

Which metal holds best in a corrosive environment?

Science Fair Project Report

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ABSTRACT

Metal play an important role in our life. This science fair project was conducted to find out the corrosiveness of different types of metals in different types of water. The science project experiment involved using copper, aluminum and iron wires.

Copper, aluminium and iron wires are immersed in sea water, distilled water, tap water and purified tap water separately ant their rate of corrosion is tested day of day. Through this project I found iron get corroded fast than the other metals, sea water corrodes the metal faster than other water and aluminium with stand best in the corrosive environment i.e. in sea water.



INTRODUCTION

Some chemical elements are called metals. They are the majority of elements in the periodic table. These elements usually have the following properties:

- They can conduct electricity and heat.
- They can be formed easily.
- They have a shiny appearance.
- They have a high melting point.

Metals are very useful to people. They are used to make tools because they can be strong and easy to shape. Iron and steel have been used to make bridges, buildings, or ships. Some metals are used to make items like coins because they are hard and will not wear away quickly. For example copper (which is shiny and red in color), aluminium (which is shiny and white), gold (which is yellow and shiny), and silver and nickel (also white and shiny).

Some metals, like steel, can be made sharp and stay sharp, so they can be used to make knives, axes or razors. Rare metals with high value, like gold, silver and platinum are often used to make jewellery. Metals are also used to make fasteners and screws. Pots used for cooking can be made from copper, aluminium, steel or iron. Lead is very heavy and dense and can be used as ballast in boats to stop them from turning over, or to protect people from ionizing radiation.

Corrosion is essentially the oxidization of metal that occurs when water and oxygen are present. It is also known as rust in the case of iron. The corrosion of metal happens when they are placed in an environment where they become chemically unstable.

Copper, gold, platinum and silver are among the few metals that can be found in nature in their purest form. Most other metals like iron are found in the form of ore and need to be processed in order to extract the metal. These metals are unstable at room temperature. Some metals will form a natural coating on their outer surface to slow down the process of corrosion.



STATEMENT OF THE PROBLEM

Corrosion is the deterioration of a metal as a result of chemical reactions between it and the surrounding environment. Both the type of metal and the environmental conditions, particularly gasses that are in contact with the metal, determine the form and rate of deterioration.

Corrosion of metals costs companies, houses and many places of the world, large amount of money each year either through replacing things or trying to prevent it from happening in the first place. For this reason it is vital to understand the most effective metal which holds best in the corrosive environment. I selected this topic for my research in order to study the properties of the metal.

HYPOTHESIS

Aluminum holds up best in a corrosive Environment.

DESIGN OF STUDY

INDEPENDENT VARIABLE:

- Types of water(sea water, distilled water, tap water, purified tap water)

DEPENDENT VARIABLE:

- The rate of corrosion

CONTROLLED VARIABLES:

- Length of each metal
- Quantity of different types of water

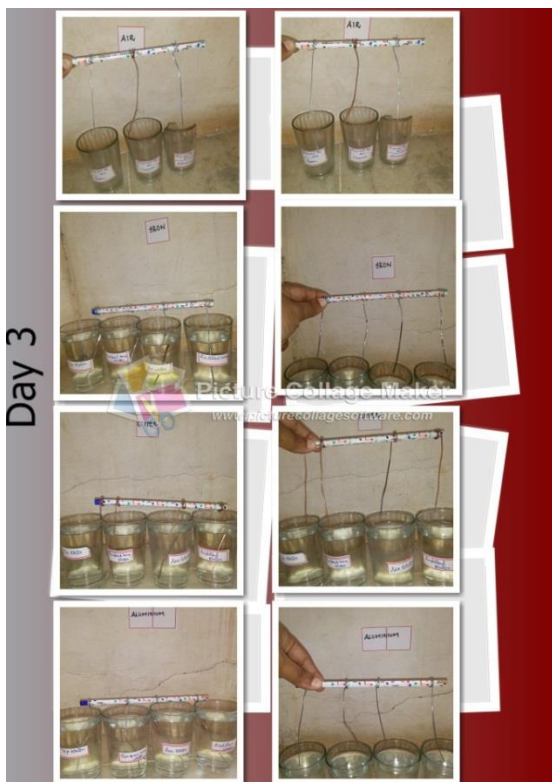
MATERIALS:

- About 35 cm of solid wire made of different metals;
 - Iron, Copper and Aluminium
- 4 pencils
- 15 clear drinking glasses
- Sea water, distilled water, tap water and purified tap water
- Wire cutter, Labels, Marker and Measuring cup

PROCEDURE:

- Found an area large enough to accommodate the glasses where they will be undisturbed for the duration of experiment.
- Cutted the wires of metals iron, copper and aluminium into 7cm lengths.
- Using the marker, marked the labels as iron, copper, aluminium,, tap water, purified tap water, sea water, distilled water and air.
- Set the glasses where they will be able to easily observed and stick the marked label on each glass.
- Using the measuring cup filled three glasses with distilled water, three glasses with sea water, three glasses with purified tap water and three glasses with tap water.
- Wrapped one end of each piece of wire around a pencil, so that when the pencil rests across the top of the glass, the wire hangs to the bottom.
- Planned to observe each wire at least once a day for 15 days.
- Some observations we want to consider are how the changes to the metal wires immersed in the distilled water compared to the wires in the salt water and then to the wires immersed in tap water and purified tap water. Which metals had the most rust? Was the formation of the rust on any of the wires concentrated on one particular area on the wire? Or was the corrosion distributed evenly along the immersed wire?

COLLECTION OF DATA- PHOTOGRAPHS



Day 15



Qualitative Data:

Day	Iron					Copper					Aluminium				
	Tap water	Purified tap water	Sea Water	Distilled water	Air	Tap water	Purified tap water	Sea Water	Distilled water	Air	Tap water	Purified tap water	Sea Water	Distilled water	Air
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	X4	X3	X1	X2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	X3	X2	C	X1	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
4	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
5	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
6	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
7	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
8	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
9	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
10	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
11	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
12	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
13	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
14	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y
15	X2	X1	C	C	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y

Coding:

Y - Metal wire is ok, no corrosion

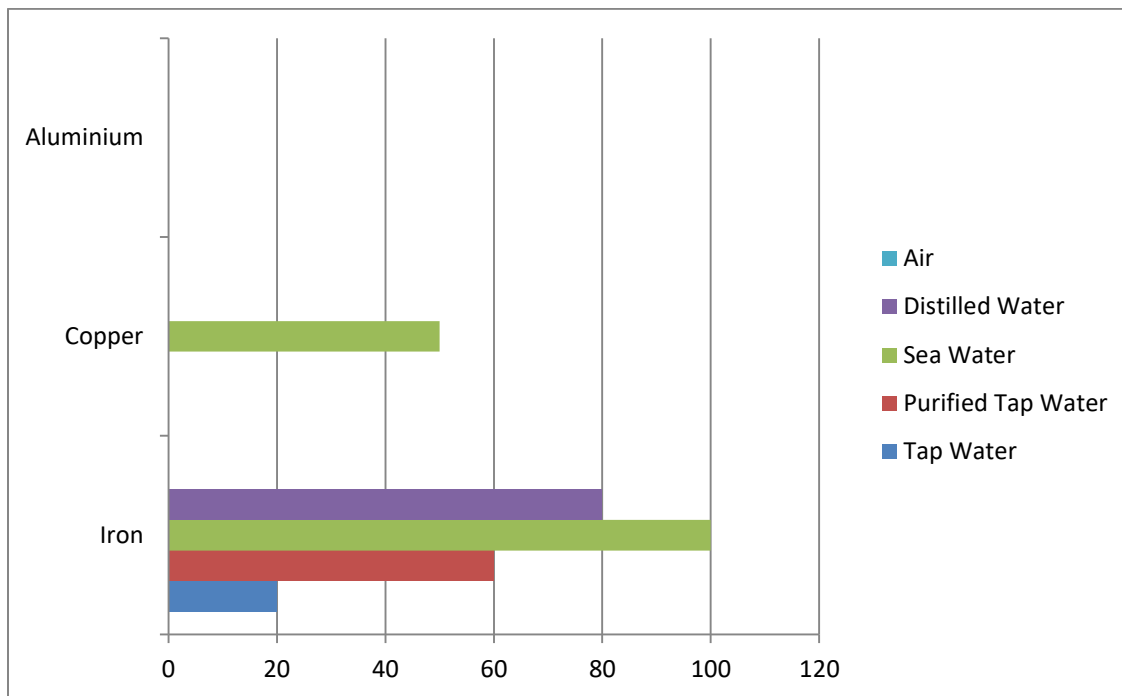
X – Corrosion has started to appear on the metal plate(X1, X2, X3 and X4 –order of corrosion

rate [HIGH TO LOW])

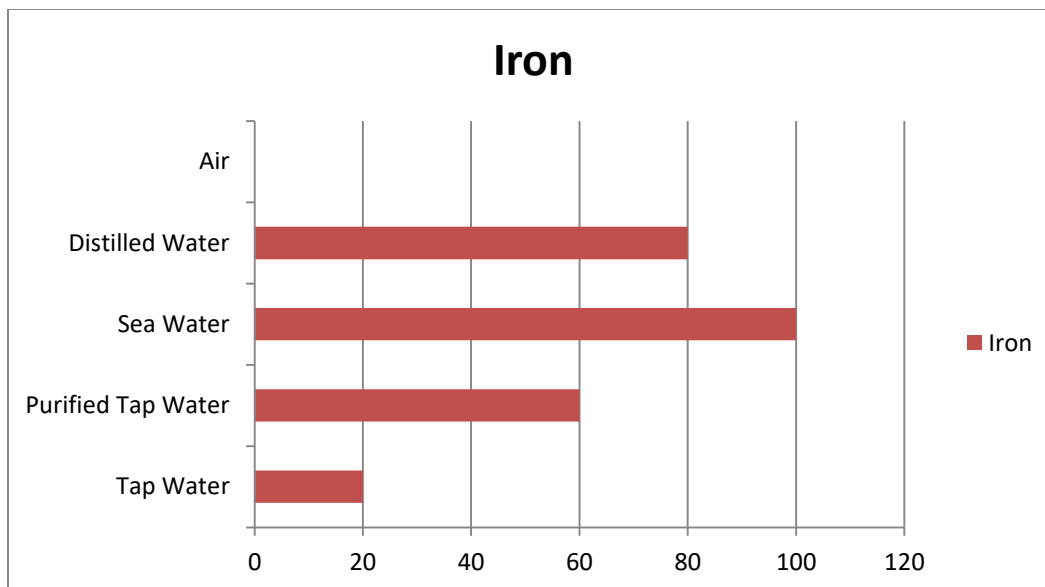
C- Fully corroded

GRAPHICAL REPRESENTATION

RATE OF CORROSION OF METALS IN DIFFERENT WATER MEDIUM



RATE OF CORROSION OF IRON IN DIFFERENT MEDIUM



RESULTS AND DISCUSSION

- Iron started rusting in the second day itself in the order as follows;
 - In Sea water at a very high rate.
 - Then in distilled water
 - And then in purified tap water
 - Shows very slight colour change in tap water.
 - Even though the rate of rusting of iron is high in sea water, the rust gets dissolved and changes the colour of the distilled water.
- Day by day the rusting rate increased in iron in all the glasses as in the same order(sea, distilled, purified tap water and tap water)
- Copper shows a light colour change in sea water alone. In all the other water types it remains inactive.
- An interesting fact I observed was, salt gets clot on the surface of sea water in which copper wire is immersed. I want to research to find out the reason.
- Aluminium remains inactive in all the four type of water.
- All the three metal wires exposed to air remains inactive.
- Sea water is the most corrosive environment.

APPLICATION

Whether you like it or not, metals play a BIG PART in our everyday life. We interact with them differently as each of them has its own properties: some are used as supporting elements for buildings, smartphones and transportation. Some are used for decoration by artists and sculptor or some are used to display wealth, like gold for example.

Metals have thousands of uses that affect our everyday lives, most of which we take for granted. Copper, for instance, is pliable and a good conductor of electricity. For those reasons, it's used to make the wire inside of electrical cables. Without electrical cables we'd have no electricity in our homes-no light, TV, or video games.

Aluminum is extremely strong and can be fashioned into thin sheets, making it vital for aircraft production. Think about that the next time you climb onto an airplane. Metals are used to make the utensils we eat with, the coins we use to buy what we want, and the cars we drive.

Obviously, metals that are used to build aircraft, cars, and electrical wiring had to be extensively tested to make sure they were suitable for use.

Based on the data we can say which metal would be recommend for the manufacture of bikes, beach chairs, and swing sets-not to mention aircraft and medical equipment?

CONCLUSION

- My hypothesis, “Aluminium holds best in a corrosive environment” has been proved.
- I learned rust is another name for iron oxide, which occurs when iron or an alloy that contains iron, like steel, is exposed to oxygen and moisture for a long period of time. Over time, the oxygen combines with the metal at an atomic level, forming a new compound called an oxide and weakening the bonds of the metal itself.
- Iron rust when they come into contact with water and oxygen. They rust faster in salty water or acid rain. Aluminium, on the other hand, does not corrode easily, because its surface is protected by a layer of aluminium oxide.
- Corrosion will cause metal surfaces to get wear out and finally disintegrate. Most metals will form a natural protective coating to prevent or delay the onset of corrosion. However, metals can also be protected from corrosion by painting the surfaces or plating them. Chroming is one of the common industrial plating practices used to protect metal surfaces.

FUTURE ENHANCEMENT

There was far-reaching research and experimentation before the first copper wire was put to use in an electrical cable. Metallurgists-experts on metals-are constantly looking for new uses of metals in many fields, including medical, military, and aeronautics.

Once we know how different metals hold up to corrosion, we'll be able to better understand why they have particular roles, and why they're important.

Further I want to continue to study the properties of metals in detail like under what type of circumstances did my father's bike rust? What would happen if the science project experiment is done using other metals like zinc, steel, tin, lead, magnesium or nickel? Also I want to research the electrical conductivity of various metals.

ACKNOWLEDGEMENT

"There are times when silence speaks so much more loudly than words of praise to only as good as belittle a person, whose words do not express, but only put a veneer over true feelings, which are of gratitude at this point of time."

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