"SCREENING OF PHYSICOCHEMICAL PARAMETERS OF WATER SAMPLES FROM PUNE AREA, INDIA ."

[1]Dr.B.M.Pardeshi
[1] Associate Prof.Chemistry,
[1] Department of Chemistry,
PDEA'S BaburaojiGholap College Sangvi,Pune27 ,India

Abstract

Water pollution is easier to study and manage but its control is highly complex and very costly. This paper presents study of some Physico-chemical parameters of water samples from Pune area viz. Sangvi, Kasarsai, Kasarwadi and University of Pune area. Physico-chemical parameters were analyzed using methods and procedures according to General Water Quality Indicators. In average the water sample from Pune area had the following measurement; pH (by pH meter) was ranging 6.3 -7.92, pH(by pH paper) 6-8, Temperature 20-24 0C, Turbidity 320-380 NTU, Total alkalinity 202 -204mg/L, Total hardness 58-66 mg/L, Electrical Conductivity 0.112-0.880 µs/cm, Total suspended solids 116-392 mg/L and Total dissolved solids 116-392 mg/L. Hardness 20-55 ppm. All samples were colorless and odorless. In some water samples chlorine was present. All the measured parameters were within the standard limits of water quality values suggested by WHO This study recommends that future studies must include biological parameters instead of using only physico-chemical parameters to assess the quality of water. The study concludes that pH values of all drinking water samples are according to EC rules and pH can be measured accurately by pH meter rather than using pH paper, TDS (ppm) of Pawana river water, Sangvi higher than standard limits .It is hard water so it should not use directly. It is necessary to make it soft by boiling and then UV filtration. The above parameters are in range in Pawana river water, Sangvi and Kasarwadi,Pune University well water and Hinjewadi water but still few more parameters are necessary to measure the potability of water like Escherichia coli is abundant in human and animal farces which is very harmful for human health.

Keywords:Physico-chemical, Total hardness, drinking water, potability, UV filtration

I. INTRODUCTION

1.1 Importance of Water

Less than 3 % availability of fresh water and its unequal distribution make water pollution a matter of great concern.. The pollutants undergo many reactions and can become hazardous. 70 % of India's fresh water is polluted. With two thirds of the earth's surface covered by water and the human body consisting of 75 percent of it, it is evidently clear that water is one of the prime elements responsible for life on earth. It is significant due to its unique chemical and physical properties (Onifade etal.,2008;Osci,2005; Obiad and Okocha,2007).Water circulates through the land just as it does through the human body, transporting, dissolving, replenishing nutrients and organic matter, while carrying away waste material. Further in the body, it regulates the activities of fluids, tissues, cells, lymph, blood and glandular secretions. An average adult body contains 42 liters of water and with just a small loss of 2.7 liters he or she can suffer from dehydration, displaying symptoms of irritability, fatigue, nervousness, dizziness, weakness, headaches and consequently reach a state of pathology. Water is one of the most important substances that are needed for plants and animals.

India is water stressed today and is likely to be water scarce by 2050 (Gupta and Deshpande,2004). India supports more than 16% of the world's population with only 4% of the world's fresh water resources (Singh,2003). The total area cultivated in India using groundwater has increased from 6.5 million hectare in 1951 to35.38 million hectare in 1993 (GWREC,1997).The data of fertilizer consumption at the state level shows that consumption of plant nutrient per unit gross area is highest in Punjab at 158.9 kg/ ha and lowest in Assam 14.6 kg/ha (Census of India 2004,Punjab).About 94% of the total sown area in Punjab is irrigated, out of which 61.6% is irrigated by tube wells and 38.3% by canals. However, uncontrolled extraction without commensurate recharge and heavy leaching of pollutants from pesticides and fertilizers to the aquifers has resulted in pollution of groundwater (Rajmohan and Elango, 2005). Various workers in our country have carried out an extensive work on water quality for various purposes. Subramani et al., (2005) studied groundwater quality and its suitability for drinking and agricultural use in Chithar River Basin. Raju (2007) has evaluated the groundwater quality in the upper GunjanaeruRiverbasin, Cuddapah District, Andhra Pradesh, South India. Tank et al.,(2010) examined the major ion constituents in the groundwater of Jaipur City for water quality determination. Physicochemical parameters of water samples of Nujendla area in Guntur District, Andhra Prades(India) was determined by Rao et al.,(2012). Mushtaq et al.,(2015) analyzed the physico- chemical parameters of ground water of Kapurthala District, Punjab. Kumar et al.,(2016)studied the physico-chemical analysis of drinking water in Hanumangarh District, Rajasthan (India). The main aim of the present paper is to highlight the variations in physico-chemical parameters of groundwater of the most extensively cultivated district (Pune,Maharashtra) and to evaluate the suitability of ground water for irrigation purposes for a sustainable agriculture. Water makes up more than half of our body weight. Without water, all organisms in the world would die. Water is necessary not only for drinking but also for our day to day life purposes like bathing, cooking, cleaning, and washing and so on other than drinking and household purposes, water is important for existence of our world. Conservation of Water is important for our goodness and for the future to come. We need to take initiatives to save water whether there is scarcity or not.

1.1.2 Importance of Water Analysis

Our drinking water today, far from being pure, contains some two hundred deadly commercial chemicals, that bacteria, viruses, inorganic minerals (making the water hard) and we get a chemical cocktail that is unsuitable (if not deadly) for human consumption. John Archer in his book 'THE WATER YOU DRINK, HOW SAFE IS IT?' refers to an estimate of 60,000 tones of fifty different chemicals being deliberately added annually to water.Water, whether for a pubic municipality, water facility or business/home, must be tested regularly to keep the source safe and free of potential health/environmental risks. The type of test needed, and to what frequency, will depend on the unique components specific to the water source in question. The necessary water test can be impacted by factors such as local and federal regulations, location, climate/weather, infrastructure, agriculture and even the desired detection level.A survey conducted by WHO in 1975 on community water supplies revealed the fact that in India while 80% of the population in urban areas had access to community water supplies and only 18% of the rural population had reasonable access to safe water.

1.1.3 Water test parameters

The following tables provide a general guideline to common water quality parameters that may appear on your water analysis report. The parameters are divided into three categories: health risk parameters, general indicators, and nuisance parameters. These guidelines are by no means exhaustive. However, they will provide you with acceptable limits and some information about symptoms, sources of the problem and effects.

1.1.4 The Health Risk parameters

The parameters in Table 1 are some commons ones that have known health effects. The table lists acceptable limits, potential health effects, and possible uses and sources of the contaminant.

Table 1: Standards, symptoms, and potential health effects of regulated contaminants.

Contaminant	Acceptable Limit	Sources/Uses	Potential Health Effects at High Concentrations
* Recommended level in water at which remedial action should be taken. No mandatory standards have been set.			
Atrazine	3 ppb or. 003 ppm	used as a herbicide; surface or ground water contamination from agricultural runoff or leaching	heart and liver damage
Benzene	5 ppb or. 005 ppm	gasoline additive; usually from accidental oil spills, industrial uses, or landfills	blood disorders like immune system depression; acute exposure affects central nervous system causing dizziness, headaches; long term exposure increases cancer risks
Lead at tap	0.015 ppm or 15 ppb	used in batteries; lead gasolines and pipe solder; may be leached from brass faucets, lead caulking, lead pipes, and lead soldered joints	nervous disorders and mental impairment, especially in fetuses and infants; kidney damage; blood disorders and hypertension; low birth weights
Nitrates (NO_3)	10 mg/l (nitrate-N) 45 mg/l (nitrate)	soil by-product of agricultural fertilization; human and animal waste leaching to groundwater	methemoglobinemaia (blue baby disease) in infants (birth to 6 months); low health threat to children and adults
Total Coliform	<1 coliform/100 ml	possible bacterial or viral contamination from human sewage or animal manure	diarrheal diseases, constant high level exposure can lead to cholera and hepatitis

1.1.4 General water Quality indicators:

General Water Quality Indicators are parameters used to indicate the presence of harmful contaminants. Testing for indicators can eliminate costly tests for specific contaminants. Generally, if the indicator is present, the supply may contain the contaminant as well. For example, turbidity or the lack of clarity in a water sample usually indicates that

bacteria may be present. The pH value is also considered a general water quality indicator. High or low pHs can indicate how corrosive water is. Corrosive water may further indicate that metals like lead or copper are being dissolved in the water as it passes through distribution pipes. Table 2 shows some of the common general indicators.

Table 2. General water quality indicators.

Indicator	Acceptable Limit	Indication
pH value	6.5 to 8.5	An important overall measure of water quality, pH can alter corrosivity and solubility of contaminants. Low pH will cause pitting of pipes and fixtures or a metallic taste. This may indicate that metals are being dissolved. At high pH, the water will have a slippery feel or a soda taste.
Turbidity	<5 NTU	Clarity of sample can indicate contamination.
Total Dissolved Solids (TDS)	500 mg/l	Dissolved minerals like iron or manganese. High TDS also can indicate hardness (scaly deposits) or cause staining, or a salty, bitter tast

The present paper deals with the drinking water quality analysis of some water sample from Pune,Maharashtra,India

The results are compared with W.H.O. and I.S.I Standard.

2. Materials and Methods

2.1. Study Area The present study has been conducted in Pune area of Maharashtra,India. Maharashtra is a diverse state with complex geography.Pune, also called Poona**,** city, west-central Maharashtra state, western India, at the junction of the Mula and Mutha rivers called "Queen of the Deccan,". Pune is the ninth populated city in India and also the second biggest in the state of Maharashtraafter Mumbai. The population of Pune in 2018 is around 6.772 Million.

2.2. Sample collection and measurement

For the collection of water sample we have visited different place near Pune at Pawana river water, Sangvi,Pune,Hinjewadi,Kasarsai Dam and Pune University ,Pune **PCMC area, Pune**. We have collected water samples Pre-sterilized bottle were used for the collection of D.O and B.O.D samples. Temperature, pH of the samples was measured in the sampling station. The water samples have preserved to determine thedifferent tests of the samples were analyzed in laboratory and recorded the particular parameters within 24hrs and after that we kept that samples in refrigerator for further work .

2.3.Determination of Physico-chemical parameters of ground water as per APHA (American Public Health Association) 1989 protocol

Following parameters were checked by their respective checking equipment.

2.3.1 Color: Color of all samples was observed by naked eyes. Drinking water should be colorless **.** Colored water is not acceptable for drinking (Aesthetic as well as toxicity reasons) Industrial waste water require color removal before discharge into water courses

2.3.2 Odor: Drinking water should be colorless odorless

2.3.3 Temperature : Temperature of water samples is checked by using thermometer and noted.

2.3.4 pH :pH of water samples is measured by pH meter and pH paper and noted the observations. pH is criteria of *acidity and basisity*of water. Acidity / Alkalinity of water samples is determined from the observed pH values.

- pH = -log $[H_30^+]$
- $[H_30^+] > 10^{-7}$ => pH < 7 (acid)
- $[H_30^+] = 10^{-7}$ => pH = 7 (neutral)
- $[H_30^+] < 10^{-7}$ => pH > 7 (base)
- natural water has pH between 6 and 8
- drinking water => pH = 6,5 – 8,5 (EC rules)

2.3.5 Conductivity :

Conductivity of water samples is checked by conductivity meter and noted the observation.

2.3.6 Total Dissolved Solids(TDS) :

TDS of water sample is measured by the TDS meter.

2.3.7 Presence of Chlorine : Presence of Cl is tested by followed test:

Take little amount of water sample + little amount of $K_2Cr_2O_7$ and add to that few drops of Conc. H_2SO_4. Heat the mix gently and pass the evolved gas into another test tube containing lead acetate solution. If yellow ppt of lead chromate is formed then we can say that Cl present in the givenwater sample.

2.3.8 Limit of Iron and Manganese in Drinking Water

As per WHO guidelines for domestic water, iron should not exceed the limit of 0.3 mg/l • Above 200mg/l iron is toxic to human health • Manganese concentration as per WHO guideline is 0.05 mg/l • However average manganese level in drinking water range from 5 to 25 ug/l • At concentration exceeding 0.15 mg/l, manganese imparts undesirable taste

2.3.9Methods for Detection of Iron and Manganese in Water

• Atomic Absorption spectrophotometer (AAS) • Inductively Coupled Plasma (ICP) • Colorimetric method In colorimetric method iron is detected at wavelength 510 nm and manganese is detected at 525 nm.

1. Iron:-Phenanthroline method
2. Manganese:- Per-sulphate method Per-iodate method

2.3.10.Hardness :

Total Hardness is defined as the sum of the calcium and magnesium concentrations, both expressed as calcium carbonate, in mg/L .

• Originally water hardness was under stood to be a measure of the capacity of eater to precipitated soap

• Soap is precipitated chiefly by calcium and magnesium ions present. Other prevalent cations also precipitate soap but they often are in complex forms and minimal concentration

Significance

- Scale formation in boilers, pipes and cooking utensils
- Adverse effect on domestic use
- Encrustation in water supply structure
- Cathartic and diuretic effect
- Calcium can be estimated by AAS, ICP and EDTA titrimetric methods
- Magnesium can be estimated by AAS, ICP and Gravimatric method
- Total Hardness by Calculation : mg CaCO3 / L = 2.497 [Ca mg/L] + 4.118 [Mg mg/L]
- Hardness of water sample is measured by titrimetric/ Volumetric method.

10. Nitrates ($NO3^-$) and Nitrite ($NO2^-$): Nitrates are the major polluters of ground water and also of many fluent and influent waters.

Sources of pollution:

- Artificial manures, intensive stockbreeding, poor infrastructure (sewage)

The functioning key of nitrates is transformation into nitrites (NO2-).

2.3.11. Ammonia(NH^{4+}):

The presence of ammonium in water shows that the water was in contact with rotting organic materials, fecals.**Table 3. Hardness classifications.**

Concentration of hardness minerals in grains per gallon (GPG)	Hardness Level
* level at which most people find hardness objectionable	
below 1.0	soft
1.0 to 3.5	slightly hard
3.5 to 7.5	moderately hard
7.5 ti 10.5*	hard
10.5 and above	very hard

The methods applied for analysis are usually followed as prescribed by NEERI (1986)(2)

3. RESULT AND DISCUSSION: We have studied following parameters of water samples of Pawana river water, Sangvi,Pune,Hinjewadi,Kasarsai Dam and Pune University,Pune and PCMC area, Pune

Table 5.Measurement of different parameters of water samples.

Sr.No.	Parameters	Standard Range	Name of the place from sample taken				
			Pawana river water Sangvi	**Hinjewadi river water**	**Kasarsai Dam water**	**PuneUniversity Well water**	**Pavana river water Kasarwadi**
1	Color	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
2	Turbidity	Clear	Turbid	Turbid	clear	clear	Turbid
3	Odor	odorless	odorless	odorless	odorless	odorless	Odorless
4	Temperature (^{0}C)	20 - 30	23	20	24	23	23
5	pH (by pH meter)	7 - 7.8	7.58	7.92	**6.23**	7.12	7.11
	pH (by pH paper)	7 - 8	7	**8**	6	7	7
6	Acidity/Alkalinity Litmus action	1-14	Alkaline	Alkaline	Acidic	Alkaline	Alkaline
7	Conductivity (µS/cm)	8 - 10 µS/cm	0.810	0.880	0.210	0.112	0.793
8	TDS (ppm)	Below 300 ppm	**315**	116	254	**392**	**320**
9	Presence of Cl	-	Present	Absent	Present	Absent	Present
10	Hardness (ppm)	60 - 120 ppm	25	20	35	55	200

4. CONCLUSION:

Groundwater is the main source of irrigation in the entire study area. Quality of water is assuming great importance with the rising pressure of industries and agriculture in Pune. For proper growth of plants the adequate amount of water is very essential but the quality of water used for irrigation and drinking purpose should also be well within the permissible limit otherwise it could adversely affect the plant growth. In this study, the collected ground water samples of Pune district were analyzed for physicochemical parameters.

To conclude:

- All water samples are colorless.
- Pawana river water Sangvi, Hinjewadi river water and Pavana river water Kasarwadiare all little turbid.
- Temperature of all water samples are in the range of 20^o -30 ^{o} C
- All water samples are alkaline except Kasarsai Dam water
- All pH values of water are according to EC rules.
- TDS (ppm) of Pawana river water, Sangvi , higher than standard limits .It is hard water so it should not use directly. It is necessary to make it soft by boiling and then filtration.
- Hardness of water sample from Pawana river ,Pune University well water and Kasarwadi is high so not potable
- The above parameters are in range in Pawana river water, Sangvi and Malavali Stream water but still few more parameters are necessary to measure the portability of water.

5. FUTURE SCOPE:

The quantity of drinking water is very less on the earth. So we have to find out different ways to protect and recycle water samples.

6.ACKNOWLEDGEMENT:

We are thankful to our Principle Dr. B.N. Zaware , Vice. Principle Dr. L. K. Nikam, BaburaojiGholapCollege,Sangvi, Pune ,India for providing the infrastructure and laboratory with required instruments.

REFERENCES:

[1] A Comprehensive Laboratory Manual for Environmental Science and Engineering- P. R SreemadhavanPillai.

[2] American Public Health Association(APHA).1998.Standards methods for examination of water and waste water. American Public Health Association Inc,Washington DC 20th Edition.

[3] BUDHLANI & NAGARNAIK, Curr. World Environ., Vol. 6(1), 109-114 (2011).

[4] EPA Publication, March 1979. "Methods for Chemical Analysis of Water and Wastes.

[5] Gupta, S.K. and Deshpande, R.D. 2004. Water for India in 2050: first-order assessment of available options. Current Science, 86: 1216–1223

[6] GWREC,1997.Report of ground water resource estimation committee, Ministry of water resoursces, Government of India, New Delhi .

[7] Instrumental Methods of chemical Analysis- B.K Sharma.

[8] J Chilton,J. In: Chapman, D. (Ed.).(1996) Water Quality Assessments - A Guide to Use of Biota, Sediments and Water in Environmental Monitoring, 2nd Edition, E and FN Spon, London.

[9] Kataria, H. C. et al., Physico- Chemical analysis of Bore Well of Bairagarth area of Bhopal city, Orient. J. Chem. 22(1): 175-176 (2006).

[10] Laboratory manual for Environmental Chemistry by SunithaHooda, SumanjeetKaur

[11] NEERI, Manual on water and waste water analysis, national environment engg. Research institute, Nagpur: 3402 (1986).

[12] Onifade, A.K.andIlori, R.M .2008. Microbiological analysis of sachet water vended in Ondo state, Nigeria.Environmental Research Journal, 2: 107-110.

[13] Osci, Y. 2005. New School Chemistry for Senior Secondary Schools. African First Publisher Ltd, Onitsha. 3rd edn., p: 292.

[14] S.k. shrivastava[1]* V.K. gupta[2], kiran vajpai[3], D.K. Shrivastava and Sharad k. Vajpai*Study of physicochemical quality of pond water in Bilaspur, Chhattisgarh 3(1): 97-107.

[15] Suman Sharma and ManpreetKaurChahal* JETIR August 2018, Volume 5, Issue 8

[16] Standard Methods for the Examination of Water and Waste water- American Public Health Administration (APHA,1992).

[17] Vogel's text book of quantitative Chemical Analysis Sixth edition- J Mendham, R C Denney, J D Barnes, M J K Thomas.

[18] WHO, guideline for drinking water quality Genewa (1984).