CHAPTER 2.PHYSICAL PARAMETERS OF WATER

COLOUR

In natural water, colour is due to the presence of humic acids, fulvic acids, metallic ions, suspended matter, plankton, weeds and industrial effluents. Colour is removed to make water suitable for general and industrial applications and is determined by visual comparison of the sample with distilled water

Visual comparison: About 20ml of the sample and 20ml of distilled water were taken in two separate wide mouthed test tubes. The results were tabulated (as clear, greenish, greyish, brownish, blackish, etc) by comparing the colour of the sample with distilled water.

ODOR:

Odor of water is due to the accumulation of excretory wastes and organic and inorganic loads and also due to pollution. The odor of the investigated pond water was smelt by nose. The odor of an ideal pond water is not fishy or odorless (Das,1997).

TEMPERATURE

Impinging solar radiation and atmospheric temperature brings about spatial and temporal changes in temperature, setting up convection currents and thermal stratification. Temperature plays a very important role in wetland dynamism affecting the various parameters such as alkalinity, salinity, dissolved oxygen, electrical conductivity etc. In an aquatic system, these parameters affect the chemical and biological reactions such as solubility of oxygen, carbon-di-oxide-carbonate-bicarbonate equilibrium, increase in metabolic rate and physiological reactions of organisms, etc. Water temperature is important in relation to fish life. The temperature of drinking water has an influence on its taste.

Apparatus required: Thermometer- 0.1° C division.

Procedure: Temperature measurement is made by taking a portion of the water sample (about 1litre) and immersing the thermometer into it for a sufficient period of time (till the reading stabilizes) and the reading is taken, expressed as °C.

TRANSPARENCY (LIGHT PENETRATION)

Solar radiation is the major source of light energy in an aquatic system, governing the primary productivity. Transparency is a characteristic of water that varies with the combined effect of colour and turbidity. It measures the light penetrating through the water body and is determined using Secchi disc.

Apparatus required: Secchi disc, a metallic disc of 20cm diameter with four quadrats of alternate black and white on the upper surface. The disc with centrally placed weight at the lower surface, is suspended with a graduated cord at the center.

Procedure: Transparency is measured by gradually lowering the Secchi disc at respective sampling points. The depth at which it disappears in the water (X_1) and reappears (X_2) is noted. The transparency of the water body is computed as follows:

$$\text{Transparency (Secchi Disc Transparency)} = (X_1 + X_2)/2$$

Where, X_1 = Depth at which Secchi disc disappears

X_2 = Depth at which Secchi disc reappear

Turbidity (NTU) = (Nephelometer readings) (Dilution factor*)

If the turbidity of the sample is more than 40 NTU, then the sample is diluted and the dilution factor is accounted in final calculations.

Fig:5 Secchi disc

CALCIUM HARDNESS

The presence of calcium (fifth most abundant) in water results from passage through or over deposits of limestone, dolomite, gypsum and such other calcium bearing rocks. Calcium contributes to the total hardness of water and is an important micro-nutrient in aquatic environment and is especially needed in large quantities by molluscs and vertebrates. It is measured by EDTA titrimetric method. Small concentration of calcium carbonate prevents corrosion of metal pipes by laying down a protective coating. But increased amount of calcium precipitates on heating to form harmful scales in boilers, pipes and utensils.

Principle: When EDTA (Ethylene-diamine tetra acetic acid) is added to the water containing calcium and magnesium, it combines first with calcium. Calcium can be determined directly with EDTA when pH is made sufficiently high such that the magnesium is largely precipitated as hydroxyl compound (by adding NaOH and iso-propyl alcohol). When murexide indicator is added to the solution containing calcium, all the calcium gets complexed by the EDTA at pH 12-13. The end point is indicated from a colour change from pink to purple.

Apparatus required: Burettes, pipette, conical flask, beakers and droppers.

Procedure: A known volume (50ml) of the sample is pipetted into a clean conical flask, to which 1ml of sodium hydroxide and 1ml of iso-propyl alcohol is added. A pinch of murexide indicator is added to this mixture and titrated against EDTA until the pink color turns purple.

MAGNESIUM HARDNESS

Magnesium is a relatively abundant element in the earth's crust, ranking eighth in abundance among the elements. It is found in all natural waters and its source lies in rocks, generally present in lower concentration than calcium. It is also an important element contributing to hardness and a necessary constituent of chlorophyll. Its concentration greater than 125 mg/L can influence cathartic and diuretic actions.

Principle: Magnesium hardness can be calculated from the determined total hardness and calcium hardness.

High concentration of magnesium proves to be diuretic and laxative, and reduces the utility o water for domestic use while a concentration above 500 mg/L imparts an unpleasant taste to water an renders it unfit for drinking. Chemical softening, reverse osmosis and electro dialysis or ion exchang reduces the magnesium hardness to acceptable levels.

NITRATES

Nitrates are the most oxidized forms of nitrogen and the end product of the aerob decomposition of organic nitrogenous matter. The significant sources of nitrates are chemical fertilize from cultivated lands, drainage from livestock feeds, as well as domestic and industrial sources. Natu waters in their unpolluted state contain only minute quantities of nitrates. The stimulation of plant growth itrates may result in eutrophication, especially due to algae. The subsequent death and decay of pla produces secondary pollution. Nitrates are most important for biological oxidation of nitrogenous orga natter. Certain nitrogen fixing bacteria and algae have the capacity to fix molecular nitrogen in nitrates. T nain source of polluting nitrates is domestic sewage. Nitrates may find their way into ground water thro eaching from soil and at times by contamination. They can be measured by the phenoldisulphonic metho

Principle: Nitrates react with phenoldisulphonic acid and produce a nitrate derivative, which in alkaline solution develops yellow colour due to rearrangement of its structure. The colour produced is directly proportional to the concentration of nitrates present in the sample.

Apparatus required: Nessler's tube, pipettes, beakers, spectrophotometer, cuvettes, measuring jar and hot water bath.

Procedure: A known volume (50ml) of the sample is pipetted into a porcelain dish and evaporated to dryness on a hot water bath. 2ml of phenol disulphonic acid is added to dissolve the residue by constant stirring with a glass rod. Concentrated solution of sodium hydroxide or conc. ammonium hydroxide and distilled water is added with stirring to make it alkaline. This is filtered into a Nessler's tube and made up to 50ml with distilled water. The absorbance is read at 410nm using a spectrophotometer after the development of colour. The standard graph is plotted by taking concentration along X-axis and the spectrophotometric readings (absorbance) along Y-axis. The value of nitrate is found by comparing absorbance of sample with the standard curve and expressed in mg/L.

AMMONIA

Ammonia is the major nitrogenous waste product in aquatic animals. Higher concentrations of ammonia in the water is toxic to the aquatic animals and hence the amount of ammonia present in the given water sample is monitored to know its concentration in sample.

Procedure: 5ml of the sample water is taken in a clean test tube . to this 0.25 ml of oxidizing solution is added and left for 30 minutes. After 30 minutes the solution turned into blue colour. Now the amount o ammonia in the sample is measured in DCR at 680nm.

DISSOLVED OXYGEN

Oxygen dissolved in water is a very important parameter in water analysis as it serves as a indicator of the physical, chemical and biological activities of the water body. The two main sources dissolved oxygen are diffusion of oxygen from the air and photosynthetic activity. Diffusion of oxygen fro the air into water depends on the solubility of oxygen, and is influenced by many other factors like wa movement, temperature, salinity, etc. Photosynthesis, a biological phenomenon carried out by autotrophs, depends on the plankton population, light condition, gases, etc. Oxygen is considered to be major limiting factor in water bodies with organic materials. Dissolved oxygen is calculated by m methods.

Method : Winkler's method

Principle: Oxygen present in the sample oxidizes the dispersed divalent manganous hydroxide t higher valency to precipitate as a brown hydrated oxide after addition of potassium iodide and sc hydroxide. Upon acidification, manganese reverts to its divalent state and liberates iodine from pota iodide, equivalent to the original dissolved oxygen content of the sample. The liberated iodine is ti against N/80 sodium thiosulphate using fresh iodine as an indicator.

CHAPTER 4. BIOLOGICAL PARAMETERS OF WATER

PLANKTON ANALYSIS

The physical and chemical characteristics of water affect the abundance, species composition, stability and productivity of the indigenous populations of aquatic organisms. The biological methods used for assessing water quality includes collection, counting and identification of aquatic organisms; biomass measurements; measurements of metabolic activity rates; toxicity tests; bioaccumulation, biomagnification of pollutants; and processing and interpretation of biological data. The work involving plankton analysis would help in:

1. Explaining the cause of colour and turbidity and the presence of objectionable odour, tastes and visible particles in waters.
2. The interpretation of chemical analyses.
3. Identifying the nature, extent and biological effects of pollution.
4. Providing data on the status of an aquatic system on a regular basis.

Plankton: A microscopic community of plants (phytoplankton) and animals (Zooplankton), found usually free floating, swimming with little or no resistance to water currents, suspended in water, non-motile or insufficiently motile to overcome transport by currents, are called "Plankton".

Phytoplankton (microscopic algae) usually occurs as unicellular, colonial or filamentous forms and is mostly photosynthetic and is grazed upon by the zooplankton and other organisms occurring in the same environment.

Zooplankton principally comprise of microscopic protozoans, rotifers, cladocerans an copepods. The species assemblage of zooplankton also may be useful in assessing water quality.

The structure of photosynthetic populations in the aquatic ecosystems is dynamic and constantl changing in species composition and biomass distribution. An understanding of the community structure dependent on the ability to understand the temporal distribution of the different species. Changes in speci composition and biomass may affect photosynthetic rates, assimilation efficiencies, rates of nutrie utilization, grazing, etc.

Plankton, particularly phytoplankton, has long been used as indicators of water qual Because of their short life spans, planktons respond quickly to environmental changes. They flourish bot highly eutrophic waters while a few others are very sensitive to organic and/or chemical wastes. Sc species have also been associated with noxious blooms causing toxic conditions apart from the tastes odour problems.

Plankton net: The plankton net is a field-equipment used to trap plankton. It has a polyethylene filter defined mesh size and a graduated measuring jar attached to the other end. A handle holds the net. The r size of the net determines the size range of the plankton trapped. The mesh number 30 of size 60 mm used for collecting samples.

COLOR AND ODOR

The color of the investigated pond water was observed visually. The color of study pond 1 and 2were found to vary from light to deep green. The deep green color represents higher planktons and light green color represents lower planktons. According to Das ([illegible]), a well and phytoplankton enriched water body appears to be dark greenish blue [illegible]. The odor of the investigated pond water was smelt by nose. The odor of pond 1 was not fishy and odor of pond 2 fishy. The odor of an ideal pond water is not fishy or odorless (Das [illegible]).

TRANSPARENCY

Transparency of the studied ponds is determined by using Secchi disc and the results were observed as 22cm and 30 cm for pond 1 and pond 2 respectively. A slight variation in the transparency were observed during study period due to cloudy weather in those months but in remaining months the variation quite negligible.

BIOLOGICAL PARAMETERS:

The sample water is tested for the presence of various phytoplankton and zooplankton to learn about plaktonic growth with in the pond and also to form an idea about the amount of feed to be given to culture organisms or amount of fertilizers to be added to the pond. The observations of the present stud[illegible] as follows.

Zooplankton:

1. In the sample 1 the following zooplankton has been observed.
   - Rotifers: *Brachionus species, Filinia species* etc.
   - Cladocerans: *Daphnia sp., Moina sp., Diaphanosoma sp*. Etc.
   - Copepods: Cyclopoids and Calanoids were found.

2. In the sample 2 the following zooplankton have been observed.
   - Rotifers: *Brachionus species, Filinia species* etc.
   - Cladocerans: *Daphnia sp., Moina sp*. Etc.
   - Copepods: Cyclopoids and Calanoids were found.