International Journal of Biology Research
ISSN: 2455-6548
Impact Factor: RJIF 5.22
www.biologyjournal.in
Volume 2; Issue 4; October 2017; Page No. 01-05

Study to assess drinking water quality from various sources in and around Penugonda

Hari Priya Saripalli, * Ramesh Tadi, Diwakar T
[1, 3] Department of Biotechnology, SVKP & Dr. K.S. Raju Arts & Science College, Penugonda, Andhra Pradesh, India
[2] Head Department of Biotechnology, SVKP & Dr. K.S. Raju Arts & Science College, Penugonda, Andhra Pradesh, India

Abstract
Water is one of the main contributors to diseases. The best of water varies geologically and periodically. It also differs primarily based on other factors including pollution, synthetic remedy, and so forth. Not all of the water sources offer water fit for drinking. Consumption of impure water causes many lethal diseases. The present study was conducted to assess the quality of drinking water from various sources. The present study takes into account BOD, TDS, MPN indexing, coliform test, and pH as the parameters for analyzing the quality of water samples obtained from the most used water sources in and around Penugonda in the month of July.

Keywords: water, microorganisms, pollution, diseases

Introduction
Water is one of the main contributors to diseases. Water from virtually all sources contains small amounts of gases, minerals, organic matter and a few microorganisms. The quality of water varies geologically and periodically. It also differs based on other factors such as pollution, artificial treatment, etc. Not all the water sources provide water fit for drinking. Consumption of impure water causes many lethal diseases. The World Bank estimates that 21% of all communicable diseases in India are related to unsafe water with diarrhea alone causing more than 0.1 million deaths. India has only 3% of the world's fresh water with 20% of its population [1] (1) and groundwater constitutes 85% of the source of drinking water. 92 million in India were without access to an improved drinking water source in 2012 [2].
The present study was conducted to assess the quality of drinking water from various sources.
The present study takes into account BOD, TDS, MPN indexing, Coliform test, and pH as the parameters for analyzing the quality of water samples obtained from the most used water sources in and around Penugonda in the month of July.
According to the CPCB, India, for drinking water source without conventional treatment but with chlorination, Total coliform organisms (MPN*/100 ml) shall be 50 or less, pH between 6.5 and 8.5 and Biochemical Oxygen Demand 2 mg/l or less [3].

Materials and Methods
pH
pH of water samples was determined using a standard pH meter at $29°C$ as per the Guidelines of water quality monitoring by the Central Pollution Control Board, India[4].

TDS
The TDS of water samples was calibrated using a standard TDS/EC meter at 29 °C as per the Guidelines of water quality monitoring by the Central Pollution Control Board India [5].

BOD
Manganese (II) Sulfate (at 48% of the total volume)
Potassium Iodide (15% in Potassium hydroxide 70%)
Thiosulfate (0.025N)
Starch solution (1% of the total volume)
The BOD of water samples was calculated by using the Winkler's method over an interval of 5 days.

Determining DO
To the sample as collected in a Winkler bottle, 2 ml. of $MnSO_4$, followed by 2 ml. of $\mathbf{KI - KOH - NaN_3}$solution well below the surface of the liquid, and stoppered with care to completely exclude air bubbles. It was mixed by inverting the bottle several times. When the precipitate settled, the stopper was carefully removed and immediately 2.0 ml. of concentrated sulfuric acid was added by allowing the acid to run down the neck of the bottle. It was stoppered again and mixed by gentle inversion until solution is complete. 50 ml of the solution was taken and the liberated iodine was titrated with thiosulfate using starch as indicator [6].
The volume of thiosulfate consumed was recorded as (*V*)
The DO of the sample is calculated by the formula,

$$DO = \frac{V \times 0.025 \times 1000 \times 8}{50}$$

Calculating BOD
The DO of water samples was determined once (D_1) within 24 hours of collection of water sample and again (D_2) after 3 days of storing the samples in an airtight Winkler bottle in a dark place.
The BOD of the sample is calculated by the formula,

$$BOD = D_1 - D_2$$

Coliform Test

Presumptive test for total coliform bacteria

The following steps are followed for each water sample.

a. Arrange three rows of three tubes each in a test-tube rack. The tubes in the first row (F1) hold 10ml of double-strength Mac Conkey broth while the tubes in the second and third rows (F2, F3) contain 5ml of single-strength Mac Conkey broth. (All of them should have an immersed Durham tube without air bubbles.)
b. With a sterile pipette add 10ml of sample to each of the three tubes in row F1.
c. With a sterile pipette, add 1ml of sample to each of the three tubes in row F2.
d. With a sterile pipette, add 0.1ml of sample to each of the three tubes in row F3.
e. After gently shaking the tubes to mix the contents, incubate the rack with the 15 tubes at 35°C or 37°C for 24 hours.
f. At the end of the 24-hour incubation period, examine each tube for the presence of gas. If present, gas can be seen in the Durham tube. If none is visible, gently shake the tube; if any effervescence (streams of tiny bubbles) is observed, the tube should be considered positive.
g. Using a table like the one shown here, record the number of positive tubes after 24 hours.
h. Reincubate negative tubes for a further 24-hour period. At the end of this period, check the tubes again for gas production as in G above. Gas production at the end of either 24 or 48 hours' incubation is presumed to be due to the presence of coliforms in the sample.
i. Record the number of positive tubes after 48 hours [7]. This data can be used for MPN Indexing.

The confirmatory test

Duplicate petriplates of Eosin Methylene Blue (EMB) agar and MacConkey agar were taken for each water sample which gave positive presumptive test and the growth of colonies and their characteristics were recorded.

Completed test

The colonies in the EMB agar and MacConkey agar were inoculated and grown on Nutrient agar after incubation, the colonies formed were subject to Gram staining and spore staining.

MPN Indexing

As stated above, the data collected from the multiple tubes in the presence absence test for coliform bacteria is used for MPN Indexing. It is recorded in a table with three columns indicating the no. of positive tubes in each row for each water sample. Comparing the values with those in the standard MacCrady's table, the MPN index is determined.

Results

Table 1: pH

Sample	pH
A	7.56
B	7.54
C	7.50
D	7.26
E	7.33

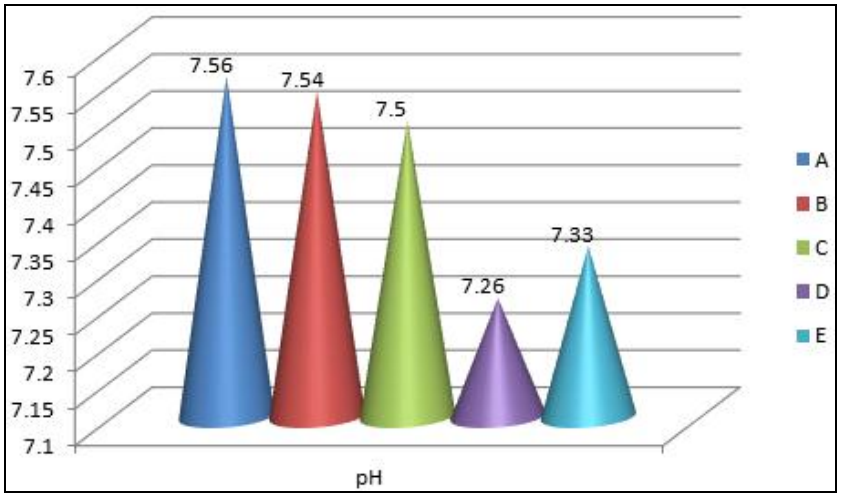

Fig 1

Table 2: TDS

Sample	TDS (ppm)
A	837
B	196
C	573
D	60
E	27

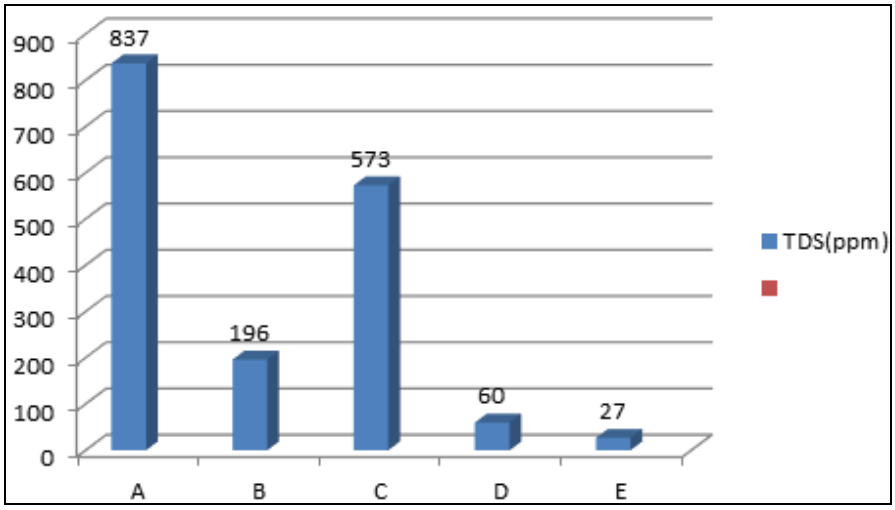

Fig 2

Table 3: BOD

Sample	D_{1}(mg/ml)	D_{2}(mg/ml)	BOD(mg/ml)
A	12.8	4.4	8.4
B	8.8	2.8	6.0
C	7.2	2.8	4.4
D	12.8	9.2	3.6
E	14.4	8	6.4

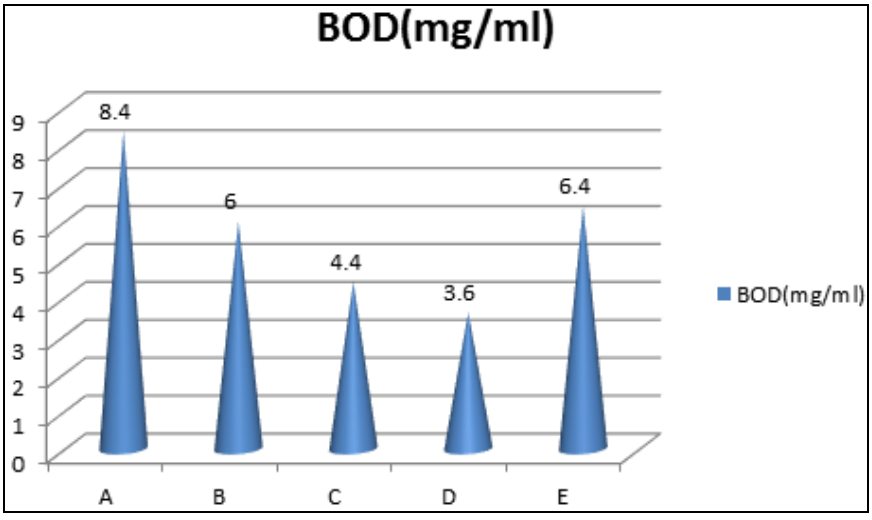

Fig 3

Coliform test

Presumptive test

In the samples B, C, D, and E air bubbles were observed in the Durham tube and hence gave positive result.

Confirmed test

Colonies were observed with Greenish metallic sheen which later changed to blackish purple. This indicates presence of rigorous lactose fermenting bacteria.

Complete test

On Gram staining, the samples B, C and D showed the presence of Gram negative rods which might be *E.coli*. On spore staining, they contained non spore forming bacteria. It indicates positive completed test for presence of *E.coli*.

Table 4: MPN Index

Sample	Number of tubes giving positive reaction out of			
	3 of 10ml each	3ml of 1ml each	3 of 0.1ml each	MPN Index per 100ml
A	0	0	0	0
B	2	0	0	9
C	3	0	2	64
D	3	2	2	210
E	3	3	1	460

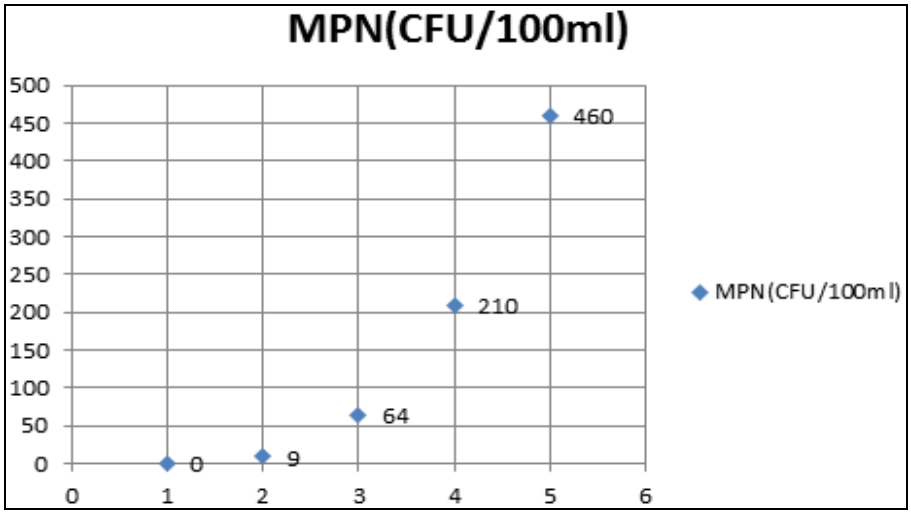

Fig 4

Table 5: Summary of Data

Sample	pH	TDS (ppm)	BOD (mg/l)	MPN (CFU/100ml)
A	7.56	837	8.4	0
B	7.54	196	6	9
C	7.5	573	4.4	64
D	7.26	60	3.6	210
E	7.33	27	6.4	460

Discussion

None of the water samples meet all the standards described above. But the water sample B seems to be somewhat near the standards and is hence the best of the five samples tested and it is from a hand pump.

The RO plant water has low TDS and is considered hazardous to drink. Low TDS water is defined in this paper as that containing between one and 100 milligrams per liter (mg/L) of total dissolved solids (TDS)[9] According to WHO, consuming water of low mineral content has a negative effect on homeostasis mechanisms, compromising the mineral and water metabolism in the body and the consumption of reverse osmosis water leads to the dilution of the electrolytes dissolved in the body water. Inadequate body water redistribution between compartments may compromise the function of vital organs. Side effects at the very beginning of this condition include tiredness, weakness and headache; more severe symptoms are muscular cramps and impaired heart rate. Further, as per the above tests, it has been concluded that the microbial quality of the RO water samples are not up to the mark. Therefore better alternatives are to be considered.

The groundwater, on the other hand, is not consistent in its quality. The water from one source may differ in quality from season and also the surrounding activities.

Conclusion

None of the water samples meet all the standards described above. But the water sample B seems to be somewhat near the standards and is hence the best of the five samples tested and it is from a hand pump.

McCrady's table [8]

Table 6: Number of tubes giving positive reaction out of

3 of 10ml each	3ml of 1ml each	3 of 0.1ml each	MPN Index per 100ml
0	0	1	3
0	1	0	3
1	0	0	4
1	0	1	7
1	1	0	7
1	1	1	1
1	2	0	1
2	0	0	9
2	0	1	14
2	1	0	15
2	1	1	20
2	2	0	21
2	2	1	28
3	0	0	23
3	0	1	39
3	0	2	64
3	1	0	43
3	1	1	75
3	1	2	120
3	2	0	93
3	2	1	150
3	2	2	210
3	3	0	240
3	3	1	460
3	3	2	1100
3	3	3	2400

References

1. Drinking Water Quality Surveillance in a Vulnerable Urban Ward of Ahmedabad byVIyer, NandiniChoudhury, Gulrez Shah Azhar, and Bhushan Somvanshi (NCBI, PMC,PMC4170141)
2. WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme page 14 Fig. 6. Number of people (in millions) without access to an improved drinking water source in by MDG region], 2012.
3. Guidelines for Water Quality Monitoring - Central Pollution Control Board page Box 4: Designated Best Use Classification of Surface water. (MINARS/27/2007-08), 6.
4. Guidelines for Water Quality Monitoring - Central Pollution Control Board (MINARS/27/2007-08), 26-27.
5. Guidelines for Water Quality Monitoring - Central Pollution Control Board (MINARS/27/2007-08), 27.
6. Determination of Dissolved Oxygen in Polluted Waters by Takeshi OKURA, Katsumi GOTO and Toshiro FURUKAWA Hokkaido University Collection of Scholarly and Academic Papers: HUSCAP
7. WHO Water Sanitation Health 2nd Edition Volume 3 i. Guidelines for Drinking Sswater Quality Annex 5 Multiple-tube method for thermo tolerant (fecal) coli forms.
8. Standard Methods for the examination of water and waste water, APHA, New York, 1971.