Chapter 2

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Acid solutions are widely used for the removal of undesirable scale and rust on metal surfaces in several industrial process. These applications may lead to corrosive attack on the virgin metal surfaces. Inhibitors are employed in this process to control the corrosion rate of the metals. Most of the well known acid inhibitors are organic compounds containing nitrogen, oxygen and sulphur atoms. The available corrosion literature shows that these compounds can adsorb on the mild steel surface and block the active sites and thereby decreasing the corrosion process. The process of adsorption of inhibitors is influenced by the nature and charge on the metal surface and the chemical structure of organic inhibitor compounds. Generally, the tendency to form a stronger coordination bond thereby its increasing inhibitive efficiency follows the order: O < N < S < P.

Generally, HCl and H₂SO₄ are employed in the treatment of steel and ferrous alloys in industry. The use of inhibitors containing heteroatoms like nitrogen, oxygen, and sulphur is one of the most practical methods for protection against corrosion in acid media. Many piperidin-4-one compounds have been proved to be effective inhibitors for the corrosion of carbon steel in acid media. A reference to the structure of piperidones reveals that they have two major anchoring sites, viz., nitrogen atom and carbonyl oxygen atom. In continuation of our work on the discovery of a new class of piperidin-4-one based inhibitors, the present work involves the study of the inhibition efficiency of certain N-formyl piperidin-4-ones, N-nitroso piperidin-4-ones and piperidines. However, in order to understand and compare the inhibitive efficiency, mechanism of corrosion inhibition of 3-alkyl piperidin-4-ones viz., r-2,c-6–diphenyl-t-3-methylpiperidin-4-one (3MPO), r-2,c-6–diphenyl-t-3-ethylpiperidin-4-one (3EPO), r-2,c-6–diphenyl-t-3-isopropylpiperidin-4-one (3IPPO), r-2,c-6–diphenyl-t-3-t-5-dimethylpiperidin-4-one (DMPO), r-2,c-6–diphenyl-t-3, t-3-dimethylpiperidin-4-one (3DMPO) were synthesized in laboratory and their inhibitive action was studied using gravimetric method, electrochemical impedance spectroscopy and potentiodynamic polarization measurements.

The present work also involves the investigation on inhibition efficiency (IE%) of substituted 2, 6-diphenylpiperidines as a new type of inhibitors in 1N H₂SO₄ and 1N HCl. As reported in literature, the inhibition action of 2,6-diphenylpiperidin-4-ones has been attributed to the adsorption of the lone pair on ring nitrogen as well as the carbonyl oxygen on the MS
surface. Hence, in the present study, we decided to remove the carbonyl group and test the IE of the resulting piperidines.

Introduction of formyl group on the nitrogen of the piperidine-4-one drastically reduces the electron density on the nitrogen atom. Hence, We planned to investigate the inhibitive properties of some azacyclic inhibitors viz., \( N \)-formyl-\( t \)-3-methyl-\( r \)-2,\( c \)-6-diphenylpiperidin-4-one (F3MPO), \( N \)-formyl-\( t \)-3-isopropyl-\( r \)-2, \( c \)-6-diphenylpiperidin-4-one (F3IPPO), \( N \)-formyl \( c \)-3,\( t \)-3-dimethyl-\( r \)-2,\( c \)-6-diphenylpiperidin-4-one (F3DMPO) and \( N \)-formyl \( t \)-3,\( c \)-5-dimethyl-\( r \)-2,\( c \)-6-diphenylpiperidin-4-one (FDMPO) on the corrosion of mild steel in sulphuric acid and hydrochloric acid.

Further we also carried out the study of the inhibition efficiency of certain \( N \)-nitroso piperidin-4-ones viz., \( N \)-nitroso-\( r \)-2,\( c \)-6-diphenyl-\( t \)-3-methylpiperidin-4-one (N3MPO), \( N \)-nitroso \( r \)-2,\( c \)-6-diphenyl-\( t \)-3-ethylpiperidin-4-one (N3EPO), \( N \)-nitroso- \( r \)-2,\( c \)-6-diphenyl-\( t \)-3-isopropylpiperidin-4-one (N3IPPO), and \( N \)-nitroso- \( r \)-2,\( c \)-6-diphenyl-\( t \)-3-\( t \)-5-dimethylpiperidin-4-one (NDMPO) for carbon steel corrosion in acid medium. In the present work, we have also investigated the effect of addition of N3MPO, N3EPO, N3IPPO and NDMPO on the corrosion inhibition of mild steel in 1N \( H_2SO_4 \) and 1N HCl by weight loss, electrochemical impedance spectroscopy and potentiodynamic polarization measurements.

Our general interest in the search for piperidin-4-one based corrosion inhibitors prompted us to choose a stereo chemically flexible system viz., 1,4-diazepan-5-ones which are derived by the expansion of stereo chemically rigid \( cis \)-2,6-diphenylpiperidin-4-ones. Hence, the aim of this part of work is to study the inhibiting efficiency of diazepan-5-ones viz., 3MHD, 3EHD, 3IPHD, 3DMHD and DMHD on mild steel.

The review of literature reveals that only very little work has been done on the corrosion inhibition of aluminium by piperidine based inhibitors. Hence this chapter is devoted to study of 3MHD, 3EHD, 3IPHD, 3MP, 3EP, DMP, F3MPO and N3MPO as corrosion inhibitors of aluminium in 1N HCl and the results were compared with inhibition on MS surface.