

# Effects Of Different Types of Water Solutions on Corrosion of Mild Steel

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## ABSTRACT

This paper aims to understand the effect of different water samples on rate of corrosion of mild steel at room temperature. this paper emphasis on three water samples those are salt water ( NaCl+ water), one time distilled water, ground water. The experimental result helps to understand the cause of corrosion and its consequences.

**Keywords:** corrosion, mild steel, turbidity.

## I. INTRODUCTION

Gradual deterioration or loss of metal at its surface by chemical, electrochemical reaction between the metal and as corrosion.

Metals are thermodynamically unstable. natural the surrounding environment is called metals are present in the form of metallic compounds(oxidized form).during extraction lot of energy is put to reduce metal ions into metal atoms. hence metals are always at higher energy state and are thermodynamically unstable hence metals try to lower their energy by spontaneously reacting with the chemicals present in surrounding environment like  $O_2$  and  $H_2O$ .thus metals get back to their compound state and hence metal is lost. this process of loss of metal is termed as metallic corrosion.

Corrosion is an electrochemical process that appears in several forms like atmospheric corrosion and chemical corrosion .when acidic substances (water) come in contact with metal such as iron, steel rusting process gets started. Rust is result of corroding steel and iron (Fe).which is exposed to oxygen and moisture (humidity, vapor).when steel is exposed to water, the iron particles are oxidized due to water's

acidic electrolyte. The iron particles then become oxidized, which result in formation of  $Fe^{++}$ .when  $Fe^{++}$  is formed, two electrons are released and flow through the steel to another area the steel which is cathodic area.

Oxygen allows these electrons to rise up and form hydroxyl ions ( $OH^-$ ).The hydroxyl ions on reaction with  $Fe^{++}$  to form hydrous iron oxide ( $Fe(OH)_2$ ),better known as rust. Where the affected iron particles were, now formed into corrosion pit and where they are now is called corrosion product (rust).

Corrosion can happen at any rate, depending on environment that the metal is in.due to low oxygen content,even marine sediments favor growth of anaerobic organisms that influences the corrosion processes in mild steel in marine media .since atmospheric corrosion gets spreadat faster rate ,it is advised to follow effective precautionary procedures when it comes to prevention of corrosion.

## II. OBJECTIVE OF THE STUDY

To study the rate of corrosion of mild steel in salt water, distilled water, ground water and in open atmosphere and discuss the results.

### III. METHODOLOGY

Four mild steel pieces of 50\*70 mm were taken and rust was removed using emery paper. Three solutions were prepared in 250 ml beaker consisting salt water (NaCl + water), one time distilled water (water that has

been boiled into steam and condensed back into liquid on a separate container and this process is conducted only one time), ground water respectively and other piece was kept open to atmosphere. They were observed at regularly intervals of 24 hours and amount of corrosion was checked.

### IV. RESULTS AND DISCUSSION



Figure 1. picture of water samples after 24 hrs.



**Figure 2.**metal surfaces on exposure to salt water ,distilled water and ground water



**Figure 3.**Metal in distilled water after 48 hrs



**Figure 4.**metal in ground water after 48 hrs.





**Figure 5.**metal in salt water after 48 hrs.

As the beaker is partially filled with water solution, part of tank just below water level is exposed to lower concentration of oxygen therefore becomes anodic and undergoes corrosion .part of above water line which is exposed to higher concentration of oxygen becomes cathodic and remains cathodic.

[concentration of oxygen in atmosphere is 20.95%

Concentration of oxygen in water is 9.03mg/l]

We observed that all the three were corroded but the quantity was different. Salt water had the highest amount of corrosion while distilled water had lowest amount of corrosion. Ground water had medium level of corrosion

Higher the salt content higher the corrosion rate. This is explained as increased solution electrical conductivity of the solution facilitate the cathodic reaction (oxygen reduction) and anodic reaction (iron dissolution). salt water has higher viscosity than ground water because of its higher salinity . corrosion also depends on temperature and also environment .oxygen content decreases with increase in pressure .it is to be noticed that the distilled water causes considerable rate of corrosion for the whole

time. The occurrence of corrosion in distilled water may be attributed to the presence of little amount of salts.

It is also noted that rate of corrosion increases with decrease in pH. The rate of corrosion increases with increase in conductance of medium.as the conductance of medium increases, ions can move easily through the medium.

#### **Turbidity:**

Turbidity can be defined as blurriness or cloudiness in the water due to impurities or dirt. We observe in the corrosion aspect, turbidity due to corrosion product. We observe that turbidity in salt is highest and turbidity in distilled water is lowest. Corrosion product insalt water does not stick to the surface of mild steel .it suspends in the solution. Whereas, in distilled water corrosion product sticks to the surface. Corrosion product covers the whole surface .it does not allow corrosion for inner surface.

## **V. CONCLUSION**

We observed that the metal gets corroded faster in salt water than in distilled water and ground water. Metal gets more corrode in salt water than in other two solutions. More the salt concentration or solution conductivity higher corrosion.it was also proved by turbidity concept.

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