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STUDY ON PHYSICO-CHEMICAL PARAMETER AND MICROBIOLOGICAL ANALYSIS OF VARIOUS WATER COLLECTED FROM RAIPUR AREA

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ABSTRACT

Raipur is a city in Raipur district in the Indian state of Chhattisgarh. The quality of water of Raipur area is determined and characterized by different physic-chemical parameters and microbiological analysis. The pH values of all water samples were found between 6.5 to 8.5 (according to WHO standard) except Vivekanand pond i.e. 8.9. In general, the water quality of Raipur area can be said to be fairly good. On the basis of the physico-chemical studies, it can be said that the Marine Drive is rich in nutrients and suitable for aquatic organisms. Slight alkaline medium and high amount of nutrients provide favorable conditions for aquaculture. An effort has been made to comprehend the groundwater quality of Raipur city for drinking purpose utilizing Water Quality Index (WQI) and Geographic Information System (GIS) techniques. In this study thirty four groundwater samples were collected during May, 2015. Standard methods has been adopted in groundwater sampling which are prescribed by the American Public Health Association (APHA, 1995). Anthropogenic activities are influencing the groundwater quality of the study area. The present study is helpful in proper planning and management of available water resource for drinking purpose. Though this type of research is the beginning, it's can't be possible to give the clear-cut conclusion. Further more details research to be required in future to draw an attention towards the population those who are working in different organization.

KEYWORDS: Water, Sampling, Acidity, Alkalinity, COD, BOD, TDS, Microbiology, Analysis.

INTRODUCTION

Chhattisgarh is a heavily forested state in central India known for its temples and waterfalls. Near the capital Raipur, the town of Sirpur on the Mahanadi River is home to the red-brick Lakshmana (Laxman) Temple, decorated with carvings from Indian mythology. In the south, the city of Jagdalpur hosts the Sanjay Market on Sundays, a bartering place for local tribes. The huge Chitrakoot Falls lie to the northwest. Raipur is a city in Raipur district in the Indian state of Chhattisgarh. It is the largest city and the capital of Chhattisgarh. It was formerly a part of Madhya Pradesh before the state of Chhattisgarh was formed on 1 November 2000. Raipur is the capital city of Chhattisgarh state in central India. In the center, the ancient Dudhadhari Math temple is a sacred monument dedicated to Lord Rama, decorated with scenes from the epic poem "Ramayana." Nearby, a statue of the Hindu monk Swami Vivekananda towers over Vivekananda Sarovar lake. Southeast, Purkhouti Muktangan is an open-air museum featuring landscaped grounds, statues and tribal artifacts.

Water is the most important component in the environment for life. 70% of surface of earth is covered by water, out of which only 3% is fresh water. [1,2] Fresh water is essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible.[3] 2.4% is trapped in polar icecaps and glaciers, from which icebergs break off and slowly melt at sea. Less than 1% water is present in ponds, lakes, rivers, dams etc, which is used for Industrial, domestic and agricultural purposes.[4] Water is one of the abundantly available substances in nature, which man has exploited more than any resources for the sustenance of life. Water of good quality is required for living organisms.[5] Water quality is described by physical, chemical, biological characteristics. All these factors affect quality of water and the lifecycle of different aquatic organisms like fish etc.[6] Because, all living organisms can tolerate certain range of these parameters. Large deviations of these parameters from there ranges can affect seriously on body functions of aquatic organisms.[7]

Pond water is very essential constituent for living being which is used for drinking purpose, domestic and irrigation demand for the city. For the evaluation of water quality water samples were collected from various ponds in Raipur city, capital of Chhattisgarh. Because of rapid industrialization and urbanization and increased population have tremendously damaged the aquatic environment.[8-12] The demands of production of increased food grains have challenging effect on agricultural community and to produce more food grains many

agricultural farmers use chemical fertilizers, pesticides, and rodenticides.[13] Consequently the excess uses of fertilizers and pesticides splash away into the near aquatic bodies. Urban wastewater discharge by the sewer pipeline has direct effect on water ecosystem of natural ponds, lakes, wetlands, and rivers. Agricultural water discharge after the fertilizer application may contain organic pollutants and heavy metals.[14-15] Pond water samples were analyzed for various physicochemical characteristics such as turbidity, pH, total alkalinity, chloride, total hardness, total dissolved solid, dissolved oxygen, Biological Oxygen Demand (BOD).

The aquatic organisms depend on dissolved oxygen for their life. The organic matter discharged into the water is used as source of food for aquatic microorganisms. The plant decay, leaf fall are the natural source of organic matter and these organic compounds are degraded to simple organic compounds by bacteria by using dissolved oxygen. For increased disposal of organic waste the utility of dissolved oxygen by the microorganisms also increased. Hence the oxygen concentration in water decreases. Microorganisms will produce offensive products in this anaerobic condition and may result in undesirable effects like fish asphyxiation. Hence the quality of water is indicated by the amount of dissolved oxygen in the water.

A widely used technique to express the concentration of organic matter in waste water samples is Biological oxygen demand. It is a measure of the amount of dissolved oxygen used by microorganisms in the water. Chemical oxygen demand is the total amount of oxygen required to oxidize organic and inorganic waste matter present in one liter of waste water sample. It is an important and quickly measure parameter for industrial waste water analysis and water treatment plants. The principle of the method involves the oxidation of organic waste matter by using strong oxidizing agent like acidified potassium dichromate in the presence of silver sulfate as catalyst which catalyses the oxidation of organic matter. Silver sulphate reacts with chloride in the waste water to form the precipitate. The difficulty is overcome by adding mercuric sulphate to the water sample which prevents interference of chloride ions by forming a complex.

MATERIALS AND METHODS

Study Area

Chhattisgarh is the tenth largest state of India located in the centre east of the country, whose capital is Raipur. Pond water samples were collected from ponds (Vivekanand Sarovar, Marine Drive, Pandri Talab) situated in the Raipur region. The sampling was carried out on

2nd October 2018. The location of the ponds was recorded by using Geological Positioning System (GPS). The sampled ponds were a mix of government and private property. Many of the sampled ponds were the main source of drinking water for the local population.

Figure showing the Satellite View of Raipur Area of Chhattisgarh

Collection of Samples

Pond water samples were collected in BOD bottles, which were previously thoroughly washed with tap water and rinsed with distilled water. All samples were transported to the laboratory in iceboxes and refrigerated at 4°C until analyzed. One sample of tap water collected from MATS University, Raipur. Two sample of packed water (Xtreme,Patidar) were collected.

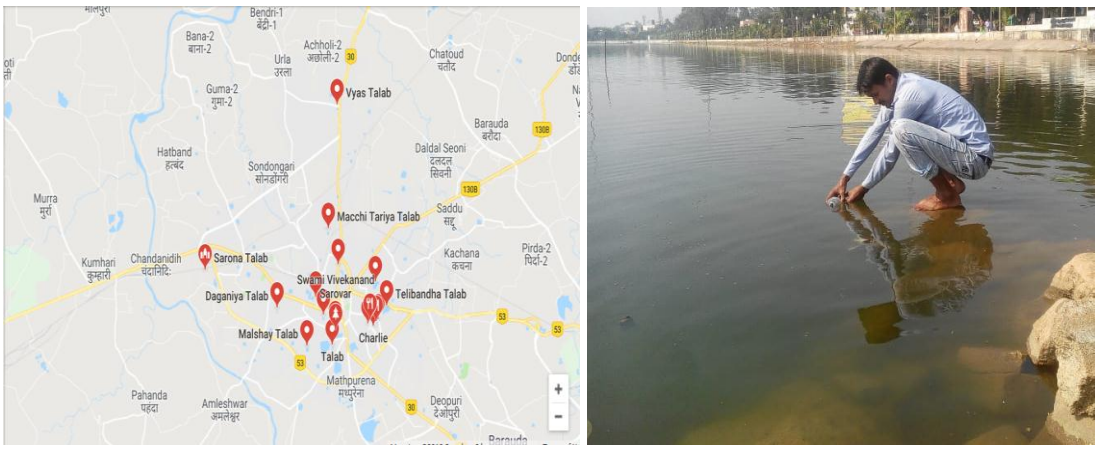

Figure Showing the Aerial View of Different Talab of Raipur Area and Collection of Water Sample.

Figure Showing the Collection of Water Samples from Different Talab of Raipur.

Water quality parameters: The water samples were collected from each pond mentioned in Table 1 for physical and chemical characterization. Analysis was carried out for various water quality parameters such as pH value, biological test etc. and results are mentioned in Table 1. Standard methods (American Public Health Association 1995) were used for sampling, preserving, transporting, and analysis. Freshly prepared distilled water was taken as standard in all experiments. The pH meter was used for the determination of pH of water samples. Total alkalinity, acidity were determined by titrimetric method. The Chemical Oxygen Demand (COD) was measured by closed refluxed method.

Figure Showing the Two Water Collection Sites of Raipur.

Microbiology Analysis: For Microbiology analysis, bacteriological study was performed by Gram staining method. Gram staining is a bacteriological laboratory technique. This method of staining is used to distinguish and classify bacterial species. Peptidoglycan is present in the cell wall of Gram positive bacteria but in gram negative it is in very small amount. [16] After staining Gram positive cell remain purple in colour where as Gram negative bacteria become pink or red in colour. [17, 18]

RESULTS AND DISCUSSION

pH measurement

The pH was measured by using pH meter. During October month the pH values varied from 7.05 to 8.9. Among all the ponds, pH of Vivekanand pond was highest i.e. 8.9. The pH of tap water collected from MATS University, Raipur, Xtreme packed water were found to be 6.55 and 7.28 respectively.

Total Alkalinity

The buffering capacity of water is known as alkalinity. It is constituted carbonates and bicarbonates of calcium, Magnesium, Potassium and Sodium, which appear in the water in the form of natural salts. The alkalinity during October month is found to be varies from 168 Mg/L to 345 mg/l. The alkalinity of Vivekananda pond is highest among the all.

Total Acidity

The quantitative capacity of water to react with a strong base to a designated pH is the acidity of water. In this it varied from 4 to 10 mg/l.

Total Dissolved Solids

The composition of solids present in the natural body of water mainly depends upon the nature of the bed rocks and soil developed from it (Nighojkar Abhineet,2014). Solids are enhancing due to decomposition of organic matter present in the water body. It varies from 414 mg/l to 7280 mg/l in sample.

Biological Oxygen Demand (BOD)

Biochemical oxygen Demand (BOD) is the amount of oxygen consumed during microbial utilization of organics (Howard S. Peavy). BOD indicates the prances of microbial activities and dead organic matter on which microbes can feed. An inverse relationship was found between the dissolve oxygen concentration and BOD value (Coscun.I.1989). In this study it varied from 0.1 to 1.54 mg/l.

Chemical Oxygen Demand (COD)

The measure of capacity of water to consume oxygen during decomposition of organic as well as in organic matter is known as Chemical Oxygen Demand. The values were varied between 0.15 to 1.76 mg/l in the samples.

Phytoplankton Identification

Water sample for plankton study were preserved for 24h and identified under an LED compound microscope (N-100 model, Germany). Phytoplankton was identified on the generic level using published literatures.[19,20] Photomicrographs were taken for proper identification of each phytoplankton.

Microbiology Analysis

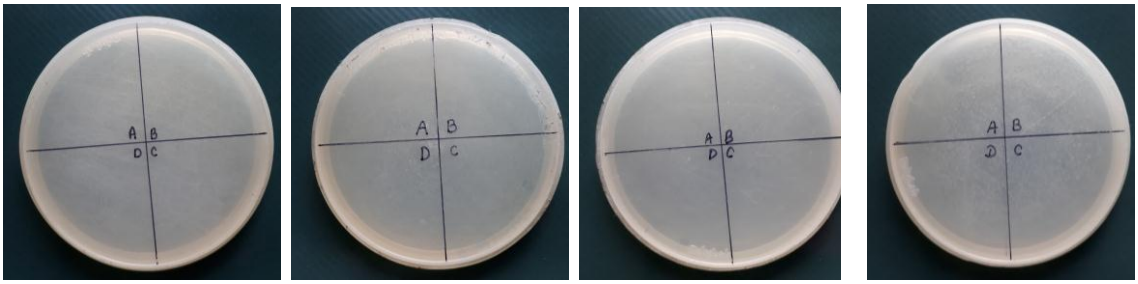

Figure Showing the Microbiological Study of Water from different collection Site.

Table No. -1.

Sample No.	Sampling Area	pH	TDS mg/l	BOD Mg/l	COD Mg/l	Acidity Mg/l	Alkalinity Mg/l
1	Tap Water	6.55	3243	1.32	1.28	10	168
2	Vivekanand Talab	8.9	2407	1.54	1.22	4	345
3	Marine Drive	7.55	414	1.47	1.76	8	298
4	Pandri Talab	7.06	7280	0.98	0.74	8	210
5	Patidar Packed Water	6.55	1245	0.1	0.15	9	189
6	Xtreme Packed Water	7.28	1423	0.14	0.46	7	200

Figure Showing the Microbiological Study of Water from different collection Sites.

Water is the most basic product for every single living animal. Creatures can't make do without water. Water is a standout amongst the most basic constituents of the human conditions. Man needs it, in any case for his physiological presence. It is utilized for some reasons e.g. mechanical water supply, water system, drinking, proliferation of fish and other amphibian frameworks and era of fish and hydro-powers. Water is the wellspring of vitality and represents the advancement and elements of the universe on the earth. Water, the most

crucial need of life, is in plenitude 97.3% of the world's water i.e. 1.45 billion cubic Kms, Ocean water is salty and can't be utilized for agrarian, residential and mechanical purposes. Just 13x106 cubic Kilometers water is accessible as stream, lakes, wells and tube wells i.e. 0.6%, 8.5x1015 m3 is groundwater, happens in the profundity of 80-135 m beneath the ground surface as water levels diminishing step by step. The keep running off water has expansive number of substances e.g. sediment, natural polluting influences.

Water is one of the most important compounds that profoundly influence life. The quality of water usually described according to its physical, chemical and biological characteristics. Rapid industrialization and indiscriminate use of chemical fertilizers and pesticides in agriculture are causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and depletion of aquatic biota. Due to use of contaminated water, human population suffers from water borne diseases. It is therefore necessary to check the water quality at regular interval of time. Parameters that may be tested include pH, turbidity, salinity, nitrates and phosphates, TDS (Total Dissolved Solids), TSS (Total Suspended Solids), alkalinity and chlorides. Water was sampled from different areas of Hyderabad like ground water, pond water and lake water for which physical–chemical data was collected to analyze the water quality. The found values were compared with the World Health Organization water quality standards. Based on the results obtained it is observed that ground water, pond water and lake water cannot be used directly for drinking purpose as they are not within the drinking water standards of WHO.

CONCLUSION

Water isWater is a vital segment for all the living structures. Portable water is basic to human and other living things despite the fact that it gives no calories and no natural supplements. The samples were taken from the different Talabs of Raipur Area of Chhattisgarh. The collection of water samples were examination for the parameters like pH, TDS, Dissolved oxygen (DO), Chemical Oxygen Demand (COD), Hardness, Ca, Mg, Chloride and Alkalinity. The comparative examination of physiochemical attributes of water tests with the BIS standard parameters that the change of water quality parameter ought to be done intermittently to build up the water sources. The examination results are range in a standard level of BIS (Bureau of Indian Standards). It will help to analysis the water quality and its effect on animal, human & plants. Our basic study of physic-chemical and microbiological analysis on water composition may provide a hydrobiological effect to the society. The rate

of pollution will decide that up to what extent the pollution should be allowed in these area. Biodiversity of industrial area should also be prepared with respect to pollution. Ecological study also measures the different other parameters in the pond water. The effects of contaminated water will give impact to the animal, plant and human health. Though this type of research is the beginning, it's can't be possible to give the clear-cut conclusion. Further more details research to be required in future to draw an attention towards the population those who are working in different organization.

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