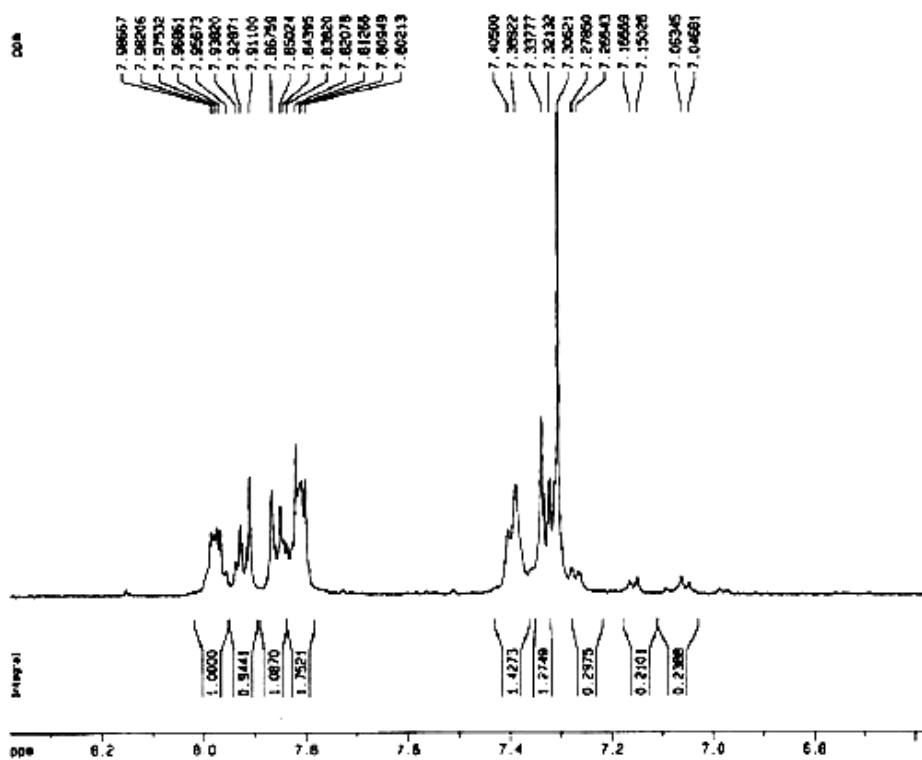
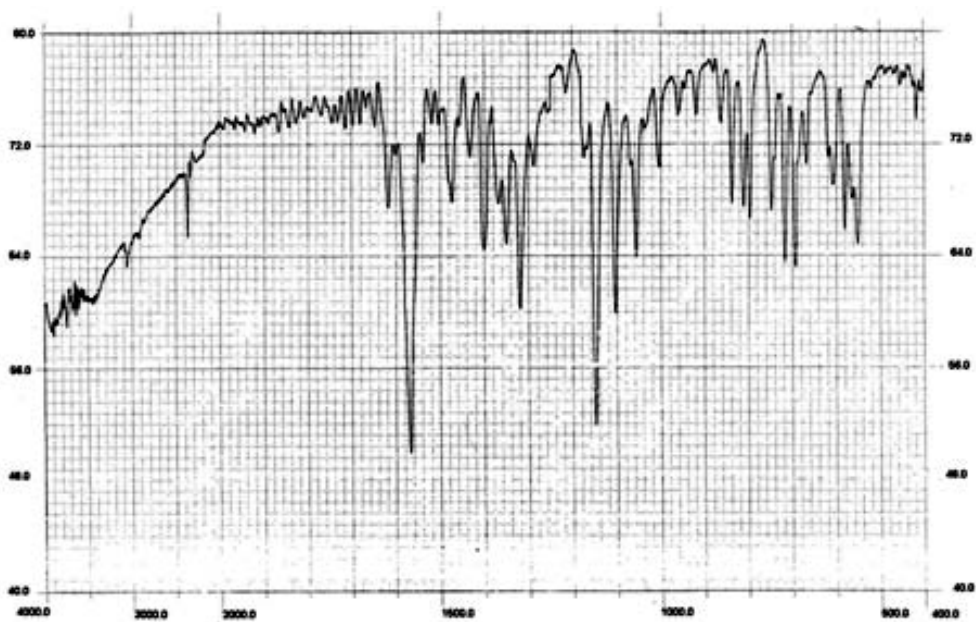
Fig. 4: ¹H-NMR Spectrum of compound 4

Fig. 5: IR spectrum of compound 5

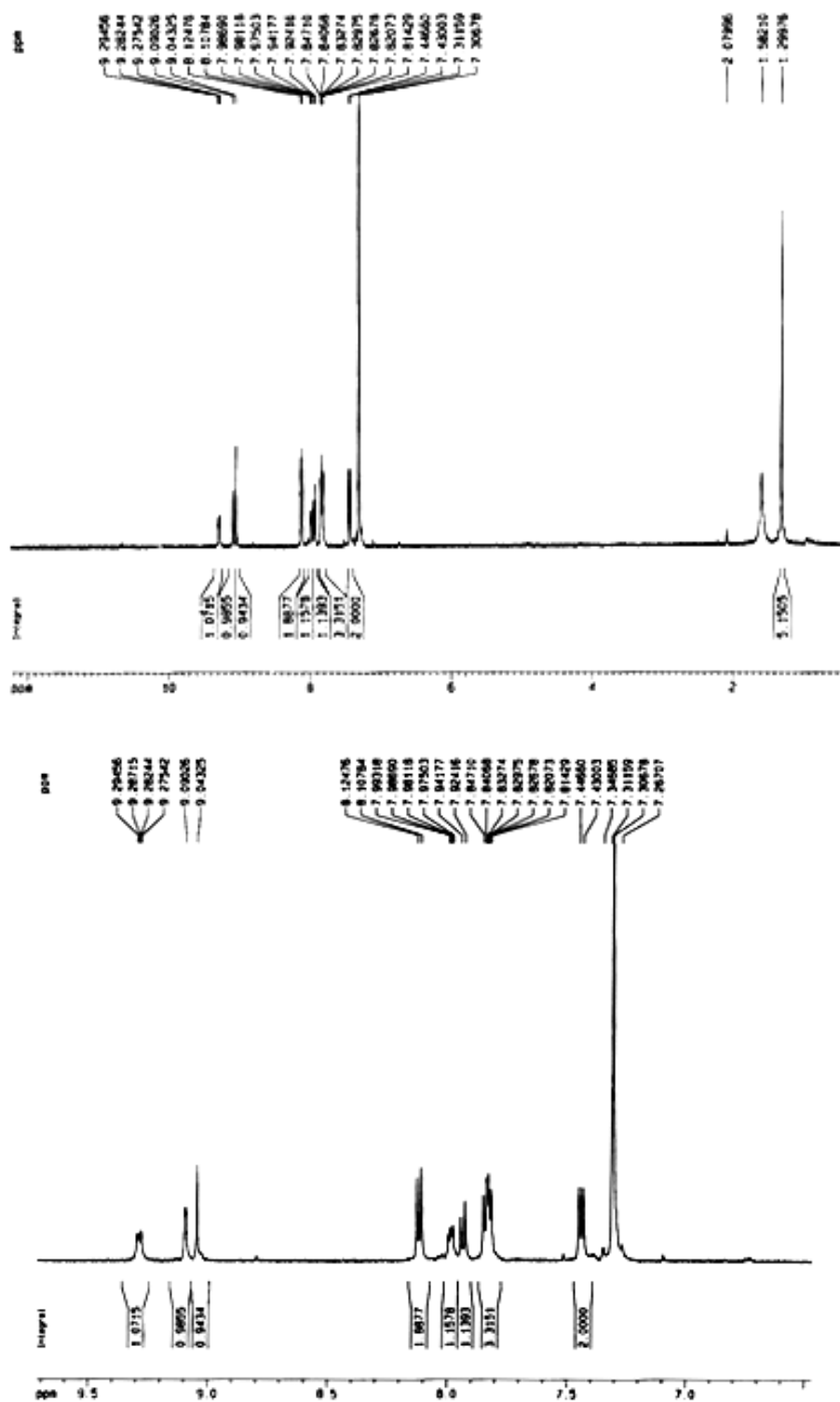


Fig. 6: ¹H-NMR Spectrum of compound 5

cm⁻¹): 3070, 2800, 1620, 1570, 1470, 1400, 1350, 1320, 1150, 1100, 1060, 800, 750, 720, 690, 580, 550. Anal. Calcd for C₄₀H₁₄Cl₂N₄O₂S; C, 70.08; H, 2.06; N, 8.17; O, 4.67; S, 4.68; found C, 70.07; H, 2.03; N, 8.19; O, 4.65; S, 4.67.

ACKNOWLEDGMENTS

We are thankful to the Research Council of University of Guilan for the partial support of this work.

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