ENVIRONMENTAL ENGINEERING LAB

Measurement of pH is one of the most important and frequently used tests in water and wastewater analysis. pH of aqueous solution can defined as negative logarithm of hydrogen ion concentration. pH values from 0 to 7 are considered to be diminishing acidity, 7 to 14 increasing alkalinity and pH, 7 is considered to be neutral. It is a measure of acid-base equilibrium. pH (6.5 to 8.5) has no direct adverse effect on health, however a lower value below 4 with produce sour taste and higher value above 8. 5 a bitter taste. Higher values of p^H hasten the scale formation in water heating apparatus and also reduce the germicidal potential of chlorine. High p^H induces the formation of trihalomethanes which are causing cancer in human beings. According to BIS, water for domestic consumption should have a pH between 6.5 to 8.5.

pH Test

Generally turbidity in surface water is caused by suspended and colloidal solids like clay, silt, finally divided organic and inorganic matter, plankton & other microscopic organisms. Turbidity is the measure of relative water clarity. It is not colour. Turbidity is defined as an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the samples. Turbidity is the haziness or cloudiness of a fluid caused by suspended solids that are generally invisible to naked eye (clay, silt, finely divided organic matter, algae).Turbidity is a measure of the degree to which water looses its transparency due to presence of suspended, colloidal & dissolved particles or solids. The turbidity is measured in Nephelometric turbidity units (NTU). Turbidity of drinking water should not be more than 5 NTU.

TURBIDITY METER

The cell constant is determined experimentally with a standard solution of known conductance. Dissolved CO2 increases conductivity without increasing the mineral salt content. How ever the effect is not large and it is usual to ignore it. Temperature affects the conductivity, which varies about 2% per degree Celsius. The temperature of 25°C is taken as standard. In low pH water H+ ions and in high pH water OH- ions, may contribute substantially to conductivity owing to high equivalent conductivity of these ions. It is not convenient to use water containing large amount suspended matter. Highly suspended matter also affects the electrical conductance values. Water samples containing fat, grease, oil, tar etc., may contaminate the electrodes causing wrong & erratic results.

CONDUCTIVITY METER

ALKALINITY :

The alkalinity of water is a measure of its capacity to neutralize acids. Alkalinity of sample can be estimated by titrating with standard sulphuric acid. Titration to pH 8-3 or decolonization of phenolphthalein indicator will indicate complete neutralization of pH and ½ of CO_3 while pH or sharp change from yellow to pink of methyl orange indicator will indicate total alkalinity (complete neutralization of OH, CO_3, HCO_3). Chemically treated waters sometimes have rather high pH values which have met with some objection on the part of consumers. Large amount of alkalinity imparts a bitter taste to water. Excess alkalinity in water is harmful for irrigation which leads to soil damage and reduce crop yields. Water having an alkalinity content of less than 250mg/I are desirable for domestic consumption.

ACIDITY :

Acidity interferes in the treatment of water (as in softening). It corrodes pipes (zinc coating of G.I. Pipes get dissolved). Aquatic life will be affected. pH is critical factor for bio-chemical reaction. The favourable pH is 6.8 to 7.5. Waters containing mineral acidity are unpalatable. Waters having acidity more than 50 mg/L cannot be used in RCC works. The amount of CO2 present is an important factor in determining whether removal by

Titration Test

aeration or simple neutralization with lime or sodium hydroxide will be chosen as the treatment method. Most industrial wastes containing mineral acidity must be neutralized before they are subjected to biological treatment or direct discharge into water course of sewers.

CHLORIDES:

Chlorides associated with sodium exert salty taste, when its concentration is more than 250mg/I. There is no known evidence that chlorides constitute any human health hazard. For this reason, chlorides are generally limited to 250mg/I in supplies intended for public use. In many areas of the world where water supply is scarce, sources containing as much as 2000mg/I are sued for domestic purposes without the development of adverse effects, once the human system becomes adopted to the water. It can also corrode concrete by extracting calcium in the form of calcite. Magnesium chlorides in water generate hydrochloric acid after heating which is also highly corrosive and create problems in boilers. Chlorides determination in natural waters is useful in the selection of water supplies for human use. Chlorides determination is used in determining the type of desalting apparatus to be used.

Total solids determination is used to assess the suitability of potential supply of water for various uses. In case, where water softening is needed, the type of softening procedures used may be dictated by the total solids. Corrosion control is frequently accomplished by the production of stabilized waters through p^H adjustment. The p^H at stabilization depends to some extent upon the total solids present as well as the alkalinity & temperature. High concentration of dissolved solids about 3000mg/L may also produce distress in livestock. In industries, the use of water with high amount of dissolved solids may lead to scaling in the boilers, corrosion and degraded quality of the product in the case of manufacturing of products. Total solids are determined as the residue left after evaporation and drying of the unfiltered water sample. Total solids includes total suspended solids and total dissolved solids.

TOTAL SOLIDS

Nitrate is a well-known contaminant of ground and stream water. It is an important environmental and human health analyte, and thus its detection and quantification are considered to be essential. Determination of nitrate is based on the reduction of nitrate to nitrite in the presence of Zn/NaCl. The produced nitrite is subsequently diazotized with sulfanilic acid and then coupled with methylanthranilate to form an azo dye and was measured at 493 NM. **Phosphorous** occurs in waters and wastewaters almost solely as phosphates. These are classified as orthophosphates, condensed phosphates (pyro, meta, and polyphosphates) and organically bound phosphates. They occur in solution, in particles, or in the bodies of aquatic organisms. Measure absorbance on the Spectronic-21 at the wave length 880 nm.	 **Spectrophoto Meter**
The biochemical oxygen demand (BOD) is defined as the amount oxygen required for biological oxidation of organic matter (biodegradable) by microorganisms in the presence oxygen of a given sample under controlled conditions of temperature and incubation period. The BOD test used to determine Pollution load of wastewaters (due to biodegradable organic matter)..Ordinary domestic sewage may have a BOD of 200mg/I. Any effluent to be discharged into natural bodies of water should have BOD less than 30mg/I. This is an important parameter to assess the pollution of surface water and ground waters where contamination occurs due to disposal of domestic and industrial effluents. Drinking water usually has a BOD of less than 1 mg/I and water is considered good up to 3mg/I of BOD. But, when BOD value reaches 5mg/I, the water is doubtful in purity. To determine strength of domestic and industrial sewage. BOD of wastes is useful in the design of treatment facilities. It is a factor in the choice of treatment method and is used to determine the size of certain units, particularly trickling filters and activated sludge units. It is used to evaluate the efficiency of various treatment units.	 **BOD**

Chemical Oxygen Demand (COD) test determines the oxygen equivalent of organic matter that is susceptible to oxidation with strong chemical oxidant. The laboratory determinations of COD is an important experiment in measuring the organic content of a sample the COD values reflects the organic content, both biodegradable as well as non-biodegradable organic substances. The COD values help us to estimate the approximate BOD of a given sample, based on which the dilution of the given sample will be determined for BOD experiment the COD will always more than BOD. The time required for this experiment is around 3 hrs compared to 5 days required for BOD. Pollution load of wastewaters (due to biodegradable organic matter). The level of organic pollution in water bodies. To assess the performance of wastewater treatment plants.	 **COD**
It determines the Optimum coagulant dosage required for water treatment. According to some recent investigations, aluminum is neurotoxin. Less dosages of alum do not remove turbidity in water which ultimately increase load on filters. So, the optimum dosage should be added in coagulation process to prevent the above problems. Coagulation removes not only turbidity, but also colour, micro-organisms, algae, phosphate, taste and odour producing sub-stances. The jar test must be performed on each water that is to be coagulated and must be repeated with each significant change in the quality of given water. It is useful to estimate optimum dosage of coagulant required for raw waters and waste waters.	 **JAR TEST**
It is the most often used techniques for the sanitary analysis of water. The test is used to detect coliforms. The test is performed sequentially in three stages presumptive, confirmed and completed test. The presumptive coliforms test is used to detect coliforms in a water sample. In this test lactose fermentation tubes are inoculated with different water volumes and production of acid and gas from the presumptive evidence of coliforms in the water sample.	 **Coli Form Test**
