Corrosion is the disintegration or loss in useful properties of metal and their alloys or material of construction into its constituent atoms due to attack of atmospheric gases resulting in to chemical (dry corrosion) or electrochemical (wet corrosion) reactions with its surroundings. Corrosion can also be defined as an electrochemical process in which oxidation and simultaneous reduction of metals takes place in a reaction in presence of an oxidant such as oxygen. Dry and wet corrosion are its two types. Formation of an oxides of metallic iron due to oxidation in solid form is a well-known example of electrochemical dry corrosion, commonly known as rusting. This type of loss of material resulting in corrosion typically produces oxide(s) or salt(s) of the original metal. Phenomenon of corrosion can not avoided but losses due to corrosion can be minimized. Almost all form of material corrodes in ways or other, such as ceramics (concrete corrosion) or polymers, although in this context, the term degradation is more commonly used.

Corrosion is also defined as loss in the useful property of the material due to attack of atmospheric gases. It can also be defined as the wearing away (loss) of metals due to attack of atmospheric gases (air and moisture) on the surface of metal and their alloys resulting in a chemical or electrochemical reaction.

Effect of atmospheric gases is different for different metallic alloys. Many structural alloys corrodes severely while other mildly depending upon a number of factors like humidity content, nature of pollutant, rate of flow etc. The rate of corrosion can be strongly affected by exposure to certain substances present in air. There are different forms of corrosion. It can be concentrated locally to form a pit or crack, or it can extended (spread) across a large area more or less uniformly corroding the surface resulting in uniform type of corrosion. Corrosion may be diffusion controlled process as it occurs mainly on the exposed surfaces of material and their alloys. There are numerous methods to control the rate of corrosion such as avoiding the direct contact of metals and their alloys from the attack of atmospheric gases. The other method to reduce the activity of the exposed surface, like passivation and chromate-conversion may be
effective in providing corrosion protection, can increase a material's corrosion resistance and hence retards the rate of corrosion. However, some corrosion reactions and their mechanisms are less visible and less predictable and much research is required in finding the actual electrochemical reaction mechanism.

Galvanic cell formation is another reason of corrosion. As far as possible formation of galvanic cell in the system must be avoided. Formation of galvanic cell is due to, when two different metals are comes into contact with each other formation of Galvanic cell takes place and hence leads to Galvanic corrosion. In Galvanic cell, a more active metal which comes above hydrogen in EMF series, corrodes at a high rate (anode) and the more noble metal which falls below hydrogen in EMF series, corrodes at a slow rate (the cathode). But when they are immersed separately, no Galvanic cell formation will occur, each metal corrodes at its own rate. Selection of metal and their alloys to be used in industry in order to avoid the formation of Galvanic cell formation, can be done with the help of Galvanic series. Let us take an example, Zinc is commonly used to protect iron and their alloys as a sacrificial anode for providing protection to steel structures. Galvanic corrosion is of major interest to the marine industry people and at contacts pipes or metal structures which are in contact with impure water which act as best electrolyte for Galvanic cell.

Different factors influence the rate of corrosion like relative size of anode, types of metal, and physical properties like temperature, humidity, salinity, etc. The surface area ratio of the anode and cathode is also an important factors which also affects the rates of corrosion of the materials.

Among the different factors that affects rate of corrosion, aired water is the most important factor. Any metallic electrode when immersed in a standard medium which is aerated for example room-temperature seawater, metal electrode will be either more noble or more active than the next, based on different factors like its position in the EMF series with respect to hydrogen, how strongly its ions are bound to the surface and whether it is completely or partially dipped in standard medium. When two dissimilar metal are in electrical contact with each other and immersed in same electrolyte and share the same electrons, so that there is a competition
between the two for free electrons between the two materials. Electrolyte act as a host for the flow of ions in the same direction, and finally the noble metal will win and take electrons from the active one. The production of electrical current can be measured to establish a order of materials in ascending or descending series in the medium of interest. This order/hierarchy is popularly called a Galvanic Series, and can be a very useful in predicting and understanding nature and type of corrosion.

There is a essential requirement that metal surface must be clean in order to minimize corrosion. Generally, it is possible to remove chemically/physically the products of corrosion to give a clean surface, but one may still exhibit one or other type of corrosion for example, pitting corrosion. Different corrosion inhibitors are required in the system in order to minimize the corrosion. For example, phosphoric acid in the form of naval jelly is often applied to ferrous tools or surfaces to remove rust.

Nature of corrosion resistance characteristics of different materials are different. Some metals are more intrinsically resistant to corrosion than others depending upon the activity, either due to the fundamental nature of the electrochemical processes involved or due to the details of how reaction products form. For some examples, EMF and Galvanic series. More such types of series or reactivity series of metals and their alloys can be prepared in different medium. It will certainly help in understanding the nature and type of corrosion.

Among the different methods to prevent corrosion a few ways of protecting carbon steel from corrosion includes painting, hot dip galvanizing, anode protection, sacrificial protection and combinations of these. If a more susceptible material is used, many techniques can be applied during an item's manufacture, transport and storage conditions and use to protect its materials from damage.

The materials most resistant to corrosion are those for which corrosion is thermodynamically unfavorable. Any corrosion products of gold or platinum tend to decompose spontaneously into pure metal, which is why these elements can be found in metallic form on Earth, and is a large part of their intrinsic value. More common "base" metals can only be protected by more temporary means.
Metals have naturally slow reaction kinetics, even though their corrosion is thermodynamically favorable. These include such metals as zinc, magnesium, and cadmium. While corrosion of these metals is continuous and ongoing, it happens at an acceptably slow rate. An extreme example is graphite, which releases large amounts of energy upon oxidation, but has such slow kinetics that it is effectively immune to electrochemical corrosion under normal conditions.

A study carried out by the US Federal Highway Administration, entitled Corrosion Costs and Preventive Strategies in the United States, in 2002 showing the direct costs associated with metallic corrosion in almost every U.S. industrial sector. The report showed that for 1998 the total annual estimated direct cost of corrosion in the U.S. was approximately $276 billion which is approximately 3.2% of the US gross domestic product. However, indirect cost associated with metallic corrosion or even more severe.

There are numerous examples of failure of concrete structures like railways, pullers, bridges, flyovers, etc. Failure is due to loss in the mechanical strength of concrete structure due to corrosion. Corrosion limits the life of any concrete structures. Engineers fix the life of any concrete structure because corrosion cannot be avoided. Rust is one of the most common causes of bridge accidents. As rust has a much higher volume than the originating mass of iron due to involvement of electrochemical reaction, its build-up can also cause failure by forcing apart adjacent parts. Rust is the main cause of the collapse of the Mianus river bridge in 1983, when the bearings rusted internally and pushed one corner of the road slab off its support. Three drivers on the roadway at the time died as the slab fell into the river below. It is found in the NTSB investigation that a drain in the road had been blocked for road re-surfacing by the engineers, and latter forget to unblocked so that runoff water penetrated the support hangers. It was also difficult for maintenance engineers to see the bearings from the inspection walkway. With the time volume of the rust increases which displaces the support which ultimately lead to tragic accident. A number of examples are there which provides that rust leads to tragic accidents. In the Silver Bridge disaster of 1967 in West Virginia Rust was an important factor, when a steel suspension bridge collapsed in less than a minute, killing 46 drivers and passengers on the bridge at the time.
Carbon steel and mild steel are the most common metallic material being used for numerous applications in a variety of industries as well as in daily life for structural and fabrication purposes. Carbon steel and mild steel corrodes heavily when it comes in contact with corrosive environment i.e. acid but their use is still the most common because of its low cost and reasonably good mechanical strength. Stainless steel is widely used in kitchen utensils, sinks, nut bolts, engine parts etc.

Corrosion destroys the objects made up of metals and alloys but the modern world can not afford without the use of these materials. Corrosion may lead to loss of metals and their strength which in turn can cause serious accidents, loss of efficiency, manpower and human lives. Scientists are always interested in understanding the mechanism of corrosion and ways to control it. Numerous corrosion inhibitors have been reported to control the corrosion of metals and alloys in different corroding systems. Any step in the direction of finding new corrosion inhibitors for any corroding system would not only lead to a significant saving but also help the engineers in running the plants and machinery without any problem arising due to corrosion phenomenon.

Carbon steel, stainless steel and mild steel are the most common materials used for structural and fabrication purposes. Chloride ions can cause heavy corrosion of Carbon steel, stainless steel and mild steel and create problems in pipes, heat exchangers, boilers, condensation units etc. Sea water also contains a lot of chloride ions and is used for flooding of oil wells, for cooling purposes, in desalination plants etc.

The uses of chemical corrosion inhibitors are common in production and processing operations. Nevertheless, the challenge is to develop a new class of corrosion inhibitors to protect the materials, which are environment friendly under various conditions. Surfactants as corrosion inhibitors are environmentally acceptable and are very economical and easily available. The aim of this manuscript is to define the ability of surfactants to inhibit the corrosion
on Carbon steel, stainless steel and mild steel surfaces. Various potential application and properties of different types of surfactants have also been discussed. Various parameters like, effect of surfactant concentration, temperature and the mechanism of corrosion inhibition and mode of adsorption are also discussed in this manuscript.

In the present work, an attempt has been made to study surfactants as corrosion inhibitor in detail for controlling the corrosion of Carbon steel, stainless steel and mild steel in acidic medium. Weight loss and electrochemical polarization techniques have been employed to carry out the experiments and the results have been discussed in detail for all the investigated surfactants used for this investigation.