

Physico Chemical Characteristic of Wardha River near Kaundinayapur Area of Wardha District

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Abstract

The present study is a part of research work to study the Physico chemical characteristics of fresh water of Wardha river in kaundanyapur area of Wardha District (Maharashtra state) Kaundinyapur is a village in boundary Wardha District in the state of Maharashtra India. Its ancient Vitthal temple, situated on a hillock overlooks the perennially flowing Wardha River. In the kaundyanapur river water is being stored in a tank for drinking purposes. The Physico chemical characteristics like temperature, PH, alkalinity, calcium, magnesium, hardness, phosphate, nitrate and total dissolved solids etc. were studied. The period of study was June 2024 to Jan 2025. The seasonal fluctuations in physico chemical parameters were observed and report finding shows some variations due to natural environmental changes and dead body ashes.

Key words: -Physico chemical, TDS, Alkalinity, Dissolved oxygen.

Introduction

Rivers have been the most important freshwater resources and our ancient civilizations have flourished along the banks of rivers. River water finds multiple uses like agriculture, industry, transportation, aquaculture, public water supply and they have been used for cleaning and disposal purposes. Huge loads of waste from industries, domestic sewage and agricultural practices find their way into rivers resulting in large scale deterioration of the water quality. The growing problem of degradation of our river ecosystem has necessitated the monitoring of water pollution and water quality of various rivers all over the country to evaluate their production, capacity, utility potential and to plan restorative measures.

Water's physicochemical properties are crucial since they significantly impact the variety of living things that call it home. An ecosystem's structural and functional processes are regulated by the water. The existence, absence, and kind of biota are all determined by the chemistry of the water. Because of differences in their physicochemical properties, ecosystems with varying climates have different biological compositions. Therefore, to comprehend phytoplankton in an ecosystem, physicochemical features must be studied.

In recent times limnological studies are often related to fisheries, biodiversity conservation, pollution assessment and rejuvenation of degraded inland fresh water ecosystems (Arlinghaus et al, 2008). In many areas the ecological impacts from human activities will far exceed the impacts from climate change, Scholze et al (2006). Have worked on a climate change, risk analysis for world ecosystems in a pond of Rajshahi University, has investigated the effects of abiotic parameters on the variations of zooplankton population.

Many species feed on particulate organic matter in detritus suspension thereby forming several links in the food web of aquatic ecosystems. Thus knowledge of their abundance diversity temporal and spatial distribution is important aspect in understanding trophodynamics and trophic progression of water body .Perusal of the available literature on the above aspects of the lotic ecosystem, reveal that lot of published documentation is available on the various aspects of above investigations on lotic ecosystem not only from the other countries of the world (Berner 1951, Greenberg 1964 , Garnier et., al 1995, choudhari and Bilgrami 1991 , Khanna etal .1997 , Sawane etal 2006 , Sharma 2021`).

APHA (1989) was used in this work to estimate all of the physicochemical properties of the Wardha River in the Wardha District. Temperature, pH, dissolved oxygen, free CO₂, alkalinity, calcium, magnesium, hardness, phosphate, nitrate, and total dissolved solids were among the physicochemical parameters whose monthly fluctuations were examined.

Methods

Between June 2024 and January 2025, samples for the experimental study were collected in plastic bottles from 8 to 11am at different places. Before being brought to the study lab for further examination, the geographic location, sample number, collection date, etc. of each place were also noted in the field journal. The Zoology Department's repository at Vidya Vikas College Samudrapur District Wardha (M.S.) now has each and every sample came. Edges of water bottle showed shallow water, it responded quickly to atmospheric fluctuations (R.M. Rajkumar and L.P..Dalal(2013).

Observation

Followings were the observations recorded in following tables.

Tables 1 Monthly variations in parameters at selected sitefrom (June 2024 to January 2025).

Month and year	Temp in degree celcius	Ph	DO (mg/lit)	Free CO ₂ (mg/ lit)	Calcium (mg/lit)	Magnesium (mg/lit)	Total alkal (mg/lit) inity	Nitrate mg/lit	Phosphate (mg/lit)	TDS PPM
June 2024	31.1	8.31	25.17	0	43.67	34.82	27.15	0.07	0.64	0.910
July 2024	28.0	8.2	17.1	297	61.4	17.42	26.12	0.12	0.63	0.468
Auguct 2024	28	8.4	17.51	507	41.82	32.24	33.62	0.17	1.33	0.691
Septem ber 2024	26.2	8.7	17.2	332	36.08	51.1	127.8	0.21	0.27	0.537
Octobe r 2024	27.7	8.32	20.91	186	92.78	7.42	91.52	0.18	0.57	0.432
Novem ber 2024	24	8.62	14.28	175	54.32	18.82	73.32	0.16	1.4	0.546
Decem ber 2024	21.7	8.62	8.82	347	41	41.04	41.06	0.12	2.8	0.643
Januar y 2025	22.6	8.57	12.27	68	71.12	7.82	91.17	0.14	0.21	0.435

Results and Discussion

pH

pH is the measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions. The pH of the water samples varied from 5.40- 6.00 at different times, as indicated by the *in situ* readings. The result reveals that the pH value was not within the desirable limit of BIS and WHO standards ^[48] so that the river water cannot be used for drinking purpose. River waters with a pH of 5.5 and below are particularly at risk ^[49]. Basically, the pH was determined by the amount of dissolved carbon dioxide which forms carbonic acid in water ^[50,51]. The pH of ground water can also be lowered by organic acids from decaying vegetation and the dissolution of sulfide minerals ^[52]. The Wardha River's observations supported the idea that all Indian rivers were somewhat alkaline. The Wardha River's reported pH readings from June 2024 to January 2025 (Table 1) Demonstrated that the lowest and maximum values. The temperature of the water has a direct impact on the rise or fall in the pH value. When the water is devoid of pollutants, Sahu et al. (1995) found that the pH of the water varies throughout the day. They found that the pH rose from 6 am to 3 pm and fell from 3 pm to 6 am. Vyas and Kumar (1968) and Sreenivasan (1964) have documented seasonal variations in PH.

The temperature

The temperature was basically important for its effects on the chemistry and biological activities of organisms in water. Temperature was known to influence in the determination of other factors like pH, conductivity, dissolved gases and various forms of alkalinity. The Wardha River displayed table 1's maximum and minimum temperatures from June 2024 to January 2025, according to the observation and analysis. Variations can be seen in the maximum and minimum temperatures reported for specific Wardha River locations. Weather variations, water pollution, and the release of dead bodies into the air could be the cause.

Dissolved oxygen

Biological Oxygen demand is a measurement of the oxygen required for micro-organisms while breaking down organic matter to stable inorganic forms such as CO_2 , NO_3 and H_2O ion and average basis, the demand for oxygen is proportional to the amount of organic waste to be degraded aerobically. BOD is less in summer because due to zooplankton and phytoplankton population, temperature by sunlight and industrial wastes. It is more in monsoon because due to tidal flow and cool environment.

Chemical Oxygen Demand is the oxygen required by the organic substances in water to oxidize them by a strong chemical oxidant. In the present investigation the recorded low value of DO and higher values of BOD and COD can be described to the discharge of effluents and non-point source of pollution in the coastal area and mangrove station.

The Wardha River's chosen sites revealed the lowest and greatest dissolved oxygen values between June 2024 and January 2025. As Sabata and Nayar (1995) noted, oxygen's solubility decreases as the temperature rises. Similarly, a drop in temperature was clearly associated with an increase in dissolved oxygen.

Free CO_2

Free CO₂ in river water is typically assessed through parameters like PH and alkalinity, which influence the concentration of dissolved CO₂. Specific data on free CO₂ levels in the Wardha Rivers is limited in the available sources. However, studies have evaluated related water quality parameters that can provide insight into the rivers condition. Day and night were directly correlated with changes in free carbon dioxide. Throughout the day, measurements made of the concentration of free CO₂. According to Sahu et al. (1995) and Jindal and Gheta (1991), concentration may even be zero during the midday hours.

Calcium

Calcium value was not with the desirable limit of BIS and WHO standard. The desirable and permissible value of calcium 75-200 mg/L. The calcium and magnesium contributes to the hardness of water as their carbonate magnesium is always considerably lower than of calcium component excessive concentration of magnesium is undesirable in domestic water because of the problems of scale formation of pitting (Ashok Prabu 2008, Jayaraman, R. 1959, APHA 2000). Calcium is crucial for the growth and metabolism of the ecosystem's flora. It has an immediate impact on the system's pH and carbonate content. Table 1 displays data from June 2024 to January 2025. Sreenivasa Netai (1974) reported the maximum concentration during April.

Magnesium

The desirable and permissible value of Magnesium is 30-100 mg/l the general effect of magnesium poor lathering and deterioration of cloths. Magnesium has an impact on the algal population, just like calcium. Magnesium concentration was found to generally show a positive correlation with total phytoplankton. The record of magnesium content from June 2024 to January 2025 is displayed in Table 1.

Alkalinity

Alkalinity of water is its acid neutralizing capacity. Alkalinity is significant in many uses and because the alkalinity of may surface water is primarily a functional carbonate, bicarbonate and hydroxide content, it is taken as an indication of the concentration of these constituents, Alkalinity value reserve as an index of productive potential of water ^[76]. Anthropogenic activity leads to entry of more domestic wastes, washing, bathing etc., High value of alkalinity were also observed by ^[77]. Acidity and alkalinity are crucial in regulating the activity of enzymes. Water alkalinity, according to Sverdrup et al. (1942), is a measurement of the amount of acid in the water and the cations that balance it out. Only carbonic and boric acid anions need to be taken into account because weak base cations are found in water in very small amounts. On the other hand, OH release from contaminated sources is a significant factor in raising the water system's alkalinity in a polluted system. The magnitude is still lower in July and August.

Nitrate

In the present study, it was been observed that the Nitrite value was within the BIS and WHO standard. The desirable and permissible value is 0.2 - 15 mg/l the general and health effects of Nitrite is to form nitrosamines which are carcinogenic. This was due to the addition nitrogenous nutrients mainly terrestrial runoff like break down of vegetation, use of chemical fertilizers in

agriculture and oxidation of ammonia from of nitrogen to nitrite (Saravanakumar A. et al 2008). Nitrate is influenced by both biotic and environmental variables. Its content is primarily determined by the activity of nitrifying bacteria, which are affected by the amount of dissolved oxygen present. During the course of the examination, the nitrate concentration in the Wardha River seemed to be rather low.

Phosphate

The growth of algae in rivers and ponds is controlled by the concentration of phosphate, which is required for the production of algae. Phosphates were one of the primary limiting nutrients in ponds and rivers. (Schindler, 1971). Usually, they were present in trace amounts in naturally contaminated water. According to Welch (1952) and Hitchinson (1957), phosphate levels rose as a result of sewage contamination.

Total dissolved salts (TDS)

TDS indicates the total amount of inorganic chemicals dissolved in water samples. The TDS values were above the drinking water standards as Prescribed by WHO and BIS. The desirable and permissible value is 1500 – 2000 mg/l. [74] have found the TDS values are higher than that of permissible limit for drinking water. [75] reported that the desirable limit of total dissolved solids in drinking water.

When suspended particles, solid particles, and deposited organic matter obstruct light penetration, the turbidity of the water increases. It has an impact on the development of microorganisms that grow at depth. Water bodies with high levels of total dissolved solids are unfit for human consumption.

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