

Analysis of Physico-Chemical Parameters of Drinking Water Quality Check in Udgir City, Dist. Latur, Maharashtra State, India.

Miss. Bhagwatgeeta Prabhu Vairale¹

¹CHB Assistant Professor, Shivaji Mahavidyalaya, Udgir, Department of Zoology, Shivaji Mahavidyalaya, Udgir-413517, Dist. Latur Maharashtra state, India

Abstract - On the earth water is a major indispensable natural resource. Due to more urbanization, chance of diminution in quality of water is increased. Lack of water quality is major problem in the environment. So that, in the present day the drinking water quality parameters of different water sample investigates at different location sites of udgir city, MH state to assure the continuous supply of clean and safe drinking water for the public health protection. In this regard parameters to assess water quality are Colour, Taste and odour, TDS, PH, Temperature, Total Hardness, Electrical conductivity, Nitrates, Nitrites, Sulphate, Phosphate, Alkalinity, Salinity, Chloride, DO, Free Co₂, Carbonate and Heavy Metal Like Iron (Fe) etc of Tube well water, Well water, Tap water and Hand pump water sources of udgir region to conclude whether water is drinkable or not. The calculated values of these parameters were compared with Standard values set by the ICMR (Indian Council of Medical Research) and BIS (Bureau of Indian Standards). The investigation is concluded by saying that the prevention of industrial and domestic sewage in ground water definitely help in controlling of water pollution. For the maintenance of good quality of water, preferable methods are said to control water pollution like use of alum or ion exchange methods.

Key Words: Physico-chemical parameter, BIS and ICMR standards, Udgir region.

1. INTRODUCTION

Water is a chemical compound and may found in a liquid form, in a solid form or in a gaseous form. All these form of water are very useful for human beings and giving luxuries and comforts, in additional to fulfilling his basic needs of life. Every person knows its importance. If there is no water in our taps, we are helpless. No life will exist without water since, water is essential for life as like air. Water is not only for survival of human beings, but also for animals, plants and all other living beings. Then it is necessary that the water required for their needs must be good and it should not contains unwanted impurities or harmful chemical compounds or bacteria in it. Therefore, in order to ensure the availability of sufficient quantity of good quality water, it becomes almost imperative in a modern society, to plan and build suitable water supply schemes which may provide potable water to the various sections of community in accordance with their demands and requirements. Water is required for all purposes like, drinking, cooking, bathing, washing, agriculture, industry, hospitals but also help in supplying water for fountains, gardens, etc and thus helping in maintaining better sanitation and beautification of surrounding, thereby reducing environmental pollution.

India is likely to have a population of around one thousand million by the end of the century, out of which urban population will be around 4 hundred million. This would entail a large responsibility on Gov. and civic bodies with safe drinking water. There are fixed Indian standards for the quantum of water to be supplied separately for aforesaid basic needs, which are as follows-

a. Domestic and Non-domestic need of water: (Gurdeep raj and P.R Trivedi³)

The following parameters have been recommended depending on the habits and standards of living of the people.

I. For communities with population up to 10,000-----70 to 100 liters/capita

II. For communities with population up to 10,000- 50,000 -----100 to 125 liters/ capita

III. For communities with population above 50,000 ----- 125 to 200 liters/capita

just like Domestic institution also needed quantity of water in (liters/capita/day) such as, hospitals- 340-455, hotels-1180,colleges and schools- 135, restaurants-70,air and sea ports - 70, stations -45,factories and offices-45, cinema halls and theatres -15.

Industries for unit production requires kilolitres per unit water like as, automobiles vehicles - 40, Distillery(alcohol)- 122-170, fertilizers(ton)- 80-200,petroleum refinery (ton)- 1.5-2, steel (ton)-200-250 etc so that water quality must be good and healthy

is very important. If any impurities present in water do adverse effects on human health causes problems such as water borne diseases i.e. cholera, dysentery, gastro-intestinal irritability etc. Water gets polluted due to adding such sewage waste, industrial, agriculture, and domestic wastes. Now a day's availability of pure and healthy water is a challenging think. So that, in the past few decades natural water bodies are checked all over the world. These regular observations helps to prevents spreading of diseases and also check water resources from going too polluted. Due to water borne diseases around 2 millions children's below 5 years of age died in a year and surprisingly India contribute about 30%. Around 1600 children's in India are dying per day due to water borne diseases like diarrhea and pneumonia. (Acc. to Pawan Malik JETIR Jan. 2017). So that main factors responsible for to contamination of water like both inorganic and organic impurities are present in soluble, insoluble and colloidal forms in water- bacteria, viruses algae, protozoan's ,fungi, dissolved impurities like salts calcium, magnesium, chloride, sodium , iron , manganese, lead and gases also oxygen Co₂,nitrogen, colour, odour, alkalinity, salinity, sulphate, phosphates, nitrate, nitrate, tds, hardness ,chloride and their values etc. a number of scientific tools and procedures have been developed to test water contaminants. These parameters can affect the quality of drinking water if their values are in higher concentrations than the safe limits set by the World Health Organization (WHO) ¹³ BIS and ICMR ¹ regulatory body. So that, water investigation is done by the researchers and government departments regularly .water can be contaminated due to various animal and human wastes, industrial effluents, Chemical fertilizers which is used in agriculture and spread on the plants it gets mixed with soil and then enters with water and water gets contaminated. Lead iron and other metals also contaminated by rusting of pipes and mixes with water sometimes we cannot take any precautions so that drinking water get polluted here (N.Rahmanian, Siti Hajar, M.Homayoonfard, and Et.al 2015)¹⁹. When heavy metal accumulates in the human body it affects nervous system and other body systems and interfere in organs functions. It has high chemical toxicity and fatal effects on human skeleton and organs also. So that water testing is very important and primary method.

Udgir is a municipal council in Latur district which is located in Maharashtra state in India. It is one of the divisions of Maharashtra based on geographical circumstance. This city has near Karnataka border. This city have a historical background i.e. Udgir Fort having the name "Udyagiri fort" the name because of saint "Udyagiri baba". Udgir is famous due to historic war between Marathas and the Nizam led by the Sadashivrao Bhau in which Marathas won a victory in the battle. This city and their near village population having main work is agriculture as a source of income. In the farming jawar, bajara, wheat and crops like sorghum, black gram, soybean, onion leafy vegetables are mostly cultivated. It's one of taluka place in Latur district it consists of 98 villages and 2 towns in Udgir Taluka. According to population ratio of 2011 Udgir taluka has 56,806 households and 311,066 populations from which 161,568 are males and females are 149,498. Out of total population 64.06% population live in urban area and 35.94% in rural areas. Its having much more amount drinking sources such as, Banshelki dam, Yenki, manki dam and other ponds from these resources gets water to Udgir city. In Udgir city, there is much less amounts of industries and their wastes but agricultural, domestic wastes are much more amounts and also presence of open drainage system and these are released directly into water bodies (Water resources in Latur districts 2011)¹⁵. Due to this ground water and surface water which is in the form of tap water, Well water, Tube well water and Hand pump water gets contaminated . This contaminated and untested water is directly used for drinking, agriculture and various purposes. There is no sewage treatment is done so that its causes water pollution in this area. The Latur districts and their villages come under "Drought Area". These areas also coincide with deeper water level ranges from 10-20 m bgl in pre monsoon season. In this area ground water quality is badly affected by chemical parameter like nitrate contamination in 62% of the samples collected in May 2011. Continues intake of high nitrate amount water affects infant's methaemoglobinemia also known as "Blue Babies disease". So that all wells water first analyzed for to know nitrate content. If the nitrate content is observed in more % then this water is used for other purposes than drinking (U. S. Balpande scientist-c 2013) ¹⁷. The suitability of ground water and surface water also for drinking purpose is determined by the effects of various chemical components in water on the biological system of human being so there is much more need to test and evaluate of water quality in particularly local and polluted area. The ICMR ¹approximates that, safe and hazardous water could minimize the disease ratio of people though many ions are very essential for growth of human but it is in excess amount causes an opposite effects on human body system. The recent study aimed to estimate the drinking water quality of tap water, tube well water and well water and hand pump water of different locations of Udgir region. The standards proposed by the BIS for drinking water (IS - 10500-91, revised 2003) were used to decide the standards of ground water. The detailed analysis of physical and chemical parameters of water is carried out from different locations of local areas of Udgir regions. The parameters like temperature, transparency, total dissolved solids, dissolved oxygen, dissolved carbon dioxide, pH, alkalinity (total alkalinity), chlorides, hardness nitrate, phosphate, nitrite, sulphate and heavy metal- iron etc.

2. METHODOLOGY

2.1 Study Area: Udgir is a municipal council in Latur district which is located in Maharashtra state in India. Udgir city has following features.

Salient features:

- 1) **Study Area:** Udgir Region Latur district in state of Maharashtra India.
- 2) **Location:** Udgir Region (Maharashtra) Tq-Udgir Dist -Latur
- 3) **Area:** 736.26 Km²
- 4) **Population:** 103,550 around (64.06% live in urban area and 35.94% in rural area)
- 5) **Latitude:** 18°23'46" N
- 6) **Longitude:** 77°07'03" E
- 7) **Density:** 17,853/km²

In this district there is no location of meteorological observation. But the nearby meteorological observatory has been taken as representative for this area (udgir district). The winter season commences by the end of November when night temperature decreases rapidly. December is generally the coldest month with the mean daily maximum temperature at 29.5 °C and the mean daily minimum temperature drops down to 4 or 5 °C due to western disturbances. May is generally the hottest month with temperature 27 °C. In summer the humidity is less than 25%. The average annual rainfall for 2008- 2011 is about 824.23 mm. The water supplying agency and sections are responsible for supplying clean water to the whole city. The raw water resources are river, dams, ponds and reservoirs and water distribution from urban to rural area with the help of pipeline system. The main cause of water pollution is all types of sewage waste and open drainage system. This research is based on analysis and investigation of various physico-chemical parameters present in water sample and the water quality which is collect from interior city of udgir region ^{15, 17}.

2.2 Selection of sampling sites:

The main concept of selecting sampling are based on the population and population density, areas of industrial or anthropogenic activities like, minerals and other toxic metals and effluents are realized directly in the catchment areas i.e. rivers, reservoirs also. More concentration is given at that site where population density is high or interior of the city. Therefore, we can considered these following areas i.e. Amberkhane Blood bank, Sahyog nagar, Banshelki road, S.T colony Area, Jalkot Road, Shivaji College, Killa Galle, Chaubara road, Shahu Chawk, Vikas nagar Deglur Road, Police Quarters, Dam Road, Deglur Road, Nayi Abadi (17 Samples) and drinking water resources present at different locations in udgir city i.e. Tube well water, Tap water, Well water and Hand pump water

2.3 Sample Collections:

All the drinking water is collected from the Tube well water, Tap water, Well water, Hand pump water from living areas. All the types of drinking water samples are open for public use like, houses, hotels, and schools, etc All these samples were put in 1 liter polyethylene or plastic bottles. Before, using these bottles sanitized and deionized. After that all these bottles are named for their identification of samples, bottles are sealed and placed in a dark place at a normal temperature to away from any contamination and effects of temperature, light and other materials. Sample period of testing during the summer and winter in 2019-2020. Table1. Show all collection of samples from different sources.

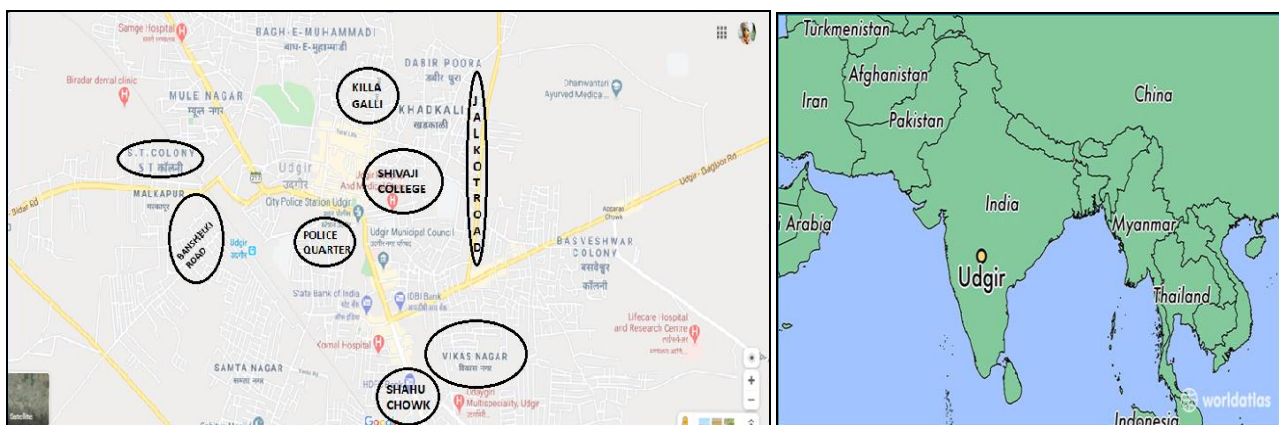


Figure 1 : Map shows location of udgir city and their different sample areas, Dist. Latur, State maharashtra,India. **Source-** [https:// www.maps.google.com/](https://www.maps.google.com/).

Table 1: Drinking Water Sample numbers Collections, locations and their sources

Sr.No.	Sources	Locations
S-1	Tube Well Water	Amberkhane Blood bank, Sahyog nagar, Banshelki road.
S-2	Tube Well Water	S.T colony Area
S-3	Tube Well Water	Jalkot Road
S-4	Tube Well Water	Shivaji College
S-5	Tube Well Water	Shahu Chawk
S-6	Tube Well Water	Killa Galli,Chawbara road
S-7	Tube Well Water	Vikas nagar Deglur Road
S-8	Tube Well Water	Police Quarters, Dam Road
S-9	Tap Water	Amberkhane Blood bank, Sahyog nagar, Banshelki road.
S-10	Tap Water	S.T colony Area
S-11	Tap Water	Jalkot Road
S-12	Tap Water	Shahu Chawk
S-13	Tap Water	Killa Galli,Chawbara road
S-14	Tap Water	Vikas nagar Deglur Road
S-15	Tap Water	Police Quarters, Dam Road
S-16	Well Water	Killa Galli,Chawbara road
S-17	Hand Pump Water	Deglur Road , Nayi Abadi

2.4 Analytical Instruments:

2.4.1 One-Site Analysis:

pH, TDS, Electrical conductivity, and turbidity were calculated at that site by using the standard rules of American Public Health Organization (APHA)⁸ and also using different types of calibrating standard instruments such as, Digital pH meter (Systronics Company), Digital Conductivity meter (350 EC meter), Digital TDS meter and Digital turbidity meter. Each water sample is kept in sample cuvette and put for few minutes for the reading stability and after that the value is note down on note pad.

2.5 Laboratory Analysis:

2.5.1 Physico-chemical parameters:

The chemicals were prepared one day before by using the standard procedure given in American Public Health Organization (APHA)⁸, Methodology of water Analysis by practical ecology by K.S Rao⁴. The physico-chemical parameters were studied by using the standard methods given in APHA Methodology of water Analysis book and Practical ecology by K.S Rao. Physical parameters like Color odour and taste, Temperature, Turbidity, electrical conductivity and chemical parameters like pH, DO, Alkalinity, Hardness, chloride and Salinity, Free CO₂, nitrate, nitrite, sulphate, phosphate, and heavy metal like iron were studied.

Calculation:

1. By titration method:

Formula: Parameter = Volume of titrate x 1000

Vol. of sample

2. by spectrophotometer (by Absorbance):

Concentration = (Absorbance- Intercept) / Slope

Firstly, I'm calculate the mean of total 17 water samples according to their different sampling areas and after that standard deviation (S.D) of each parameter of different water sample is calculated here. The standard deviation is used for measuring absolute dispersion. The concept of standard deviation (S.D) was introduced by Karl Pearson in the subject of Biostatics (Biostatistics By P.Ramakrishanan, First Edition 1995)⁵.

Formula

1. Mean = $\bar{X} = \frac{\sum X}{N}$

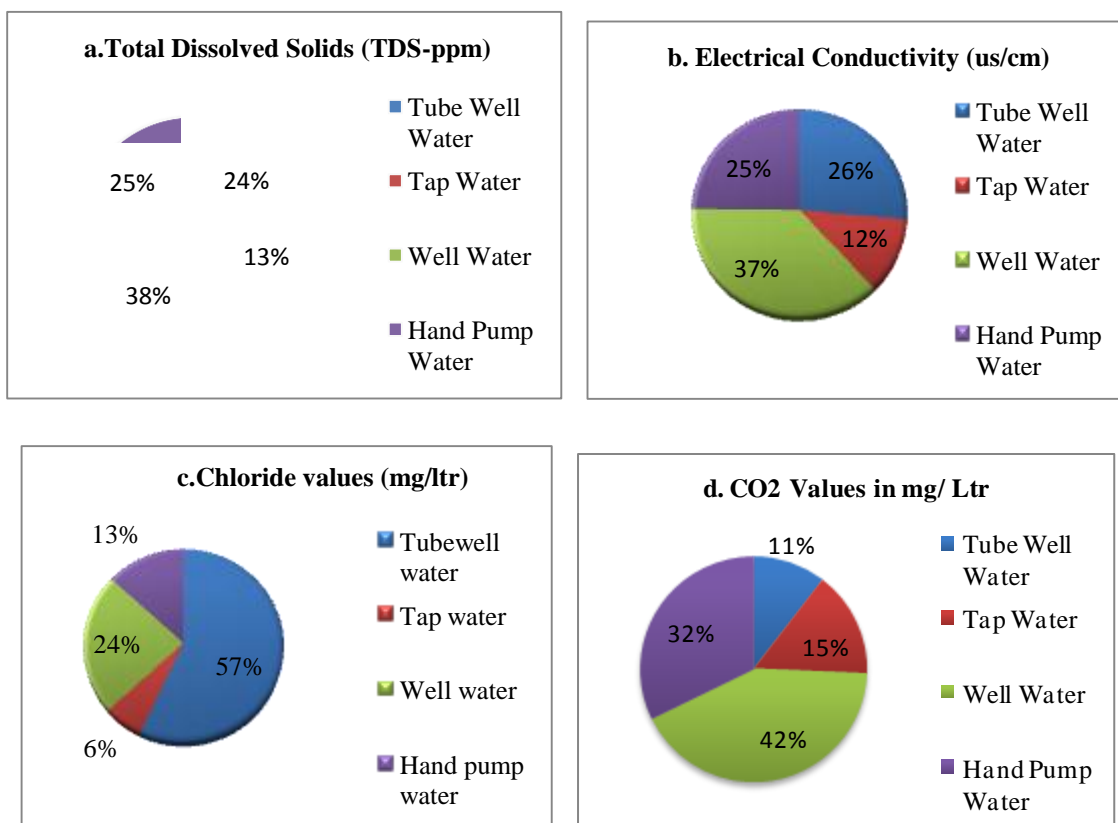
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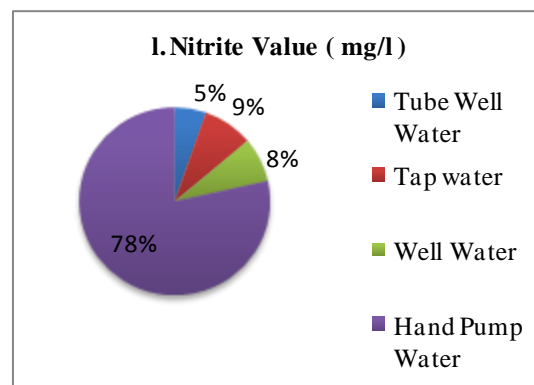
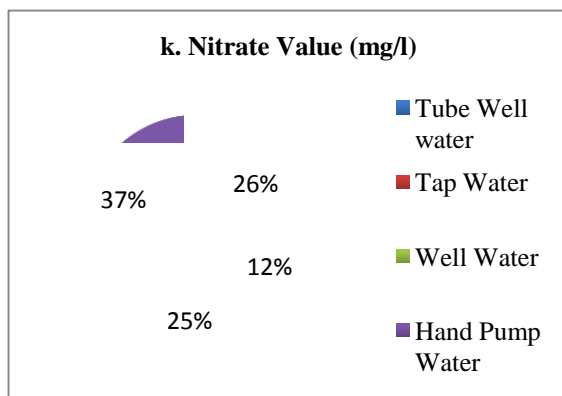
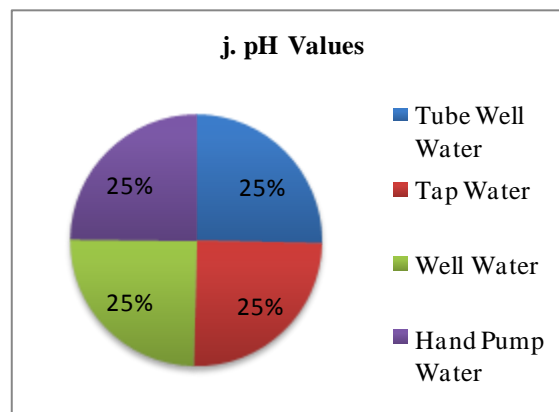
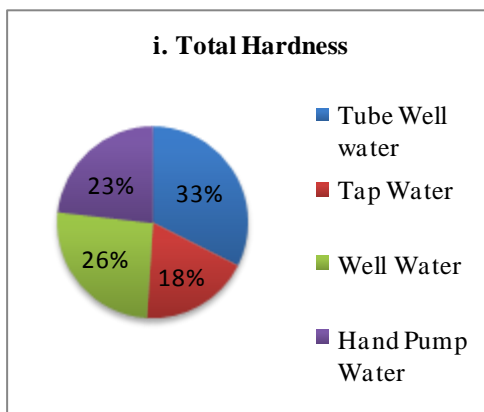
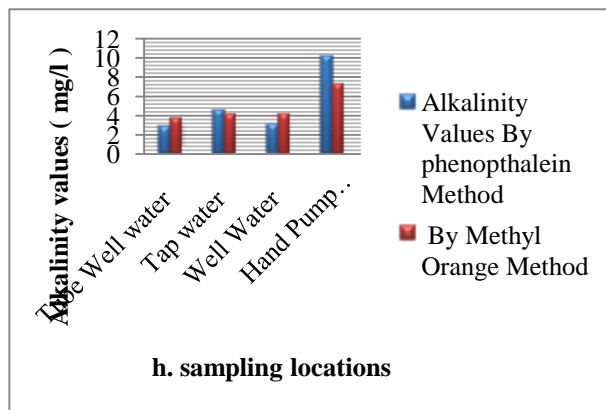
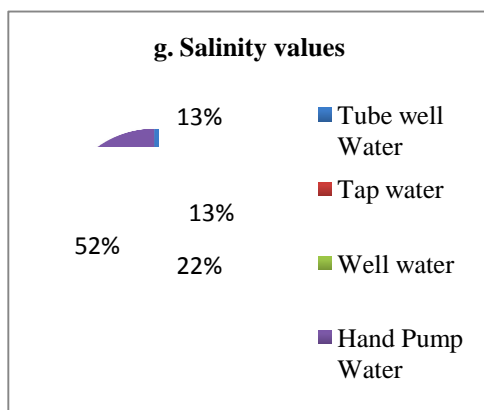
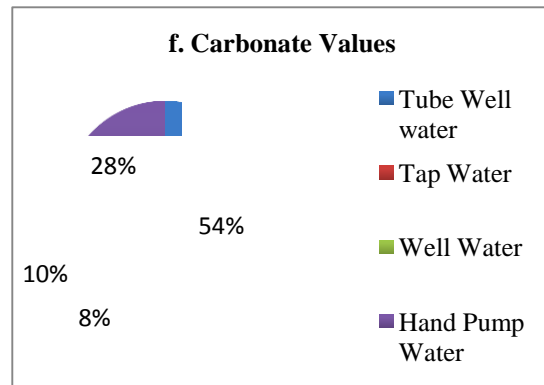
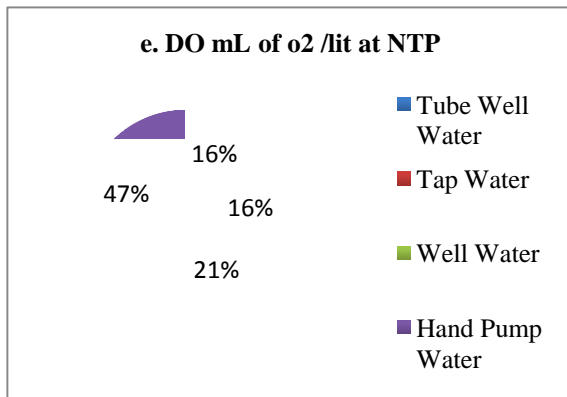
2. Standard Deviation (S.D) = $\sqrt{\frac{\sum x^2}{N} - (\bar{X})^2}$

$\sum x^2$

N

Graph:





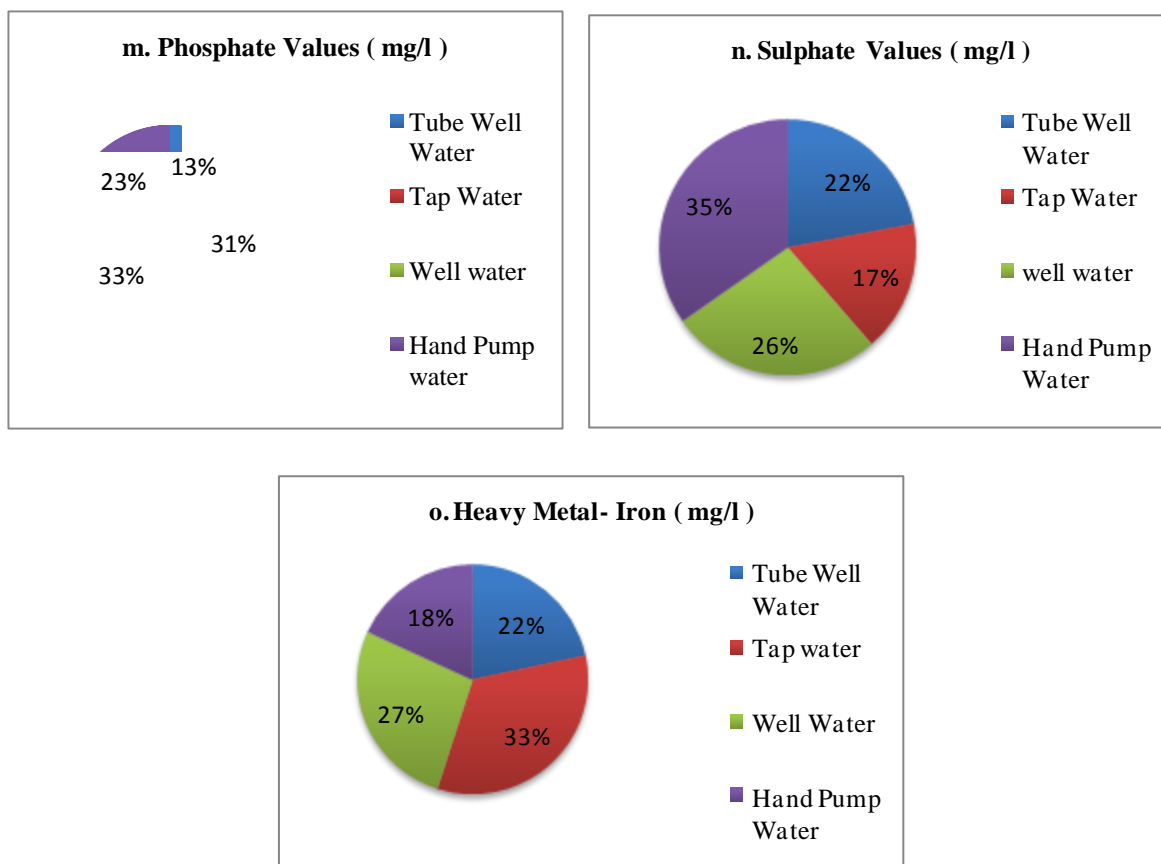


Chart1. Show comparative values of physico-chemical parameter with their water type in the form of Pie chart.

3. RESULT AND DISCUSSION

Colour, Taste and Odour:

Color of water body is observed physically. The odour and taste is a chemical examination and depends upon actual contact with receptor and sensitivity organs, by the process of smelling and tasting of water sample (Pawan Malik, 2013)¹⁶. All the samples collected from the tube well water and hand pump water is somewhat salty in taste. Tap water and well water have suitable taste for drinking water. The taste of hand pump and tube well water samples are different due to dissolved anions in that. There is absence of any type of odour in it.

Temperature:

The surface water temperature is recorded by using thermometer having 0.1°C division end a range of 0 to 100°C. Different water temperature values are observed and recorded. The present study of water is varying between 15 0c to 21 0c. The maximum value is recorded of the well water i.e. 21 0c and minimum value is 15 0c of tube well water and tap water. The temperature values are fluctuate in various season. (Kumbhar A. K & Et.al 2009)¹¹

Table II. The safe limits of BIS for determining drinking water quality.

Samples	Colour	Taste	Odour	TDS (mg/lit)	pH	Conductivity (us /Cm)
Sample of tap water	5-25 hazen	Agreeable	unobjectionable	500	6.5-8.5	800
Sample of hand pump	--	Agreeable	unobjectionable	500	--	--

water						
Sample of tube well water	--	Agreeable	unobjectionable	500	----	-

Table III. Drinking water standard recommending agencies (ICMR) and Unit Weight

(All values except pH is in mg/L.).

Parameters	Standards	Recommended agency	Unit Weight
pH	6.5-8.5	ICMR/BIS	0.2190
Total Alkalinity	120	ICMR	0.0155
Total Hardness	300	ICMR/BIS	0.0062
TDD	500	ICMR/BIS	0.0037
Calcium	75	ICMR/BIS	0.025
Magnesium	30	ICMR/BIS	0.062
Chloride	250	ICMR/BIS	0.0074
Nitrate	45	ICMR/BIS	0.0413
Sulphate	150	ICMR/BIS	0.0124
D.O	5.0	ICMR/BIS	0.723
B.O.D	5.0	ICMR	0.3723
Iron	3.0	ICMR	

1. PHYSICAL PARAMETER:
Table IV. Experimental Data of Physical Parameters like - Temperature, TDS and Electrical Conductivity.

Sr.No.	Sources	Temperature (0C)	TDS (ppm)	Electrical Conductivity (Micromoho's-us/cm)
S-1	Tube Well Water (TWW)	15 0c	1070	1.33
S-2	Tube Well Water	15oC	1600	1.69
S-3	Tube Well Water	15oC	1320	1.61
S-4	Tube Well Water	15oC	1020	1.5
S-5	Tube Well Water	15oC	990	2.19
S-6	Tube Well Water	15oC	980	2.71
S-7	Tube Well Water	15oC	860	1.67
S-8	Tube Well Water	15oC	820	1.19
S-9	Tap Water (TW)	15oC	430	0.63
S-10	Tap Water	15oC	370	0.65
S-11	Tap Water	15oC	1110	0.68
S-12	Tap Water	15oC	420	1.74
S-13	Tap Water	15oC	440	0.57
S-14	Tap Water	15oC	410	0.55
S-15	Tap Water	15oC	520	0.64
S-16	Well Water (WW)	21oC	1700	0.68
S-17	Hand Pump Water (HPW)	20oC	1000	1.63
	Mean + S.D Values	1.TWW-15 0c 2.TW- 15 0c 3WW- 21 0c 4.HPW- 20 0c	1.TWW-955 2.TW- 528 3WW- 1528 4.HPW- 1000	1.TWW-1.736 2.TW- 0.768 3WW- 2.42 4.HPW-1.63

2. CHEMICAL PARAMETER:

Table V. Experimental Data of Chemical Parameters like: - Chloride, DO, Free Co2, Carbonate, Alkalinity, Salinity, and Total Hardness (According to Titration Method or Procedure).

Sample Sr.No	Chloride (mg/lit)	DO mg/lit at NTP	Free Co2	Carbonate (mg/lit)	Alkalinity		Salinity (g/lit)	pH	Total Hardness
					Phenolphthalene Method	Methyl orange Method			
S-1	405	2.1	190	50	10	230	18.08	7.8	1143
S-2	250	4.9	70	100	170	80	45.15	7.1	690
S-3	645	3.5	50	80	30	60	36.13	7.9	1010
S-4	555	6.3	150	100	40	40	54.18	9.1	590
S-5	970	9.8	430	40	200	100	36.13	7.9	460
S-6	1020	6.3	330	90	20	210	45.15	7.5	930
S-7	635	4.9	400	260	30	110	63.20	8.0	440
S-8	365	6.3	50	30	20	50	758	9.0	990
S-9	235	2.8	380	120	110	230	27.10	9.0	640
S-10	200	3.5	350	40	170	310	27.10	9.3	270
S-11	205	7.7	180	50	440	120	27.10	9.0	560
S-12	645	9.1	150	70	120	40	81.25	8.0	1300
S-13	220	3.5	150	20	20	50	108.3	8.8	400
S-14	40	3.5	30	40	130	60	27.10	9.3	230
S-15	165	4.2	140	50	10	40	216.6	9.5	500
S-16	405	7.0	300	50	40	140	153.4	8.7	930
S-17	225	6.3	230	270	100	50	101.1	8.8	490
Mean _+ S.D	1.TWW-972 2.TW-105 3WW-405 4.HPW-225	1.TWW-0.83 2.TW-2.00 3.WW-1.10 4.HPW-2.50	1.TW-74.20 2.TW-109 3WW-300 4.HPW-230	1.TWW-270 2.TW-40 3WW-50 4.HPW-140	1.TWW-120 2.TW-52 3WW-40 4.HPW-100	1.TWW-155 2.TW-62 3.WW-140 4.HPW-50	1.TWW-4.2 2.TW-2.59 3WW-4.19 4.HPW-10.0	1.TW-9.0 2.TW-8.0 3WW-8.8 4.HPW-8.8	1.TWW-695 2.TW-395 3WW-552 4.HPW-495

Table VI- Experimental Data of Chemical Parameters like: - Nitrate, Nitrite, sulphate, Phosphate, Heavy Metal (Iron) (Values According to Spectrophotometer).

Sample Sr.No	Nitrite (mg/l) Value of Absorbance	Nitrates (mg/l) Value of Absorbance	Phosphate (mg/l) Value of Absorbance	Sulphate (mg/l) Value of Absorbance	Heavy Metal Iron (Fe) (mg/l) Value of Absorbance
S-1	0.098	0.198	0.039	0.171	0.140
S-2	-	0.328	0.014	0.231	0.101
S-3	-	0.298	0.027	0.370	0.090
S-4	-	0.247	0.136	0,166	0.132
S-5	-	0.357	0.320	0.186	0.113
S-6	0.07	0.320	0.040	0.420	0.123
S-7	-	0.162	0.033	0.455	0.096
S-8	-	0.465	0.010	0.263	0.071
S-9	0.005	0.341	0.056	0.207	0.115
S-10	0.11	0.171	0.037	0.271	0.104
S-11	0.330	0.198	0.09	0.167	0.114
S-12	-	0.787	0.054	0.169	0.083
S-13	0.088	0.156	0.83	0.169	0.072
S-14	-	0.152	0.056	0.283	0.030
S-15	-	0.167	0,007	0.227	0.092
S-16	0.010	0.631	0.205	0.146	0.104
S-17	-	0.421	0.121	0.445	0.073
Mean + S.D	1.TWW-0.084 2.TW- 0.133 3WW-0.118 4.HPW-1.22	1.TWW-0.33 2.TW- 0.14 3WW- 0.28 4.HPW-0.42	1.TWW-0.07 2.TW- 0.161 3WW-0.176 4.HPW-0.121	1.TWW-0.282 2.TW- 0.213 3WW- 0.34 4.HPW-0.445	1.TWW-0.087 2.TW- 0.134 3WW- 0.108 4.HPW-0.073

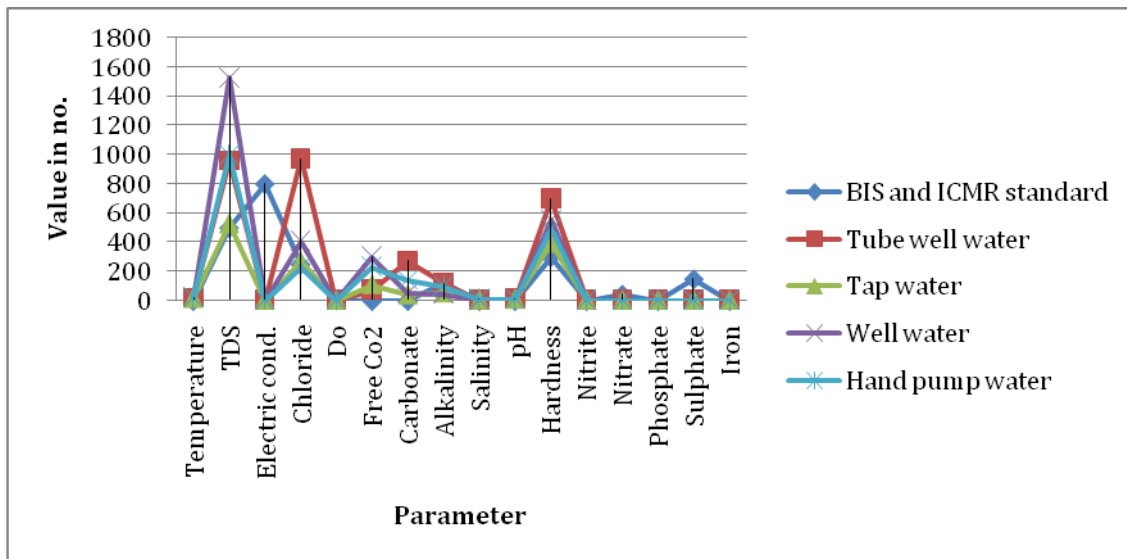


Chart2. Show comparative values of parameter with water type and their standards.

TDS:

When total dissolved solid value is high may cause adverse effect on water condition. Acc. to BIS and ICMR standard water tds is in the range of 500. But in the present study tube well water having value about 955 mg/l, tap water 528mg/l, well water 1528 mg/l and hand pump water 1000 mg/l along with sample S1,S2,S3,4,11,16,17 shows high value. Table no. 4 and graph (a) shows all these values.

Electrical Conductivity: (EC)

It is expressed in us/cm or ms/cm. EC show capacity of water to transfer electric current. According to ICMR and BIS standards conductivity of drinking water is about 200 to 800 us /cm. pure distilled water has conductivity range is 0.05 um/cm. In the present study tube well water having value about -1.736, tap water- 0.768, well water - 2.42, hand pump water -1.63. Table no.4 graph (b) shows all these values.

pH:

The pH value of present study is ranging from 8.8 to 9.0. Tube well water having pH 9.0, Tap water 8.9, and well water pH is 8.8 and hand pump water pH is 8.8. According to ICMR and BIS pH range is 6.5-8.5. All type of water show value beyond permissible limit. Table no5 graph (j) shows all these values.

Dissolved Oxygen (DO):

Amount of DO can be depends upon water temperature, salinity, turbidity and pressure. In the water bodies oxygen is an important parameter for the living organism and their growth. This water parameter indicates level of water quality and organic pollution in the water bodies (Wetzel and Likens, 2006) .In the present study DO value varying between range of 0.83 to 2.5 mg/l. Tube well water having value about 0.83 mg/l, tap water having 0.83 mg/l, well water having 1.1mg/l and hand pump water having DO about 2.5 mg/l minimum value is tube well and tap water and high value is in the hand pump water. It means that water is good for drinking purpose when DO is very less amount. Standard ICMR and BIS value is 5.0. Table no5 graph (e) shows all these values.

Alkalinity:

Alkalinity calculate by phenolphthalein and methyl orange method. Observed value is in the range of 120- 140mg/l. Tube well water-120, tap water-52, well water-140 and hand pump water-100mg/l. Standard ICMR and BIS value is 120 mg/l. Except hand pump water all water sample shows permissible limit. Table no5 graph (h) shows all these values.

Total Hardness:

Observed value of total hardness is in the range of 395- 695 mg/l. Tube well water-695, tap water 395- well water-552 and hand pump water- 495 mg/l. Standard ICMR and BIS value is 300 mg/l. All values of water type beyond the permissible limit. Table no5 graph (i) shows all these values (Hardness in drinking water 2011) ¹³.

Free CO₂:

Observed value of free co₂ is in the range of 74.20-300mg/l. Tube well water-74.20, tap water 109- well water-300 and hand pump water- 230 mg/l. Standard ICMR and BIS value is nil. Normal free co₂ value is 0-50mg/l. All values of Co₂ beyond the normal limit. Table no5 graph (d) shows all these values.

Chloride:

Observed value of chloride is in the range of 105-972 mg/l. Tube well water-972, tap water 105- well water-405 and hand pump water- 225mg/l. Standard ICMR and BIS value is 250 mg/l. Except hand pump and tap water other two water type beyond the permissible limit. Table no.5 graph (c) shows all these values.

Carbonate:

Observed value of carbonate is in the range of 40-270 mg/l. Tube well water-270, tap water 40, well water-50 and hand pump water- 140 mg/l. There is no suggested value of carbonate by ICMR and BIS standards. Table no5 graph (f) shows all these values.

Salinity:

Observed value of salinity is in the range of 2.59-10.0 mg/l. Tube well water-4.2, tap water 2.59, well water-4.19 and hand pump water- 10.0 mg/l. There is no suggested value of salinity by ICMR and BIS standards. Table no5 graph (g) shows all these values.

Nitrite:

Observed value of nitrite is in the range of 0.084-1.22 mg/l. Tube well water-0.084, tap water 0.133, well water-0.118 and hand pump water-1.22 mg/l. There is no suggested value of nitrite by ICMR and BIS standards. Table no.6 graph (l) shows all these values

Nitrate:

Observed value of nitrate is in the range of 0.14-0.42 mg/l. Tube well water-0.33, tap water 0.14- well water-0.28 and hand pump water- 0.42 mg/l. Standard ICMR and BIS value of nitrate is 45 mg/l. All 4 water type within the permissible limit. Table no.6 graph (k) shows all these values.

Sulphate:

Observed value of sulphate is in the range of 0.213-0.445 mg/l. Tube well water-0.282, tap water -0.213 well water-0.34 and hand pump water- 0.445 mg/l. Standard ICMR and BIS value is 150 mg/l. All 4 water type within the permissible limit. Table no6 graph (n) shows all these values.

Phosphate:

Observed value of phosphate is in the range of 0.07-0.176 mg/l. Tube well water-0.07, tap water 0.161, well water-0.176 and hand pump water- 0.121 mg/l. There is no suggested value of phosphate by ICMR and BIS standards. Normal range of phosphate is about 0.15 ppm. Table no.6 graph (m) shows all these values (GAANN-exp-9-Spectrophotometric determination of Phosphates of water ¹²).

Heavy Metal (Iron):

Observed value of iron is in the range of 0.073-0.134mg/l. Tube well water-0.087, tap water -0.134 well water-0.108 and hand pump water- 0.073 mg/l. Standard ICMR and BIS value of iron is 0.3 mg/l. All 4 water type within the permissible limit. Table no.6 graph (o) shows all these values.

4. CONCLUSIONS

1. In the present study concluded about results of some water resource area of Udgir city is highly contaminated due to high values of TDS, hardness, pH, chloride, salinity, carbonate and alkalinity. The presence of high TDS in water it causes health problems. These abnormal values of parameter can be easily changed by testing the water time to time. Presence of high values of TDS, pH and hardness can be maintained by using the water softener and if there is also presence of high concentration of nitrate ion, then reverse osmosis process can be used.

2. Almost all the samples collected from different living and commercial areas of Udgir region of Maharashtra state found to be beyond the recommended limit of ICMR and BIS standards. Heavy metal like iron value within the limits. So that, the quality of tap water, tube well water, well water and hand pump water quality is poor and not totally safe for human consumption in above mentioned residential area. However, it also important that to evaluate other potential contaminants of water bodies like microbial and radiological substances and also includes human body fluids in that of Udgir city.

3. After the study of physico-chemical parameters, here biological parameters also check in future study.

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BIOGRAPHIES



Miss. Bhagwatgeeta Prabhu Vairale is a CHB Assistant Professor, Shivaji Mahavidyalaya, Udgir. Department of Zoology, Shivaji Mahavidyalaya, Udgir-413517, Dist. Latur Maharashtra state, India