Experiment – 2

Aim: To determine the pH value of the different samples of Water.

Apparatus required:

Test tube, Beaker, Electrometric apparatus

Theory:

pH is the term used universally to express the intensity the acidity and alkalinity of a solution. It is a way expressing hydrogen ion concentration or more precisely hydrogen in activity. pH is the negative logarithm of hydrogen ion concentration to base 10.

$pH = -\log 10\ [H^+]$

-Higher pH value means lower H+ ion concentration.

- Entire concentration of H^+ ions does not correspond to the measurement of pH due to ionic interaction among themselves. Measurement of pH of water relates only to the active portion of the H+ ion concentration .Water is a poor electrolyte and only a small portion of it dissociates as

$$H_2O \rightarrow H^+ + OH^-$$

- According to the law of mass action of physical chemistry ionization constant k at equilibrium

Is given by

$$K = [H^+][OH^-]\ /H_2O$$

- At 25°c value of k is l.82 x 10 $^{-16}$ and density of water is 0.997 gm/cm ^{3}.

- Molar concentration of water in 1 liter = 997/18 = 55.39

Moles/Liter $[H^+][OH^-] = k[H_2O] = 1.82*10^{-16} *55.39$

$$= 1.0 x 10^{-14}$$

-In pure water the concentration of H^+ ion and OH^- ion are equal or $[H^+] = [OH^-] = 10^{-7}$ moles/liter i.e. Concentration of H^+ or OH^- per litre of pure water is $1/10^7$ moles.

-But this figure inconvenient for use. Therefore, logarithm of its reciprocal is used for indicating the pH value accordingly, pH of neutral water

$$\text{Log}_{10}\ (1/[H^+]) = 7$$

- When the pH value is in between 0 to 7, water is acidic and when the pH value is in between 7to 14, water is alkaline

Determination pH by electrometric method:-

The basic principle of electrometric pH measurement is determination of the activity of the hydrogen ion by potentiometric measurement using a standard hydrogen electrode and a reference electrode. It consists of potentiometer, glass, electrode, a reference electrode and a temperature compensating device to complete pH meter.

Procedure:-

1. Before use the electrode is rinse blot and dry using a soft tissue paper.
2. The instrument is calibrate with standard buffer solution (7.0 pH).
3. Then the electrode remove from standard solution to rinse blot and dry.
4. The electrode dip in the sample whose pH to be measure.
5. The sample stir to ensure homogeneity and to minimize CO_2 entrainment.
6. Finally not the pH from the reading of the pH meter.

Tabulation:-

(pH of the samples are noted at 25^0c)

S.No.	Name of the sample	Source	Ph
01			
02			
03			
04			
05			

Result:-

The pH found for ……………………………………………………………………… at
temperature 25^0c

Discussion:

1) Is pH of water affected by rise in temperature?

Ans) Temperature plays a significant role on pH measurement. As the temperature rises molecular vibration increases, which result in the ability of water to ionize and form hydrogen ions in the ability of water to ionize and form hydrogen ion . Yes, it does change the pH as a result it drops down.

2) Define pH.

Ans) pH is a scale used to specify how acidic or basic a water-based solution .As it is the negative logarithm of the hydrogen ion concentration.

$$pH = \log_{10} [H^+]$$

3) What do you mean by pOH?

Ans) The 'p' means potential and 'OH' means hydroxide OH^- in the hydrogen ion. pOH is the inverse log of the concentration hydroxide in a solution.

$$P[OH] = -\log_{10} [OH^-] .$$

Significance:-

1. In the coagulation process, chemicals used have higher efficiencies within a certain pH value range. Hence determination and adjustment of pH is very important for effective and economic coagulation.
2. In corrosion control, the pH of water should be maintained at appropriate level as water of low pH is highly corrosive and damages the pipe lines and valves etc.
3. In disinfection of water by excessive line treatment.
4. In water softening process by lime soda.
5. In sewage and industrial waste treatment employing biological treatment:
6. The portability of water also depends on pH value