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Water Quality Parameters –A Review

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ABSTRACT **Water resources are equally important for natural ecosystem and human development. It is essential for agriculture, industry and human existence. All life on earth depends on water. Fresh water is a critical, finite, vulnerable, renewable natural resource on the earth and plays as important role in our living environment without it life is impossible. More than 70% of the Earth's surface is covered with this simple molecule. Scientists estimate that the hydrosphere contains about 1.36 billion cubic kilometers of these substances of physicochemical parameters such as pH, colour, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), and turbidity. The quality of water can be assessed by studying its physical and chemical characteristics. The present review paper describes about the importance of different parameters of water quality.**

Key words –BOD, COD, PH, Turbidity. TDS, TSS.

I INTRODUCTION

Water is most indispensable requirement for all living organisms and any alterations in water may lead to the issue of survival for these organisms. Good quality of water is essential for living organisms. The quality of water can be assessed by studying its physical and chemical characteristics. Because of vast population and negligence of human being the quality of water is being deteriorated day by day [1].An enormous industrial growth has taken place throughout the world in the past few decades, to fulfill the increased demand of human civilization, which has created an overexploitation of available resources and caused pollution of water, land, and air. Rapid industrialization, urbanization and anthropogenic activities consequently cause water pollution which has brought a variable water crisis. Environmental pollutants arising from anthropogenic source have the potential to affect the aquatic ecosystem in a synergistic manner. The determination of such environmental pollutants can be assessed by physicochemical almost 70% of the water in indie has become polluted due to the discharge of domestic sewage and industrial effluents in to natural water resources such as river, streams, lakes [2]. The requirement of water in all lives, from microorganisms to human beings, is increased day-by-day but it is a serious problem to provide a safe drinking water because all water resources have reached to a point of crisis due to unplanned urbanization and industrialization [3].

According to WHO estimate about 80% of water pollution in India is due to domestic waste. The improper management of water systems may cause serious problems in availability of drinking water [4]. Water resource is most often polluted by industrial effluents. When waste from different industry are discharged with out proper treatment in to the water. The physical, chemical and biological characteristics of water are altered in such a way that they are not useful for the purpose for which they are intended [5].Consideration of water quality is important in wetland habitat evaluation because a host of interacting physical and chemical factors can influence the levels of the primary productivity and thus influence trophic structure and total biomass throughout the aquatic food web [6]. In this paper, some parameters assessing the quality of water has been presented with past work carried out by scientist and academicians related with quality of water.

II WATER QUALITY PARAMETER

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physico-chemical parameters. Selection of parameters for testing of water is solely depends upon for what purpose we going to use that water and what extent we need its quality and purity. Water does content different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, color, odour, pH, turbidity, TDS etc, while chemical tests should be perform for its BOD, COD, dissolved oxygen,

alkalinity, hardness and other characters. For obtaining more and more quality and purity water, it should be tested for its trace metal, heavy metal contents and organic i.e. pesticide residue. It is obvious that drinking water should pass these entire tests and it should content required amount of mineral level. Only in the developed countries all these criteria's are strictly monitored due to very low concentration of heavy metal and organic pesticide impurities present in water it need highly sophisticated analytical instruments and well trained manpower. Following different physic chemical parameters are required to for monitoring quality of water.

Temperature - Temperature can exert great control over aquatic communities. If the overall water body temperature of a system is altered, an aquatic community shift can be expected. In water above 30degree C, a suppression of all benthic organisms can be expected. Also, different plankton groups will flourish under different temperatures. For example, diatoms dominate at 20 - 25 degrees C, green algae dominate at 30 – 35 degrees C, and cyano-bacteria dominate above 35 degrees C.

pH- pH is an indicator of the existence of biological life as most of them thrive in a quite narrow and critical pH range.

DO- DO is essential for aquatic life. A low DO (less than 2mg/l) would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic life.

Colour- Color is vital as most water users, be it domestic or industrial, usually prefer colorless water. Determination of colour can help in estimated costs related to discoloration of the water.

Conductivity- Conductivity indicates the presence of ions within the water, usually due to in majority, saline water and in part, leaching. It can also indicate industrial discharges. The removal of vegetation and conversion into monoculture may cause run-off to flow out immediate thus decrease recharge during drier period. Hence, saline intrusion may go upstream and this can be indicated by higher conductivity.

Turbidity -Turbidity may be due to organic and/or inorganic constituents. Organic particulates may harbour microorganisms. Thus, turbid conditions may increase the possibility for waterborne disease. Nonetheless, inorganic constituents have no notable health effects. The series of turbidity-induced changes that can occur in a water body may change the composition of an aquatic community. First, turbidity due to a large volume of suspended sediment will reduce light penetration, thereby suppressing photosynthetic activity of phytoplankton, algae, and macrophytes, especially those farther from the surface. If turbidity is largely due to algae, light will not penetrate very far into the water, and primary production will be limited to the uppermost layers of water. Cyanobacteria (blue-green algae) are favoured in this situation because they possess flotation mechanisms. Overall, excess turbidity leads to fewer photosynthetic organisms available to serve as food sources for many invertebrates. As a result, overall invertebrate numbers may also decline, which may then lead to a fish population decline. If turbidity is largely due to organic particles, dissolved oxygen depletion may occur in the water body. The excess nutrients available will encourage microbial breakdown, a process that requires dissolved oxygen. In addition, excess nutrients may result in algal growth. Although photosynthetic by day, algae respire at night, using valuable dissolved oxygen. Fish kills often result from extensive oxygen depletion.

Total Suspended solids- Total Suspended solids are an indication of the amount of erosion that took place nearby or upstream. This parameter would be the most significant measurement as it would depict the effective and compliance of control measures e.g. riparian reserve along the waterways. The series of sediment-induced changes that can occur in a water body may change the composition of an aquatic community. The settling of suspended solids from turbid waters threatens benthic aquatic communities. Deposited particles may obscure sources of food, habitat, hiding places, and nesting

sites. Most aquatic insects will simply drift with the current out of the affected area. Benthic invertebrates that prefer a low-silt substrate, such as mayflies, stoneflies, and caddis flies, may be replaced by silt-loving communities of oligochaetae, pulmonate snails, and chironomid larvae. Increased sediment may impact plant communities. Primary production will decline because of a reduction in light penetration. Sediment may damage plants by abrasion, scouring, and burial. Finally, sediment deposition may encourage species shifts because of a change of substrate. Sediment deposition may also affect the physical characteristics of the stream bed. Sediment accumulation causes stream bed elevation and a decrease in channel capacity. Flooding is more likely after sediment accumulation because the stream can not accommodate the same volume of water. Also, a substrate that is closer to the surface receives more light and supports increased numbers of photosynthetic organisms, such as rooted algae. As a result, recreational use may be threatened because moving parts of boats may become tangled in aquatic plants. Sediment, which is generally negatively charged, attracts positively charged molecules. Some of these molecules (phosphorus, heavy metals, and pesticides) are pollutants. These positively charged pollutants are in equilibrium with the water column and are often released slowly into the water resource

TDS- The total dissolved solids (TDS) in water consist of inorganic salts and dissolved materials. In natural waters, salts are chemical compounds comprised of anions such as carbonates, chlorides, sulphates, and nitrates (primarily in ground water), and cations such as potassium (K), magnesium (Mg), calcium (Ca), and sodium (Na). In ambient conditions, these compounds are present in proportions that create a balanced solution. If there are additional inputs of dissolved solids to the system, the balance is altered and detrimental effects may be seen. Inputs include both natural and anthropogenic source.

BOD- BOD is a measure of organic pollution to both waste and surface water. High BOD is an indication of poor water quality. For this tree plantation project, any discharge of waste into the waterways would affect the water quality and thus users downstream.

Nitrate Nitrogen -The growth of macrophytes and phytoplankton is stimulated principally by nutrients such as nitrates. Many bodies of freshwater are currently experiencing influxes of nitrogen and phosphorus from outside sources. The increasing concentration of available phosphorus allows plants to assimilate more nitrogen before the phosphorus is depleted. Thus, if sufficient phosphorus is available, high concentrations of nitrates will lead to phytoplankton (algae) and macrophyte (aquatic plant) production. This is mostly due to the usage of fertilisers.

COD- COD is an indicator of organics in the water, usually used in conjunction with BOD. High organic inputs trigger deoxygenation. If excess organics are introduced to the system, there is potential for complete depletion of dissolved oxygen. Without oxygen, the entire aquatic community is threatened. The only organisms present will be air- breathing insects and anaerobic bacteria. If all oxygen is depleted, aerobic decomposition ceases and further organic breakdown is accomplished anaerobically. Anaerobic microbes obtain energy from oxygen bound to other molecules such as sulphate compounds. Thus, anoxic conditions result in the mobilization of many otherwise insoluble compounds.

In areas of high organics there is frequently evidence of rapid sewage fungus colonization. Sewage fungus appears as slimy or fluffy cotton wool-like growths of micro-organisms which may include filamentous bacteria, fungi, and protozoa such as Sphaerotilus natans, Leptomitus lacteus, and Carchesium polypinuym, respectively. The various effects of the sewage fungus masses include silt and detritus entrapment, the smothering of aquatic macrophytes, and a decrease in water flow velocities. An accumulation of sediment allows a shift in the aquatic system structure as colonization by silt-loving organisms occur. In addition, masses

of sewage fungus may break off and float away, causing localized areas of dissolved oxygen demand elsewhere in the water body.

Ammonia Nitrogen- Ammonia levels in excess of the recommended limits may harm aquatic life. Although the ammonia molecule is a nutrient required for life, excess ammonia may accumulate in the organism and cause alteration of metabolism or increases in body pH. It is an indicator of pollution from the excessive usage of ammonia rich fertilizers.

Potassium- Potassium is macro nutrient element for plant growth. It can occur naturally in minerals and from soils. High levels in surface water, especially in areas where there are agricultural activities as indicative of introduction of K due to application of fertilizers.

Microbiological- Microbiological test is to detect the level of pollutions caused by living thing especially human who live or work in the area especially upstream of the site. These tests are based on coliform bacteria as the indicator organism. The presence of these indicative organisms is evidence that the water has been polluted with faeces of humans or other warm-blooded animals.

III SOME PHYSICO CHEMICAL ANALYSIS STUDY OF WATER SAMPLE IN INDIA

Physico chemical parameter study is very important to get exact idea about the quality of water and we can compare results of different physico chemical parameter values with standard values .Some past work carried out by researchers are briefly summarized here.

According to Tripathi et al. [7] pulp and paper industry effluents are highly polluted industries in India. Small and large scale pulp and paper mills which have different production capacity as well as different raw materials, adopt different processes that lead to radical differences in the physico-chemical properties of effluents. Such polluted effluents must be treated properly before being discharged into the drainage channel, to minimize the effect of various pollutants on the environment. On the basis of results reported herein it can be concluded that the effluent discharged from both the paper industries is highly polluted and has exceeding values as prescribed by the standards of regulatory agency of India. It is further stated that the pollutants generated during different stages from paper industries can be minimized either by replacing some existing pulping and bleaching techniques like bio-pulping, bio-bleaching, TCF (Total Chlorine Free bleaching), ECF (Elemental Chlorine Free bleaching) and ozone bleaching or by treatment of the effluent by physico-chemical or biological methods. The data bank generated herein by this monitoring study of pulp and paper mill effluent are collected from Agro-based and one from wood based could successfully be used in prediction of their toxicity and effective management.

Agarwal et al., [8] studied to provide an informative data and helps to understand water characteristics and indicate that the water of Bihar River can serve as a good habitat. The pH value indicates the alkaline water of in the month of May might be due to high temperature that indicates the solubility of CO2. The analysis of the quality parameters of water from Baba Ghat of Bihar River shows that pH, alkalinity, chloride ion, total hardness, BOD and COD etc. are well within the permissible limit. Hence proper strategies should be designed to counter.

Vyas et al. [9] studied that the most of the fresh water bodies all over the world are getting polluted due to domestic waste, sewage, and industrial waste, agricultural and religious activities like idol immersion.

Central Pollution Control Board [10] has formulated a comprehensive set of guidelines on the practice of idol immersion in lakes, rivers and seas (CPCB, Guidelines for Idol Immersion, 2006). These guidelines delineate and specify the role of the state pollution control boards in conducting water quality assessments of water bodies and classifying them on the basis of certain physio-chemical parameters. These guidelines if followed and acted upon can help in bringing tremendous

change in the water quality of river post idol immersion.

According to Tamot et al.,[11] DO is the most important parameter to study the quality of water and is required for the metabolism of all aquatic organisms was found to be Nil at seven sites.

Ganai and Parveen [12] concluded that the most important factors affecting the phytoplankton distribution are water temperature, CO2, chloride, transparency, TDS, alkalinity and dissolved oxygen. However, conductivity and hardness has lesser influence on the distribution of phytoplankton groups.

Mishra et al., [3] illustrated that Rani Lake water exhibits low DO, High BOD, COD, turbidity, hardness, TDS, chloride, alkalinity, phosphate and nitrate during 2008 and 2009.The values of these parameters were found to be beyond the permissible limit (IS: 10500). Higher pH value indicates slightly alkaline nature of the water. The findings clearly indicate that this lake is polluted and eutrophic in nature because of discharge of sewage and other anthropogenic activity.

Biological Oxygen Demand represents the quantity of oxygen which is consumed in the course of aerobic processes of decomposition of organic materials, caused by microorganisms. The BOD therefore provides information on the biologically-convertible proportion of the organic content of a sample of water. This leads to the consideration of these materials in terms of their susceptibility to oxidation by the use of oxygen. The range of 1.4-35, 4-55 and 3.3-38 mg/L were obtained from the pre, during and post immersion activities. The maximum value of BOD was observed during the immersion period at Site-7 (Majnu Ka Tila). The COD which is commonly used to indirectly measure the amount of organic compounds in water was also analyzed. Most applications of COD determine the amount of organic pollutants found in surface water (e.g. lakes and rivers) or wastewater making COD a useful measure of water quality. The value of COD in conjugation with BOD is helpful in knowing the toxic conditions and presence of biologically resistant organic substances as also reported by (Rajkumar et al., 2003) and (Gupta et al., 2011)[13,14].

IV CONCLUSION

All above impacts have resulted in the deterioration of water quality of river and lakes. It gives the clue to develop appropriate management strategies by municipal authorities. The temperature variation is mainly related with the temperature of atmospheric and weather condition [15]. The reduction in the pH of River Betwa could have been due to the discharged industrial effluents. This result agrees with the reports by previous scientist [16, 17, and 18]. The increase in hardness can be attributed to the decrease in water volume in the rate of evaporation at high temperature, high loading organic substances, detergent, chlorides and other pollutants [19, 20]. Minimum dissolved oxygen due to effluents discharge, as suggested by Agrawal and Saxena [21] that the industries were releasing some organic substances that were of high oxygen demanding wastes. Biological oxygen demand is an important parameter which is widely used to determine the pollution load of waste water. The aim of BOD test is to determine the amount of bio-chemically oxidisable carbonaceous matter [22]. Values of BOD were due to higher rate of decomposition of organic matter at higher temperature, turbidity and less water current) [23]. Chemical oxygen demand is a test which is used to measure pollution of domestic and industrial waste. This gives valuable information about the pollution potential of industrial effluents and domestic sewage [22, 24]. Highest value of COD indicates that most of the pollution in study zone in Betwa River is caused by industrial effluents discharged by industrial units. Similar results were also reported by Pande and Sharma, Murhekar [25, 26].Hence it is essential to examine the quality of water by different parameters as stated above before using the water.

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