1.1 Corrosion is the destructive attack of a metal by chemical or electrochemical reaction with its environment.

The conservation of our natural resources of important metals is a problem of top priority. Prevention of corrosion is of importance from economic and conservation of metals viewpoints. The cost of corrosion in India has been estimated at ₹1,540 million annually.

1.2 Stainless steel used in the present investigation was AISI type 304. Square specimens of size 2.5 x 2.5 cm. (1/16 s.w.g.) were immersed in 250 ml of corrosive media. Weight loss due to corrosion was measured at definite intervals. The media contained HCl (2.5, 5.0 and 7.5 M), H₂SO₄ (1.25, 2.5 and 3.75 M) and FeCl₃ (0.5 and 1.0 M each containing 0.5 M NaCl).

The corrosion resistance of stainless steels is mostly combated by modifying their chemical compositions. Very little data are available regarding inhibition by modifying the environment by suitable chemical amendments. An attempt has been made in the present work to prevent corrosion by adding various inhibitors to the corrosion media. In all, about forty various compounds have been studied as inhibitors.

Galvanostatic measurements were also carried out in HCl and H₂SO₄ solutions containing inhibitors.
2.1 Stainless steel is an alloy of iron containing chromium and nickel. A number of alloys have been prepared each containing various elements in varying proportions. The properties of the steels mainly depend upon its constituent chemical elements and heat treatment.

The use of stainless steels in industries is very extensive and is increasing every year. The corrosion resistance of stainless steel is attributed to an oxide film which is transparent, extremely thin and adherent.

2.2 Stainless steels are resistant to natural waters. They have been successfully used in a number of industries for distillation, transport of chemicals etc. They are resistant to HNO₃, very diluted H₂SO₄ at certain temperatures, most of the food-stuffs, etc.

Depending upon the metallurgical structures and carbon content, stainless steels have been grouped into three main divisions: martensitic, ferritic and austenitic.

According to AISI, when the carbon content of 18-8 Cr-Ni austenitic stainless steel is about 0.08 % (low carbon content) it is called AISI type 304 stainless steel.

2.3 The presence of chromium, the carbon content and heat treatment decide the nature of attack on stainless steel in corrosion media.
Stainless steel can undergo various forms of corrosion depending upon the characteristics of the environment.

HCl and aerated H₂SO₄ solutions can lead to uniform corrosion.

A combined action of tensile stresses in the steel in the corrosive environment can lead to stress corrosion. Heating of stainless steels at elevated temperatures for some critical time and then exposure to corrosive environment may develop attack at grain boundaries, the form of corrosion being known as grain boundary attack. With stainless steels, pitting type of corrosion takes place in weakly acidic solutions containing active depolarizing ion like Fe⁺³ and penetrating Cl⁻ ions.

In the present investigation, the results obtained with various substances have been tabulated and the nature of inhibition has been described. The nature of the film, if unusual, has also been described. In HCl and in H₂SO₄, the nature of the film was black. In the presence of inhibitors, the colour and the nature of the film usually changed.

2.4 In HCl solutions, some substituted thioureas (e.g. diphenyl thiourea, dibutyl thiourea), dibutyl sulfoxide
and dibenzyl sulphoxide and a few more (e.g. propargyl alcohol) show excellent inhibition usually at their higher concentrations.

2.5 Derivatives of thiourea, in general, show good to excellent inhibition in most of the $\text{H}_2\text{SO}_4$ solutions. Usually, their inhibition is low at lower concentration of the substance.


2.6 The inhibitive power of organic compounds has been attributed to chemisorption. The chemisorption may range from simple adsorption to a formation of true physical barriers. The nature and the extent of chemisorption depend upon the characteristics of the metal surface and of the polar organic compound. The inhibitive power can also be attributed to an increase in the overvoltage of the proton discharge process taking place at the cathode.

In thiourea, and its derivatives two polar groups having atoms of $\text{N}$ of $\text{S}$ are present. The chemisorption takes place through the $\text{S}$ atom. In sulphoxides, the inhibition is ascribed to the reduction products. In amines and in quinolines the chemisorption takes place through
the N atom. The results obtained with the various substitutents have been examined in light of the existing theories on inhibition.

2.7 The results of the shift of the open-circuit potential with time in both the acids, in the cases of the majority of the inhibitors, indicate a mixed control. The polarization data show, in general, predominence of cathodic control in HCl solutions; while in H₂SO₄ it is only the anode which is usually strongly polarized.

3.1 Pitting is a particular insidious type of corrosion. Stainless steels resist many corrosive media, but in some solutions rapid penetration takes place at several small areas, resulting in pit formation. Pitting corrosion is considered as an electrochemical process in which the pit acts as a fixed anode and the remainder of the surface acts as a cathode.

Stainless steel is supposed to have a layer of an oxide film or a layer of chemisorbed film of O₂ or passivating ion. According to one view, Cl⁻ ions penetrate the oxide film through pores or Cl⁻ ions may colloidaly disperse the oxide film and increase its permeability. According to second view, Cl⁻ ions get adsorbed on the metal surface in competition with dissolved
$O_2$ or $OH^-$, $Cl^-$ ions favour hydration of metal ions and facilitates entry of metal ions into solution. This breakdown of passivity occurs locally at the preferred sites in the passive film. It is here that a pit is formed.

3.2 Experiments were carried out with 0.5 M and 1.0 M $FeCl_3$ each containing 0.5 M NaCl. Inhibitors were added to these solutions and observations were made regarding their tendencies to inhibit pit formation. Weight loss data were also taken.

3.3 Thiourea and most of its derivatives decreased pitting tendency and lead to general corrosion at their higher concentrations, although their corrosion inhibitive powers were much low. The other inhibitors which retarded pitting tendency include dimethylsulphoxide and o-anisidines.

Mechanism of pit-inhibition has been discussed.