

Physicochemical Analysis of Water Quality Parameters: A Review

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Abstract: Water is one of the most important compounds that majorly influence life. It is the most important aspect in land shaping and climate control. The quality of water usually described according to its physicochemical and biological parameters. Rapid industrialization and excessive use of chemical fertilizers and pesticides in agriculture are causing tremendous pollution which reduces water quality and depletion of aquatic flora and fauna. This is the one of the serious problems now a day. Due to use of contaminated water in day today life human being suffers from water borne diseases. Thus the analysis of the water quality is necessary to regulate the natural eco system. As ground water is more valuable than surface water it is necessary to check the water quality parameters at regular interval of time viz. pH, TDS, alkalinity, turbidity, nitrates, chlorides phosphates, BOD,COD, DO, minerals, salts. Present research paper focus on review of different research papers related to physico-chemical analysis of water from different sources used for drinking purpose.

Index Terms: Physicochemical, Alkalinity, Dissolved Oxygen, BOD, Water Quality Index (WQI).

I. INTRODUCTION

Water plays an important role for all living organism. Life cannot run without water. (Erach Bharucha 2005) Water resources are divisible into two distinct categories the surface water resources and groundwater resources (Handbook ICAR 1980). Increase in urbanization, industrialization, agriculture activity and various human activities increase the pollution of surface water & ground water. The raw sewage dumped into soil the liquid percolate into ground this will cause pollution of bore well water (Purohit shammi 2004). According to WHO, about 80% diseases in human being are caused by water (Kavitha R. and Elangovan K. 2010). Water should be free from the various contaminations like organic and inorganic pollutants, heavy metals, pesticides etc. Apart from strict guidelines are provided by Central Pollution Control Board (CPCB 2010), the environmental situation is not satisfactory. So study of ground water and surface water used for drinking purpose, irrigation purpose becomes important. As the safe & potable drinking water is under necessity, various treatments and methods are adopted to increase the quality of drinking water. All its parameter like pH, Electrical Conductivity, Calcium, Magnesium, Total Hardness, Carbonate, Bicarbonate, Chloride, Total Dissolved Solid, Alkalinity, Sodium Potassium, Nitrate, and DO should be within a permissible limit recommended by BIS, WHO and USEPA.

II. LITERATURE REVIEW

The various technical research papers on the assessment of water quality for lake, river, dug well, bore well and different areas have been presented at research level for the study. (M. Suresh Kumar et al 2016) focused on groundwater quality in the Kanchipuram municipality during July 2015. Seventeen samples of ground water were collected from different stations around the municipal solid waste dump yard. Global Positioning System (GPS) and Geographical Information System (GIS) were used to prepare spatial map of the study area with sample locations. Both physical and chemical parameters such as Total Dissolved Solids (TDS), Electrical Conductivity (EC), pH, Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Free Ammonia (NH₃), Nitrate (NO₃), Chloride (Cl), Fluoride (F), Sulphate (SO₄) and Phosphate (PO₄) were tested and compared with standards prescribed by WHO and BIS. The results show the physical and chemical properties of groundwater samples are affected by pollution. Water Quality Index (WQI) was calculated for the study area to know the quality of groundwater. Some samples were above the desirable limit of drinking water. Water quality index values lies between 41.98 to 215.48, and samples were categorized as very poor, poor, good and excellent. This study reveals that the effect of solid waste dump yard on sample locations which are nearby in the dump yard affected more. It is important to treat the water before used for drinking purposes.

A study conducted (Sandip Singh Bhatti, Vaneet Kumar 2016) to analyse the physicochemical characteristics of the groundwater of Jalalabaad village in Tarn Taran district of Punjab situated on the bank of the river Beas. Groundwater samples were collected from hand pumps and tube wells with depth of 50-75 feet and 200-225 feet respectively. The results obtained were in the permissible limits of BIS. Concentration of nitrates was very low in both the samples. As the groundwater quality changes due to changing climate and anthropogenic activities constant analysis of the water quality is mandatory in this area. More profound physico-chemical and biological studies are required for avoiding and minimizing contamination in groundwater.

(Rajiv Das Kangabam et al) carried out work to assess a water quality index (WQI) of the Loktak Lake, Manipur. An important wetland highly contaminated due to the increasing human and natural activities. Eleven different physicochemical parameters were analyzed for five sampling sites using standard procedures and results obtained were compared with the guidelines by BIS and WHO for drinking purpose. The result shows that in all the location higher nitrite concentration which is beyond the permissible limit. The highest values of pH were observed in Sendra 7.66 in pre-monsoon and minimum 6.15 in Keibul Lamjao in winter...The WQI values range from 64 to 77 indicating that the Loktak Lake water is not suitable drinking for both human and animals. The WQI is important for proper management of the Loktak Lake.

Dr.C.Nagamani (2015) investigated Physico- chemical status of four water samples taken from Urban and rural locations of Bangalore for water samples. The pH of all water samples were found almost neutral. The TDS, conductance, hardness increased towards the urban water as compared to rural water All Parameters were within the permissible limits prescribed by World health organization (WHO). This study indicated that urban water is less hard and containing more dissolved ions safe for drinking purpose

(Dhanaji Kanase et al 2016) carried out comparative study on the physico-chemical analysis of well water and bore well water in Kadegaon Tahsil, Maharashtra, India. The parameters such as water temperature, total dissolved solid, hardness, pH, alkalinity, dissolved oxygen, chemical oxygen demand, biological oxygen demand, conductivity and chloride, were analyzed for water samples collected from different places of Kadegaon Tahsil. Water samples from studied area were not suitable for drinking and require pretreatment like both the well and bore well water samples can be quite safe after the boiling. Sewerage waste treatment, X-rays water filter can be used for clarifying water from microorganism, awareness about the harmful effect of water on human health.

(S. M. Tandale, et al 2014) studied the water quality by means of Water Quality Index. Physicochemical analysis of ground water near industrial area Dathav, Roha, Raigad were carried out for one year. The findings were compared with standards prescribed by APHA. All sampling sites except G3 sampling site were within permissible limit. The values of parameters like electric conductivity, dissolved oxygen, turbidity were above the permissible limit. The water quality index values at four sampling sites namely, G1, G2, G4 were below 50 except at G3 =58.54, shows quality of water is good.

(Manjesh Kumar, Ramesh Kumar 2012) was carried out study in granite mining area in Jhansi (Bijjoli) to determine current status of physicochemical contaminants and their sources in groundwater. Groundwater samples collected from mining and residential area in 6 different locations where 13 crushers running in the study area. . The physico-chemical parameters have been analyzed and compared with WHO standards. The results of the present work show that most of the physico-chemical parameters like alkalinity, turbidity, D.O, calcium hardness, magnesium hardness, total hardness, nitrate, fluoride, iron and chloride are well within the acceptable limit except some samples of D.O in mining areas in the month January and may and slightly exceeded value of pH, T.D.S and E.C were reported at some locations of study area. A reason for pollution is dissolution of rock minerals with the ground water. This study also confirms that the ground water quality is not up to the mark and is slowly changing, but if contamination is not controlled in future, the ground water will be completely polluted and becomes unsuitable for potable use. To maintain quality of water require proper management of mining waste; proper way of mining technique, the public awareness.

(Dr. Nidhi Jain 2018) throws light on assessment of Physico- chemical parameters in Alard College Campus, situated in Hinjewadi, Pune from various sampling station. The results were compared with the water quality standards of WHO and ISI 10500-91. EC, pH and turbidity values for all investigated samples were found to be above the permissible limit. The result shows that the rest of the parameters like TDS, Alkalinity, Total Iron, DO Zinc, Copper, Chloride Potassium, BOD and COD values are well within the permissible limits. A systematic correlation study showed that the TDS, EC and pH are important physicochemical parameters of water quality and are correlated with most of the other parameters. .The systematic calculation of correlation coefficient (r) between various physicochemical parameters suggests priority for the necessary treatment to a particular location. It indicates that the outlet water from Alard campus is highly polluted and unsafe for domestic use.

Prof. Mohammed Sadeque et al 2015) studied the ground water quality of Waluj Industrial Area in Aurangabad district, Maharashtra. The eleven samples were collected for physico-chemical characteristics such as temperature, PH, EC, TDS, TA, TH, chloride (Cl⁻), sulphates , phosphate, calcium (Ca²⁺),Magnesium (Mg⁺) sodium(Na⁺), potassium (k⁺), DO, and BOD. Some parameters were in high concentration and quality of the potable water has deteriorated to a greater extent at some sampling locations as compared with WHO and BIS limits. The results showed that Bore well water samples under research are generally used for domestic use and rarely for drinking purpose. But it should not be used for drinking purpose without pretreatment as it is contaminated.

(A.K. Satone, et al 2011) studied water samples collected from the historical area; M.I.D.C. of Wardha (M. S.) has been carried out to examine its potability for domestic purposes. The physicochemical parameters were studied by using various analytical techniques. Sodium & Potassium were determined Flame photometrically. The parameters were analyzed & compared with standard values prescribed by American Public Health Association (APHA) & World Health Organization. In conclusion it can be stated that the different studied physico-chemical parameters such as BOD, DO, COD exceeds WHO acceptable limit. Alkalinity, acidity, chloride, hardness, total dissolved solids, total suspended solid, pH, conductivity, sulphate, pathogen are within the permissible limit. The high value of BOD is an indication of the contamination and low oxygen available for living organisms in the wastewater. The present study concluded that majority of physico-chemical parameters of the quality of water samples were within acceptable limit. In order to overcome water pollution in MIDC area, Wardha remedial treatment is necessary to remove excess of hardness by boiling & ion exchange.

(Ashwani Kumar Sonkar and Aarif Jamal 2019) investigated groundwater quality around Singrauli coalfield area due to mining and industrial activities. Eight groundwater samples were collected from the hand pump & Dug-wells located around Singrauli coalfields area during pre-monsoons and post monsoons seasons in the year 2018 and analyzed for physicochemical parameters Assessment of the groundwater quality followed by statistical analysis. A systematic calculation of the correlation coefficient has also been carried out between different analyzed parameters. The correlation of 13 physicochemical parameters of groundwater of the study area indicated that all the parameters were more or less correlated with one another. The ground water of the study area is alkaline in nature. EC found above maximum permissible limit prescribed by BIS in the pre-monsoon (933 µS/cm) and post-monsoon (831µS/cm).The analysis shows that the groundwater of the study area needs pretreatment for potable use.

(Sakuntala Chakrabarti and Pulak Kumar Patra 2016) conducted study on the chemical analysis of ground water in Bolpur block of Birbhum district, West Bengal, India. 89 groundwater Samples were collected from deep tube wells, shallow tube wells, supply water and dug wells for each season during April, July and November of 2013 in order to assess potability of water as well as irrigation purpose. All water samples were analyzed for physical and chemical parameters by standard techniques and methods. The results concluded that the maximum SAR (Sodium adsorption ratio) in all three seasons was below 1 and well within the safe limit. Na% was found to be good in Pre-monsoon season indicates it's suitable for irrigation. Fe²⁺, EC, Ca²⁺ concentrations for few samples were above the acceptable limit prescribed by WHO and USEPA standards and in some samples value of NO₃⁻

,Na⁺and K⁺were found to be increased. Fluoride concentration was within the permissible limit. The groundwater quality in Bolpur block is inappropriate for drinking as some water samples contaminated and need proper treatment but suitable for irrigation.

(B.R.Kiran 2010) has studied the physico-chemical characteristics of the waters in two fish ponds, located near Bhadra project in Karnataka, which is the main water source for fish seed rearing and culture of brood fishes in this area. This study was carried out during December 2006 to May 2007. The physicochemical parameters like temperature, pH, acidity, total alkalinity, free CO₂, dissolved oxygen, biological oxygen demand, chloride, sulphate, phosphate, nitrate, calcium, magnesium and total hardness were analyzed. The resultant values were compared with water quality standards suggested by WHO, BIS and USPHS. The high phosphate and nitrate content were indicated that water gets polluted due to addition of cow dung and poultry manure to the ponds that is fish ponds are moderately eutrophicated. For proper growth of two fish ponds must provide a suitable environment. As precaution is better than cure, proper management should be necessary to prevent any chance of bacterial diseases.

III. FIGURES AND TABLE

Table-Physical and chemical properties of water as per IS 10500-2012

S.No.	Parameter	Unit	Accep.Limit	Permi. Limit
1	Colour	Hazen Unit	5	15
2	Odour		Agreeable	Agreeable
3	pH		6.5-8.5	No relaxation
4	Turbidity	NTU	1	5
5	Total Dissolved Solids	mg/l	500	2000
6	Ammonia	mg/l	0.5	No relaxation
7	Boron	mg/l	0.5	1
8	Calcium	mg/l	75	200
9	Chloride	mg/l	250	1000
10	Fluoride	mg/l	1	1.5
11	Magnesium	mg/l	30	100
12	Nitrate	mg/l	45	No relaxation
15	Total Alkalinity	mg/l	200	600
16	Sulphate	mg/l	200	400
17	Total Hardness	mg/l	200	600
18	Temperature	°C	-	-
19	Sodium	mg/l	-	-
21	Iron	mg/l	0.3	No relaxation
22	Cadmium	mg/l	0.003	No relaxation
23	Chromium	mg/l	0.05	No relaxation
24	Zinc	mg/l	5	15
25	Manganese	mg/l	0.1	0.3
26	Nickel	mg/l	0.02	No relaxation

IV. CONCLUSION

The impacts of water pollution are not only harmful to human being but also to animals, fish, and birds. It diminishes aquatic life, flora and fauna. It deteriorates the aesthetic quality of ground water, lakes and rivers. Polluted water is unsuitable for drinking, agriculture, and industry. Ultimately human and animal life is in danger due to pollution. So it's necessary to bring perceptive awareness among the people about the quality of water environmental balance. The water pollution can be minimized by doing proper management effluent treatment in industries and proper practices in society to control the waste, sewage generated in public and private life.

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