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Physico – Chemical Analysis of Water Samples of Urban and Rural Area In Tirunelveli District., India.

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ABSTRACT

The investigation of physico-chemical characteristics of rural and urban ponds in the Tirunelveli district from October 2021 to December 2021 is the main focus of the present investigation. Four different pond sites were used for the water samples in this investigation. Physicochemical analysis of various parameters, including pH, Total dissolved solids (TDS), Total hardness (TH), Total alkalinity (TK), calcium, magnesium, sodium, potassium, iron, manganese, ammonia, nitrite, nitrate, chloride, fluoride, sulphate, phosphate, and faecal coliform, are measured in these water samples. All metrics were within acceptable ranges.

Key words: water samples of urban and rural areas, Physico chemical, Pond water, Rain water, WHO permissible.

Introduction:

One of the most fundamental needs of all living things is water. Oxygen, water, and food are three essential elements for human life. The most crucial element for all living things is water. Man can go for a few days without eating, but he can no longer survive without water. One of the most vital resources for the survival of all living things is fresh water. Human life depends on groundwater in many ways. Industrialization and urbanisation cause the water to become contaminated. According to Deshmukh and Ambore (2006), there is a direct connection between the hydrobiological characteristics of a freshwater body and the metabolism of aquatic organisms. According to Thitame and Pondhe (2010), surface water sources, including rivers, reservoirs, dams, etc., provide the majority of the water used in Indian agriculture. Better water supply, sanitation, and resource management can increase a nation's economy and have a significant impact on reducing poverty (WHO, 2017). These physico-chemical metrics show that water quality has declined as a result of a variety of

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anthropogenic disturbances, including industrialization, construction projects, and the use of agricultural and forest areas for other types of development. These water bodies' chemical quality is mostly affected by pollution, which subsequently gradually destroys the community and upsets the delicate balance of the food chain. 2008 (Ademola). Nowadays, anthropogenic activities such as industrialization (Ebenstein 2012; Teng et al. 2011; Temesgen and Seyoum 2018), urbanisation (Luo et al. 2017; Ren et al. 2003; Pires et al. 2015), and others are the primary causes of the problem with fresh water quality. For various land use types, different pollutant types may worsen water quality (Yu et al. 2016; Zhou et al. 2016; Bu et al. 2014). According to Chang (2008), Waziri and Ogugbuaja (2010), and Mereta et al. (2012), they vary depending on the usage of the land, such as crop cultivation, pastoral use, health care facilities, residential areas, and institutions that release pollutants without sufficient treatment. Environments near water are important natural resources. The world's most diverse ecosystem is the aquatic one. Our own activities have already begun the process of devastation through water pollution, and if it is not managed, our survival will be threatened. Saline and freshwater ecosystems are two broad categories that describe the world's aquatic ecosystems. Freshwater habitats are found in inland waters with little salt content. Its abundance of aquatic life entails the presence of numerous fascinating aquatic plants and animals. According to Dwivedi and Pathak (2000), the physical, chemical, and biological features of water play a significant role in determining the welfare of a civilization. Environmental contamination is pollution. Pollutants' initial impact is to reduce the physical quality of the water. The quantity, variety, and organisation of the live organisms in the water become indicators of later biological degradation (Grey, 1989). Water fluctuations in physico-chemical conditions adversely affect the organism, limiting their production and interfering with physiological processes, which reduces their ability to compete with other populations in the environment. Freshwater environments are highly diverse and marked by a wide range of physico-chemical conditions that greatly influence life. Due to overuse and contamination, fresh water has become scarce in some areas (Ghosh and Basu, 1968; Patil and Tijare, 2001; Singh and Mathur, 2005; and Gupta and Shukla, 2006). The purpose of this study was to evaluate the physical and chemical water quality characteristics of pond water in Tirunelveli's rural and urban areas.

Materials and Methods

Study Area:

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This study was conducted in the Tirunelveli district.

Sample I : New Bus stand (Venthankulam)

New bus stand Tirunelveli Latitude : 9.0789

New busstand Tirunelveli Longitude : 77.3467

SampleII : Town (NainarKulam)

Latitude. 8.7362° or 8° 44' 10"

Longitude. 77.6903° or 77° 41' 25"

Sample III :Manur

Latitude: 8.8507202

Longitude: 77.6546452

Sample IV :Uthamapandiyankulam

Latitude 8.9383° N,

Longitude 77.7033° E

Collection of Samples:

Samples were taken throughout the rainy season, from October 2021 to December 2021, in order to ascertain specific physico-chemical characteristics of water. Samples were taken from four distinct water sources in the Tirunelveli District, including ponds, urban lakes, and rural ponds. Polythene bottles were used to collect the sample, which was done between the hours of 6:00 and 7:00 in the morning. The water sample was then taken straight to the lab for measurement of several physical and chemical parameters, including pH, TDS, water temperature, and others. The pH of the water samples was tested using a digital pH metre, and the TDS level was determined using a TDS metre. Other parameters, including hardness (measured using flame photometers, Na+, K+, Cl-, Ca+2, Mg+2, No3, and F), were estimated in the lab using standard titration techniques.

Result:

The result obtained by Physico – Chemical analysis of all samples given in Table 1.

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Physico – Chemical properties of water sample during the month of October 2021-December 2021.

SL.No	Physico – Chemical properties (mg/Lit)	Acceptable limit	Sample – I	Sample - II	Sample - III	Sample – IV
01	Appearance	-	Turbid	Turbid	Clear	Clear
02	colour	Agreeable	Brownish	Brownish	colourless	Colourless
03	Odour	None	None	None	None	None
04	Turbidity NT units	1 – 5	7	19	3	33
05	Total dissolved solids mg/L	500 – 2000	312	980	358	419
06	pH	6.5 – 8.5	7.55	8.91	7.92	8.55
07	Ammonia mg/L	0.5	1.28	1.37	0.16	0.98
08	Total Alkalinity mg/L	200 - 600	76	440	96	180
09	Total Hardness mg/L	200 - 600	96	560	116	280
10	Calcium mg/L	75 - 200	17	90	16	30
11	Magnesium mg/L	30 – 100	13	16	18	40
12	Sodium mg/L	130	42	180	44	17
13	Potassium mg/L	100	38	95	42	13
14	Iron mg/L	0.3 - 1	0.47	2.5	1.88	0.7
15	Manganese mg/L	0.1 – 0.3	-	-	-	-
16	Nitrite mg/L	-	0.37	0.34	0.00	0.12
17	Nitrate mg/L	45	5	6	2	7
18	Chloride mg/L	250 - 400	83	240	106	71
19	Fluoride mg/L	1.0 – 1.5	0.3	0.6	0.3	0.3
20	Sulphate mg/L	200 - 400	40	64	13	5
21	Phosphate mg/L	-	0.19	0.25	0.03	0.11
22	Fecal coliform per 100 ml.	Nil/100ml	20	150	30	50

Appearance:

Results from the testing of water samples in the urban and rural settings are shown. one of the crucial factors in figuring out the quality of the water. The samples I and II are turbid, whereas samples III and IV are clear, giving the impression of different colours.

Colour:

Sample I and II are Brownish colour because the formation of algal bloom. III and IV are colourless sample.

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Turbidity: The WHO-approved water sources The permitted limits are 1 to 5 mg/l, therefore samples I, II, III, and IV all have 5 mg/l, whereas sample IV has excessive turbidity at 33 mg/l.

Total Dissolved Solids: According to ANZECC (2000), total dissolved solids are a measurement of all the inorganic compounds that are dissolved in water. TDS is a general indicator of salinity or water quality. The TDS value of 500 mg/l has been endorsed by the WHO as safe for ingestion. Sample II - 980 water has higher TDS values in the urban region range seen in sample I - 312, which is not consumable according to (BIS, 2012).

pH:

Water's pH is a key environmental component; variations in pH are related to chemical changes, species composition, and biological activity. It is typically used as a measure of how suitable the environment is (Rani et al., 2012).pH values between 6.5 and 8.5 were found in the current study. Urban regions varied between 7.55 and 8.91 in samples I and II, whereas rural areas ranged between 7.92 and 8.55 in samples III and IV.

Total Alkalinity: The ability of water to neutralise acids is measured by alkalinity. According to Smitha et al. (2007), alkalinity rises as dissolved carbonates and bicarbonates increase. 2002, Singh et al.It is also utilised as a productivity indicator (Hulgal and Kaliwal, 2008), who found an inverse relationship between alkalinity and water level. In the current investigation, the alkalinity ranged from 76 to 440 mg/l.

Total Hardness: The industrial effluent from the nearby residential neighbourhood may be the cause of this hardness. According to WHO guidelines, the hardness of the water is within the acceptable range and is referred to as soft water. According to Kamal et al. (2007), high amounts of bicarbonate, chloride, and dissolved sulphate in water cause water to become hard.The range of the water's total hardness was 200–600 mg/l. Total hardness in the current investigation ranged from 96 to 560 mg/l.

Calcium: Calcium is an essential micronutrient in aquatic environments, and calcium ion absorption on metallic oxides has an impact on these environments. Additionally, it has an impact on microorganisms, which are crucial in the exchange of calcium between sediments and subsurface water (Annalakshmi and Amsath, 2012). The sample II calcium content was 90 mg/l at its highest. The surge of industrial waste may be to blame for the greater calcium value seen throughout the study period.

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Magnesium: Magnesium is necessary for the production of chlorophyll and limits the growth of phytoplankton. As a result, magnesium deficiency lowers the population of phytoplankton (Garg et al., 2010). Sample IV in the current study had a high magnesium level of 40 mg/l.

Sodium: One of the significant cations that exist naturally is sodium. Pregnant women have cardiovascular illnesses and toxicemia due to the elevated salt concentration in the groundwater (Shah et al., 2008). The growth of plants is stunted when high salt water is used for irrigation. The salt amount varied greatly between each station, with sample II's reading of 180 mg/l having a higher sodium content than other stations.

Potassium: Generally speaking, potassium concentrations in natural water are modest, but high values are a sign of domestic waste contamination (Trevedy and Goel, 1986). The potassium concentration in the current study ranged from 100 mg/l. The lower value recorded in sample IV and the higher availability of potassium discovered in sample II.

Iron: Iron is typically found in soil-borne plant debris and organic waste. As iron-bearing minerals become more soluble, the amount of dissolved iron in ground water becomes more enriched (Jain and Sharma, 2000).The total iron concentration varied greatly in each sample, with station II having the highest concentration at 2.5 mg/l and station I having the lowest at 0.47 mg/l.

Manganese: Manganese compounds from industrial emissions, soil erosion, volcanic emissions, and the combustion of MMT-containing fuel may be present in the atmosphere as suspended particles (IPCS, 1999). The manganese concentration in the current study ranged from 0.1 to 0.3 mg/l. There was no evidence of manganese in the sample.

Ammonia: Ammonia is created when organic nitrogenous matter engages in microbial activity. Its presence is mostly brought on by decomposing plants, sewage, industrial waste, and fertilisers that include ammonia. In a channel close to the Mathura refinery, the average ammonia nitrogen content of effluent and sewage was 2.29 mg/l (Seema, 1997).Sample II had the highest ammonia concentration across all stations. Ammonia concentrations must not exceed 0.5 mg/l.

Nitrite: The presence of a slightly higher value in water is a sign that the River is polluted. Seema (1997).In samples I, II, III, and IV, the nitrite concentration was 0.37 mg/l, 0.34 mg/l, and 0.12 mg/l, respectively. In samples II and III, the nitrate content was found to be high in sample II and low in sample III.

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Nitrate: According to Murugavel and Pandian (2000) and Koc (2008), nitrate is also produced when human and animal waste are combined with agricultural fertilisers and dumped into lakes.In sample IV, the highest nitrate concentration was found to be 7 mg/l. The result showed that there is no organic pollution in the pond's water.

Chloride: One of the main inorganic ions in drinking water and sewage is chloride. One of the most crucial factors in determining the water quality is chloride (Munawar, 1970).In sample II, the maximum chloride level was found to be 240 mg/l.

Sulphate: Oxidation of sulphide, which is prevalent in the Earth's crust, and oxidation of hydrogen sulphide, which is produced during volcanic eruptions and is present in atmospheric precipitation, respectively, enrich water with sulphates (Nikanorov and Brazhnikova, 2000).Sulphate levels in this pond's water ranged between 200 and 400 mg/l during the current investigation. Sample II was determined to have the highest sulphate content. High levels of so42- can have a cathartic effect on people and can also lead to respiratory issues.

Phosphate: Determining phosphate levels is helpful since it is a crucial component of plant nutrition and acts as a limiting factor for all other plant nutrients. According to Rabalais (2002), the nutrient phosphate is the one that is thought to be the most important in limiting the eutrophication of freshwater systems.The highest concentration of phosphate was found in samples I and IV, where it was 0.19 mg/l, 0.25 mg/l, 0.03 mg/l, and 0.1 mg/l, respectively.

Fluoride: Sample II had the highest fluoride amount, which was 0.6 mg/l, whereas the other samples all had fluoride contents of about 0.3 mg/l.

Discussion:

One of the most fundamental needs of all living things is water. Oxygen, water, and food are three essential elements for human life. The most crucial element for all living things is water. Man can go for a few days without eating, but he can no longer survive without water. One of the most vital resources for the survival of all living things is fresh water. Human life depends on groundwater in many ways. Industrialization and urbanisation cause the water to become contaminated. According to Deshmukh and Ambore (2006), there is a direct connection between the hydrobiological characteristics of a freshwater body and the metabolism of aquatic organisms. According to Thitame and Pondhe (2010), surface water sources, including rivers, reservoirs, dams, etc., provide the majority of the water used in

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Indian agriculture. Better water supply, sanitation, and resource management can increase a nation's economy and have a significant impact on reducing poverty (WHO, 2017). These physico-chemical metrics show that water quality has declined as a result of a variety of anthropogenic disturbances, including industrialization, construction projects, and the use of agricultural and forest areas for other types of development. These water bodies' chemical quality is mostly affected by pollution, which subsequently gradually destroys the community and upsets the delicate balance of the food chain. 2008 (Ademola). Nowadays, anthropogenic activities such as industrialization (Ebenstein 2012; Teng et al. 2011; Temesgen and Seyoum 2018), urbanisation (Luo et al. 2017; Ren et al. 2003; Pires et al. 2015), and others are the primary causes of the problem with fresh water quality. For various land use types, different pollutant types may worsen water quality (Yu et al. 2016; Zhou et al. 2016; Bu et al. 2014). According to Chang (2008), Waziri and Ogugbuaja (2010), and Mereta et al. (2012), they vary depending on the usage of the land, such as crop cultivation, pastoral use, health care facilities, residential areas, and institutions that release pollutants without sufficient treatment. Environments near water are important natural resources. The world's most diverse ecosystem is the aquatic one. Our own activities have already begun the process of devastation through water pollution, and if it is not managed, our survival will be threatened. Saline and freshwater ecosystems are two broad categories that describe the world's aquatic ecosystems. Freshwater habitats are found in inland waters with little salt content. Its abundance of aquatic life entails the presence of numerous fascinating aquatic plants and animals. According to Dwivedi and Pathak (2000), the physical, chemical, and biological features of water play a significant role in determining the welfare of a civilization. Environmental contamination is pollution. Pollutants' initial impact is to reduce the physical quality of the water. The quantity, variety, and organisation of the live organisms in the water become indicators of later biological degradation (Grey, 1989). Water fluctuations in physico-chemical conditions adversely affect the organism, limiting their production and interfering with physiological processes, which reduces their ability to compete with other populations in the environment. Freshwater environments are highly diverse and marked by a wide range of physico-chemical conditions that greatly influence life. Due to overuse and contamination, fresh water has become scarce in some areas (Ghosh and Basu, 1968; Patil and Tijare, 2001; Singh and Mathur, 2005; and Gupta and Shukla, 2006). The purpose of this study was to evaluate the physical and chemical water quality characteristics of pond water in Tirunelveli's rural and urban areas.

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Conclusion:

For the period of October to December 2021 during the rainy season, a study of the physico-chemical parameters of the Tirunelveli District was conducted using significant parameters such as turbidity, TDS, pH, total alkalinity, total hardness, calcium, magnesium, sodium, potassium, iron, manganese, nitrite, ammonia, nitrate, chloride, fluoride, sulphate, and phosphate. In the current study, there are two study areas: rural ponds and urban ponds in the Tirunelveli District. The water in the rural ponds is acceptable because it is less contaminated, while the water in the urban ponds is not ideal because it is extremely polluted and so has less pisiculture, irrigation, and species variety. If this water is used for drinking or other domestic purposes, it may pose health hazards.

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