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Physico-Chemical Analysis of Potable Water Supplied in Lanja City

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Abstract
In order to ascertain water quality for human consumption, major and minor ions were evaluated in the drinking water supplied to the city of Lanja, Ratnagiri. Standard methods were used for determining of chemical and physical characteristics of the water samples. The data showed that the investigated parmeters in Borewell, River, and well water samples as follows: pH, temperature, dissolved oxygen (DO), Biochemical Oxygen Demand (BOD), Hardness, Alkalinity. The concentrations of investigated parameters in the drinking water samples from Lanja, Ratnagiri were within the permissible limits of the world Health Organization drinking water quality guidelines.

Keywords: Water quality, Lanja city, Physico-Chemical Parameters, WHO

Introduction

Water is essential to life with a supposed supply of clean and safe drinking water for the sustenance of life. Water plays an important role in human life. It is necessary for industry, agriculture and human existence. The healthy water ecosystem is depended on the physico-chemical and biological characteristics.

Due to increase in industrialization, urbanization, agriculture activity and various human activities has increase the pollution of surface water and ground water. In total, there is approximately 1400 million billion litters 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. Use of ground water for human being depends upon ambient water quality. Ground water plays important role in human life. The effect of industrialization and urbanization leads to spoil the water for agricultural purposes ground water is explored in rural especially in those areas where other sources of water like river, dam or a canal is not substantial.

Aims and Objectives

During past two decades, it is observed that ground water get polluted significantly due to human activities. Hence, it is necessary to check the quality of well and bore well water at regular time interval, because due to use of infected drinking water, human population suffers from wide-ranging of water borne diseases. It is complicated to comprehend the biological phenomena fully because the chemistry of water revels much about the metabolism of the ecosystem and explain the general hydro-biological relationship.

Lanja is located at 16.85°N 73.55°E. It has an average elevation of 166 meters (544 feet). It's a Taluka head in Ratnagiri district. About 50 km from the district headquarters Lanja is well known for its climatic variability as it has ample rains as well as good enough winters followed by heating summers. Lanja had a population of 237000. Males constitute 51% of the population and females 49%. Lanja has an average literacy rate of 73%, higher than the national average of 59.5%: male literacy is 78%, and female literacy is 69%. In Lanja, 14% of the population is under 6 years of age.

For last few years' population in and around Lanja city is continuously increasing tends to increase in number and units of small scale industries (SSI) in and around Lanja city. It tends to utilize more and more amount of surface water and ground water. As a context it will have impact on the quality of water at both surface as well as ground water. With increasing population and increasing industrialization can cause the diminishing values of water quality in Lanja city. Most of the people of Lanja city fulfill the resource of water from private supply of resources. But for Lanja city Nagarpanchayat is providing supply of water by Nal-Pani Yojana. Nagarpanchayat have possession of seven water storing tank all around the city. Main source of water for Lanja city is from Beni river running in very close vicinity of the city. There are about Five Pumping station at five different locations on the Beni River. The water is pumped from these stations and stored in seven tanks and supplied to various areas, residential and commercial as well.

As there is no proper unit in working condition for Filtration, Purification, Chlorination, Settling, etc. Hence this makes author to carry present research work to analyze the physico-chemical and biological properties of water collected from different places of Lanja city including the seven tanks and pumping stations of Nagarpanchayat. This water is basically for drinking agriculture and domestic purpose.

Review of Literature

Water Quality Status Report of Maharashtra, Year 2016-17, published by Maharashtra Pollution Control Board (MPCB) has shown that there is only one Monitoring Station (MS) working in Lanja taluka at Waked village. This station monitors the Surface Water (SW) quality of Muchkundi River flowing near to Lanja city. The report shows that the surface water quality of Muchkundi River is good to Excellent.

The research carried out by Dhanaji Kanase G and others (2016) has concluded that, water samples from studied area were not suitable for drinking, both the well and bore well water samples can be quite safe after the boiling X-rays water filter can be used for clarifying water from microorganism, sewerage waste treatment and education of peoples through media about the harmful effect of water on human health.

S. A. Manjare and others (2010) has carried analysis of water quality using physico- chemical parameters Tamdalge tank in Kolhapur district, Maharashtra. The study reveals that, All Parameters were within the Permissible limits. The results indicate that the tank is Non-polluted and can be used for Domestic, Irrigation and Pisciculture.

Richa Saxena and Manju Sharma (2014) have done the qualitative and quantitative evaluation of water sources of few areas in and around Gwalior, MP, India. The cumulative evidences obtained after analyzing the water samples, support the fact that the water of this region contains high pathogenic content, TDS, fluoride, chloride and sodium ion concentration mainly and in few samples high BOD and COD is indicative of the pollution status of these water sources. Thus, making it unfit for drinking purpose and requires proper treatment, however in some cases boiling and filtering of water before its usage would be suitable and for defluorination Nalgonda technique at domestic level is suggested.

Neerja Kalra and others have carried extensive study on physico-chemical analysis of ground water taken from five blocks (Udwantnagar, Tarari, Charpokhar, Piro, Sahar) of southern Bhojpur, Bihar. This study shows that ground water is the only source for people in the study area, and the results of the chemical analyses of ground water indicate considerable variation. Most of the water samples do not comply with ICMR standards for drinking purpose. The water quality in the investigated area is found to be suitable for drinking only in few locations, while as out prior treatments. It must be noted that a regular chemical analysis must be done to insure that the quality of water in this area is not contaminated, in addition to research for new walls in the area in order to get additional water for the resident people.

Anwar Khalid and other have done qualitative and quantitative analysis of drinking water samples of different localities in Abbottabad district, Pakistan. The results of the research work shown that drinking water collected from different areas of Abbottabad district was not found to be suitable for human health due to microbiological issues.

Relevance to Social Benefit by this R&D

Water and health are linked. The top causes of disease outbreaks related to drinking water are various disease causing pathogens. There are also health risks related to water contaminated with organic and inorganic matter, other bacteria and viruses and other pollutants. Still, water is essential. The human body is, after all, 70% water, and although a human being can survive a month or more without food, a week without water can be fatal.

High quality water is good for your home and appliances. Softened water can save you money by keeping appliances at top efficiency, and making them last longer. The amount of dish and laundry detergent you use can be cut by half, or even more, if you use softened water. You can also lower wash temperatures from hot to cold without a drop in performance, according to two other independent studies.

In the present area of study No Unit has been installed for monitoring the contamination in water supplied to people of Lanja city. Even there is No Provision of Filtration, Chlorination, Settling, types of processes.

This emphasizes the present research to be carried to analyze physicochemical and biological parameters of drinkingwater samples collected from the selective localities of Lanja city of Ratnagiri district to assess health impacts linked with the consumption of unsafe drinking water and to suggest possible mitigation measures for the identified problems.

Water Quality, Water Quantity and Ecosystem Service

Rapid population increases in the study area accompanied by intensified industrial, commercial and residential development have led to point and nonpoint population of surface and ground water by contaminants such as fertilizers, insecticides, human wastes, motor oil and landfill leachates. Thus, simply maintaining regional water quality and quantity means considering the effects of a wide variety of human activities on watersheds and water bodies.

It is essential to consider the ecological effects and constraints on water development. Water pollution and releases of nutrient-laden municipal sewage effluents have increased and water consumption has also increased, reducing the flows available for dilution of wastes. Maintaining sufficient freshwater in its natural channels helps keep water quality at levels safe for fish, other aquatic organisms, and people. But regional drainage of wetlands and large-scale ground water development have had serious negative effects.

As biological communities provide many good and services to humankind: food, fuel, fiber, pharmaceuticals and other biological products, improvement of air and water quality, reduction of climatic extremes, recreation and aesthetic values.

Recent studies are confirming that the capacity of ecosystems to resist changing environmental conditions, as well as to rebound from unusual climate or biotic events, is related positively to species numbers. The relationship between the natural diversity of biological communities and their provision of good and services is not precisely known, but it is certain that if diversity is reduced enough, there will be a significant loss of goods and services. One of these services is the provision of clean water.

Characteristics of Drinking Water

- Drinking water should be colourless and odourless.
- It should be transparent.
- It should be free from impurities such as suspended solids.
- It should contain some minerals and salts, necessary for our body and some dissolved gases to add taste.
- It should be free from harmful microorganisms.

Materials and Methods

Sampling of water from various sites has been done in all three seasons viz.

Monsoon, Post Monsoon and Pre Monsoon seasons. Total Nine Site of water resources were finalized in Lanja city.

These Sites are designated as Follows

Site-I	Agar Wadi	Site-IV	Vaibhav Vasahat
Site-II	New English School, Lanja	Site-V	Kale Chatralaya
Site-III	Beni		

The detailed study of physico-chemical parameters of water has been carried out at various stations in Lanja city. The physical parameters like temperature and pH of sample water were measured at each site using instruments (ike standard thermometer and pH meter. Water sample, at each site, was collected in a HDPE bottle with a screw tight lid. Furthermore, BOD bottles were filled with the water and fixed for measurement of dissolved oxygen. The collected water samples were brought to the laboratory for further estimation of different parameters such as, salinity, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and hardness. The water samples were analyzed using the standard methods (APHA, Strickland J.D.H. and Parsons T.R., 1972, Trevedi R.K. and Goel P.K., 1984).

1. **Salinity:** 1 ml of sample water is taken in the conical flask, to this potassium chromate indicator is added. This solution is titrated with 0.02 N silver nitrate solution. The end point is with buff colour precipitation. The salinity in terms of chlorinity was calculated with the help of standard table provided by Strickland and Parson.
2. **Dissolved Oxygen (DO):** Dissolved oxygen is calculated by Winkler's Iodometric Method. BOD bottles of 300 ml volume are filled with the water sample by avoiding the bubbles and stopper is placed. Then 12ml each of $MnSO_4$ and alkaline KI solutions are added to each of the BOD bottles well below the surface of water from the walls. A precipitate has occurred, the stoppers are placed and BOD bottle is then shaken by inverting it for several times repeatedly. The bottle kept for some time so that precipitate got settled down at the bottom. Then 2 ml of concentrated H_2SO_4 and added and by placing the stopper the bottle is again shaken by inverting so that the precipitate will dissolve completely.

Within the one hour the content of the BOD water sample is titrated against the 0.025 N sodium thiosulphate solution using starch as an indicator, at the end point initial dark blue colour changes to colourless.

Dissolved oxygen (DO) can be calculated by using the standard formula as,

$$\text{Dissolved Oxygen, mg/L:} = \frac{(\text{ml x N}) \text{ x } 8 \text{ x } 1000}{V1-V}$$

Where,

Ml = burette reading,

N = normality of titrant,

V1= volume of sample bottle after placing the stopper,

V = volume of $MnSO_4$ and KI added.

3. **Biochemical Oxygen Demand (BOD):** BOD can be calculated by the difference of the oxygen concentration in the sample water between initial (DO) and after incubating for 5 days (DOS) at 20° C.

In the sample water 1 ml each of phosphate buffer, magnesium sulphate, calcium chloride and ferric chloride solutions are added. The sample is filled in two BOD bottles. One BOD bottle is kept in incubator for 5 days at 20° C and dissolved oxygen (DO) of another bottle is calculated immediately. Dissolved oxygen can be calculated with the procedure of Dissolved Oxygen. Dissolved Oxygen (DO5) after the incubation for 5 days can be calculated.

The BOD of the sample water is calculated with the formula as,

$$\text{BOD, mg/L} = (D0 - D5) \text{ x dilution factor}$$

Where,

Do is Initial Dissolved Oxygen in the sample, D5 is Dissolved Oxygen after 5 days.

4. **Chemical Oxygen Demand (COD):** 20 ml of sample is taken in a 250-500 ml COD round bottom flask. To this add 10 ml of 0.025 N potassium dichromate ($K_2Cr_2O_7$) solution and pinch of silver sulphate ($AgSO_4$) and mercuric sulphate ($HgSO_4$). To this solution 30 ml of concentrated sulphuric acid was added. The above solution is refluxed at for at least 2 hours on a hot plate. The flask is then removed, cooled and then added distilled water to made final volume 140 ml. 2-3 drops of ferroin indicator are added and the whole solution (140 ml) is titrated with 0.01 N ferrous ammonium sulphate solution, with end point as bottle green to pale brown colour.

The chemical oxygen demand is calculated with the formula as,

$$\text{COD, mg/L} = \frac{(ba) \text{ x Normality of Ferrous Ammonium Sulphate x}}{\text{ml of sample}}$$

Where,

a = ml of titrant with sample,

b = ml of titrant with blank.

5. **Hardness:** Hardness is generally caused by the presence of calcium and magnesium ions in water. Calcium and magnesium form a complex of wine red colour with Eriochrome Black T. The disodium salt of EDTA has strong affinity towards the calcium and magnesium, therefore by adding the EDTA solution the complex is broken down and the blue coloured solution is formed.
For calculating the hardness of sample water, 50 ml of sample water is taken is a conical flask. To this added 1 ml of buffer solution and pinch of Eriochrome Black T. A wine red colour is formed; this solution is titrated with 0.01 N disodium salt of EDTA. The end point will be initial wine red colour changes to blue.

The hardness of sample water is calculated with the formula as,

$$\text{Hardness as mg/L of } CaCO_3 = \frac{\text{ml of EDTA used} \times 1000}{\text{ml of sample}}$$

6. **Alkalinity**

- **Scope**
  - Prescribe the potential and indicator method for determination of alkalinity.
  - These method are applicable to determine alkalinity in water and waste water in the range 0.5 to 500 mg/litre alkalinity as $CaCO_3$.
  - They upper range may be extended by dilution of the original sample.
- **Principle**
  - Alkalinity of water is the capacity of that water to accept protons.
  - It may be defined as the quantitative capacity of an aqueous medium to react with hydrogen ion to pH 8.3 equation in its simplest form is as follows.
    $CO_3^- + H^+ = HCO_3^-$ (pH 8.3)
- **Apparatus**
  - (Burette, burette stand, conical flask).
- **Reagent**
  1. $H_2SO_4 = 0.2$ N
  2. $Na_2CO_3 = 0.2$ N
  3. Phenolphthalein indicator
  4. Methyl Orange indicator
- **Calculation**
  - Prepare 0.2 N H_2SO_4

$$= N1\ V1 = N2\ V2$$
$$= 36 \times V1 = 0.2 \times 100$$
$$= \frac{0.2 \times 100}{36}$$
$$V1 = 0.55 \text{ cm}^3$$

0.55 cm3 H_2SO_4 dissolved in 100 cm3 distilled water.

- Prepare 0.2 N Sodium Carbonate (Na_2CO_3)

$$= \frac{\text{Eq.Wt.} \times \text{Normality} \times \text{Volume}}{1000}$$
$$= \frac{52.99 \times 100 \times 0.2}{1000}$$
$$= 1.0598 \text{ g}$$

1.0598 g Na_2CO_3 dissolved in 100 cm3 distilled water.

- **Observation: Standardization of H_2SO_4**
  1. Solution in burette: 0.2 N H_2SO_4
  2. Solution in Conical flask: 0.2 N Na_2CO_3
  3. Indicator: Phenolphthalein indicator
  4. End Point: Pink to Colourless

- **Observation Table**

Burette Level	Burette Reading			C.B.R. cm3
	I	II	III	
Initial	0.0	0.0	0.0	7.0 cm3
Final	7.0	7.0	7.0	
Difference	7.0	7.0	7.0	

- **Calculation**
  N1 V1 = N2 V2
  N1 x 7.0 = 0.2 x 10/7.0
  N1 = 0.28 N

- **Main Titration: Observation**
  1. Solution in burette: 0.28 N H_2SO_4
  2. Solution in flask: 100 ml sample+Indicator
  3. Indicator: Phenolphthalein+Methyl Orange Indicator
  4. End point: Yellow to Orange

- **Observation Table**

1. **Borewell Water**

Burette Level	Burette Reading			C.B.R. cm3
	I	II	III	
Initial	0.0	0.0	0.0	0.6 cm3
Final	0.6	0.6	0.6	
Difference	0.6	0.6	0.6	

2. **Well Water**

Burette Level	Burette Reading			C.B.R. cm3
	I	II	III	
Initial	0.0	0.0	0.0	1.0 cm3
Final	1.0	1.0	1.0	
Difference	1.0	1.0	1.0	

Calculation

1. **Borewell Water**

A + B x 0.02 x 50000/Volume of sample
A = phenolphthalein added
B = methyl orange indicator added
0.6 x 0.02 x 50000/100
6 mg per litre
The total alkalinity is 6 mg/L.

Calculation

2. **Well Water**

A + B x 0.02 x 50000/Volume of sample
A = phenolphthalein added
B = methyl orange indicator added
1.0 x 0.02 x 50000/100
10 mg per litre
The total alkalinity is 10 mg/L.

7. **pH**

pH is most important in determining the corrosive nature of

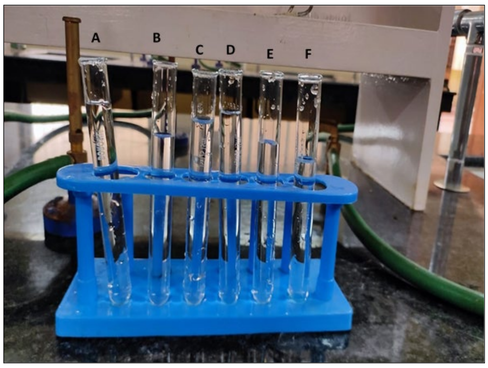
water. Lower the pH value higher is the corrosive nature of water pH was positively with electrical conductance and total alkalinity. The reduced rate of photosynthetic activity the assimilation of carbon dioxide & bicarbonates which are ultimately responsible for increase in pH. The low oxygen values coincided with high temperature during the summer month. Various factors bring about changes the pH of water. The higher pH values observed suggests that carbon dioxide. Carbon, bicarbonate equilibrium is affected more due to change in physicochemical condition.
pH is the negative logarithm of the hydrogen ion activity in a aqueous solution. The letters pH stands for power of hydrogen and the numerical value is defined as the negative base 10 logarithm of the molar concentration of hydrogen ions.

$$pH = -\log10 [H+]$$

A pH meter will be made up of probe which itself is made up of two electrode. This probe passes electrical signals to a metal which displace reading in pH unit. The glass probe has been two electrodes because one is a glass sensor electrode and another is reference electrode. Same pH meter to have two separate probes. In which case one would be the sensor electrode and other reference point.
Both electrode hollow bulbs containing a potassium chloride solution with a silver chloride wire suspended into it. The glass sensing electrode has bulbs made up of a very special glass coated with silica and metal salt. This glass sensing electrode measures the pH has the concentration of hydrogen ion surrounding the tip of the walled glass bulb. The reference electrode has bulb made up of a non-conducting glass or plastic.

8. Taste

- **Scope**
  - This method is applicable only to water not to waste water.
- **Principle**
  - Each panellist (tester) is presented with a list of nine statements about the water ranging from very favourable to very favourable.
  - The tester select the statements that best express his opinion.
  - The scored rating is the scale number of the statement selected.
  - The panel rating is the arithmetic mean of the scale number of all testers.
- **Apparatus**
  - Tasting present each sample to the observer in clean 50 ml beaker filled to the 30 ml level.
- **Reagent**
  - Taste and odour free water.



- **Procedure**
  - Take about 15 ml of sample into the mouth.
  - Holding it for several seconds.
  - Discharge with without swallowing.
  - Make a first judgment.
  - Again take 15 ml of sample into the mouth.
  - Holding for several seconds.
  - Discharging it without swallowing.
  - Make a second judgement.
  - Rinse the mouth with taste and odour free distilled water which is prepaid by passing distilled water through carbon column.
  - Rest for one minute.
  - Repeat above procedure for other sample.

9. Odour

- **Scope**
  - Prescribes a method for the determination of true odour.
  - This method to applicable to all types of water and waste water.
- **Preparation of Apparatus**
  - Thoroughly clean the required number of wide mouth glass stoppered bottle of about one liter capacity.
  - Rinse them with hydrochloric acid and render them completely odourless by repeated washing with odour- free distilled water which can be prepared by passing distilled water through a column of granulated activated carbon.
  - Wide mouth glass stoppered bottle 1 litre.
  - Activated carbon column.
- **Chemicals**
  - Hydrochloric acid
  - Activated carbon
- **Procedure**
  - Pass the distilled water twice from carbon column containing activated carbon.
  - Wash the wide mouth bottle with HCL and above distilled water.
  - Take water sample (500 ml) in a wide mouth bottle.
  - Insert the stopper.
  - Shake for 2 to 3 seconds.
  - Quickly observe the odour.
  - Wright agreeable or disagreeable in the results.
- **Report**
  - Report the true odour of the sample at the mouth of the bottle as rotten egg, burnt, sugar, soapy, fishy, septic, aromatic, chlorinous, alcoholic, odour or any other specific odour.
  - In case it is not possible to specify the exact nature of odour report as agreeable or disagreeable.

10. Conductance

Principle

- The Principle by which instruments measure conductivity is simple two plates are placed in the sample a potential is applied across the plates (normally a sine wave voltage).
- The current that passes through the solution is measured.

Apparatus

- Conduct meter
- Conductivity cell

Procedure

- Take water sample
- Add conductivity cell
- Note down the conductance

Result and Discussion

Close examination of the results of various physico-chemical parameters of potable water at all five sites shows, variations in these factors. Following is the account of interpretation of data analysed during present investigation. The five sites which are examined are as follows.

1. **Temperature:** Temperature is an expression of heat or coldness in terms of a specific scale; a measure of the average kinetic energy due to thermal agitation of the particles in a system. Temperature of the water always shows inconsistency according to the season. The water temperature ranges has been recorded with the help of standard thermometer. Table No. 1 shows the temperature recorded at all five sites in Lanja city. Temperature recorded in various water resources rages from minimum 27°C to maximum 29°C in monsoon season, while it ranges from minimum 27°C to maximum 31°C in post monsoon season, whereas there is no much variation in temperature in pre monsoon season as it ranges from 29 °C to 32 °C. Variation in temperature values can be seen in Chart No.1.
2. **pH:** pH is the measure of the intensity of acidity and alkalinity and measures the concentration of hydrogen ion in water. Table No. 2 shows values of pH measured at all five sites. pH values shows variation for all three seasons. Overall findings shows that the nature of water in all five sites is acidic to neutral. In post and pre monsoon period the acidity of water bodies are reduced while in monsoon season it shows acidity at its peak. As in Lanja city the groundwater tables found are in lateritic plateaus, hence that could be the reason for the acidic nature of water resources in this area. Variations in pH Values measured in all five sites for three seasons can be observed in Chart No.2.

Table 1: Temperature at all five sites in Lanja city

Site No	Temperature in °C		
	Monsoon	Post Monsoon	Pre Monsoon
Site l	28	30	31
Site ll	27	29	31
Site lll	28	29	30
Site Iv	26	27	30
Site v	27	28	30

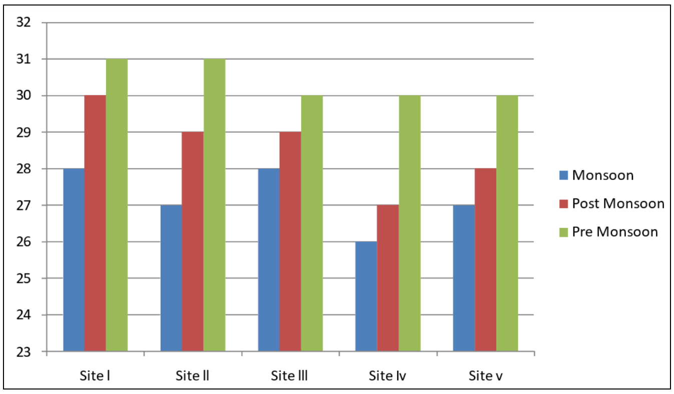


Chart 1: Chart of Temperature at all five sites for three seasons in Lanja city

Table 2: pH values at all five sites in Lanja city

Site No	pH		
	Monsoon	Post Monsoon	Pre Monsoon
Site l	6.7	6.9	7.1
Site ll	6.8	6.9	6.9
Site lll	6.8	6.8	6.9
Site Iv	6.8	6.8	6.9
Site v	6.7	6.7	6.8

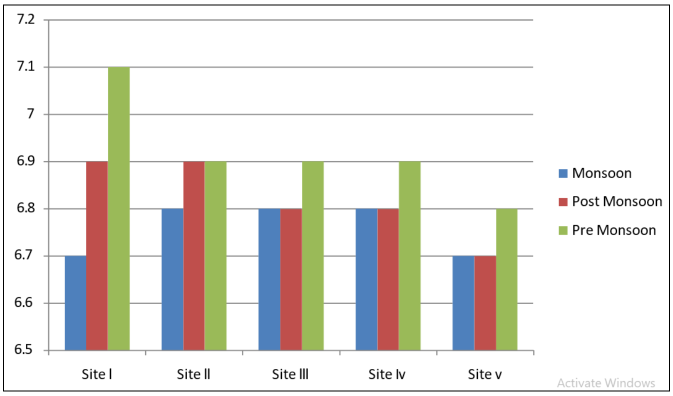


Chart 2: Chart of pH values at all five sites for three seasons in Lanja city

3. Hardness

Hardness of all five sites has been measured for three seasons. The hardness was calculated with the help of standard table provided by Strickland and Parson. Hardness at all five sites is measured in mg/l of CaCO3 value. Table No. 3 shows values of hardness calculated at five sites for three seasons. All five sites shows optimum level of hardness of water, as this level of hardness of water can be used as potable purpose. Chart No. 3 shows seasonal variations in hardness at all five sites in Lanja city.

Table 3: Values of Hardness (mg/I of CaCO3) at all five sites in Lanja City

Site No	Hardness (mg/l of CaCO3)		
	Monsoon	Post Monsoon	Pre Monsoon
Site l	86	94	115
Site ll	77	94	112
Site lll	76	102	121
Site Iv	81	112	120
Site v	90	98	114

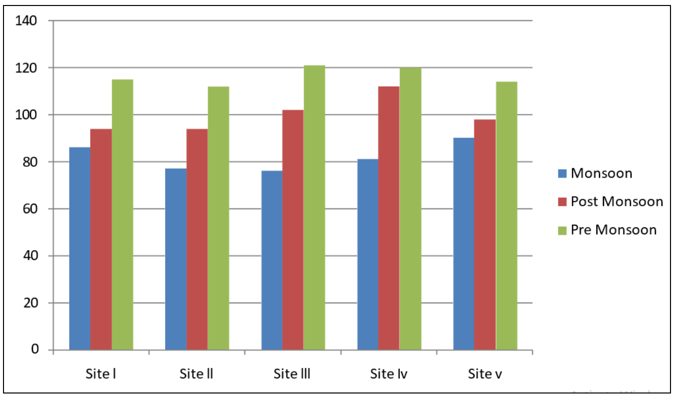


Chart 3: Chart of Values of Hardness (mg/I of CaCO3)

4. Dissolved oxygen (DO)
Dissolved Oxygen is one of the most important parameter in water quality, which reflects the physical and biological processes prevailing of water. The Dissolved oxygen (DO) is essential to maintain the higher forms of biological life in the freshwater. The concentration of oxygen also reveals whether the biological processes undergoing are aerobic or anaerobic. The DO is calculated at five sites persistently for three season and listed in Table No. 4. There is no much variations in DO values measured in Monsoon, Post Monsoon and Pre Monsoon season. The Chart No.4 shows seasonal variation in DO values at all five sites of the Lanja city.

Table 4: Dissolved Oxygen (DO) Values of water at five sites in Lanja city

Site No	Dissolved Oxygen (mg/l)		
	Monsoon	Post Monsoon	Pre Monsoon
Site l	5.68	8.91	5.62
Site ll	6.89	7.29	6.52
Site lll	6.49	7.70	6.20
Site Iv	6.08	8.51	5.88
Site v	5.68	8.53	5.42

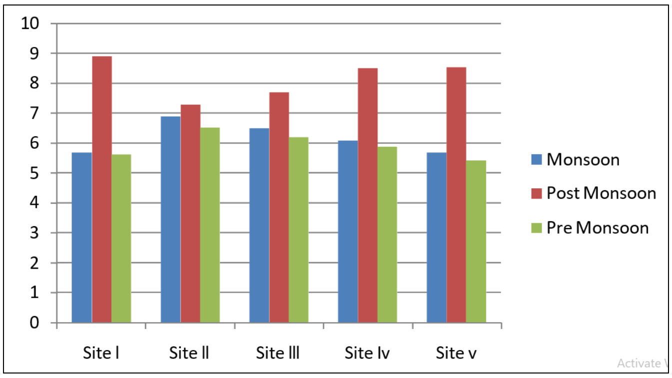


Chart 4: Chart of Dissolved Oxygen (DO) Values at five sites in Lanja city

5. Biochemical Oxygen Demand (BOD)
Values of BOD are measured at all nine sites in Lanja city. Table No.5 shows the measured values of BOD. It depicts that during monsoon season the BOD is low, while it shows increased values in post monsoon season when the conditions are favorable for microorganism activities with availability of ample amount of DO. Whereas the BOD is somewhat decreased during pre-monsoon period. Chart No. 5 shows seasonal variations in values of BDO.

Table 5: Values of Biochemical Oxygen Demand (BOD) at five sites in Lanja city

Site No	Biochemical Oxygen Demand (BOD) (mg/l)		
	Monsoon	Post Monsoon	Pre Monsoon
Site l	3.22	4.21	4.00
Site ll	2.89	3.12	3.25
Site lll	3.96	4.10	4.20
Site Iv	2.88	3.45	3.68
Site v	2.98	3.23	4.13

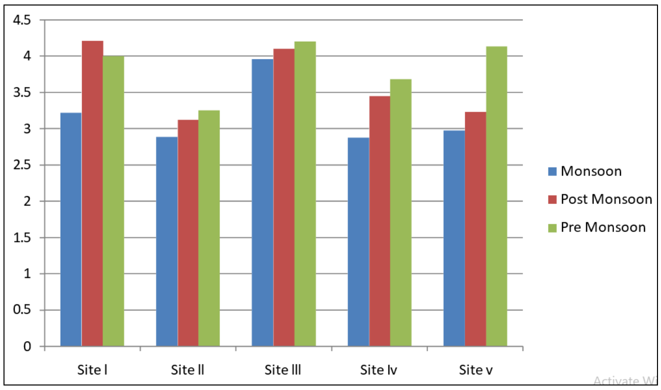


Chart 5: Chart of Biochemical Oxygen Demand (BOD) at five sites in Lanja city

Conclusion
Growth, development, colonization, reproduction, etc. are the main features of the metabolic activities of microorganisms like algae, bacteria, etc. For each activity, they are dependent on physical as well as chemical parameters. The present study has been carried out at various potable water resources in Lanja city.

The outcome of the present research work shows that,
1. Dissolved Oxygen (DO) of all nine sites is present at optimum level.
2. Biochemical Oxygen Demand (BOD) is also at optimum level.
3. Water shows low level of salinity and pH of water is slightly neutral to acidic in nature.
4. The Hardness water is also optimum as it will be used for drinking purposes.
5. The total coliform report reveals that, at only two sites Site-II (Shewar Wadi) and Site-III (Saraswat Vasahat) water is potable without any application of filtration or sterilization methods. But at all remaining three sites water has moderate to high contamination by bacteria and other pathogens. Hence need of filtration and sterilization application. From the research carried for five sites of Potable water resources from Lanja City, it will be suggested to authority of Lanja Nagarpanchayat to implement unit of Filtration Sterilization, Chlorination etc. to minimize the bacterial and pathogenic contamination in various resources, in and around Lanja city for good health of citizens of Lanja City. The same report will be submitted to Lanja Nagarpanchayat for the persuasion.

Future Plan
1. Removal of heavy metal ions from wastewater.
2. Effects of water pollution on Human Health and Disease.
3. Effect of waste landfill site on surface and ground water drinking quality.
4. Drinking water quality assessment and its effects on resident's health.

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