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Synthesis and Anti-Microbial Activities of Some Novel Schiff Bases

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Abstract: ***A series of Novel Schiff bases have been prepared by the condensation of phenylhydrazine (1), 2,4 dinitrophenylhydrazine (2) with different aromatic aldehydes the reaction takes place efficiently with excellent yield and high purity. The structures of all the synthesised compounds were confirmed by their elemental analysis, m.p., IR, and electronic spectra. All the synthesized compounds have been screened for their antimicrobial activity.***

Keywords: Schiff base, phenylhydrazine, electronic spectra, antimicrobial activity

1. Introduction

Schiff bases, named after Hugo Schiff [1], are formed when any primary amine reacts with an aldehyde or a ketone under specific conditions.

Imines are the functional groups or compounds containing a carbon nitrogen double bond, formed by the condensation of primary amine and carbonyl compounds such as aldehydes and ketones under different conditions with different solvents by the elimination of water molecules. Because of the presence of pai bond and lone pair of electrons present on the Nitrogen atoms, it shows variety of biological activities.

Schiff bases play an important role in biological systems with several applications. They act as anticancer [1-3], antibacterial [4-9], antifungal [10-12], antiviral [13], antiparasitic agents [10] in addition to other biological performances [14-15] Some of the Schiff's bases of heterocyclics, such as quinazolinones, toluidinones, benzimidazole, thiazole, glucosamine pyrazolon, hydrazidefurforaldiamine, halogenated thiazolidiones, indolep-fluorobenzaldehyde show remarkable biological activities [11]. Schiff's bases derived from N-substituted and quaternized chitosan show good antifungal activity [12]. Many hydrazide Schiff's bases derived from 4-chloro benzaldehyde, substituted hydrazide Schiff's bases of carboxy methyl chitosan show anti-oxidant activity by the DPPH method and NO scavenging method [13-14]. A number of acyl hydrazide Schiff's bases have shown interesting biological activities such as antibacterial, antifungal, anticonvulsant, anti-inflammatory, antimalarial, analgesic, antiplatelets, antituberculor activities [15-22]. These observations led to the conception that a series of some different novel hydrazide Schiff's bases, were synthesized using different aromatic aldehydes and their chemical structure were confirmed by IR, Elemental analysis and UV-vis spectroscopy. These compounds were screened for their antibacterial activity against two types of bacteria Grampositive bacteria (Staphylococcus aureus ATCC 9144), and Gram-negative bacteria (Escherichia coli ATCC 25922) activities by paper disc diffusion technique.

2. Materials and Methods

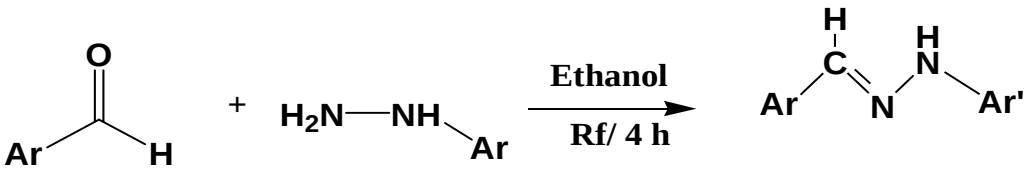
Analytical grade chemicals and solvent used in these studies. phenyl hydrazine, 2-4 Di nitro phenyl hydrazine, 4-Nitroanaline and 4-dimethylaminobenzaldehyde were taken from BDH. Other pure chemicals and solvent were used without purification.

Melting points were determined by open capillary method and are uncorrected. The purity of the compounds was monitored by thin layer chromatography (TLC)

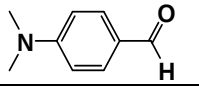
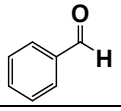
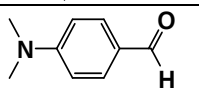
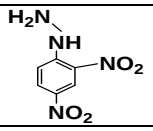
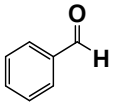
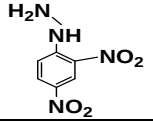
The elemental (CHN) analysis were also determined. UV-Vis monitored on Shimadzu-1800 spectrophotometer in alcohol. Stock solutions prepared in absolute ethanol and were of 0.01 M concentration. These solutions were used for the UV-Vis spectral determinations by making desired dilutions. The FTIR spectra were recorded on a Shimadzu FTIR 8400 spectrophotometer using sample mixed in powder form with KBr powder.

General Procedure for Schiff Base Synthesis:

Schiff base (1 -4) of aldehyde was synthesized by adding amine (0.01 mole of each) in 20 ml of ethanol. The reaction mixture was heated under reflux for four hours [24]. After completion of the reaction (checked by TLC), it was allowed to cool and solid separated out was filtered, dried, recrystallized from ethanol and then dried under vaccum to give crystal. The yield of product and M.P. was recorded.



Scheme 1

Compound	Ar	Ar'
1. Dpa		
2. Bpd		
3. Dhd		
4. Bdh		

Scheme – 1

Antimicrobial activity

Bacterial resistance to the antibiotic is a big blow to humanity and continual search for newer chemotherapeutic agent is the only way to fortify against this awful throat. The antimicrobial activity was determined for the investigated compounds against the Gram positive bacteria (Staphylococcus) and Gram negative bacteria (Escherichia coli), by using well diffusion method using agar nutrient as the medium . The stock solution was prepared by dissolving (100 mg) of compounds in DMSO. In a typical procedure a well was made in the agar medium inoculated with the microorganism. The well was filled with the test solution using micropipette and the plate was incubated 24 h at 35 °C. During this period the test solution diffused and the growth of the inoculated microorganisms was affected.

3. Results and Discussion

Elemental analysis

The results of elemental analysis for prepared compounds show that the found percentages of carbon ,hydrogen and nitrogen are equivalent to calculated values as show in Table 1 .This is evidence that proposed chemical structures of these compounds are true .

Table 1: Physical characterization as CHN, mp, color and elemental analysis data of schiff base compounds

Compound Molecular Formula	M.wt	Color	M.P	Yield%	Found (calculated)		
					C	H %	N %
$C_{15}H_{17}N_3$	239.32	Brown	145	33%	74.85 (75.28)	7.24 (7.16)	17.70(17.56)
$C_{13}H_{12}N_2$	196.25	Pal-yellow	170	84%	79.45 (79.56)	6.41 (6.16)	14.30(14.27)
$C_{15}H_{15}N_5O_4$	329.31	Pal-Brown	247	85%	54.89 (54.71)	4.72 (4.59)	21.42(21.27)
$C_{13}H_{10}N_4O_4$	286.24	Orange	243	53%	54.72 (54.55)	3.85 (3.52)	19.62(19.57)

UV-Visible spectra of the Schiff Base:

The electronic spectrum data of the Schiff base compounds shown in Table 2 and Figure 1 appear absorption bands in two distinct regions. The first region ranging from 200 to approximately 229 nm, is characteristic for the electronic inter-ligand π→π* transitions [25], while the second characteristic wavelength in the region of 280 nm to approximately 350 nm is the second inter ligand n→π transition [26].

Table 2: UV-Visible spectra of the Schiff Base

Compound	π → π*	n → π*
1	**220**	**350**
2	**218**	**288**
3	**220**	**345**
4	**213**	**322**

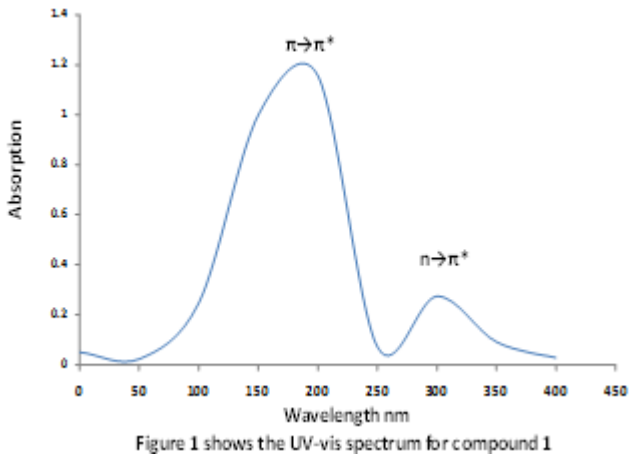


Figure 1 shows the UV-vis spectrum for compound 1

Infrared spectra

The important infrared spectral bands of the prepared compounds are presented in Table (3). It depict prominent bands at 3230, 1650, 1360 and 1250 cm-1 assignable to υ NH, υ C=N (azomethine), υ C=C aromatic ring and υ C-N (aryl azomethine) stretching modes respectively. Chelation by nitrogen of azomethine (C=N) is confirmed by observing band at 1650 cm-1 in the all spectra of compounds. All spectral data has good agreement with structure.

Table 3: IR spectra of the Schiff Base

Compound	C-N Al - 1360-1800	C=C 1400-1600	C=N 1650-1700	C-H(Al) 2850-3000	C-H(Ar) 3000-3100	N-H 3300-3500
1(dpa)	1118	1373	1650	2940	1339	3233
2(bpd)	1136	1371	1643	2936	3152	3298
3(dhd)	1139	1381	1660	2971	3120	3232
4(bdh)	1136	1337	1655	2971	3099	3233

Antibacterial Activity

The results of the antibacterial screening of the Schiff bases at a concentration of 10 mg/ml and 20mg/ml against all bacteria have been found. The inhibition zones were measured in mm and results are shown in Table 4. The results of antimicrobial screening, indicate that Schiff bases show significant activity against the tested bacteria. Compound 1 and 4 were found to be more active against all tested bacterial strains because of the presence of amino group in the aldehydic group which itself is active against microbes. Antibacterial activity of these compounds show

ascending order. When we increase concentration, area of inhibited growth also increased. Also the enhancement in the activity is rationalized on the basis of the structures of the ligands by possessing an additional azomethine (C=N) linkage which is significant in determining the mechanism of transamination and resamination reaction in biological system [27,28]

Table 4: Antibacterial activity of Schiff base compounds

Compound	Staphylococcus Inhibition zone (mm)		E-coli Inhibition zone (mm)	
	1	0.5	1	0.5
Control ceftriaxane	25	22	20	18
1(dpa)	8	7	12	10
2(bpd)	9	8	10	9
3(dhd)	8	7	9	8
4(bdh)	9	8	10	9

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