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ORIGINAL ARTICLE

SYNTHESIS, CHARACTERIZATION, BIOLOGICAL EVALUATION AND ANTI–CORROSION ACTIVITY OF PIPERIDIN-4-ONE DERIVATIVES

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ABSTRACT: 4-Thiazolidinone has been prepared by the reaction of various Schiff bases (2,4) with thioglycolic acid in presence of anhydrous zinc chloride and solvent N,N-Dimethyl formamide to afforded novel componds of 4-thiazolidinone (3,5), The intermediate Schiff base were synthesized by the condensation of 2,6-bis (m-chloro phenyl) 3,5-dimethyl-4-piperidone-4 (1) with 4,4'-diaminodiphenylsulphone (2) and 4-methylbenzene -1,3-diamine (4) The structure of all the synthesized compounds were elucidated by spectral (IR,^{1}H-NMR,^{13}C-NMR and Mass) and elemental (C,H,N) analysis. All the synthesized compounds have been screened for their antibacterial properties against various bacterial strains in order to obtain chemotherapeutic properties and these compounds were tested to determine their ability to inhibit corrosion of mild steel in 1 mol.l^{-1}H_2SO_4 and measured by polarization measurements. The studies revealed that nitrogen, the piperidine moiety, the phenyl ring, 4-thiazolidinone assist largely in corrosion control.

KEYWORDS: Piperidin-4-One, 4-Methylbenzene -1,3-Diamine, Schiff Bases, Antibacterial, Anticorrosion.

INTRODUCTION

Substituted piperidin-4-ones are important synthetic intermediates for the preparation of various alkaloids and pharmaceuticals (Angle and Breitenbucher, 1995). The piperidine nucleus can also be frequently recognized in the structure of numerous naturally occurring alkaloid and synthetic compounds with interesting biological and pharmacological properties. Many piperidine derivatives are found possessing pharmacological activities like anesthetic activity and antimicrobial activity (Perumal *et al.*, 2001). As a consequence the development of general methods for the synthesis of piperidine derivatives (figure 1) has been the subject of considerable synthetic effort (Lednicer, 1980). Dapsone (4,4'-diaminodiphenyl sulphone), a sulphone analog has been proved to be a powerful antimicrobial agent (Lednicer, 1980). Schiff bases are used as substrates in the preparation of a number of industrial and biologically active compounds via closure, cycloaddition and replacement reactions. Moreover, Schiff bases are also known to have biological activities such as antimicrobial, antifungal, antitumor, and as herbicides (Jarrahpour *et al.*, 2007). Schiff bases have also been employed as ligands for complexation of metal ions (Al-Sha'alan, 2007). On the industrial scale, they have a wide range of applications such as dyes and pigments (Toggi et al., 2002).

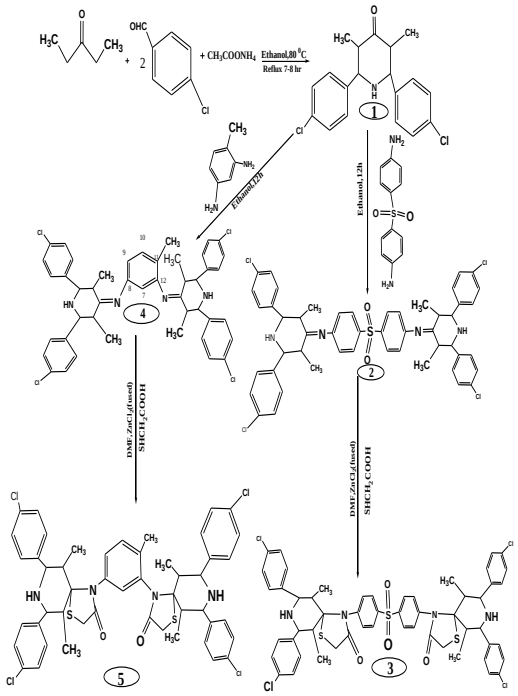

Figure 1: Synthetic schemes for synthesis of piperidone derivatives

4-Thiazolidinone ring are reported to possess various biological, anti-inflammatory, antiviral, antiparasitic and antituberculosis (Vigoritaa *et al.*, 2001; Nair and Shah, 2007; Mishra *et al.*, 2007). 4-thiazolidinone give good pharmacological properties (Yadav *et al.*, 2003) are known to exhibit antitubercular (Desai and

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Desai, 1994), antibacterial (Fadayon *et al.,* 1993), anticonvulsant (Srivastava *et al.,* 1999), and antifungal activity (Bhatt *et al.,* 1994). Many work has been carried out on 4-thiazolidinone but no information is available about 4-thiazolidinone bearing piperidone moiety. An essential component of the search for new leads in a drug designing program is the synthesis of molecules, which are novel yet resemble known biologically active molecules by virtue of the presence of some critical structural features. Certain small heterocyclic molecules act as highly functionalized scaffolds and are known pharmacophores of number of biologically active and medicinally useful molecules (Silverman, 1992). In the interest of above, we planned to synthesize a system which combines these two bioavailable components together to give a compact structure like title compounds. Several Schiff bases have recently been investigated as corrosion inhibitors for various metal and alloys in acid media (Behpour *et al.,* 2008; Bouklah *et al.,* 2006). These substances generally become effective by adsorption on metal surface. The adsorbed species protect the metal from the aggressive medium, which causes decomposition of the metal. Adsorption depends on to only the nature and charge of the metal but also on the chemical structure of the inhibitor. In this work, the inhibiting action of two Schiff base compounds and their derivative on the corrosion steel in 1M H_2SO4 solution has been investigated. The electrochemical techniques such as polarization measurements were used in this study. Differences in behavior of inhibitors were explained based on structural properties of investigated inhibitors.

MATERIAL AND METHODS

The course of reaction and the purity were ascertained by performing TLC. Melting points (M.P) of the compounds were determined in open capillaries and are uncorrected. IR spectra were recorded in perkin-Elmer 297 spectrophotometer with KBr pellets and only noteworthy absorption levels (reciprocal centimeter) are listed. Mass spectra were recorded on Avg analytical 7070E instrument equipped with VG 11-250data acquisition system. Elemental analysis (C,H and N) were carried out on aCarlo Erba Model 1106 and Perkin Elmer models 240 CHN analyzer.

^1H,^{13}C-NMR Spectra were recorded at 400MHz spectrophotometer in $CDCl_3$. Unless otherwise stated, all the starting materials and reagents were of high grade, purchased from Aldrich, Fluka and Merck. All the solvents were distilled prior to use.

2.1. General synthesis procedure for compound (1-5)

2.1.1. Synthesis of 2,6-bis (m-chloro phenyl) 3,5-dimethyl-4-piperidone-4(1)

Pentanone-3 (8.6ml, 0.1mol), chlorobenzaldehyde (28gr, 0.2mol) and ammonium acetate (7.7gr, 0.1mol) were taken in a500 ml round bottom flask. Further ethanol (25ml) was added to the flask and mixed well, so as to make a homogenous mixture. Then this mixture was refluxed at 80 ^{0}C for 7-8 hr. Once the reaction was completed, the mixture was poured over cooled ice. The crude product obtained was filtered and the solid product was collected and washed with cold water. Then which was dried at room temperature and recrystallized with ethanol.

IR: 3326.06cm^{-1}(NH), 2970.45cm^{-1}(CH_2Asymmetric), 2887.13cm^{-1}(CH_2symmetric), 1702.34cm^{-1}(C=O), 1491.06cm^{-1}(C-CStretching (phenyl ring), 1087.27cm^{-1}, 826.61 cm^{-1}(=C-H Ar OOP 1,4- disubstituted), 518.32 cm^{-1} (C-Cl Stretching).

LC-MS: 348(100%), 333(26.92%), 319(21.79%), 312(25.64%), 303(6.41%), 288(15.38%), 275(12.82%), 261(8.97%), 181(5.12%), 166(1.26%).

^{1}H-NMR:($CDCl_3$): 0.843(d,6H,2$\underline{CH_3}$-CH,J=4.02HZ), 2.04(s,H,NH), 2.73(m,2H,2$\underline{CH}$-CH_3,$^3J_{CHCH3}$=7.68HZ,$^3J_{CH(3)CH(2)}$=6.22HZ), 3.61(d,2H,$\underline{CH}$-NH,^{3}J=10.97HZ), 7.32(d,4H,4CH(Ar),^{3}J=8.05H$_Z$), 7.39(d,4H,4 CH(Ar).

^{13}C-NMR ($CDCl_3$): 10.52 (2C,2$\underline{CH_3}$-CH), 52.07(2C,2CH_3-$\underline{CH}$), 68.14(2C,NH-$\underline{CH}$-Ar), 76.82, 77.14, 77.46($CDCL_3$), 128.83(C-2',C-2'',C-6',C-6''), 129.13(C-3',C-3'',C-5', C-5''), 133.78(C-4',C-4''), 140(C-1',C-1'',Ar), 210.30(C=O).

Elemental analysis: for $C_{19}H_{19}$ Cl_2NO

Calculated: C:(65.53%), H:(5.50), Cl:(20.36%), N:(4.02%), O:(4.59%).

Found: C:(65.63%, H:(4.50%), Cl:(21.45%), N:(3.95%), O:(4.47%).

2.1.2. Synthesis of 4,4'-bis [N-(3,5-(dimethyl)-2,6-bis (4-chlorophenyl) -piperidin-4-ylidene) aniline] sulphone (2)

To a mixture of 4,4'-diaminodiphenylsulphone (2.48gr,0.01mol) and 2,6-bis (m-chlorophenyl) 3.5-dimethyl-4-piperidone-4 (3.48gr, 0.01 mol) dissolved in ethanol, one drop of concentrated sulphuric acid was added. The reaction mixture was refluxed for 12 h. The reaction mixture was then poured into crushed ice, Separated solid was filtered dried and recrystallized from ethanol, and the reaction was monitored by TLC.

IR: 2979.79 cm^{-1} (C=C Stretching phenyl), 1626.36 Cm^{-1}(C=N), 1484.43 cm^{-1}(C-C Phenyl

ring Stretching), 1269.29 cm^{-1}(asymmetric $-SO_2$-Stretch), 1152.94 cm^{-1} (symmetric $-SO_2$-Stretch).
LC-MS: 910(M+2), 908, 755, 614, 524, 409, 382(100%), 304, 305, 198, 143, 103.
^{1}H-NMR:(DMSO): (δ/ppm)0.80((d,2$\underline{CH_3}$-CH), 2.33(m,4H,4$\underline{CH}$-CH_3), 3.90(d,4H,4$\underline{CH}$-NH), 7.14(d,4H,CH-Arsulfon,^{3}J=8.96Hz), 7.30,7.32(d,8H,8$\underline{CH}$-Ar,^{3}J=7.68Hz), 7.38, 7.40(d,8H,8CH-Ar ,^{3}J=7.68Hz), 7.97 (d,4H,$\underline{CH}$-Ar sulfon,^{3}J=8.96 Hz).
^{13}C-NMR: **(DMSO): (δ/ppm):** 10.8(4C,4$\underline{CH_3}$-CH), 39.5(4C,4CH_3-$\underline{CH}$), 70.3(4C,4$\underline{CH}$-NH), 188.2(2C,2C=N), 128.9, 129.5, 131.6, 138(24C,Ar), 123.3, 129.6, 139.9, 154(12C,Ar-sulfonyl).
Elemental analysis: for $C_{50}H_{46}Cl_4SO_2$
Calculated: C:(66.08%), H:(5.10), Cl:(15.60%), N:(6.16%), O:(3.52%), S:(3.53).
Found: C:(65.64%), H:(5.45%), Cl:(14.95%), N:(7.58%), O:(2.95%), S:(3.43%).

2.1.3. Synthesis of 4,4'-bis[4(4-chlorophenyl)-(6,10-dimethyl-3-oxo-1-thio-4,8-diazaspero [4,5] decyl)- phenyl] solfone (3)
A mixture of Schiff bases (2.27gr, 0.0025 mol²), DMF (15ml) and thioglycolic acid (0.46ml, 0.005 mol) was taken in round bottom flask. Small amount of fused $ZnCl_2$ (200 mg) was added in reaction mixture. The contents of round bottom flask refluxed for five hours, cooled and poured on crushed ice. Thus, the product obtained was filtered, washed with water and recrystallized from DMF.

IR: 3270.11 Cm^{-1}(NH Stretching) 2979.64 Cm^{-1}(CH_2 asymmetric), 1665.62 Cm^{-1} (C=O Stretching Five membered cyclic amido), 1563.65 Cm^{-1}(C-C Stretching phenyl ring), 1402.65Cm^{-1}, 1221.42Cm^{-1}, 1105.05Cm^{-1}(Symmetric–SO_2-)1091.55Cm^{-1}, 1014.74Cm^{-1}, 699.95Cm^{-1}.
LC-MS: (M^+, 1057), 1056, 1049, 1048, 1043, 1038, 1036, 1029, 1028, 1021, 1019, 1014, 1011, 1008.
^{1}H-NMR: (DMSO): (δ/ppm) 0.817(d,2CH_3,6H,J=6.22Hz), 2.77(m,4H,4$\underline{CH}$-CH_3,$^3J_{CHCH3}$=7.50Hz,$^3J_{CH(3)CH(2}$=6.40HZ), 2.85 (s,2H,$\underline{CH_2}$-S), 2.94(s,2H,CH_2-S), 3.64 (d,4H,4$\underline{CH}$-NH,$^3J_{CH(2)CH(3)}$=10.42H_Z), 3.89(s,H,NH), 4.89 (s,H,NH), 7.16(d,4H,CH-Ar sulfon,^{3}J=8.96Hz), 7.29, 7.31 (d,8H,8$\underline{CH}$-Ar,^{3}J=7.68Hz), 7.37, 7.39 (d,8H,8CH-Ar ,^{3}J=7.68Hz), 7.95 (d,4H,$\underline{CH}$-Ar sulfon,^{3}J=8.96 Hz).
^{13}C-NMR(DMSO): 10.47(4C,4CH_3-CH), 36.68 (2C,2CH_2-S), 45.26(4C,2C-3,2C-5), 67.91(4C,2C-2,2C-6), 77.15(CDCl3), 86.26(2C,N-$\underline{C}$-S), 26.79(4C,4CH(Arsulfon,128.10,128.54(2C-2',2C-2'',2C-6',2C-6''), 128.90(2C-3',2C-3'',2C-5',2C-5''), 129.09(4C,4$\underline{CH}$-SO_2), 130.90(2C,2C-4',2C4''), 133.78 (2C,2C-So2), 138.43 (2C-1',2C-1''), 139.85 (2C,Sulfonyl-Ar-2C-N), 175.67 (2C,2C=O).
Elemental analysis: for $C_{54}H_{50}Cl_4N_4O_4S_3$
Calculated: C:(61.36%), H:(4.77%), N:(5.30%), S:(9.10%).
Found: C:(60.16%), H:(4.07%), N:(4.90%), S:(10.10%).

2.1.4. Synthesis of 4,4'-bis [N-(3,5-(dimethyl)-2,6-bis (4-chlorophenyl)-piperidin-4-ylidene)-5-methylbenzene-1,3-diamine (4)
To a mixture of 5-methylbenzene-1,3-diamine (1.22gr,0.01mol) and 2,6-bis (m-chlorophenyl) 3.5-dimethyl-4-piperidone-4 (3.48gr,0.01 mol) dissolved in ethanol, one drop of concentrated sulphuric acid was added. The reaction mixture was refluxed for 12 h. The reaction mixture was then poured into crushed ice, Separated solid was filtered dried and recrystallized from ethanol, and the reaction was monitored by TLC.
IR: 2932.80Cm^{-1} (CH_2 asymmetric), 1666.35Cm^{-1}(C=N), 1631.76Cm^{-1}, 1484.35Cm^{-1}(Ar C=C Stretch), 1452.32Cm^{-1}(CH_2 Scissoring), 1383.38Cm^{-1}(CH_2 Wagging), 1241.91 Cm^{-1}1157.52 Cm^{-1}943.66 Cm^{-1}(N-H Wagging), 752.04Cm^{-1} (C-Cl)
LC-MS:782.67(6.94%), 768(M-CH_3,12.5%), 743(18.05%), 680(23.61%), 663 (11.11%), 635(19.44%), 591(20.83%), 531(20.83%), 503(23.611%), 482(90.27%), 424($C_{25}H_{24}N_2Cl_2$,100%), 407(36.11%), 379(5.55%), 333(2.77%), 285(58.33%,$C_{17}H_{24}N_4$), 245(8.33%), 189(9.72%), 137(1.2%), 122(0.22%), 78(0.12).
^{13}C-NMR:($CDCl_3$): 16.77(4C,4$\underline{CH_3}$-CH), 18.08(1C,$\underline{CH_3}$-Ar), 45.76(4C,4$\underline{CH}$-CH_3), 72.08(4C,4$\underline{CH}$-NH), 118.52(1C,C-7,Ar-(diamino methyl benzene), 128.73(2C-2',2C-5',2C-2'',2C-5'',C-9), 131.08(2C-3',2C-3'',2C-5',2C-5''), 131.36(C-11), 132.35(C-10), 141.41(C-4',C-4''), 143.47(C-1',C-1''), 143.96 (C-8,C-12), 181.2(2C,2C=N).
^{1}H-NMR: 0.91(d,6H,2CH-$\underline{CH_3}$), 1.98(m,2H,2$\underline{CH}$-CH_3), 2.34(s,3H,$\underline{CH_3}$-Ar), 3.36(d,2H,2$\underline{CH}$-NH), 6.83-6.87(s,3H,Ar), 7.44-7.48(m,16H,Ar).
Elemental analysis: for $C_{49}H_{48}N_4O_2Cl_4S_2$
Calculated: C:(69.06%), H:(5.67%), N:(7.16%), Cl:(18.12%)
Found: C:(68.99%), H:(5.5 9%), N:(7.06%), Cl:(18.36%)

2.1.5. Synthesis of 7,9-bis[4(4-chlorophenyl)-6,10-dimethyl-3-oxo-1-thio-4,8-diazaspiro[4.5]decyl-4)-5-methylphenyl)-7,9-bis(4-chlorophenyl)-6,10-dimethyl-1-thia-4,8-diazaspiro[4.5]decan-3-one (5)

A mixture of Schiff bases ((1.956gr, 0.0025mol **4**), DMF (15ml) and thioglycolic acid (0.46ml, 0.005 mol) was taken in round bottom flask. Small amount of fused $ZnCl_2$ (200 mg) was added in reaction mixture. The contents of round bottom flask refluxed for five hours, cooled and poured on crushed ice. Thus, the product obtained was filtered, washed with water and recrystallized from DMF.

IR: 3210.11 Cm^{-1}(NH Stretching) 2980.64 Cm^{-1}(CH_2 asymmetric), 1650.62 Cm^{-1} (C=O Stretching Five membered cyclic amido), 1563.65 Cm^{-1}(C-C Stretching phenyl ring), 1402.65Cm^{-1}, 1221.42Cm^{-1}, 1091.55Cm^{-1}, 1014.74Cm^{-1}, 699.95Cm^{-1}.

LC-MS: 930,874(3.89%), 854(6.49%), 840(5.19%), 796(11.68%), 768(10.38%), 744(24.67%), 708(14.28%), 679(24.67%), 636(22.07%), 591(23.37%), 575(25.97%), 525($C_{29}H_{30}Cl_2N_2O_S$31.16%), 492(68.83%), 459($C_{25}H_{34}N_2O_2S_2$(33.46%), 424(100%), 389(53.24%), 378($C_{19}H_{19}Cl_2N_2S$(51.94%), 361(38.96%), 350[M-)$C_{32}H_{26}N_2$], 345 (10.38%).

^{1}H-NMR: (DMSO): 1.92(s,3H,$\underline{CH_3}$-Ar), 2.66(d,12H,4$\underline{CH_3}$-CH), 2.71(s,H, NH), 2.79(s,1H,NH), 2.87 (m,4H,4CH_3-$\underline{CH}$), 3.34(s,4H,2N-C=O-$\underline{CH_2}$-S), 5.54(d,4H,4$\underline{CH}$-NH), 6.85(s,1H,CHAr(methyldiaminobenzene), 7.44 (d,8H,8CH(Ar)), 7.65(d,8H, 8CH (Ar)), 7.94(d,1H,$\underline{CH}$ Ar (methyl diamino benzene), 8.28(d,1H,$\underline{CH}$ Ar (methyl diamino benzene).

^{13}C-NMR(DMSO): 11.10(1C,$\underline{CH_3}$-Ar), 18.09(4C,4$\underline{CH_3}$-CH), 31.41(2C,2C=O-$\underline{CH_2}$-S), 39.84(DMSO), 46.61(4C,2C-3,2C-5), 67.61(4C,2C-2,2C-6), 89.931(2C,2C-4), 118.12(1C,C-9,CHAr), 126.93(4C,2C-5',2C-5''), 128.73(4C,2C-3',2C-3''), 128.97(4C,2C-6',2C-6''), 129.93(4C,2C-2',2C-2''), 130.20(1C,C-10), 130.65(1C,C-9), 131.20(1C,C-11), 132.69(2C,2C-4',2C-4''), 135.93(2C,C-12,C-8), 136.25(4C,2C-1',2C-1''), 138.12(4C,2C-1',2C-1''), 169.17(2C,2$\underline{C}$=O).

Elemental analysis: for $C_{49}H_{48}N_4O_2$ Cl_4S_2

Calculated: C:(69.06%), H:(5.67%), N:(7.16%), Cl:(18.12%).

Found: C:(68.99%), H:(5.5 9%), N:(7.06%), Cl:(18.36%).

2.2. Biological Activity

The newly synthesized compounds were screened for their antibacterial activity against Escherichia *coli, Staphylococcus aureus, Klebsiella, Salmonella, Pseudomonas, Enterobacte*r bacterial strains by disk-diffusion method (Cruickshank *et al.,* 1975; Collin, 1976) Disks measuring 6.25 mm in diameter were punched from Whatman no.1 filter paper .Batches of 100 disks were dispensed to each screw-capped bottle and sterilized by dry heat at 140^0 C for an hour. The test compounds were prepared with different concentration (250,500,1000ppm) using DMSO. Disks of each concentration were placed in triplicate in nutrient agar medium seeded with fresh bacteria separately. The incubation was carried out at 37^0C for 24h.The solvent; DMSO used for the preparation of compounds did not show inhibition against the tested organisms.

2.3. Anti-Corrosion Activity

2.3.1. Polarization Measurements

Electrochemical measurements were carried out in conventional three-electrode system in CHI 604 instrument (USA) at 303 K. The working electrode (mild steel) has a geometric area of 1 cm^2. The saturated calmmel and platinum electrodes were used as reference and auxiliary electrodes. The aggressive solution of 1 mol.l-1 H_2SO_4 was prepared by the dilution of analytical grade H_2SO_4 with double distilled water. the concentration of inhibitors was 1.69×10^{-3}(mol.l-1). The result of polarization studies were obtained as Tafel plot Equation (1) shows the calculation of IE from corrosion current:

$$IE = \left(1 - \frac{icorri}{icorr0}\right) \times 100 \qquad (1)$$

RESULTS AND DISCUSSION

3.1. Synthesis

Piperidone and its derivatives were synthesized by reaction between chlorobenzaldhyde, pentanone-3 and ammonium acetate and 4,4'-diaminodiphenylsulphone and5-methylbenzene-1,3-diamine respectively then reaction of Schiff bases compounds (2,4) with mercaptoacetic acid in the presence of catalytic amount of anhydrous zinc chloride in DMF for about 5 hr furnished the compounds (3,5) whose structures were assigned on the basis of spectral data. Thin layer chromatography was performed on pre-coated silica gel G, glass plates using chloroform:ethanol (9:1) solvent system to ascertain the purity of these compounds. The compounds gave signal spots. The physicochemical properties of the synthesized compounds were determined and are given in Table 1. The structures of synthesized compounds were confirmed by, IR, MS, ^{1}H, ^{13}C-NMR spectroscopy method and elemental analysis.

Table 1: physicochemical data of synthesized compounds

Compound NO.	Molecular formula	R_f	Molecular weight	MP (^{0}C)	Yield (%)
1	$C_{19}H_{19}Cl_2NO$	0.58	348	109^0C	70%

2	$C_{50}H_{46}Cl_4N_4O_2S$	0.43	908	133^{0}C	40%
3	$C_{54}H_{50}Cl_4N_4O_4S_3$	0.56	1057	290^{0}C<	20%
4	$C_{45}H_{44}Cl_4N_4$	0.74	782.67	180^0	40%
5	$C_{49}H_{48}Cl_4N_4O_2S_2$	0.67	930.87	290 ^{0}C<	12.23%

Infrared spectroscopy of compounds (2,4) in KBr shows absorption band at (1626.36 cm^{-1},) due to (C=N) Stretching and absorption band at (1650.62 cm^{-1}) due to five membered cyclic amido (C=O)Stretching. The mass spectra of the synthesized compounds (1-5) showed the parent peak confirming the molecular weight of the compounds. ^{1}H-NMR spectrum of compound (2) showed deplete peaks at δ: 7.14 ppm due to aromatic protons of sulphonyl rings and multiple peaks at (δ: 7.30, 7.38, 7.40 ppm) Due to aromatic protons of substituted benzene aromatic of piperidine and deplete peaks at 7.97 ppm due to aromatic protons of (sulphonyl), ^{1}H-NMR spectrum of compound (3) showed signal peak at δ: 2.94 ppm due to -CH_2- Of five membered cyclic ring, compound (4) showed signal peak at δ: 2.34 ppm due to CH_3 –Ar and signal peaks at δ: 6.83-6.87 ppm due to aromatic proton of 5-methylbenzene-1,3-diamine in addition to aromatic proton of piperidone, compound (5) showed signal peak at δ: 3.34 ppm due to –CH_2- Of five membered cyclic ,^{13}C-NMR spectrum of compounds (2) show no signals in the C=O range And show signal at (188.42 ppm) due to (C=N), signals at (123.3, 129.64, 139.9, 154.16 ppm) due to carbone of sulphonyl aromatic rings, compound (3) show signal at (36.68 ppm) due to (2$\underline{CH_2}$-S) and signal at (175.67 ppm) due to (C=O) of five membered cyclic, compound (4) show signal at (181.2 ppm) due to (2$\underline{C=N}$-), and signals at (118.52,131.36,132.35,143.96 ppm) due to aromatic carbons of 5-methylbenzene-1,3-diamine, compound (5) show signal at (31.41 ppm) due to ($\underline{CH_2}$-S), and signal at (169.17 ppm) due to (C=O) of five membered cyclic .

3.2. Polarization Measurements

Table 3 shows the corrosion Potential (E corr), corrosion current (I corr) and Tafel slopes (ba and bc) values of mild steel in 1 mol.L $^{-1}H_2SO_4$ Solution in the absence and presence of inhibitor of all the five compounds at 303K calculated from Figures 2-5. The transition of metal/solution interface from a state of active dissolution to the passive state is attributed to the adsorption of the inhibitor molecules and the metal surface, forming a protective film. The rate of adsorption is usually rapid and hence, the reactive metal surface is shielded from the aggressive environment (Chao *et al.*, 1981).

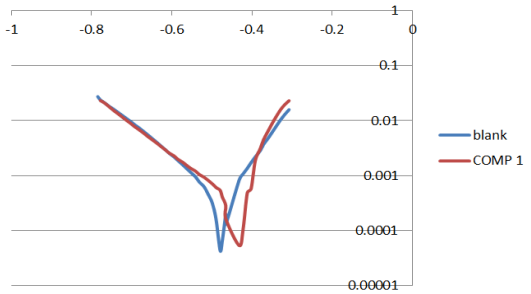

Figure 2: Polarization curves for mild steel in 1M H_2SO_4 in the absence and presence of compound 1.

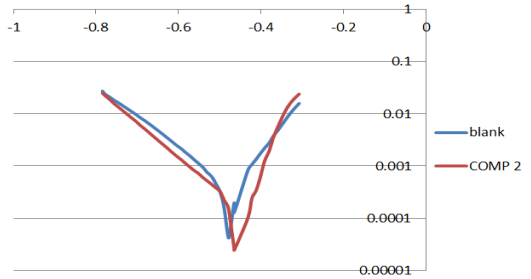

Figure 3: Polarization curves for mild steel in 1M H_2SO_4 in the absence and presence of compound 2.

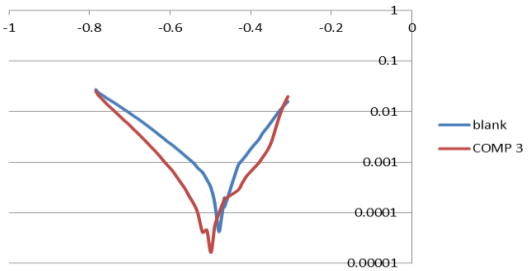

Figure 4: Polarization curves for mild steel in 1M H_2SO_4 in the absence and presence of compound 3.

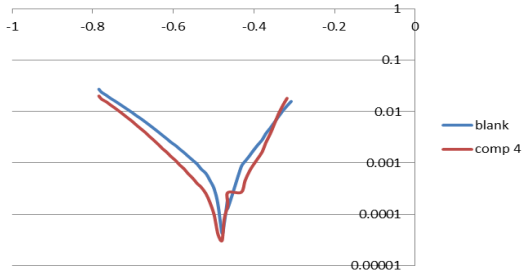

Figure 5: Polarization curves for mild steel in 1M H_2SO_4 in the absence and presence of compound 4.

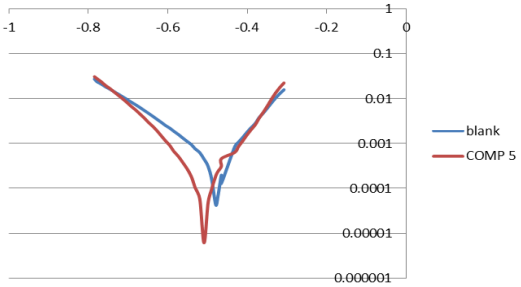

Figure 6: Polarization curves for mild steel in 1M H_2SO_4 in the absence and presence of compound 5.

Adsorption process can occur by electrostatic forces between ionic charges or dipoles of the adsorbed species and the electric charge on the metal surface can be expressed by its potential with respect to the zero charge potential (Intropor, 1962). Also, the inhibitor molecules can be adsorbed to the metal surface via the electrontransfer from the adsorbed species to the vacant electron orbital of low energy in the metal to form acoordinat type of link (Migahed and Nassar, 2008).

3.3. Biological Activity

The newly synthesized compounds were screened for their antibacterial activity against (*Escherichia coli, Staphylococcus aureus, Klebsiella, Salmonella, Pseudomonas, Enterobacter*).

The results of such studies are given in Table 2. The above data showed that compounds 3 and 5 exhibited very good activity against *Escherichia coli, Staphylococcus aureus, Klebsiella, Salmonella, Pseudomonas, Enterobacte*r. While, compound 2 showed good activity against *Staphylococcus aureus, Klebsiella, Escherichia coli, Pseudomonas* and moderate activity against *Enterobacte*r.

The compounds 1 and 4 Show good activity against *Staphylococcus aureus, Escherichia coli* and moderate activity against *Klebsiella, Pseudomonas*.

Table2: Antibacterial activity of prepared compounds

Compound	Compound 1 (ppm)			Compound 2 (ppm)			Compound 3 (ppm)			Compound 4 (ppm)			Compound 5 (ppm)		
Bacterial	250	500	1000	250	500	1000	250	500	1000	250	500	1000	250	500	1000
Staphylococcus	7	10	20	10	10	20	10	20	20	7	7	10	12	20	20
Klebsiella	-	7	20	20	20	20	10	10	30	7	7	10	10	10	15
E.coli	7	10	20	7	20	20	7	7	10	7	10	10	7	7	15
Pseudomonas,	-	-	20	8	20	20	4	20	40	1	5	10	10	10	10
Salmonella	-	-	-	-	-	7	10	20	30	-	-	-	7	10	20
Enterobacter	-	-	-	7	7	7	10	20	20	-	-	-	12	25	30

Zone of inhibition (in mm)

Table 3: Corrosion kinetic parameters of mild steel exposed to 1 mol.L $^{-1}$ H_2SO_4 solution in absence and presence of inhibitors

Compound Name	Rp	bc/(mv.dec -1)	ba/(mv.dec -1)	icorr/ $\mu A.cm^{1-}$	-Ecorr/mv	IE(Using icorr) %
BLank		12.43	6.38	480	480	-
1	410	375	6.40	56.48	20.52	21.87
2	440	199	5.98	26.25	105.73	58.54
3	510	100	7.86	14.55	221.58	79.16
4	480	220	7.80	16.78	105.09	54.16
5	480	110	7.65	12.67	103.55	77.08

CONCLUSION

The main aim of the present study is to synthesize and investigate the antimicrobial activity and anticorrosion activity of new piperidones derivatives containing 4-thiazolidinone moieties with hope of discovering new structures serving as potential broad spectrum antimicrobial agents and anticorrosion agents, the antibacterial data revealed that the compounds 1-5 showed good to moderate antimicrobial activity basically introduction of thiazolidinone moiety in the structure of compound (3,5) has increased the antimicrobial activity compared to the other. The inhibition efficiency values of examined compounds at a common concentration of 1 Mm follow the order: 3>5>2>4>1. The difference in the efficiency is referred to the molecular structure effect, to rigidity of π-delocalized system of Schiff bases that may cause the increasing or decreasing of the electron density on center of adsorption and leading to an easier electron transfer from the function group (C=N-group) to the metal, producing greater coordinate bonding and hence different adsorption and inhibition efficiency, the surface coordination is through the sulfur and the nitrogen atoms attached to the hetero ring it was concluded that the mode of adsorption depends on the affinity of the metal towards the π –electron clouds of the ring system (Abdallah *et al.*, 2006). High inhibition efficiency of compounds (3,5) is attributed to

presence of π electrons and unshared pairs of electrons of N,S and O atoms in five membered cyclic. Thus, the adsorption of the examined molecules could occur due to the formation of links between the d-orbital of iron atoms, involving the displacement of water molecules from the metal surface, and the lone SP_2 electron pairs present on the N, S and O atoms of the heterocyclic rings.

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