International Journal of Chemical Studies

SS Sagar
I. C. S. College, Khed
(Maharastra) India.

RP Chavan
Department of chemistry
Dnyanasadhana College, Thane
(Maharashtra) India.

CL Patil
Department of chemistry B.N.N.
College Bhivandi, Thane
(Maharashtra) India.

DN Shinde
Department of chemistry B.N.N.
College Bhivandi, Thane
(Maharashtra) India.

SS Kekane
I. C. S. College, Khed
(Maharastra) India.

Physico-chemical parameters for testing of water- A review

SS Sagar, RP Chavan, CL Patil, DN Shinde, SS Kekane

Abstract
Due to increase population, advanced agricultural practices, industrialization, man- made activity, water is being highly polluted with different contaminants. Water is a vital resource for human survival. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such as colour, temperature, Total hardness, pH, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality.

Keywords: Ground water, water quality standard, Physico-chemical Parameter.

Introduction

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, the use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. Therefore, it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varying of water borne diseases. It is difficult to understand the biological phenomenon fully because the chemistry of water revels much about the metabolism of the ecosystem and explain the general hydro - biological relationship[1].

Water pollution is a serious problem in India as almost 70 per cent of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs. This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem. Due to growth of population, agriculture, and industries, demand for domestic water has increased many times during the last few years. Improper waste disposal and over exploitation of resources has affected the quality, not only of tap water, but also of ground water (V. Nigam 2013)

Industrial waste and the municipal solid waste have emerged as one of the leading causes of pollution of surface and ground water. In many parts of the country available water is rendered non-potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rain water discharge. Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful microorganisms is one of the serious major health problems.(Gupta-2009)

Generally, most pollutants are introduced into the environment as sewage, agricultural waste, domestic waste, industrial waste, accidental discharge and as compounds used to protect plants and animals. Pollution occurs when a product added to our natural environment adversely affects nature's ability to dispose it off. A pollutant is something which adversely interferes with health, comfort, property or the environment of the people. Generally, most pollutants are introduced into the environment as sewage, agricultural waste, domestic waste, industrial waste, accidental discharge and as compounds used to protect plants and animals. There are many types of pollution such as air pollution, sound pollution, water pollution, oil pollution and soil pollution[2].

Correspondence:
SS Sagar
I. C. S. College, Khed
(Maharastra) India.

Material and Methods
Environmental pollutants affect the aquatic ecosystem in a synergistic manner, which cannot be detected comprehensively by determination of selected physical-chemical parameters alone. Whereas, biological system can integrate all environmental variables over a long period two times of effects which can be easily measured and quantified.

Physico-Chemical Assessment
The physico-chemical parameters of water quality will analyze using standard methods given an APHA (American Public Health Association)
The work was carried out on the following lines
(1) Physico-chemical characterization of river, ground, and surface water, such as pH, Hardness, total alkalinity, phosphate, chloride, Calcium, Magnesium, and Nitrate values, C.O.D, B.O.D., total alkalinity, Temperature, pH, dissolved oxygen (DO), total dissolved solid (T.D.S). etc.
(2) Data processing for statistical analysis

Sr. No.	Studied Parameter	Method used
1	pH	Recorded by pH meter
2	Hardness	EDTA Method
3	Total alkalinity	Neutralizing with Std. HCl
4	Phosphate	Spectophotometric
5	Chloride	Mohrs method
6	Nitrate	Spectrophotometric
7	Sulphate	Spectrophotometric
8	B.O.D.	Titrometric
9	C.O.D.	Titrometric
10	D.O.	Titrometric

Review of Literature
The various technical research paper on the assessment of water quality for lake, river, sea and different areas have been presented at research level for the study. These papers are presented below.
Bhagat S. Chauhan, S. K. Sagar [03] has studied, in present investigation an attempt was made for assessment of physical-chemical parameter and quality of Sutlej River in Nangal area of Punjab (India). The Physico-Chemical parameter were studied and analyzed for the period of one year i.e. July 2010 to June 2011. Various physico-chemical parameters such as water temperature, water colour, Turbidity, free ammonia, Total dissolved solid, pH, Dissolved oxygen, Free CO_2, Total hardness, total alkalinity, chlorides, BOD, Nitrates, Phosphates, Sulphates were studied. The results revealed that there was significant seasonal variation in some physico-chemical parameters and River water was moderately polluted in Nangal area. On the basis of primarily study, it was apparent that water was not potable but can be used for propagation of wildlife, fisheries and irrigation.
Manjusha Bohr, Prakash Kadave, Sheetal Bhor, Manisha Bhosale [04] has studied Water quality assessment of the River Godavari, at Ramkunda Nashik. Three samples collected from three locations along the area. Study area during the months June, August, and October respectively. During present study some physical and chemical properties were determined. The measurement of temperature, pH and TDS were taken in the field. Immediately after the collection of samples, using a portable water quality analyzer, Chlorides, Total hardness, Ca, Total alkalinity. The result of the study shows that, the river is polluted at Ramkunda. It is believed that continued pollution of the water sources by various human activities may lead to any health problem to human. The values of correlation coefficients and their significance levels will help in selecting the proper treatments to minimize the contaminations of river water of Godavari at Ramkunda.

Pratiksha Tambekar, pravin P. Morey, R.J. Batra and R.G. Weiginnwar [05] have studied physico-chemical parameter evaluation of water quality around Chandrapur (Maharashtra). Two sampling stations were selected at the downstream of Chandrapur City. The water sample was collected from the Wardha River at 3 different selected stations. Over a period 12 months during the year. The various physicochemical parameters were studied. In the present study it is our efforts to evaluate many physico-chemical and its characteristic behavior of the river water samples in different seasons and different sampling stations. Many values of parameter crossed the maximum permissible limit. The study suggested immediate need to take extensive water quality monitoring studies and to find the remedial measures to perfect this important natural water source in the study area.

Vijaya Kumar K.M. and Vijaya Kumara [06] has studied physico-chemical analysis water quality of Kundapurs Mangrove forest (Karnataka). We studied a four different stations for a period of one year during April-2011 to March-2012 seasonal variation of different parameters investigated were as follows pH (6.65 to 8.42),dissolved oxygen (3.25 to 11.78 mg/l), BOD (0 to 3.65 mg/l), CO2 (0.55 to 2.3 mg/l), Electrical conductivity (0.36 to 29.1ms^{-1}), Pottasium (0.12 to 9.74 mg/l), Calcium (0.50 to 42.34 mg/l), Magnesium (0.25 to 109.5 mg/l), Sodium (0.017 to 878.04 mg/l), bicarbonate (1.40 to 6.23 mg/l), Carbonate (nill), Chloride (2.23 to 380.70 mg/l). The result of the study shows that as the season changes there is fluctuation in the physic chemical characters of the water, this will be due to ebb and flow flushing of rain water change in the temperature and salinity as the season changes. In addition, intense pollution from both agricultural input and shrimp culture ponds deteriorates the water quality of mangrove ecosystems.

J.G. Koliyar and N.S. Rokade [07] have studied in order to understand the water quality in pond lake, Mumbai. The purpose of the survey was to collect information concerning the use and value of water quality improvement at Powai. The result is that the impurities are present in Lake. There are many different parameter formed to be increased during summer season and got diluted during rainy season. Lack of oxygen content can cause fish kills and lack of fish enable malaria hosting mosquitoes as mosquitoes are natural food for fish.Throwing waste material and garbage in the lake water should be strictly prohibited proper bioremediation techniques should also use in order to improve the water quality.

Prabhakar R. Pawar and Balasaheb G. Kulkarni [08] has studied assessment of water quality in the karanja creek (Raigad). Monitoring of coastal water quality on a regular basis plays an important role in the detection and evaluation of marine water pollution. During the present investigation different physical and chemical parameter were monitored during spring low and high tides for nightly from the Karanja creek for the period of 24 months (January -2004 to December -2005). It is stated that at present the Karanja creek water is relatively clean, the variation observed with respect to physical and chemical variables of surface water are seasonal and are not significantly imparted by the anthropogenic pressure. The load of pollution in the Karanja creek is within the assimilate capacity of the creek. The data on nutrient level also indicate that sewage added into the creek, either gets diluted or utilized as a source of nutrients for the photosynthesis.

Budharatna Bhavare, Miguel A. Rodriguez, Anil Kurthe [09] has studied different physic chemical parameter and nutrients in water of Bhatye estuary, Ratnagiri central, West coast of India. The present study was carried out to find the changes in physical, chemical parameters in different sites of Bhatye Estuary. The preliminary data about the physical, chemical parameter and nutrients in this area would be a useful fool in the future for ecology, Biodiversity and Culture aspects from the Bhatey estuary

Francis Andrade, H.B. Arvinda, and E.T. Puttaiah [10] have studied Manglore coastal water pollution by analysis of physical, chemical parameter. The effluent sample was collected from 6 different locations of the study area. Three times during 2008 premonsoon, monsoon and post monsoon seasons for the physic chemical analysis of samples standard methods were followed (APHA-1995). Due to rapid industrialization and the formation of SEZ, there is an urgent need to arrest the spread of pollution of coastal water.

Ramalingam manikannan, Subramanian asokan and A.H.M.S. Ali [11] have studied Seasonal variation of physicochemical properties of the great vedaranyam swamp point calimere wildlife Sanctuary, South east coast of India. The present study was attempted on the physico chemical variability in this area. The seasonal variation study was carried out to examine level of varying physicochemical parameters such as Temperature, Salinity, pH, Dissolved oxygen, Nitrate, Nitrite, Electrical conductivity, Phosphate, Turbidity, Total dissolved solid, and water depth. The present base line information of the physic chemical properties of water would from a useful tool for further ecological assessment and monitoring of this wetland of point calimere wildlife sanctuary.

Sujata Sen, Dr. Minal Kanti Paul, and Madhab Borah [12] have studied the some physico chemical parameter of pond and river water with reference to correlation study. The surface water sample was taken and collected from pond and river in around of Lumding town of Assam and analyzed for Temperature, pH, conductance, TS, TDS, TSS, Turbidity, Hardness, Total alkalinity, Dissolved oxygen, COD, f^-, NO_3^-, HCO_3^-, Cl^-, SO_4^{-2}, Na^+, K^+, Ca^{+2}, Mg^{+2}, Fe. The result was considered for correlation analysis and it was observed that many of the parameters bear's good positive correlation and some bears a negative correlation and pollution level of the various surface water of the locality is observed.

G.Velsamy, N. Manoharan, S.Ganesan [13] has studied analysis of physicochemical variations in sea water sample Uppanar estuary, Cuddalore, Tamilnadu (India). The present study was the physico chemical variations of 2 stations along the Cuddalore coast during July-December-2012 monthly variations of physic chemical parameters such as atmospheric temperature, surface water temperature, pH, salinity, Total solids, TDS, DO, Nitrate, Nitrite, Phosphate, Silicate. The variation of physicochemical parameter mainly depends on Monsoon rain.

Parameter Included In Water Quality Assessment
Following different physico-chemical parameter are tested regularly for monitoring quality of water.

1) Temperature: Temperature is the most importance environment factor with effect on plants and animals. Water has several unique thermal properties which combine to minimize temperature change. The Water temperature depends on the depth of the water column, climatic and topographic changes[14].

2) pH: pH, one of the most common analyses in soil and water testing, is the standard measure of how acidic or alkaline a solution is. It is measured a scale from 0 -14. pH of 7 is neutral, pH is less than 7 is acidic and pH greater than 7 is basic. Aquatic organisms need the pH of their water body to be a certain range optimal growth and survival. The presence of acid rain can lower the pH in lakes making them more acidic

3) Electrical conductivity: Electrical conductivity (EC) a measure of the electric current that solution carries. Electrical conductivity used to quickly estimate the ionic or soluble salt concentration in soils, water supplies, fertilizer solution and chemical solution. It is measured with the help of EC meter which measures the resistance offered by the water between two platinized electrodes. The instrument is standardized with known values of conductance observed with a standard KCl solution.

4) Alkalinity: Alkalinity is a chemical measurement of water's ability to neutralize acid. Alkalinity is also a measure of a water buffering capacity or its ability to resist changes in pH upon the addition of acids or bases. Alkalinity of natural water is due to primarily to the presence of weak acid salts, although strong bases may also contribute (i.e. OH^-) in the extreme environment. Bicarbonate represents the major form of alkalinity in natural water, so its source being the partitioning of CO_2 from the atmosphere and the weathering of carbonate minerals in rocks and soil. Other salts of weak acids, such as borate, silicates, ammonia, phosphate, and organic bases from natural organic matter may be present in small amounts.

5) Dissolved Oxygen: The amount of oxygen dissolved in water, such as a lake, river or stream. Dissolved oxygen is the most important indicator of the health of water bodies and its capacity to support a balanced aquatic ecosystem of plants and animals. Warm water released from industrial outlets, flowages or storm sewers can also reduce dissolved oxygen levels. Dissolved oxygen may play a large role in the survival of aquatic life in temperature lakes and reservoirs during summer months.

6) Total Hardness: Total hardness is defined as the sum of calcium and magnesium hardness in mg/L as $CaCO_3$. Total hardness in fresh water is usually in the range of 15 to 375 mg/L as $CaCO_3$. Calcium hardness in freshwater is in the range of 10 to 250 mg/L, often double that of magnesium hardness (5 to 125 mg/L) and total hardness of 6630 mg/L as $CaCO_3$. A high concentration of hardness may be due to leaching from of the soils or due to the high background concentration of the waters. WHO permissible limit for total hardness of water is 150 mg L^{-1} and ISI desirable limit was 300 mg L^{-1}. Suggested that the values between 150 and 300 mg L^{-1} of TH means the water was hard, and TH greater than 300 mg L^{-1} means the water is very hard. High concentration of hardness may cause the problem of heart disease and kidney stones.

7) Total dissolved solid: Total dissolved solids are the total amount of mobile charged ions, including minerals, salts or metal dissolved in a given volume of water in mg/L. TDS is directly related to the purity of water and the quality of water purification system and affects everything that consumes, lives in, or uses water, whether organic or inorganic, whether for better or for worse. Common inorganic salts that can be found

in water include calcium, magnesium, potassium and sodium, which are cations and carbonates, nitrates, bicarbonates, chlorides and sulphates which are anions.

8) Chemical oxygen demand: The standard method for indirect measurement of the amount of pollution in a sample of water. The chemical oxygen demand test procedure is based on the chemical decomposition of organic and inorganic contaminants, dissolved or suspended in water. 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(P. Maheshkumar 2012)

9) Biochemical oxygen demand: Biochemical oxygen measures the amount of oxygen that microorganisms consume while decomposing organic matter, it also measures the chemical oxidation of inorganic matter
BOD is a measure of organic material contamination in water, specified in mg/L. BOD is the amount of dissolved oxygen required for the biochemical decomposition of organic compounds and the oxidation of certain inorganic materials (e.g., iron, sulphites). Typically the test for BOD is conducted over a five-day period (Milacron Marketing Co.).

10) Carbonates: Whenever the pH touches 8.3, the presence of carbonates is indicated. It is measured by titration with standardized hydrochloric acid using phenolphthalein as indicator. Below pH 8.3, the carbonates are converted into the equivalent amount of bicarbonates. The titration can also be done pH metrically or potentiometrically.

11) Bicarbonates: It is also measured by titration with standardized hydrochloric acid using methyl orange as indicator. Methyl orange turns yellow below pH 4.0. At this pH, the carbonic acid decomposes to give carbon dioxide and water.

12) Nitrate: Nitrate is naturally occurring inorganic ions present our environment. The decomposition of organic materials in soils, releases ammonia. This ammonia oxidizes to form nitrate. Drinking water containing nitrates. Wells with high levels of nitrate can contribute to significant exposure. Eating foods containing nitrates preservative, such as processed meats. Nitrates can change normal hemoglobin to methemoglobin. Nitrate test can be detected through urine and blood test.

13) Chloride: Chloride, the ionized form of chlorine, is one of the most abundant inorganic ions in natural water and wastewater. Though most prevalent in sea water at concentration averaging 35000ppm, Chloride permits rivers, lakes, and other freshwater systems. In normal fresh water, chloride concentration is usually less than 10 ppm, but quite often less than 1 ppm. The potentiometric method of chloride analysis by silver nitrate titration is an effective technique of chloride level determination. The effect of chloride on stomach discomfort, Eye/nose irritation.

14) Sulphates: It is measured by the nephelometric method in which the concentration of turbidity is measured against known concentration of synthetically prepared sulphate solution. Barium chloride is used for producing turbidity due to barium sulphate and mixture of organic substances (Glycerol or Gum acetia) and sodium chloride is used to prevent the settling of turbidity.

15) Calcium: It is measured by complexometric titration with a standard solution of EDTA using patton's and Reader indicator under the pH condition of more than 12.0

16) Iron: Iron is one of the most important constituent of blood in human and other living organism. Iron is an essential element for human nutrition and metabolism, but in excess quantities results in toxic effect like hemochromatosis in tissues. The maximum permissible limit of iron in drinking water is 0.3 ppm. (P.Tambekar 2013)

Conclusion
The effects of water pollution are not only devastating to people, but also to animals, fish, and birds also destroy aquatic life and reduces its reproductive ability. Polluted water is unsuitable for drinking, recreation, agriculture, and industry. It diminishes the aesthetic quality of lakes and rivers. Eventually, it is a hazard to human health. The present review paper undertaken to account to bring an acute awareness among the people about the quality of water. The individual and the community can help minimize water pollution by simple housekeeping and management practices the amount of waste generated can be minimized.

Reference
1. Basavaraja, Simpi, S. M., Hiremath, K. N. S. Murthy, K. N. Chandrashekarappa, Anil N. Patel, E.T .Puttiah, Analysis of Water Quality Using Physico-Chemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India, Global Journal of Science Frontier, Research,2011, 1(3), pp 31-34.
2. Misra, S.G. and D. Mani, Soil Pollution. Efficient offset Printer ABC, New Delhi,India,1991 pp:6- 42.
3. Bhagat S, Chauhan, SK Sagar. Impact of pollutants on water quality of river Sutlej in Nangal Area of Punjab, India, Biological Forum-An International Journal. 2013; 5(1):113-123
4. Manjusha Bhor, Prakash Kadave, Abhijit Bhor. Water Quality Assessment of the River Godavari, At Ramkund, Nashik, (Maharashtra), India International Journal of Engineering and Science. January 2013; 2(2):64-68
5. Tambekar P, Morey P, Batra RJ. Physico- chemical parameter evolution of water quality around Chandapuer District, Maharashtra, India, Journal of Chemical and Pharmaceutical Research. 2013; 5(5):27-36.
6. Vijaya Kumar KM, Vijaya Kumara. Physico chemical analysis of water quality of kundapura angrove forest, Karnataka India., International journal of Engineering and science. 2013; 2:64-68
7. J. G. Koliyar and N. S. Rokade, Water quality in Powai Lake, Mumbai,Maharashtra. 2008, 12th world Lake Conference:1655-1659.
8. Prabhakar R, Pawar, Balasaheb G. Kulkarni Assessment of water quality in Karanja creek (District–Raigad), Maharashtra, west coast of India.

9. Budharatna Bhaware, Miguel A. Rodríguez , Anil Kurhe, Study of seasonal variations in physico-chemical parameters and nutrients in water of Bhatye estuary, Ratnagiri central, West coast of India International Journal of Evironmental Sciences, 2013, Volume 3, No. 5.

10. Francis Andrade, H.B. Arvinda, and E.T. Puttaiah, Studies on Manglore coastal water pollution and its sources, Indian journal of Science and Technology. 2011 Vol. 4

11. Ramalingam Manikannan, Subramanian Asokan, Abdul Hameed Mohamed Samsoor. Seasonal variations of physico-chemical properties of the Great Vedaranyam Swamp, Point Calimere Wildlife Sanctuary, South-east coast of India., African Journal of Environmental Science and Technology. September2011; 5(9):673-681.

12. Sujata Sen , Dr Mrinal Kanti Paul and Madhab Borah Study of some Physico-Chemical Parameters of Pond and River water with reference to Correlation Study, International Journal of ChemTech Research 2011,Vol.3, No.4, pp 1802-1807,

13. Velsamy G, Manoharan N, Ganesan S. Analysis of Physico-Chemical Variations in Sea Water samples Uppanar Estuary, Cuddalore, Tamilnadu, India. International Journal of Research in Biological Sciences.

14. Water Quality Assessment (WQA), A guide to use of biota, sediments and water in environmental monitoring, 2nd Edition,1992,UNESCO/WHO/UNEP.

15. Devendra Dohare, Deshpande S, Kotiya A. Analysis of ground water quality parameter A Review, Research Journal of Engineering Science. 2014; 3(5):26-31.

16. Patil PN, Sawant DV, Deshmukh RJ. Physico chemical parameters for testing of water–A Review, International journal of Environmental sciences. 2012; 3:3.

17. APHA. Standard Methods for Examination of Water and Wastewater, 20th Edition, American Public Health Association, Washington D. C. 1985.

18. Chavan RP, Lokhande RS, Rajput SI. Monitoring of organic pollutants in Thane creek water, Nature Environment and Pollution Technology 2005; 4(4):633-636.

19. P. Mahesh Kumar and C. Prabhahar , Physico - Chemical Parameters of River Water: A Review, International Journal of Pharmaceutical & Biological Archives 2012; 3(6): 1304-1312.

20. Gupta, D. P., Sunita and J. P. Saharan, (2009), Physiochemical Analysis of Ground Water of Selected Area of Kaithal City (Haryana) India, Researcher, 1(2), pp 1-5.