Analysis and Prediction of Quality of Water Resources in Palghar City Using Excel Tool

Amit Ghorude[1], Akshay Chate[2] , Tanmay Patel[3] , Yash Patel[4] , Swati Dhurve[5]

[1](Department of Civil Engineering, University of Mumbai, Palghar
Email:amitghorude@gmail.com)
[2](Department of Civil Engineering, University of Mumbai, Palghar
Email: ac9881159961@gmail.com)
[3](Department of Civil Engineering, University of Mumbai, Palghar
Email: pateltanmay0@gmail.com)
[4](Department of Civil Engineering, University of Mumbai, Palghar
Email: yashp369.yp@gmail.com)
[5](Department of Civil Engineering, University of Mumbai, Palghar
Email: sdswatidhurve@gmail.com)

ABSTRACT

Water is one of the most vital component in every living organism, hence finding a reliable water resource that is safe for drinking is very important task. This can be determined by factors like turbidity, demand oxygen (DO), hardness, chloride content, alkalinity, pH and bio-chemical oxygen demand (BOD). Hence we need to carefully measure the above factors. When the sample meets the specified standard only then the water sample will be considered fit for domestic purpose for mankind. The various methods and the sample results are analysed and explained in the paper. The results are represented in graphical presentation.

Keywords *–Alkalinity, BOD, DO, hardness, quality of water, chloride, Palghar.*

1. Introduction

Water is one of the most important and vital resource for biological sphere and human civilization. The other agents responsible for living are air, heat, soil and sky. All these agents are linked in between themselves and any irregularities between them affect others as well. Due to progress in human civilization the quality of these resources is depleted.

It has been observed that the coastal areas as well as river banks has been most populated with respect to the availability of ample water resources. Increase in urbanization, industrialization, agriculture activity and various human activities has increase the pollution of surface water & ground water.

In total, there is 1400 million billion litres of water, but most of this water is not used for drinking purpose, because 97% is sea water and only 3% is fresh water, out of which 2% is ledged in the polar ice caps and glaciers, only 1% water is available for portable use.

The safety of drinking water is an on going concern within the global village. Likewise other part of India, Maharashtra also depends largely on monsoon rainfall for fulfilling its water demand. There are many rivers, lakes and ponds located surrounding area of the "Palghar".

2. Problem Statement

Poor quality and unsatisfied demand of water leads to search of alternative water supplies having ample amount of water and good quality. Hence, Prediction Of Quality Of Water Resources In Palghar City Using Excel Tool.

3. Objectives

- To identify the sources of water recognized by the Palghar Municipal Co-operation.
- To collect the seasonal samples from the sources.
- The obtained results are compared with IS 10500-2012.
- To analyse the samples by performing the experimental tests.
- Compilation of results and predict on excel tool.

4. Geographic Location

The present study is focused on the rivers, wells, dams and lakes of Palghar city. Following are the locations:

- Bore well, Navali (1.1km away from Palghar Railway station)

- Well water, Navali (1.0km away from Palghar Railway station)
- Dev kumb, Manor (3 km away from Palghar Railway station)
- Ganesh kund, Tembode (1.0km away from Palghar Railway station)

5. Literature Review:

5.1 Testing and Analysis of Pond Water InRaipur City, Chhattisgarh, India 2016. (Arvind Kumar Swarnakar & Dr. Shweta Choubey)

Thestudy was on Testing and analysis of pond water samples. Samples were analyzed for various physics-chemical characteristics such as turbidity, pH, total alkalinity, chloride, total hardness, total dissolved solid, dissolved oxygen, Biological Oxygen Demand (BOD) and total coliform. Out of these nine ponds were most polluted. All these water bodies are not suitable for domestic and drinking purposes, therefore proper treatment is necessary before can be suitable for domestic use.

5.2 Qualitative and quantitative analysis of drinking water samples of different localities in Abbottabad district, Pakistan 2011. (Anwar Khalid, Amir Haider Malik, Amir Waseem, Shazmeen Zahra and Ghulam Murtaza **)**

The qualitative and quantitative analysis of water samples of different localities was conducted to determine the exact amount of different pollutants present in water. The results of the present research work showed that drinking water collected from different areas of Abbottabad district was not found to be suitable for human health due to microbiological issues.

5.3 Water Quality Assessment and Modeling of Cuttack City 2012. (Lipi Mishra)

Water samples were collected from Mattagajpur and Khannag arrivers and were tested in the laboratory for various water quality parameters. Streeter Phelp's equation was used for modeling of the water quality, few programs were compiled in MATLAB and were executed. The Rivers are highly polluted in summer season followed by winter and rainy season.

5.4 Assessment of Physical-Chemical Drinking Water Quality in the Logone Valley (Chad-Cameroon) 2013. (Sabrina Sorlini, Daniela Palazzini, Joseph M. Sieliechi, Martin B. Ngassoum)

The samples were analyzed for their physical-chemical and microbiological quality in order to identify the contamination problems and suggest appropriate solutions.Results of the assessment confirmed that in the studied area there are several parameters of health and aesthetic concern.

6. Case Study

The samples were bought and preserved to the laboratory. Various experimental tests were carried out on them in order to determine the water quality. The parameters are:

1) pH
2) Turbidity
3) Demand Oxygen
4) Hardness
5) Chloride content
6) Alkalinity
7) Biochemical Oxygen Demand(BOD)

The experiments were carried out at the Environmental Engineering Laboratory of Civil Engineering Department. The DO and BOD are the parameters of great importance and are interrelated. BOD shows us the presence of micro-organisms in a water body. Turbidity, Total Solids and Hardness directly give us a measure to decide whether the water meets the desirable and required conditions or not.

6.1 Analysis method for pH

The pH (potential of hydrogen) value of the water sample is nothing but the logarithm of the reciprocal of hydrogen ions activity present in moles per litre. For neutral sample, it is generally found to be around 7. If it is less than 7, the sample is considered to be acidic and for the opposite case, it is taken as basic. For general water, pH ranges between 6.5 to 8.5.

6.2 Analysis method for Turbidity

Turbidity is caused in natural waters by fine suspended particles of clay, silt, sand or some organic materials. The standard unit for turbidity is that turbidity which is produced by mixing 1mg of finely divided silica (SiO_2) in distilled water.

The apparatus used for measuring Turbidity of water sample is 'Nephelometer' which uses the principle of scattering of light. In this instrument, the sample scatters the light that impinges on it. The scattered light is measured by photometers which are kept at right angles to the original direction of the light. The unit used for the measurement of Turbidity is known as the Nephelometric Turbidity Unit (NTU).

6.3 Analysis Method for Dissolved Oxygen

Dissolved Oxygen in a water sample is determined by following Winkler's method. The saturation DO value

is the maximum dissolved oxygen which a given water can contain at a given temperature and pressure. In this principle, the water sample to be tested is mixed with manganese sulphate ($MnSO_4$) and an alkali iodide reagent. The Mn^{2+} ions released from $MnSO_4$ react with OH^- ions of water to form white precipitate if no dissolved oxygen is present otherwise they give rise to a red precipitate. The expected DO value for suitability in domestic use is 4-8mg/l.

6.4 Analysis method for Hardness of water

Hardness of water is that characteristic which prevents the formation of sufficient foam. The hardness is usually caused by the presence of calcium and magnesium pin water. Hard water are undesirable because they lead to greater soap consumption. Carbonate hardness are caused by the divalent metallic ions principally of Ca^{2+} and Mg^{2+} while sulphates, chlorides and nitrates cause noncarbonated hardness.

6.5 Analysis Method for Chloride Content :

Chlorides are widely found in all water samples and reasonable amount of chlorides are harmful as they cause a threat if the concentration surpasses 250mg/l. The principle of chloride detection works on the following outlines: This method uses Silver Nitrate ($AgNO_3$) because silver ions combine with chloride ion to produce a white precipitate of Silver Chloride (AgCl). The end point is determined by using potassium chromate indicator. Chromate ions combine with silver ions to form a reddish brown precipitate of silver chromate. This gives the evidence that all chloride has been precipitated.

6.6 Analysis Method for Alkalinity

Source of OH^- alkalinity is industrial water. Top soil is major source of HCO^{3-} and CO^{3-} alkalinity. Source of CO_2 acidity is also the source of alkalinity. Relation between hardness and alkalinity hardness is found in form of Ca and Mg.

6.7 Analysis Method for Biochemical Oxygen Demand (BOD) :

BOD shows us the extent of micro-organisms present and their behaviour in a water-sample. It gives the value of the amount of oxygen required for complete biological decomposition of waste and organic matter present in water thereby reducing the carbonaceous material from the water.

BOD is measured using the Ox top measuring instrument. The ox top measuring system is based upon pressure measurement which notes the pressure by piezo-resistive electronic sensors. It can note the features like automatic temperature detection, data logging and measuring range value.

Indian standards for drinking water are

(Table: IS 10500-2012)

Characteristics	Desirable limits
Ph	< 200 mg/l
Turbidity	1-5NTU
Alkalinity	300-500 mg/l
BOD	250 mg/l
DO	6.5-8.5
Chloride content	7-10 mg/l
Hardness	30-50 mg/l

7. Methodology

The samples are collected in monsoon, winter and summer season. The sampling technique used is grab sampling. The samples were collected in plastic bottle and all the tests, viz., pH, hardness, turbidity, alkalinity, BOD, DO and chloride content were carried out. The results are represented in graphical manner. The results are thus used for prediction and best suited sample is noted.

8. Experimental Parameters :

(Table 8.1: Result interpretation)

Season	Test	Sample 1 (Sub-Surface)	Sample 2 (Sub-Surface)	Sample 3 (Surface)	Sample 4 (Surface)
Monsoon	pH	7.2	6.8	6.7	6.2
	Alkalinity	255 mg/l	105 mg/l	100 mg/l	98.1 mg/l
	DO	4.2 mg/l	5.9 mg/l	6.2 mg/l	6.4 mg/l
	Hardness	420 mg/l	325 mg/l	135 mg/l	400 mg/l
	Turbidity	4.4 NTU	5.8 NTU	5.2 NTU	4.4 NTU
	BOD	56 mg/l	54 mg/l	60 mg/l	49 mg/l
	Chlorides	102.5 mg/l	76 mg/l	92.3 mg/l	69 mg/l
Winter	pH	8	7	8	7.2
	Alkalinity	255 mg/l	185 mg/l	325 mg/l	235 mg/l
	DO	6.1 mg/l	6.3 mg/l	7.1 mg/l	7.3 mg/l
	Hardness	330 mg/l	410 mg/l	489 mg/l	389 mg/l
	Turbidity	1 NTU	1.5 NTU	1NTU	1 NTU
	BOD	49 mg/l	50 mg/l	55 mg/l	52 mg/l
	Chlorides	60 mg/l	103 mg/l	62 mg/l	90 mg/l
Summer	pH	7.9	8	7.9	8.1
	Alkalinity	330 mg/l	400 mg/l	345 mg/l	200 mg/l
	DO	5.2 mg/l	5.5 mg/l	4.9 mg/l	6.1 mg/l
	Hardness	389 mg/l	300 mg/l	235 mg/l	410 mg/l
	Turbidity	2.2 NTU	1 NTU	1.2 NTU	1.6 NTU
	BOD	86 mg/l	66 mg/l	78 mg/l	68 mg/l
	Chlorides	105 mg/l	92 mg/l	115 mg/l	106 mg/l

9. Results :

The graphical representation of the analysed results is shown below.

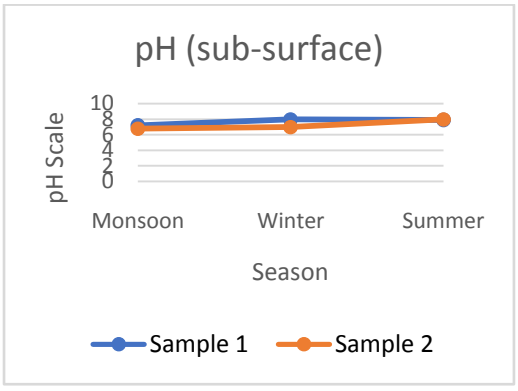
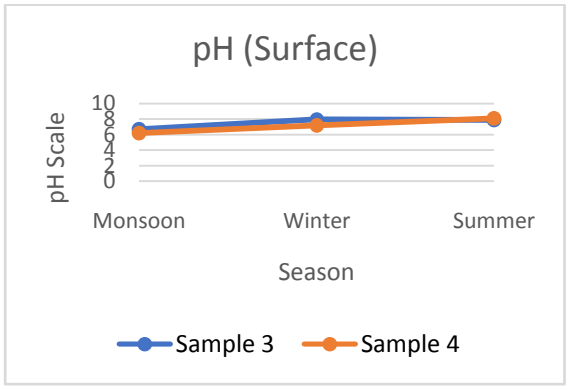


Fig.1



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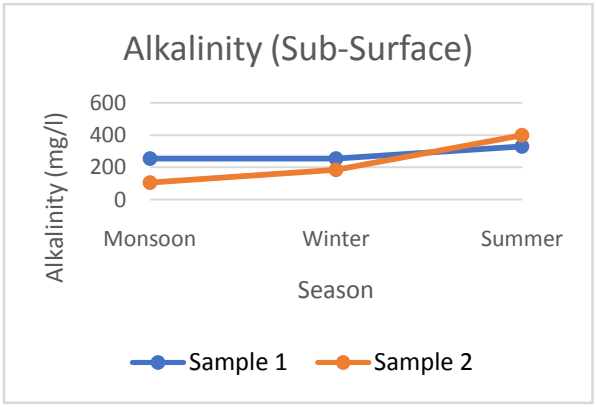

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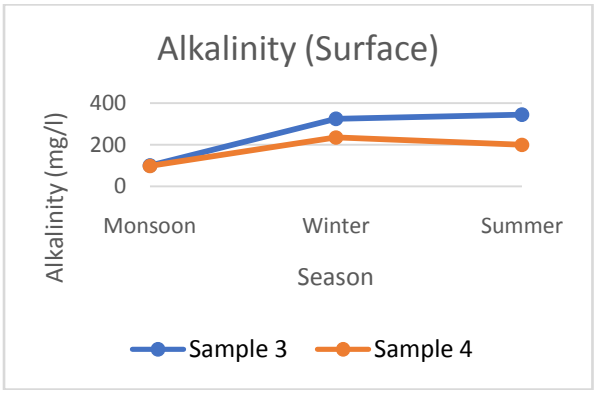

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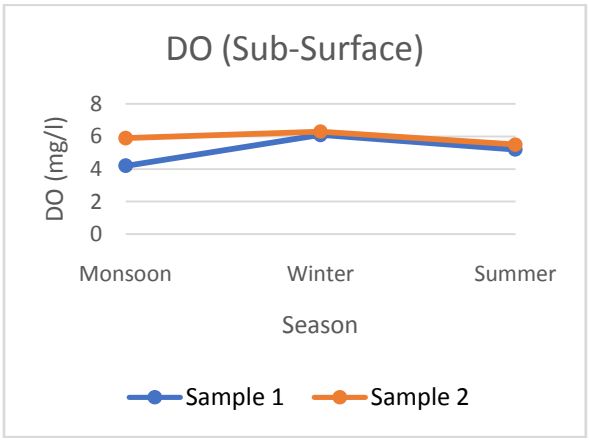
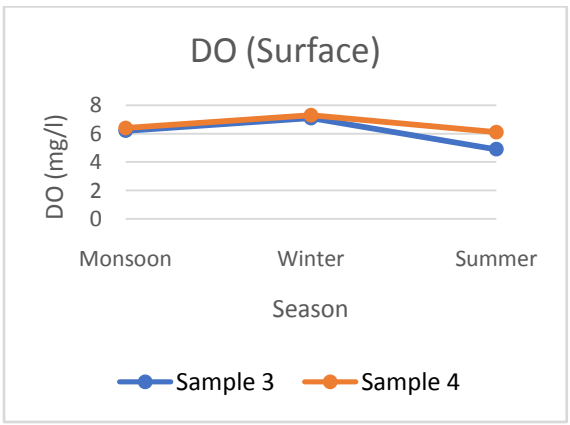


Fig.5



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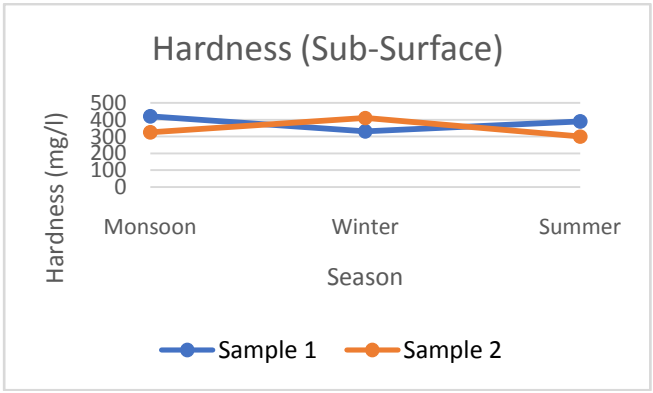

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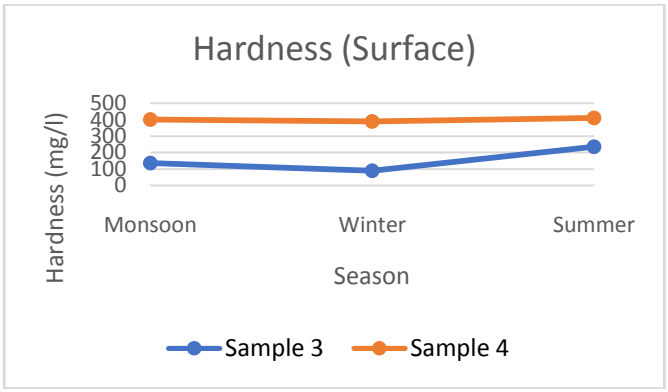

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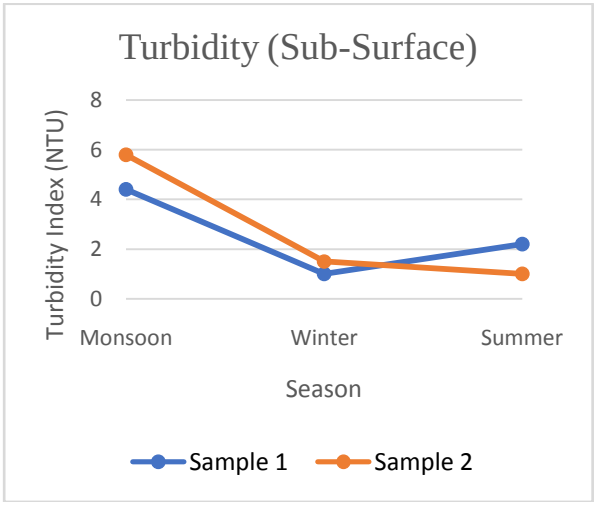

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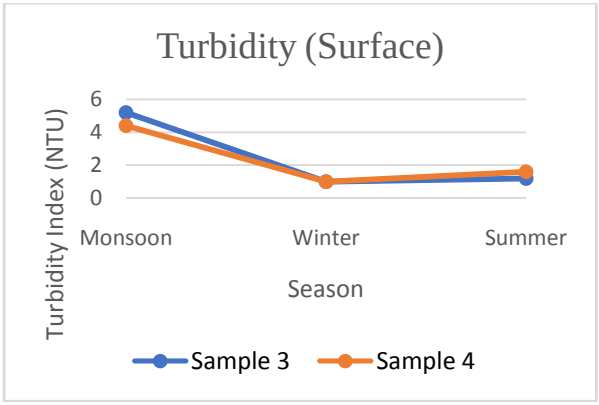

Fig.10

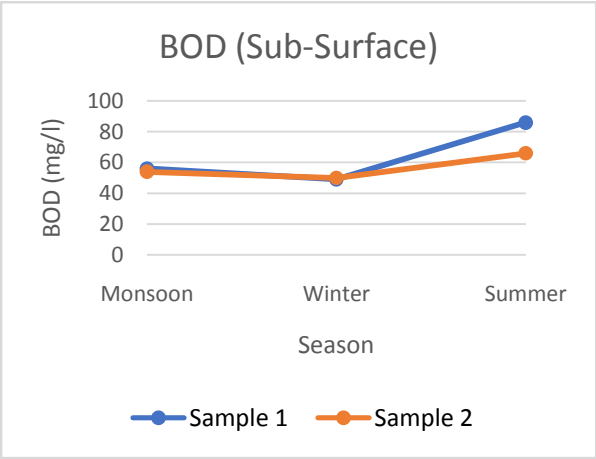

Fig.11

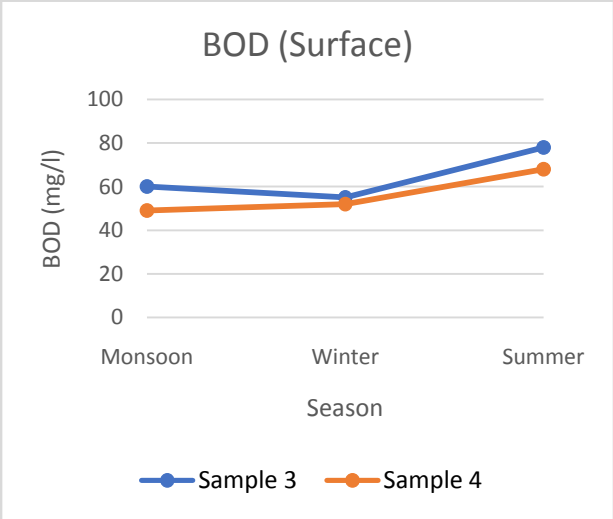

Fig.12

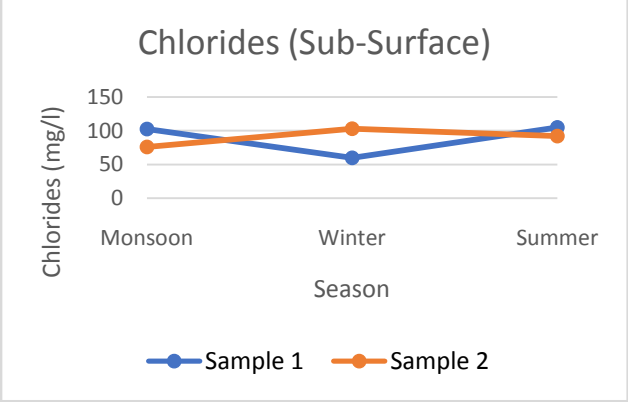

Fig.13

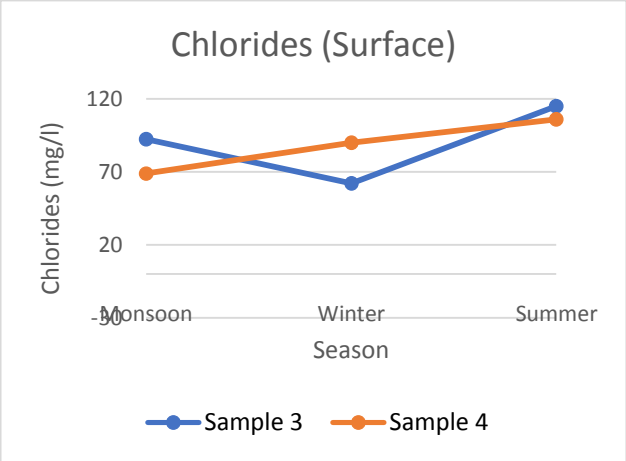

Fig.14

10. Conclusion

From all the test performed during all the season is shown above. The graphical representation using Excel tool is also shown. From the results above we conclude that sample 3, i.e, Dev kumb lake water is best suitable for domestic purpose including drinking for mankind after disinfection.

The sample 1 and sample 2 are ground water sources which can be used for all domestic purpose after water softening, sand filtration and disinfection.

Sample 4 which is surface source can be used best after disinfection and filtration.

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