Chapter VIII

CONCLUSIONS

CHAPTER - 8

CONCLUSIONS

8.1. Main conclusions

(i) There can be a correlation between the corrosion inhibitory effect of an organic substance for steel in 1 N. H_2SO_4 solution and its adsorption on Hg surface in the same solution (Ch. 7.4.1, 7.4.2, and 7.4.3); though certain deviations from the rule exists (Ch. 7.4.2, 7.4.3, 7.4.4.1, 7.4.4.2, 7.4.4.3, 7.5.2 and 7.5.3).

(ii) Adsorbability is a predominant factor in the process of inhibition and, therefore, charge on the metal or, approximately, potential of the metal on the phi-scale of potentials, plays a principal role in the performance of a chemically stable surface active organic inhibitor in acid corrosion of steel (Ch.7.4.1, 7.4.2, 7.4.3 and 7.4.4.4).

(iii) Adsorption of an additive on Hg at a potential corresponding to the 'null-point' of iron is not always a dependable index of its corrosion inhibition efficiency for steel in sulphuric acid, since non-coulombic interactions specific for the adsorbed species or for the metal may sometimes play an auxiliary role in adsorption and in corrosion inhibition (Ch. 7.4.4.1, 7.4.4.2, 7.4.4.3, 7.4.4.4, 7.5.1, 7.5.2 and 7.5.3)

(iv) On the basis of 'phi-scale of potentials', a relationship may be found between surface activity of different organic compounds as measured on Hg and their inhibition efficiency in acid corrosion of iron (Ch. 7.4.1 and 7.4.2); but surface activity of an organic compound is not the only factor which determines its property as an inhibitor; the nature of the active groups and the steric configuration of the molecules (Ch. 7.4.3) should also be taken into account.

(v) Size and especially the configuration of the adsorbate is important for closeness of packing on the metal surface (Ch. 7.4.2, 7.4.3, and 7.4.4.4), as well as the strength of the adsorption bond between the anchoring group and the metal (Ch. 7.4.3) which are some of the factors that would affect the value of the adsorbate as an inhibitor.

(vi) Inductive (+ I) effect of the alkyl groups plays an important role in enhancing the activity of the 'anchoring' group of the adsorbate on Hg surface and the inhibition of corrosion of steel in 1 N. H_2SO_4 solution (Ch. 7.1.2 and 7.4.3).

(vii) Adsorption and corrosion inhibition increases with an increase of N-alkyl chain length of a homologous series of organic substances (Ch.7.1.1, 7.1.2, 7.4.2 and 7.4.3).

(viii) Monohydric alcohols are, in general, better inhibitors in acid corrosion of steel than the polyhydric alcohols with same number of carbon atoms in the hydrocarbon chain (Ch. 7.4.4.2).

(ix) High molecular weight is not always necessary for good inhibition if a strongly adsorbing group is present in the molecule (Ch. 7.4.4.4).

(x) Properties of adsorption and corrosion inhibition would be displayed by a rather insoluble substance having both sulphur atom, an aromatic ring and a methyl group, since such a compound can have (i) the advantage of electron density and polarizability of the sulphur atom, (ii) the π-electron interaction of the aromatic ring favouring a more horizontal orientation on the metal surface and, (iii) the electron repelling, + I effect of the nucleophilic alkyl group which would increase the electron charge on the sulphur atom by an inductive effect (Ch. 7.4.4.3).

8.2. Subsidiary conclusions

(i) It is difficult to arrive at a correspondance between solubility, adsorbability and corrosion inhibition (Ch. 7.4.4.3).

(ii) Though the concept of 'phi-scale' may present some difficulties in application (Ch.7.4.2, 7.4.3, 7.4.4.1,

7.4.4.2, 7.4.4.3 and 7.5.2), the general usefulness of studying the electrocapillary behaviour of substances for understanding their action as corrosion inhibitors can be advocated. This would be more true, if either surface active substances are concerned,or if the absolute value of 'phi-potential' is sufficiently high to neglect all types of interaction between metal and adsorbed particles (Ch. 7.4.4.1), except those of coulombic origin.

Further extension of its application in electrochemical kinetics involving adsorption would, however, depend on the accuracy of the determination of the 'electronic work function' of the metal (Ch.7.5.3).

(iii) Information on the electrocapillary behaviour of an inhibitor is useful in cases where corrosion inhibition by ionic or molecular additives is directly related to their adsorption at metal surfaces (Ch.7.4.1).

(iv) Adsorption studies on Hg is an appropriate method for determining the effective range of concentration of substances capable of inhibiting corrosion, for screening of such compounds and for investigation of structural group effect among them (Ch.7.4.2 and 7.4.3).

(v) Interaction of the adsorbed organic dipoles with the double layer field in the adsorption of organic substances is important, since the charge corresponding to maximum adsorption on Hg of different aliphatic compounds does not remain constant but varies within wide limits depending on the polarity of adsorbate molecules (Ch. 7.1.2).