Chapter - 2
AIM AND SCOPE
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The study of corrosion of metals and its control occupies a prominent place in the field of material world. Every industry makes use of one or more metals and alloys in its functioning. Therefore, it is rightly said that metals are the backbone of industries for their progress. Metals and alloys are increasingly used in newer fields besides their conventional applications. As metals are universal in their use, the corrosion of metals is fundamental, academic and industrial concern that has received good attention.

Metals and alloys are used widely in the industry. The development of many new technologies employs the use of some uncommon and expensive metals. Furthermore, the increasing pollution of the environment produces a more corrosive medium. Therefore there is a much greater need for corrosion protection techniques. Studies on corrosion protection find a unique position in the field of corrosion research. The corrosion of metals received a prime attention of material scientists and chemists as corrosion results in a tremendous financial loss both directly and indirectly. Corrosion of metals and its prevention is an international problem and every country encourages research and investigation on the subject to develop better remedial measures for combating corrosion. Publication of thousands of research papers on the subject in international journals shows the importance of corrosion studies. Extensive work on corrosion inhibition in cases of steel, zinc, copper, magnesium, stainless steel, nickel-chromium alloy etc, in aggressive
media like aqueous, acidic, neutral and alkaline environments is being carried out predominantly.

Among many other metals, iron (in the form of alloy steel) and zinc have got innumerable industrial and technical applications and as can be expected, their surfaces get deteriorated, mainly due to corrosion.

The study of different aspects of corrosion of steel and its control is an important and active area of research. Iron and its alloys like steel have been used extensively under different conditions in the chemical and allied industries for handling alkalies, acids, salt solutions and also they are widely used in power generating units, heat exchangers and cooling towers for varied purposes. Varieties of steel are widely used in industries like, construction, automobiles (fuel systems, radiators, exhaust systems), petroleum, space crafts, pipelines, ship building, chemicals and house hold appliances among others. Also, they are used in power generating units, heat exchangers and cooling towers for varied purposes. But being an active metal, iron undergoes rusting process easily, particularly in humid atmosphere and acidic media. Still, it is found to be better structural material because of its availability in large quantities and cheaper cost. It is estimated that steel in different compositions constitutes about 99% of the materials used in industries. Its susceptibility to rusting and high dissolution rate in acidic medium, is the major obstacle in its use. Despite of the above drawbacks, iron still continues to be the major metal in construction as there is no better alternative to it. Hence, it becomes imperative to protect it from corrosion on a continuous basis in the coming days. This has made the study of corrosion inhibition of mild steel in aqueous aggressive media, an important field (aspects) of research in the area of corrosion research.
Like iron, zinc being an active metal finds many applications in industry and technologies. Zinc is employed as a galvanizing material for steel piping, fencing, nails, electronic goods and many types of machinery. It is also used as bars, plates, slabs to protect ship hulls, pipelines and other structural materials. About 45% of the world production of zinc is used for the galvanization of steel. This prevents the corrosion of steel (sacrificial action of zinc) and helps to store the contents in good condition. But as zinc and zinc coated materials undergo corrosion easily, the service life of the materials gets reduced. Hence, like iron, the study of corrosion inhibition of zinc in aqueous aggressive environment is also important. A large number of investigations have been made to understand the various aspects of corrosion such as mechanism of corrosion, kinetics of corrosion etc.

A number of attempts have been made to enhance the service life of steel and zinc by reducing their corrosion. Various methods have been employed in controlling their corrosion. The use of chemical inhibitors is one of the best practical methods in controlling the corrosion. Various types of chemical inhibitors- organic and inorganic compounds, pharmaceuticals drugs, dyes and even plant extracts are developed to control corrosion. The inhibitor is added to the environment where the metal surface is exposed to reduce corrosion.

Due to rapid development in the inhibitor technology, much recognition is given to the role of inhibitors in corrosion science. Various types of inhibitors were developed to control the corrosion. But the practice of corrosion inhibition is greatly influenced by new regulations that have been developed to check the use of toxic compounds and environmental damage resulting from the use of such compounds. Hence there is a trend
to replace some widely used inhibitors such as chromates and cyanides because of their toxicity, environmental damage and pollution caused by these chemicals. Extensive studies have been made over the years in this corrosion field. Although many organic inhibitors were developed as corrosion inhibitions for mild steel and zinc, a little work has been done in detecting and using electroactive compounds such as Schiff’s bases, dyes, drugs and natural extracts as corrosion inhibitors for steel and zinc.

The present study is aimed at filling this void by investigating these (said class of compounds) and finding a few electroactive compounds (Schiff’s bases, certain dyes, drugs and natural extracts) as corrosion inhibitors for mild steel and zinc in acid media. Further, the surface treatment of zinc with the synthesized condensation product (Schiff’s base) and the corrosion behaviour of the surface modified zinc in aggressive medium also studied. Technical utility of these compounds were examined by their performance in corrosion control.

Chemical and electrochemical methods are employed to study the corrosion inhibition ability of the compounds. Rate of corrosion, inhibition efficiency and mechanism of inhibition have been investigated by mass loss, Tafel extrapolation, Linear polarization and Electrochemical Impedance spectroscopic methods. Adsorption of inhibitor molecules and formation of passive film on the metal surface have been investigated by using Scanning Electron Microscopy (SEM) and Fourier Transforms Infrared Spectroscopy (FTIR) techniques.

Further a new organic chelating agent has been proposed to protect zinc surface through its modification against corrosion. The emphasis is given to establish mechanism
of corrosion inhibition by chelation. The protective layer formed on the zinc surface after immersion in the treatment solution is analyzed using SEM and FT-IR techniques.