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A REVIEW PAPER ON ACIDS AND BASES

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ABSTRACT

The theory of acids and bases, like many other chemical theories, has undergone numerous changes in recent times. acids are sour in taste and change the color of blue litmus to red, whereas, bases are bitter and change the color of the red litmus to blue. Litmus is a natural indicator; turmeric is another such indicator. Acid-base indicators can be used to distinguish between an acid and a base. The universal indicator shows different colours at different concentrations of hydrogen ions in a solution. A scale for measuring hydrogen ion concentration in a solution, called pH scale has been developed. The p in pH stands for 'potenz' in German, meaning power. On the pH scale we can measure pH generally from 0 (very acidic) to 14 (very alkaline). pH should be thought of simply as a number which indicates the acidic or basic nature of a solution. Higher the hydronium ion concentration, lower is the pH value.

KEYWORDS: *Acids, Bases, Salts, Hydrogen Concentration, pH Value.*

1. INTRODUCTION

The amount of H+ ions and OH– ions generated determines the strength of acids and bases, respectively. If we use the same quantity of hydrochloric acid and acetic acid, say one molar, we get different quantities of hydrogen ions. Acids that produce more H+ ions are known as strong acids, whereas acids that produce fewer H+ ions are known as weak acids. A neutral solution has a pH of 7. A pH value of less than 7 indicates an acidic solution. As the pH value rises from 7 to 14, the concentration of OH– ions in the solution rises, indicating an increase in alkali strength. In most cases, pH is measured using paper soaked with the universal indicator and shown in Figure 1[1]–[3].

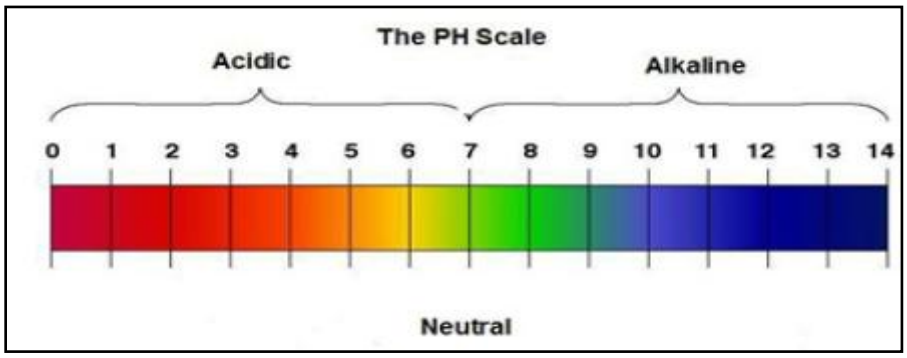

Figure 1: The above figure shows the pH Scale [keiarrabryant].

Our bodies operate in a pH range of 7.0 to 7.8. Only a small range of pH changes allows living creatures to survive. Acid rain occurs when the pH of rainwater falls below 5.6. Acid rain lowers the pH of river water when it falls into them. In such waterways, aquatic life has a hard time surviving[4].

The fact that our stomach generates hydrochloric acid is fascinating. It aids in food digestion while causing no damage to the stomach. Indigestion causes discomfort and irritation because the stomach generates too much acid. Antacids are used to alleviate this discomfort. You must have mentioned one of these remedies at the start of this chapter. The excess acid is neutralized by these antacids. Magnesium hydroxide (Magnesium Milk) is a mild base that is often used for this purpose[5].

When the pH of the mouth falls below 5.5, tooth decay begins. The hardest material in the body is tooth enamel, which is made composed of calcium phosphate. It does not dissolve in water, but when the pH in the mouth falls below 5.5, it corrodes. By degrading sugar and food particles left in the mouth after eating, bacteria in the mouth generate acids. The easiest method to avoid this is to brush your teeth after each meal. Toothpastes that are usually basic may be used to clean teeth and neutralize excess acid, preventing tooth decay[6].

With a pH of 7, salts of a strong acid and a strong base are neutral. Salts of a strong acid and weak base, on the other hand, are acidic with a pH less than 7, while salts of a strong base and weak acid are basic with a pH more than 7.

Sodium chloride is the salt produced when hydrochloric acid and sodium hydroxide solution are combined. This is the salt you put in your meal. You must have seen that it is a neutral salt in the preceding Activity. There are numerous salts dissolved in seawater. These salts are split into sodium chloride and potassium chloride. Solid salt deposits may also be found in many areas of the globe. Because of impurities, these big crystals are often brown. This is referred to as rock salt. When ancient oceans dried up, rock salt beds were created. Like coal, rock salt is mined[7].

2. DISCUSSION

Acids are ionic compounds (a compound with a positive or negative charge) that break apart in water to form a hydrogen ion (H^+).

2.1 Common salt:

Chemicals' starting material The resulting common salt is an essential raw material for a variety of everyday products, including sodium hydroxide, baking soda, washing soda, bleaching powder, and many more. Let's take a look at how a single ingredient is utilized to create all of these other compounds. Sodium hydroxide (sodium hydroxide) When electricity is transmitted through an aqueous sodium chloride solution (called brine), sodium hydroxide is formed. Because of the products formed– chlor for chlorine and alkali for sodium hydroxide– the process is known as the chlor-alkali process[8].

$2NaCl(aq) + 2H2O(l) \rightarrow 2NaOH(aq) + Cl2\ (g) + H2\ (g)$

Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode.

2.2 Bleaching powder:

Chlorine is produced during the electrolysis of aqueous sodium chloride (brine). This chlorine gas is used for the manufacture of bleaching powder. Bleaching powder is produced by the action of chlorine on dry slaked lime [Ca(OH)2]. Bleaching powder is represented as CaOCl2, though the actual composition is quite complex.

$Ca(OH)2 + Cl2 \rightarrow CaOCl2 + H2O$

Bleaching powder is used:

- For bleaching cotton and linen in the textile industry, for bleaching wood pulp in paper factories and for bleaching washed clothes in laundry.
- As an oxidising agent in many chemical industries.
- For disinfecting drinking water to make it free of germs.

Baking soda The soda commonly used in the kitchen for making tasty crispy pakoras is baking soda. Sometimes it is added for faster cooking. The chemical name of the compound is sodium hydrogen carbonate ($NaHCO3$). It is produced using sodium chloride as one of the raw materials and shown in Figure 2[9].

$NaCl + H2O + CO2 + NH3 \rightarrow NH4Cl + NaHCO3$

- Carbon dioxide produced during the reaction causes bread or cake to rise making them soft and spongy.
- Sodium hydrogen carbonate is also an ingredient in antacids. Being alkaline, it neutralizes excess acid in the stomach and provides relief.
- It is also used in soda-acid fire extinguishers.

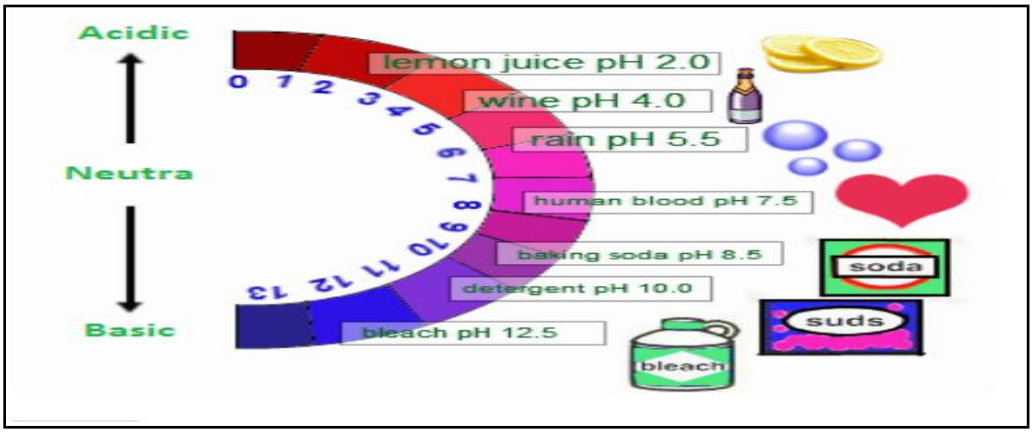

Figure 2: The above figure shows pH of different components [keiarrabryant].

2.3 Washing soda:

Chemical that can be obtained from sodium chloride is $Na2CO3 .10H2O$ (washing soda). Sodium carbonate can be obtained by heating baking soda; recrystallisation of sodium carbonate

gives washing soda. It is also a basic salt. Sodium carbonate and sodium hydrogen carbonate are useful chemicals for many industrial processes as well. Uses of washing soda:

- Sodium carbonate (washing soda) is used in glass, soap and paper industries.
- It is used in the manufacture of sodium compounds such as borax.
- Sodium carbonate can be used as a cleaning agent for domestic purposes.
- It is used for removing permanent hardness of water.

Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. Five water molecules are present in one formula unit of copper sulphate. Chemical formula for hydrated copper sulphate is Cu SO4.5H2O.

Example of acids are:

- Hydrochloric Acid (HCl)
- Sulphuric Acid (H*2SO4)*
- Nitric Acid (HNO*3)*
- Phosphoric Acid (H*3PO4)*
- Carbonic Acid (H*2CO3)*

Classification of Acids:

The author has different classification based on different factors so let's sum up and make ourselves familiar with it.

1. Depending upon source from which they are obtained

- Organic acids
- Inorganic acids

Organic Acids are obtained from plants and animals or we can say they are present in organic matter. Example: in tomato, oxalic acid is present, in apple, malic acid and in lemon, we have citric acid and so many other acids are present in different organic substances.

Inorganic Acids are those that are obtained from minerals present in earth. These are quite reactive in nature. Examples we have are**:** nitric acid, sulphuric acid, etc.

2. Classification of acids on the basis of strength, If we talk about strength, it means the amount of hydrogen ions given out when acid is dissolved in water.

On the basis of this we have two categories of acids –

- Strong acids
- Weak acids

Strong Acid is the acid that completely dissociates into hydrogen ion. These acids totally dissociate and leave no dissociated molecule of acid.

Example**:** Hydrochloric acid, sulphuric acid, etc. Weak Acid is the acid that partially dissociates into hydrogen ions. There actually exists the equilibrium between dissociated ions and un dissociated molecules of acids. Example: Carbonic acid.

3. Classification of acids on the basis of water content

- Dilute acid
- Concentrated acid
- Dilute Acid is the acid that has more amount of water in it and less salt content.
- They are not quite strong.

Concentrated Acid is that which has less amount of water in it and more amount of salt content. We can dilute the concentrated acid but need to take certain precautions as follows: One can dilute concentrated acid by adding concentrated acid slowly in water with continuous stirring. By doing so, the heat released is comparatively less and is constantly absorbed by water. So, it prevents the reaction from becoming violent.

BASES: If we talk about bases, according to Arrhenius, they are those that when dissolved in water give hydroxide ion (OH-).

Example: Calcium hydroxide Ca(OH)2 Magnesium hydroxide Mg(OH)2.

- *Classification of bases:*

Classification of bases on the basis of their solubility in water. The bases that are soluble in water are called alkalis.

Classification on the basis of strength

- strong bases
- weak bases

*I. Strong Bases**:***

That completely dissociates in water to give hydroxide ions. These bases totally dissociate and leave no dissociated molecule of base.

Example**:** Hydroxides of all reactive metals

II. Weak Bases:

That do not completely dissociate in water to give hydroxide ions.

- There actually exists the equilibrium between dissociated ions and dissociated molecules of bases.

Example**:** Calcium hydroxide etc.

3. CONCLUSION

Every chemical item we encounter has some nature, just as the author people do. However, when it comes to chemicals, we associate nature with acidic, basic, or neutral states. However, in order to understand what is acidic, basic, or neutral, we must first understand what it is to be acidic,

basic, or neutral. As a result, several ideas were developed to define them. So, let's have a look at them first. Acids were formerly believed to be chemicals that are sour, turn blue litmus red, and are corrosive. Bases are those that are bitter, turn red litmus blue, and feel soapy when touched. However, subsequent ideas like as the Lewis concept, the Bronsted Lowry concept, and the Arrhenius concept supplanted it[10].

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