The work embodied in the present thesis deals with the study of some nitrogen and sulphur containing heterocyclic compounds as corrosion inhibitors for mild steel in 1N HCl and 1N H_2SO_4. The performance of these compounds as corrosion inhibitors has been investigated using the Weight Loss Studies and Potentiostatic Polarization technique. Hydrogen Permeation, AC Impedance techniques; Auger Electron Spectroscopy and Scanning Electron Microscopy have also been used to examine the inhibitive performance of some selected compounds.

The compounds examined in the present investigations are listed in Table (1-4). Their inhibiting action has been discussed in the following four series.

1. 2-aminobenzothiazole and its substituted analogues.
2. 2-salicylideneaminobenzothiazole and its substituted analogues.
3. 2-amino-4-phenylthiazole and its anil derivatives.
4. Azathiones.

The results of the present investigations reveal the fact that aminobenzothiazole and its derivatives inhibit the corrosion of mild steel effectively in both the acid solutions at all the studied concentrations (100-500 ppm). Maximum value of inhibition efficiency is achieved at a concentration of 500 ppm. The order of inhibition efficiency has been found as follows :

ACLBT > ABT > AMEOBT > AMEBT

The higher inhibition efficiency of ACLBT may be attributed to its high dipole moment. The better performance of methoxy derivative as compared to methyl derivative has

Table1

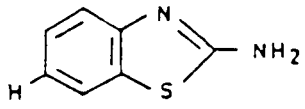
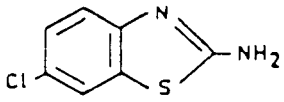
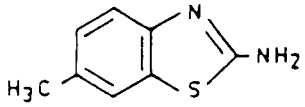
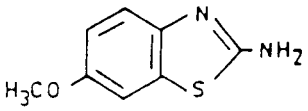
Sl.No	NAME	STRUCTURE	ABBREVIATION USED
1	2-AMINO BENZOTHIAZOLE		ABT
2	2-AMINO-6-CHLORO-BENZOTHIAZOLE		ACLBT
3	2-AMINO-6-METHYL-BENZOTHIAZOLE		AMEBT
4	2-AMINO-6-METHOXY-BENZOTHIAZOLE		AMEOBT

Table2

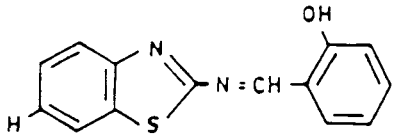
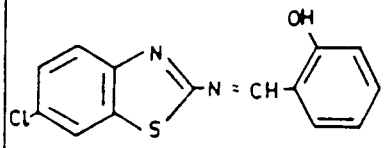
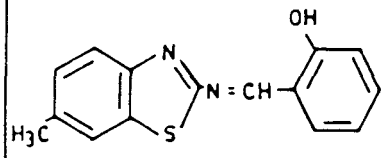
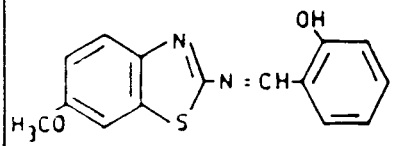
Sl.No.	NAME	STRUCTURE	ABBREVIATION USED
5	2-SALICYLIDENE AMINO-BENZOTHIAZOLE		SABT
6	2-SALICYLIDENE AMINO-6-CHLORO-BENZOTHIAZOLE		SACLBT
7	2-SALICYLIDENE AMINO-6-METHYL-BENZOTHIAZOLE		SAMEBT
8	2-SALICYLIDENE AMINO-6-METHOXY-BENZOTHIAZOLE		SAMEOBT

Table 3

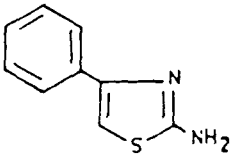
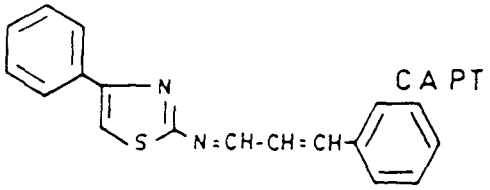
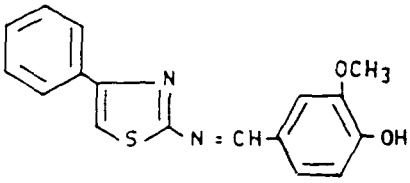
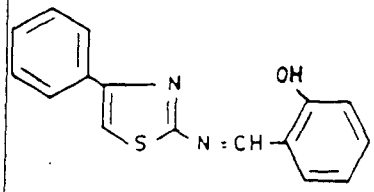
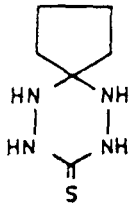
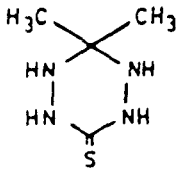
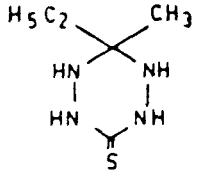
Sl.No.	NAME	STRUCTURE	ABBREVIATION USED
9	2-AMINO - 4 - PHENYL - THIAZOLE		APT
10	2-CINNAMALIDENE AMINO - 4- PHENYL - THIAZOLE		CAPT
11	2-VANILLIDENE AMINO - 4-PHENYL - THIAZOLE		VAPT
12	2-SALICYLIDENE AMINO - 4-PHENYL - THIAZOLE		SAPT

Table 4

Sl.No.	NAME	STRUCTURE	ABBREVIATION USED
13	CYCLO PENTYL - TETRAHYDRO - AZA - THIONE		CPTAT
14	DIMETHYL - TETRAHYDRO - AZA - THIONE		DMTAT
15	ETHYL - METHYL - TETRAHYDRO - AZA - THIONE		EMTAT

been explained on the basis of Pearson's HSAB principle.

The inhibition of corrosion by 2-aminobenzothiazole and its derivatives may be explained on the basis of adsorption of these compounds on the metal surface in terms of the following interactions. a) lone pair of electrons of N and S atoms of the benzothiazole ring can interact with metal surface; b) π-electrons of benzothiazole ring can interact with positively charged metal surface; c) protonated aminobenzothiazoles can also interact with negatively charged metal surface.

All the anils derived by the condensation of salicylaldehyde and aminobenzothiazoles are found to give better performance than the corresponding amines. Their enhanced inhibition efficiency may be attributed to the presence of an additional π-bond of the azomethine group, π-electrons of the benzene ring and an electron releasing -OH group.

The inhibition efficiency values of 2-amino-4- phenylthiazole and its condensation products, anils in acidic solutions follow the order :

CAPT > VAPT > SAPT > APT

The higher value of inhibition efficiency of SAPT than APT can be explained due to the presence of an additional azomethine double bond, benzene ring and an electron releasing -OH group. VAPT gives better inhibition efficiency than SAPT because it contains an additional $-OCH_3$ group. The highest inhibition value obtained by CAPT can be explained due to the presence of an additional π-bond in its molecules which is absent in the case of VAPT, hence it gives the best performance among the investigated anils.

The inhibition efficiency of azathiones follow the order:

CPTAT > EMTAT > DMTAT

The highest inhibition efficiency achieved by CPTAT among azathianes has been explained on the basis of its larger molecular area.

The order of performance of various classes of organic compounds examined in the present investigations is :

Anils > Amines > Azathiones.

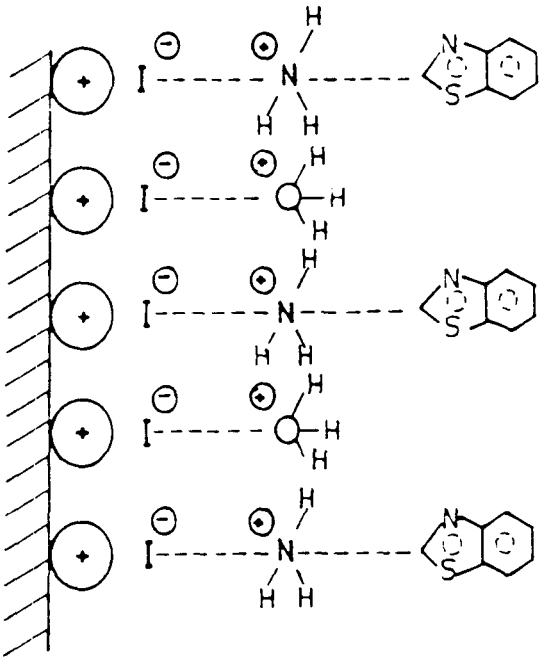
The lower inhibition efficiency of azathiones can be explained due to the absence of aromatic character in these compounds.

All the compounds investigated have shown good inhibition efficiency at the studied temperatures ranging from 40 to 60 C. The inhibition efficiency of the investigated compounds decreased at lower concentrations except ACLBT and all the anils which showed nearly 90% inhibition efficiency even at 60^0C. All the inhibitors are found to obey Temkin's adsorption isotherm.

The Potentiostatic Polarization studies were carried out at 35 ± 2^0C. The polarization behaviour of different series of compounds in both hydrochloric and sulphuric acids were studied. All the compounds are found to be mixed inhibitors except aminobenzothiazoles which are predominantly cathodic and SABT predominantly anodic in hydrochloric acid.

The interesting feature of the investigation is that the inhibition efficiency of all the amino compounds (ABT and APTs) enhanced significantly on the addition of Potassium Iodide (KI). This has been explained on the basis of the

synergistic model given below :



All the investigated compounds are found to reduce the permeation of hydrogen through steel surface effectively in both the acid solutions.

The decrease in double layer capacitance values as evident from AC impedance study in presence of SAMEBT supports the adsorption of SAMEBT inhibitor on the steel surface. The results of Auger Electron Spectroscopy studies show that the adsorption of heterocyclic compounds on the metal surface occurs through N and S atoms. The better appearance of mild steel surface in inhibited acid solutions than in plain acid solutions as evident from Scanning Electron Microscopic (SEM) studies, further supports the fact that inhibitor molecules are adsorbed over the steel surface and prevent the attack of corrosive solution on the surface.