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Comparative study of conventional and microwave assisted synthesis of novel schiff bases and their antimicrobial screenings

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ABSTRACT

A series of Schiff base of 4,4'-sulfonyldianiline/ 4,4'-sulfonylbis(2,6- dichlo/dibromo/diiodo dianiline) have been synthesized under microwave irradiation and conventional heating for comparison. 4,4'-sulfonyldianiline/ 4,4'-sulfonylbis(2,6- dichlo/ dibromo/ diiodo dianiline) was condensed with hydroxy halo substituted aromatic aldehyde in ethanol/DMF in the presence of Glacial acetic acid as a catalyst under conventional heating and microwave irradiation to yield the Schiff base respectively (2a-p). The microwave assisted reaction was remarkably successful with higher yield within less reaction time compared to conventional heating method. Spectral data (IR, NMR and Mass spectra) confirmed the structures of the synthesized compounds. All the synthesized products are screened for their in vitro antibacterial activity. The results indicated that the synthesized compounds have moderate to potent activities at low and high concentration with reference to their appropriate reference standards.

Key Words: Schiff bases, Conventional heating, Microwave irradiation method, Antibacterial activity.

INTRODUCTION

Dapsone (4, 4'-sulfonyldianiline), a sulphone analog, has been proved to be a powerful antimicrobial agent. Dapsone has been clinically used for the treatment of leprosy and dermatitis herpetiformis. Reports have shown that is also effective against rheumatoid arthritis [1-2], systemic lupus erythematosus (SLE)[3], thrombocytopenia[4-5], and dernentia[6]. A number of

less toxic and potent antimycobacterial and anti-inflammatory derivatives of dapsone have shown promise in previous work [7-8] and await further development [9].

Schiff bases appear to be important intermediate in a number of enzymatic reactions involving interaction of enzyme with an amino or a carbonyl group of the substrate [10]. One of the most catalytic mechanism in biochemical processes involves condensation of a primary amine in an enzyme, usually that of a lysine residue, with a carbonyl group of the substrate to form an imines, or Schiff bases. It plays a prominent part in the enzymatic or unenzymatic transaminating reactions of the carbonyl compounds with amino acids [11]. Schiff bases derived from aromatic amines and aromatic aldehydes have a great utility in important fields as, *e.g.*, medicine, agriculture, cosmetic products and wide variety of applications in inorganic and analytical chemistry [12-14]. Schiff bases lay in their usefulness as synthons in the synthesis of bioactive molecules such as 4-thiazolidinines, 2-azetidinones, benzoxazines, formazans, etc. Due to the great flexibility and diverse structural aspects of Schiff bases, a wide range of these compounds have been synthesized and their complexation behavior studied [15-16]. In the coordinate chemistry field, a lot of Schiff bases operate as ligands [17-19]. Some of the Schiff bases complex combinations with metals are used as insecticides, fungicides, herbicides [20].

Nitro and halo derivatives of Schiff bases are reported to have antimicrobial and antitumor activities [21]. Antimicrobial and antifungal activities of various Schiff bases have also been reported [22-24]. Many Schiff bases are known to be medicinally important and are used to design medicinal compounds [25-27]. They are known to exhibit anticonvulsant, anti-inflammatory activities [28-30]. In addition some Schiff bases show pharmacologically useful activities like anticancer [31-32], anti-hypertensive and hypnotic [33] activities, anti-tuberculosis [34], antifeedant [35] etc. Schiff bases belongs to a widely used group of organic intermediates important for production of specially chemicals, e.g. pharmaceutical or rubber additives[36], as amino protective groups in organic synthesis [37-40]. They also have used as liquid crystals [41], in analytical [42], medical [43] and polymer chemistry [44].

Microwave irradiation of organic reactions has rapidly gained popularity as it accelerates the reaction towards a variety of synthetic transformations, solvent-free procedures without the use of supporting reagents, and hence eco-friendly. Chemical transformations that took hours or even days to complete can now be accomplished in minutes. Microwave energy offers numerous benefits for performing synthesis such as increased reaction rates, enhanced yields together with simplicity in processing and handling and cleaner chemistries [45-48].

Hence, in this paper, we are reporting the synthesis of some new Schiff bases of 4, 4'-sulfonyldianiline/ 4, 4'-sulfonyl bis (2,6- dichlo/dibromo/diiodo dianiline) with hydroxy halo substituted aromatic aldehydes by using microwave irradiation technique and also compare it with traditional method of conventional heating approach, and their characterization through spectral data such as IR, ^{1}H-NMR and Mass spectra and element analysis. All the synthesized compounds have been screened for their antibacterial activity.

EXPERIMENTAL SECTION

Melting points were determined in open glass capillaries and were found uncorrected. The purity of the compounds was checked by TLC. IR spectra were recorded in KBr on a Perkin-Elmer spectrometer. ^{1}H NMR spectra were recorded on a Gemini 300-MHz instrument in DMSO as solvent and TMS as an internal standard. The FAB mass spectra were recorded on a Jeol SX 102/Da-600 mass spectrometer/data system using Argon/Xenone (6kv, 10mA) as the FAB gas. Elemental analysis was carried out on a Carlo Erba 1108 analyzer.

Synthesis of 4, 4'-sulfonylbis (2, 6-dichlo/dibromo/diiodo aniline (1a-c)

1] Preparation of 4, 4'-sulfonylbis (2, 6-dichloroaniline)[1a]

4, 4'-sulfonyldianiline (2.48 gm, 0.01 mole) was dissolved in glacial acetic acid (20 ml). Chlorine gas, prepared by the action of HCL on $KMnO_4$ was passed till color of solution changes to pale greenish. Solution was kept at room temperature for 10 min. and then water (20 ml) was added. Solid was filtered, washed with water and crystallized from DMF. Yield 70%, m.p.258-259°C, IR (KBr) cm^{-1}: 3495, 3385 (Ar-NH_2), 1485 (Ar C=C stretch), 1323 (asymmetric-SO_2-stretch), 1165 (symmetric-SO_2-stretch), 873 (Ar-Cl), 605(-SO scissoring); MS (m/z) 386, 320, 303, 284, 269, 249, 208, 176, 160, 124, 90; ^{1}H-NMR (DMSO δ ppm): 6.54-7.79 (s,4H,Ar-H), 2.49-3.34 (s,2H,NH_2), Anal. Calcd. for $C_{12}H_8Cl_4N_2O_2S$: N,7.26, Cl, 36.73., Found : N, 7.35, Cl, 36.86.

2] Preparation of 4, 4'-sulfonylbis (2, 6-dibromoaniline)[1b]

4,4'-sulfonyldianiline (2.48 gm, 0.01 mole) was dissolved in glacial acetic acid (15 ml) and bromine in acetic acid (32ml, 0.01 mole, 20% bromine in acetic acid) was added. The reaction mixture was kept overnight at room temperature. It was diluted with excess of cold water. Solid product was separated. It was filtered, washed with cold water, dried and crystallized from ethyl acetate. Yield 85%, m.p.193-194°C, IR(KBr) cm^{-1}: 3365(Ar-NH_2), 1489 (Ar C=C stretch), 1291 (asymmetric –SO_2- stretch), 1146 (symmetric-SO_2- stretch), 735 (Ar-Br) ,584(-SO scissoring); MS (m/z) 563 (M^+), 487, 407, 372, 327, 307, 289, 273, 154, 137, 107, 89; ^{1}H NMR (DMSO δ ppm): 6.28-7.97 (m, 4H, Ar-H), 3.32(s,2H,NH_2). Anal. Calcd. for $C_{12}H_8Br_4N_2O_2S$: N,4.97, Br,56.68 Found : N, 5.03,Br,56.89.

3] Preparation 4, 4'-sulfonylbis (2, 6-diiodoaniline)[1c]

4,4'-sulfonyldianiline (2.48 gm, 0.01 mole) was dissolved in acetic acid (15 ml) and iodine monochloride (32 ml, 0.01mole, 20% ICl in acetic acid) was added. The reaction mixture was kept overnight at room temperature. It was diluted with cold water. Solid product was separated. It was filtered, washed with cold water, dried and crystallized from DMF. Yield 70%, m.p.207-208°C. IR(KBr) cm^{-1}: 3383 (Ar-NH_2), 1487 (Ar C=C stretch), 1284 (asymmetric –SO_2- stretch), 1145 (symmetric-SO_2- stretch), 831 (Ar-Cl) ,574 (-SO scissoring); MS (m/z); 752 (M+), 625, 501, 436, 375, 342, 310, 282, 249, 136, 107, 77; ^{1}H NMR (DMSO δ ppm): 6.28-7.97 (m, 4H, Ar-H), 3.32(s,2H,NH_2)Anal. Calcd. for $C_{12}H_8I_4N_2O_2S$: N,3.73, I,67.51 Found : N, 3.87,I,67.73.

Preparation of Schiff base by Conventional and MWI method:-

Method I (Conventional method for Compound (2 a-p) [49]

4, 4'- sulfonyldianiline/ 4, 4'-sulfonylbis (2, 6 dichloro/ dibromo / diiodoaniline) (0.01 mol) and hydroxy halo substituted aromatic aldehyde (0.02 mol) was dissolved in 20 ml of methanol/DMF respectively; in this solution mixture one to two drops of conc. HCl was added. The reaction mixture was refluxed for 15 min.-360 minutes. The reaction mixture was then poured into crushed ice. Separated solid was filtered, dried and crystallized from DMF and water to gave 4,4'-bis (2 hydroxy , substituted ,benzylidene amine) diphenyl sulphone/ 4,4'-bis (2 hydroxy, substituted ,benzylidene amine) 2,6 dichlo/dibromo/diiodo di phenyl sulphone. The reaction was monitored by TLC. The physico-chemical data for synthesized Schiff base are given in Table 1.

Method II (Microwave method for Compound (2 a-p)

4,4'-sulfonyldianiline/ various 4,4'-sulfonylbis(2,6-dihaloaniline) (0.01 mol) and halo substituted aromatic aldehyde (0.02 mol) was dissolved in 20 ml of ethanol/DMF in a 100 ml Pyrex conical flask capped with glass funnel. The flask was irradiated in a Qpro-M Modified Microwave System (200w) for about 10 sec.-320sec. by giving a short interval for cooling and to avoid solvent evaporation. After completion of reaction i.e. after 10 sec.-320sec., flask was cooled in ice water. It was then diluted with ice-cold water. The schiff bases formed was filtered, dried and crystallized from DMF.

Following the same procedure, compound **2a-p** was prepared. The characterizations data of **2a-p** are recorded in table 1.

Characterization data of compounds:

1] 4, 4'-bis (2- hydroxybenzylidene amine) diphenyl sulphone [2a].

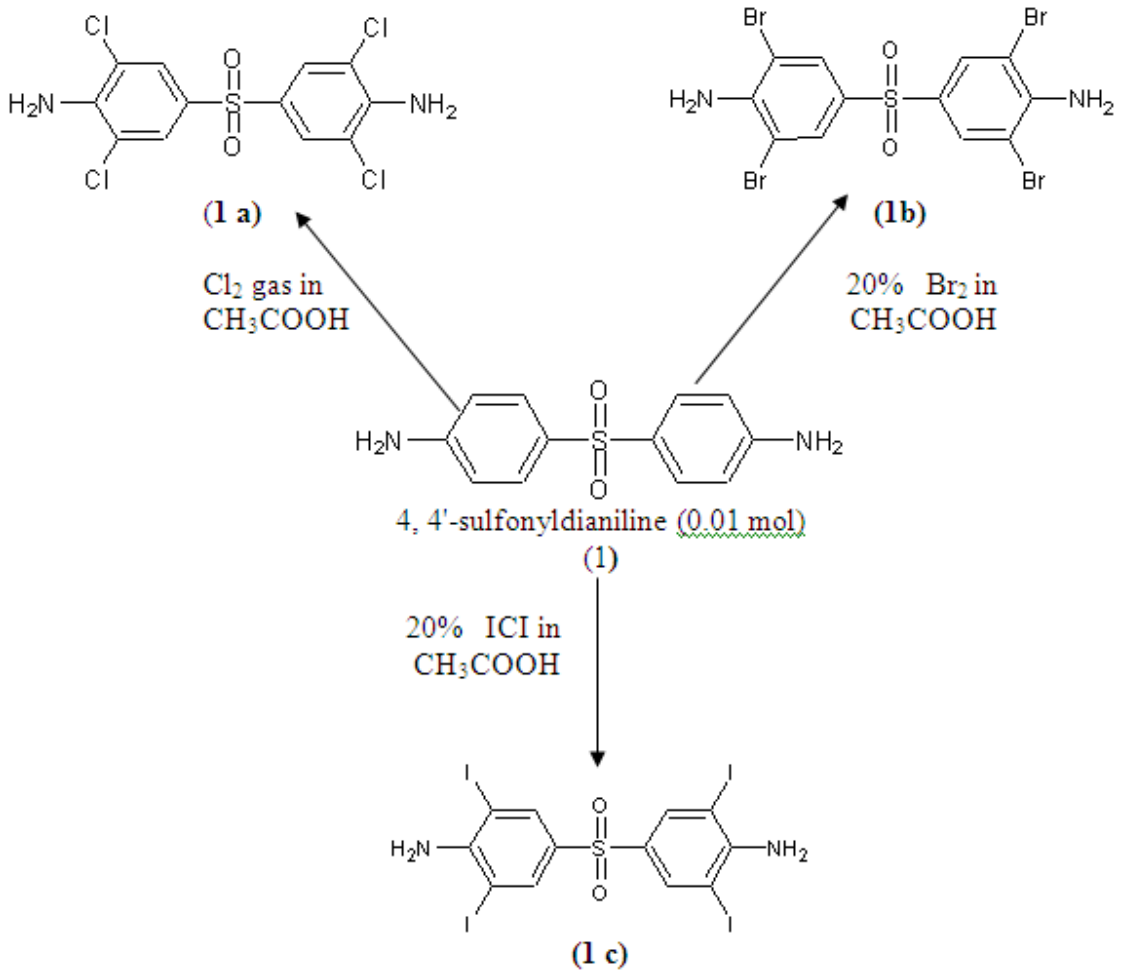
IR (KBr) cm $^{-1}$: 3366.9 (Ar-OH), 3000 –3100(Ar C-H stretch), 1617-1676.3 (-N=CH)1485.8-1567.6 (Ar C=C stretch), 1281.8 (asymmetric $-SO_2-$ stretch), 1152.5 (symmetric $-SO_2-$ stretch), 834.7(2 adjacent H on Ar-ring), 606.4 (-SO scissoring); MS: (m/z) at 457(M^+).Other fragment observed at 456,443,391,307,289,167,154,136,107 and 89; ^{1}H-NMR (DMSO δ ppm):12.36(s, Ar-OH),8.93(s,1H,-N=CH-),6.55-8.05(Ar-H).

2] 4, 4'-bis (2- hydroxy-5 chlorobenzylidene amine) diphenyl sulphone [2b].

IR (KBr) cm $^{-1}$: 3370.8 (Ar-OH), 3000 –3100(Ar C-H stretch), 1582.0-1612.3 (-N=CH)1443 (Ar C=C stretch), 1285.3 (asymmetric $-SO_2-$ stretch), 1153.1 (symmetric $-SO_2-$ stretch), 860 (2 adjacent H on Ar-ring), 741(C-Cl),643 (-SO scissoring); MS: (m/z) at 525(M^{-10}) 515.Other fragment observed at 456,443,391,307,289,167,154,136,107 and 89; ^{1}H-NMR (DMSO δ ppm):12.36(s, Ar-OH),8.93(s,1H,-N=CH-) 6.16-8.05(m,14H,Ar-H).

3] 4, 4'-bis (2- hydroxy-3, 5 -dibromobenzylidene amine) diphenyl sulphone [2c].

IR (KBr) cm $^{-1}$: 3351 (Ar-OH), 3072 (Ar C-H stretch), 1587.6-1616.9 (-N=CH) 1477-1563 (Ar C=C stretch), 1275.0 (asymmetric $-SO_2-$ stretch), 1150.8 (symmetric $-SO_2-$ stretch), 831.9 (2 adjacent H on Ar-ring), 664 (-SO scissoring), 546 (C-Br); MS: (m/z) at 773(M^+).Other fragment observed at 635, 594, 585, 561, 525, 387,307,289,249,154,136,and 89 ; ^{1}H-NMR (DMSO δ ppm):12.34(s,Ar-OH) 8.99 (s,1H,-N=CH-) 6.55-8.05(m,12H, Ar-H).



Scheme 1: Synthesis of halogenated Dapsone (1a-c)

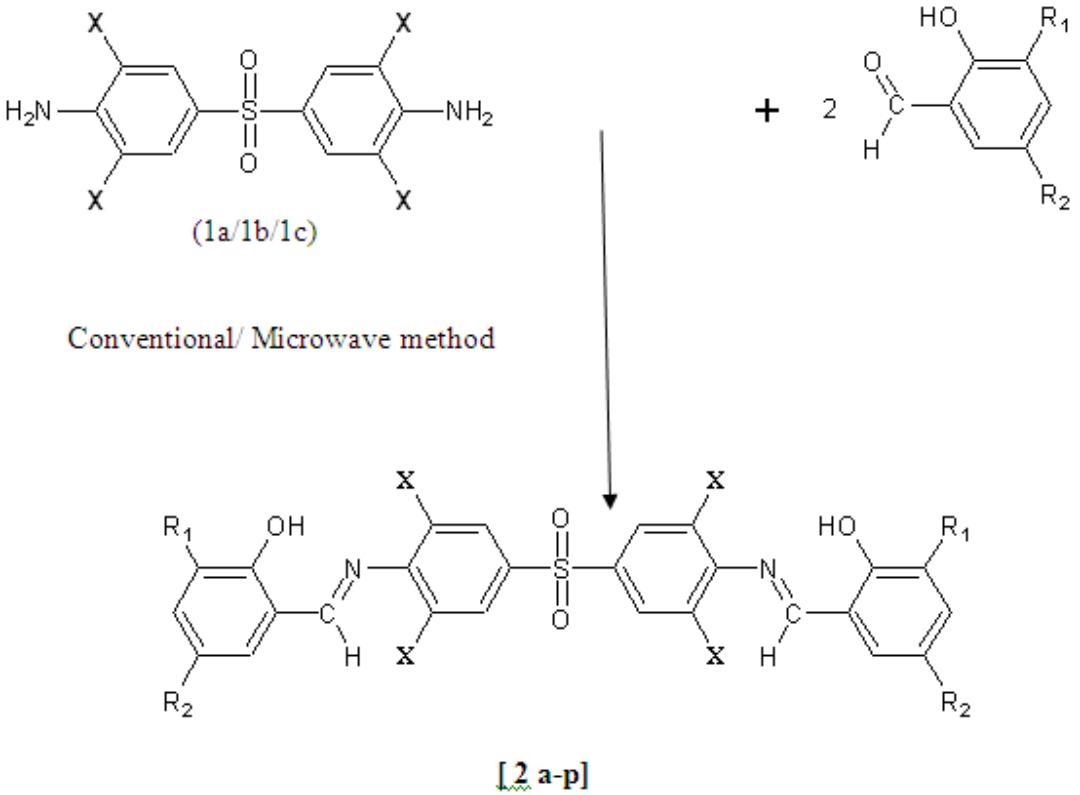
4] 4, 4'-bis (2 -hydroxy-3, 5 -diiodo, benzylidene amine) diphenyl sulphone [2d].
IR (KBr) cm $^{-1}$: 3352 (Ar-OH), 3072 (Ar C-H stretch), 1587.7-1616.9 (-N=CH) 1477-1563 (Ar C=C stretch), 1275.0 (asymmetric –SO_2- stretch), 1150.8 (symmetric –SO_2- stretch), 831.9 (2 adjacent H on Ar-ring), 664 (-SO scissoring), MS: (m/z) at 960(M^+).; ^{1}H-NMR (DMSO δ ppm):12.23(s,Ar-OH) 8.89 (s,1H,-N=CH-) 5.95-8.06(m,12H, Ar-H).

5] 4, 4'-bis (2- hydroxybenzylidene amine) 2, 6-dichloro-diphenyl sulphone[2e].
MS: (m/z) at 594(M^+), Other fragment observed at 547, 524, 496, 404, 353, 278, 233, 149, 69 and 46; ^{1}H-NMR (DMSO δ ppm):12.36(s, Ar-OH), 8.93(s, 1H,-N=CH-), 7.79 (s, 4H,Ar-H), 6.55-8.05(Ar-H).

6] 4, 4'-bis (2- hydroxy-5chlorobenzylidene amine) 2,6-dichloro-diphenyl sulphone[2f].
MS: (m/z) at 664(M^+), 579, 409, 387, 353, 310, 265, 151, 82, 46

7]4,4'-bis(2- hydroxyl-3,5-dibromobenzylidene amine) 2,6- dichloro-diphenyl sulphone[2g].
IR (KBr) cm $^{-1}$: 3386.18 (Ar-OH), 3068 (Ar C-H stretch), 1612.54 (-N=CH) 1477-1563 (Ar C=C stretch), 1275.0 (asymmetric $-SO_2-$ stretch), 1159.26 (symmetric $-SO_2-$ stretch), MS: (m/z) at 911(M^+),865,680,599,515,491,457,409,220,186,141,74,46

8] 4, 4'-bis (2 -hydroxy-3,5-diiodobenzylidene amine) 2,6-dichloro-diphenyl sulphone[2h].
IR (KBr) cm $^{-1}$: 3385.18 (Ar-OH), 3070.78 (Ar C-H stretch), 1627 (-N=CH) 1483 (Ar C=C stretch), 1275.0 (asymmetric $-SO_2-$ stretch), 1159.26 (symmetric $-SO_2-$ stretch), 663.53 (-SO scissoring), MS: (m/z) at 1097(M^+).; ^{1}H-NMR (DMSO δ ppm):12.43(s,Ar-OH) 8.17-8.79 (s,1H,-N=CH-) 6.31-7.94(m,8H, Ar-H).



Scheme 2: Synthesis of Schiff base from 4,4'-sulfonyldianiline

9] 4, 4'-bis (2- hydroxybenzylidene amine) 2, 6-dibromo-diphenyl sulphone[2i].
MS: (m/z) at 773(M^+),759,637,502,429,353,301,172116,74,58.

10]4, 4'-bis (2- hydroxy-5chlorobenzylidene amine) 2,6- dibromo-diphenyl sulphone[2j].
MS: (m/z),840(M^{-1})at 839,835,755, 509,310,265,116,74.;^{1}H-NMR (DMSO δ ppm): 12.46(Ar-OH),10.23(C=N-),6.26-8.67(6H,Ar-H),

15] 4, 4'-bis (2- hydroxyl-3,5-dibromobenzylidene amine) 2,6-didiiodo-diphenyl sulphone
IR(KBr) cm $^{-1}$: 3367.82(Ar-OH), 1487.17 (Ar C=C stretch), 1618.33-1654.98 (C=N-),1274.99 (asymmetric $-SO_2-$ stretch), 1147.68 (symmetric $-SO_2-$ stretch); MS (m/z); 1275(M^+),

1279(M^++4)),1177, 1153, 1037, 897, 639,318,175,141,74;^{1}H NMR (DMSO δ ppm): 12.35 (Ar-OH),10.23(C=N-),6.30- 8.81 (m, 4H, Ar-H),

Table 1. - Characterization and Comparison of conventional and microwave synthesis of compound 2a-p

Compd. No.	X	R1	R2	M.P. (^{0}c)	Yield(%) (Time) Method I	Yield(%) (Time) Method II	Molecular formula	Elemental Analysis % Calculated (Found)		
								C	H	N
2a	H	H	H	253	75 (10 min)	92(10 Sec.)	$C_{26}H_{20}N_2O_4S$	68.41(68.29)	4.42 (4.31)	6.14(6.04)
2b	H	H	Cl	296	81 (15 min)	91(20 Sec.)	$C_{26}H_{18}N_2O_4SCl_2$	59.44(59.21)	3.45(3.24)	5.33(5.11)
2c	H	Br	Br	281	78 (15 min)	90(20 Sec.)	$C_{26}H_{16}N_2O_4SBr_4$	40.45(40.18)	2.09(2.02)	3.63(3.39)
2d	H	I	I	285	75 (15 min)	93(20 Sec.)	$C_{26}H_{16}N_2O_4SI_4$	32.53(32.29)	1.68(1.44)	2.92(2.74)
2e	Cl	H	H	261	70 (270 min)	78(240 Sec.)	$C_{26}H_{16}N_2O_4SCl_4$	52.55(52.46)	2.71(2.60)	4.71(4.59)
2f	Cl	H	Cl	249	74 (210 min)	79(200 Sec.)	$C_{26}H_{14}N_2O_4SCl_6$	47.09(46.91)	2.13(1.97)	4.22(4.03)
2g	Cl	Br	Br	231	70 (200 min)	80(210 Sec.)	$C_{26}H_{12}N_2O_4SCl_4Br_4$	34.32(34.19)	1.33(1.22)	3.08(2.89)
2h	Cl	I	I	252	81 (240 min)	80(180Sec.)	$C_{26}H_{12}N_2O_4SCl_4I_4$	28.44(28.13)	1.10(1.01)	2.55(2.41)
2i	Br	H	H	296	68 (260 min)	85(220 Sec.)	$C_{26}H_{16}N_2O_4SBr_4$	40.45(40.53)	2.09(2.21)	3.63(3.74)
2j	Br	H	Cl	228	75 (320 min)	86(320 Sec.)	$C_{26}H_{14}N_2O_4SBr_4Cl_2$	37.13(37.25)	1.68(1.78)	3.33(3.46)
2k	Br	Br	Br	200	64 (270 min)	76(280Sec.)	$C_{26}H_{12}N_2O_4SBr_8$	28.71(28.63)	1.11(1.01)	2.58(2.42)
2l	Br	I	I	312	73 (330 min)	80(320Sec.)	$C_{26}H_{12}N_2O_4SBr_4I_4$	24.48(24.62)	0.95(1.03)	2.20(2.38)
2m	I	H	H	232	75 (290 min)	89(320 Sec.)	$C_{26}H_{16}N_2O_4SI_4$	32.53(32.39)	1.68(1.50)	2.92(2.81)
2n	I	H	Cl	250	67 (300 min)	78(310 Sec.)	$C_{26}H_{14}N_2O_4SI_4Cl_2$	30.35(30.19)	1.37(1.22)	2.72(2.64)
2o	I	Br	Br	225	72 (360 min)	82(320 Sec.)	$C_{26}H_{12}N_2O_4SI_4Br_4$	24.48(24.57)	0.95(1.02)	2.20(2.43)
2p	I	I	I	205	65 (340 min)	70(320 Sec.)	$C_{26}H_{12}N_2O_4SI_6$	21.34(21.46)	0.83(0.94)	1.91(1.96)

Table 2:-Antimicrobial activity data of synthesized compound 2a-p.

Compound No.	Zone of inhibition in mm							
	Gram negative bacteria				Gram positive bacteria			
	E. coli		*P.aeruginosa*		*S. aureus*		*B. subtilis*	
	50µg	100 µg	50 µg	100 µg	50µg	100 µg	50µg	100 µg
2a	-ve	-ve	09	14	05	10	08	12
2b	08	12	11	19	09	18	09	19
2c	09	19	13	17	14	20	15	23
2d	11	20	13	20	12	18	11	19
2e	13	19	11	16	10	17	12	18
2f	12	17	12	17	12	22	08	20
2g	13	18	13	19	13	18	11	20
2h	12	21	08	14	16	27	10	18
2i	14	22	14	23	12	21	09	16
2j	-ve	-ve	07	13	04	21	06	11
2k	12	21	10	20	11	20	12	21
2l	13	23	11	20	12	21	15	20
2m	09	12	10	19	15	21	10	16
2n	14	24	15	25	15	20	15	24
2o	10	18	14	21	13	23	14	23
2p	18	25	12	20	14	24	16	23
Ampicilline	16	24	17	24	15	25	16	22
DMF (Control)	-	-	-	-	-	-	-	-

-ve indicate no zone of inhibition,

RESULTS AND DISCUSSION

In this present work, prepared Schiff bases (**2a-p),** the reaction of 4,4'-sulfonyldianiline (1) / 4,4'-sulfonylbis(2,6 dichlo/dibromo/diiodo dianiline) (1a,1b,1c) with various hyroxy halo substituted aromatic benzaldehyde under microwave assisted technique as well as conventional heating method were studied (Scheme2). The precursor, 4,4'-sulfonylbis(2,6- dichlo (1a)/ dibromo(1b)/ diiodo(1c) dianiline) ,were first time prepared by direct chlorination(by passing chlorine gas), bromination and iodination (by 20% bromine and iodine monochloride in acetic acid) respectively (Scheme 1). All the reactions under microwave irradiation were completed within 10 sec.-320 sec, whereas similar reactions under conventional heating (steam bath) at refluxed temperature gave poor yields with comparatively longer reaction time periods i.e. 10 min-360 minutes. The impact of microwave irradiation and conventional heating for the synthesis of compound **2a-p** has been compared. Moreover, the % yield and time on the reaction were also studied and the results summarized in (Table 1).

All the compounds synthesized were adequately characterized by their elemental analyses and spectral IR,^{1}H-NMR and Mass data. All the structures of the above compounds were in good agreement with spectral and analytical data**.** The IR spectra of Schiff bases (**2a-p**) Showed absorption band in the region of 1587-1676 cm-1 (N=CH), 3300-3390 cm-1 (2'-OH). 606.4 - 700(-SO scissoring), 1260-1290 (asym.-SO_2- stretch), 1150-1160 (sym. -SO_2- stretch), The ^{1}H NMR spectra further supported for their structure and showed singlet at near δ 8.17-8.99 and also showed singlet in the region δ 12.20-13.15 due to ortho hydroxyl group, multiplet in the region δ 6.16-8.05 due to aromatic protons.

All the newly synthesized compounds were evaluated for *in vitro* antibacterial activity. The results are showed in Table-2. It has been observed that compounds 2c, 2h, 2n, 2o and 2p indicated better activity than standard Ampicilline. The remaining compounds were moderate to significant activity compare to the reference drug.

Anti-microbial screening

All the compounds **2a-p** was screened only for their *in vitro* anti-bacterial activity. The antibacterial activity of the synthesized compounds were tested against two Gram positive bacteria (*Bacillus Subtillies* and *Staphycoccus aureus*) and two Gram negative bacteria (*E.Coli* and *Pseudomonas aeruginosa*) at a concentration of 50μg/ml and 100μg/ml using DMF as a solvent for the comp 2a-p. The antimicrobial activity was assayed by using the cup-plate agar diffusion method[50-52] by measuring the inhibition zone in mm. Ampicilline was used as standard drug at a concentration of 50μg/ml and 100μg/ml. Nutrient agar was used as culture media for antibacterial activity. DMF was used as a diluent which not effected the growth of microbes. The results of the antimicrobial activity are shown in Table 2.

CONCLUSION

The preparation procedure follow in this work for the synthesis of schiff base offers reduction in the reaction time, excellent yields with without formation of undesirable side products, operation simplicity, cleaner reaction and easy work-up. All spectroscopic analysis confirmed

the proposed structures for these compounds.From data of antimicrobial activity, it Could be observed that compounds of the series, **2a-p** showing comparable and potent activity against standard drugs.

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