A CASE STUDY ON QUALITY PARAMETERS OF MUSI RIVER WATER AND GROUNDWATER ALONG IT

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ABSTRACT:

The disposal of untreated urban sewage in to open water bodies is common in most developing countries. This poses potential negative consequences to public health and agricultural sustainability.

Hyderabad is one of India's largest cities, disposes large amounts of its untreated wastewater into the Musi River, because of which the river is polluted.

Musi River or Musinuru is a tributary of the Krishna River in the Deccan Plateau flowing through Telangana state in India. Previously, the water used for drinking purpose and the river was polluted due to unnecessary activities .The various parameters are analysed for Musi River water related to wastewater quality and for Bore well water with reference to sample households around the periphery of the Musi river related to ground water quality.The various tests will be conducted for four sample areas located along the periphery of the Musi river . The water quality parameters will be compared with the standards.

This paper emphasizes the aspect of various water quality parameters related to water collected in four locations along the periphery of the Musi river and around the periphery of Musi river i.e., Bore well water.

KEYWORDS: Musi River, Bore well water, BOD, Quality, Variation

***Introduction* :**

Water is the most important natural resource and essential for life, as it provides habitat for diverse types of aquatic life in rivers, lakes and oceans and makes 65% of human body. The great historical cities grew around rivers and lakes because of human dependence on water.

The expansion of agriculture and industrial development has not only increased water consumption considerably but has also affected water quality. . Water is easily polluted because of its great ability to dissolve substances. Even before raindrops touch the earth, they stand picking up pollutants. The various human activities and industries not only require water in large amounts, they also pollute it while using it. Apart from industries, water is polluted by agricultural and domestic or municipal sources. The water pollutants vary in nature; they include biological agents, chemicals that make water rich in nutrients, chemicals that poison water sediments, heat and radioactive waste. Nearly all water bodies are affected by pollution, including ground water. In many developed countries, water pollution is a major problem and many river basins have been found to show high organic matter concentration. Polluted water loses its economic and aesthetic value.

Rapid and uncontrolled urbanization is often associated with environmental contamination, especially the pollution of surface water bodies like rivers and lakes by solid and liquid wastes. Large scale pollution of rivers has resulted in strict enforcement of waste disposal legislation in most industrialized countries, where wastewater is disposed of only following extensive treatment. This is in contrast to most developing countries where most sewage goes untreated; in India for example, it is estimated that over 70% of all wastewater is disposed of untreated. The situation in India is likely to deteriorate even further as India's population will grow by almost 400 million people in the next quarter of a century, with approximately 85% of this growth taking place in cities. Rivers have a natural, though limited, capacity to restore water quality to pre-pollution levels, through dilution, die-off, sedimentation and biological processes. . However with the growth of cities the amount of wastes disposed into rivers often grows beyond their self-purifying ability.

The Musi River, a tributary of the Krishna River is located on the Deccan Plateau in the State of Telangana, Southern India. It originates 60 km upstream of the city of Hyderabad and enters the Krishna River 200 km downstream of it. In the 1920s two large reservoirs were created upstream of Hyderabad to meet the city's increased (drinking) water demand and to mitigate the effect of frequently occurring floods. Due to increased demand for drinking water by the city, no controlled water releases from the reservoirs occur and the river downstream of the reservoir and upstream of Hyderabad is dry. In the city the river reappears as a result of the large scale sewage disposal into the river bed.

Objectives:

To carry out the analysis of various parameters related to water quality with reference to

- Sample household bore holes along the periphery of Musi River
- Musi River water at certain locations and comparing with the standards and to know the variation for two a month period.

Scope :

To know the concentration of impurities by analysis and comparing same with the standards and to know the cause for pollution and remedies for safe disposal of effluents in to the streams and nalas.

Study area:

The area selected for the water quality assessment is from sangam(Bapu nagar) to Peerzadiguda in Hyderabad district.

A 35km stretch of Musi River, was selected for the water quality assessment from Sangam(Bapunagar) to Peerzadiguda.

This stretch of the river was selected as it had no tributaries, restricted surface run-off and more industrial effluents and reasonable access to the River

Sample point selection:

On this stretch, four Musi River water sample points were selected and denoted as MR and four other bore well samples were collected near by the range of 0.2 km , denoted as BR.

The sample point locations are selected based on the previous year study on Musi River obtained from TSPCB Sanathnagar. These locations are selected based on the high concentration of impurities as per the previous year study..

Physical, Chemical water quality Assessment：

Musi River water samples were collected in sterile plastic bottles and stored in a dark light and analysed within 2 weeks of collection. The Parameters like pH, Conductivity, Turbidity, DO, BOD, Boron are analysed to know the quality of Musi River water

Bore well water samples were collected in sterile plastic bottles and stored in a dark light and analysed within 2 weeks of collection. The Parameters like pH, TDS, Turbidity, Alkalinity, Total Hardness, Chlorides, Nitrates are analysed to know the quality of bore well water and compared with the drinking water standards.

Number of cycles：

The tests are performed twice i.e., in January and march to know the variation for two month time period. Same methodology adopted for both the cycles .Samples are collected separately in January as well as in march for the analysis.

Musi River water samples(MR)

Collection of sample MR 1 at Sangam (Bapughat)

Collection of sample MR 2 at Moosarambagh

Collection of sample MR 3 at Nagole

Collection of sample MR 4 at peerzadiguda

Bore Well water samples: (BW)

Collection of Bore Well water sample BW1 near sangam (Bapughat)

Collection of Bore Well water sample BW 2 near moosrambagh

Collection of Bore Well water Sample BW3 near Nagole(at a construction site)

Collection Bore Well water of sample BW 4 near peerzadiguda (at a construction site)

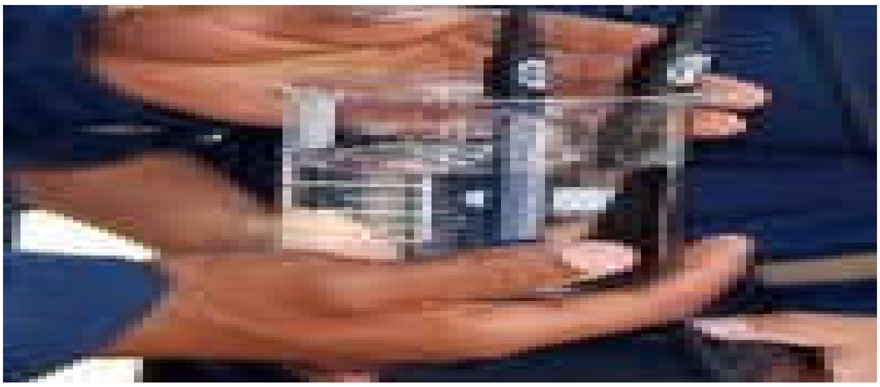
Methodology:

pH

The pH is determined using a pH meter

The procedure of determination of pH of water involves the following steps:

- The water sample is properly mixed and stirred using a glass rod
- By using a watch glass, a sample of water equal to 50ml is added to the beaker. The temperature of the water is allowed to stabilize by placing the sample stand for 1 hour. In between this time stirring can be done. After 1 hour, the temperature of the water is measured and this temperature is adjusted in the pH meter. Hence the pH meter shows a temperature similar to that of the sample. All these adjustments to the apparatus must be performed and fixed before the test is conducted. There are some pH meters with automatic temperature controls. In such cases, the instructions provided by the manufacturer have to be followed.
- The standard solutions are used to standardize the pH meter. Here also the temperature is adjusted as mentioned above.
- Next, into the water sample, the electrodes are inserted. The beaker is turned and adjusted so that there is good contact between the electrodes and the water.
- Before starting the reading, the electrodes have to be placed in the solution for more than 30 seconds. This period is required for the proper stabilizing of the meter to have proper reading. In pH meters that have an automatic reading system, a signal will be provided to tell that the meter is stabilized.
- Once the reading is shown, it must be read to the nearest tenth of the whole number. If the value shows to 100^{th} place then it has to be rounded off. The tenth-place digit is left if the 100^{th} place is less than 5. For values greater than 5 after the decimal, it is rounded to 1 unit. If the 100^{th} place is equal to 5, the nearest even number is taken as a rounded value.
- The apparatus must be maintained after each use. The electrodes used are washed thoroughly with distilled water. If there is any form of film around the electrodes, it has to be cleared. Wiping of the electrodes must be avoided as this will result in polarization which will result in a slow response to the experiment



pH meter

Conductivity

Conductivity is measured using a Conductivity meter.

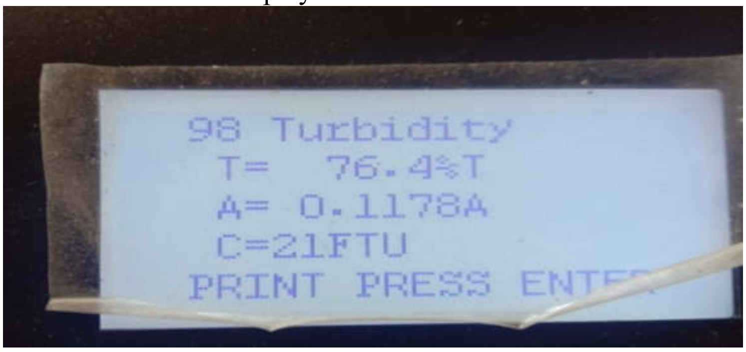
- The procedure of determination of conductivity of water involves the following steps:
  - Prepare the conductivity meter for use.
  - Use a conductivity standard solution (usually potassium chloride or sodium chloride) to calibrate the meter for the range that you will be measuring.
  - Rinse the probe with distilled or deionized water.
  - Select the appropriate range beginning with the highest range and working down. Read the conductivity of the water sample. If the reading is in the lower 10 percent of the range, switch to the next lower range. If the conductivity of the sample exceeds the range of the instrument, you may dilute the sample. Be sure to perform the dilution according to the manufacturer's directions because the dilution might not have a simple linear relationship to the conductivity.
  - Rinse the probe with distilled or deionized water and repeat step 4 until finished.

Conductivity meter

Turbidity:

- The turbidity of a sample should be determined as soon as possible after it is collected.
- Ensure that the sample is agitated well enough to provide a uniform and representative suspension, but without creating air bubbles. Pour the sample into the sample cell and again, make sure there are no air bubbles. If necessary use a sonic bath to dislodge air bubbles from the glass walls of the sample cell by immersing the sample cell into the bath for 1 or 2 seconds.
- Use a soft, lint-free cloth to dry, if necessary, and clean dust or smudges from the outside of the sample cell. Optionally, apply a thin film of silicone oil to the glass on the outside of the sample cell to mask minor imperfections in the glass.

Gently invert the sample cell two or three times to ensure the suspension is uniform, insert the sample cell and read turbidity from the instrument's display.



Spectrophotometer

Alkalinity:
Procedure to determine alkalinity by titration:
The burette is filled with standard sulphuric acid to zero levels, following usual precautions.

- 20 ml of the given water sample is pipetted out into a conical flask.
- Two drops of phenolphthalein indicator are added and titrated against the standard sulphuric acid. The endpoint is the disappearance of the pink color. The titer value is noted.
- A drop of methyl orange indicator is added to the same solution after the phenolphthalein endpoint and the titration is continued until the solution becomes orange. The total titer value is noted.

Total Hardness:

- The total hardness of water is estimated by titrating the water sample against EDTA using the Eriochrome Black-T (EBT) indicator.
- Initially, EBT forms a weak EBTCa2+/Mg2+ wine red colored complex with Ca2+/Mg2+ ions present in the hard water.
- In addition to EDTA solution, Ca2+/Mg2+ ions preferably form a stable EDTACa2+/Mg2+ complex with EDTA leaving the free EBT indicator in solution which is steel blue about in the presence of ammonia buffer (mixture of ammonium chloride and ammonium hydroxide, pH 10)**.**

Estimation of Total Hardness:

20 ml of the given water sample is pipetted out into a clean conical flask. 5 ml ammonia buffer and 2 drops of EBT indicator are added and titrated against EDTA from the burette. The endpoint is the change of color from wine red to steel blue.

Chlorides:

Procedure to determine chlorides by titration:
Before starting the titration, rinse the burette with silver nitrate solution. Fill the burette with a silver nitrate solution of 0.0282 N. Adjust to zero and fix the burette in the stand.
• Take 20 mL of the bore well water sample in a clean 250mL conical flask
• Add 1 mL of Potassium Chromate indicator to get light yellow color
• Titrate the sample against silver nitrate solution until the color changes from yellow to brick red. i.e., the endpoint.
• Note the volume of Silver nitrate added. (A)

Blank Titration:

• Take 20 ml of the distilled water in a clean 250ml conical flask
• Add 1 ml of Potassium Chromate indicator to get light yellow color
• Titrate the sample against silver nitrate solution until the color changes
from yellow to brick red. i.e., the endpoint.
Note: The volume of silver nitrate added for distilled water(B)

Total Dissolved Solids:

To measure total dissolved solids, take a clean porcelain dish that has been washed and dried in a hot air oven at 180ºc for one hour

1. Now weigh the empty evaporating dish in analytical balance. Let's denote the weight measured as W_1.
2. Using a pipette transfer 50 ml of sample to the porcelain dish.
3. Switch on the oven and allow it to reach 105ºc. Check and regulate oven and furnace temperatures frequently to maintain the desired temperature range.
4. Place it in the hot air oven and care should be taken to prevent the desired temperature range.

5. Dry the sample to get the constant mass. Drying for a long duration usually 1 to 2 hours is done to eliminate the necessity of checking for constant mass.
6. Cool the container is a desiccator.
7. Weigh the dish as soon as it has cooled. Note the weight with residue as W_2.

Nitrates, Sulphates, Boron:

These parameters are measured using a spectrophotometer.

Spectrophotometer

DO and BOD :

- Carefully fill a 300-mL glass Biological Oxygen Demand (BOD) stoppered bottle brim-full with sample water.
- Immediately add 2mL of manganese sulphate to the collection bottle by inserting the calibrated pipette just below the surface of the liquid. (If the reagent is added above the sample surface, you will introduce oxygen into the sample.) Squeeze the pipette slowly so no bubbles are introduced via the pipette.
- Add 2 mL of alkali-iodide-azide reagent in the same manner.
- Stopper the bottle with care to be sure no air is introduced. Mix the sample by inverting several times. Check for air bubbles; discard the sample and start over if any are seen. If oxygen is present, a brownish-orange cloud of precipitate or floc will appear. When this floc has settle to the bottom, mix the sample by turning it upside down several times and let it settle again.
- Add 2 mL of concentrated sulphuric acid via a pipette held just above the surface of the sample. Carefully stopper and invert several times to dissolve the floc. At this point, the sample is "fixed" and can be stored for up to 8 hours if kept in a cool, dark place. As an added precaution, squirt distilled water along the stopper, and cap the bottle with aluminum foil and a rubber band during the storage period.
- In a glass flask, titrate 201 mL of the sample with sodium thiosulfate to a pale straw color. Titrate by slowly dropping titrant solution from a calibrated pipette into the flask and continually stirring or swirling the sample water.
- Add 2 mL of starch solution so a blue colour forms.
- Continue slowly titrating until the sample turns clear. As this experiment reaches the endpoint, it will take only one drop of the titrant to eliminate the blue color. Be careful that each drop is fully mixed into the sample before adding the next. It is sometimes helpful to hold the flask up to a white sheet of paper to check for absence of the blue color.
- The concentration of dissolved oxygen in the sample is equivalent to the number of milliliters of titrant used. Each ml of sodium thiosulfate added in steps 6 and 8 equals 1 mg/L dissolved oxygen.

RESULTS & DISCUSSIONS :

The various parameters are analyzed using ph meter conductivity meter, spectrophotometer and some standard titrations. The values obtained for both the cycles are

January (1st Cycle):

***Musi River Water Samples*:**

s.no	parameters	sangam	moosarambagh	nagole	pguda
1	pH	8.1	8.4	8.3	8.2
2	Conductivity(µs/cm)	1493	1670	1529	1557
3	Turbidity(mg/l)	92	150	96	103
4	DO(mg/l)	8.6	10.2	11.4	10.8
5	BOD(mg/l)	241	277	293	281
6	Boron(mg/l)	0.49	<0.01	<0.01	0.59

Bore Well Water Samples:

s.no	parameters	sangam	moosarambagh	nagole	pguda
1	pH	7.5	7.6	7.4	7.9
2	TDS(mg/l)	1450	1146	2250	1820
3	Turbidity(mg/l)	7.3	6	7.56	7.4
4	Alkalinity(mg/l)	288	246	302	259
5	TH(mg/l)	329	328	355	342
6	Chlorides(mg/l)	148	132	209	202
7	Sulphates(mg/l)	245	231	345	302
8	Nitrates(mg/l)	2.8	2	5.1	3.8

March(2nd Cycle)

Musi River Water Samples

S.no	parameters	sangam	moosarambagh	nagole	pguda
1	pH	7.7	8	7.62	7.8
2	Conductivity(µs/cm)	1489	1429	1340	1555
3	Turbidity(mg/l)	87	68	52	102
4	DO(mg/l)	10.2	10.4	13.6	9.4
5	BOD(mg/l)	261	257	314	249
6	Boron(mg/l)	0.3	<0.01	0.04	0.04

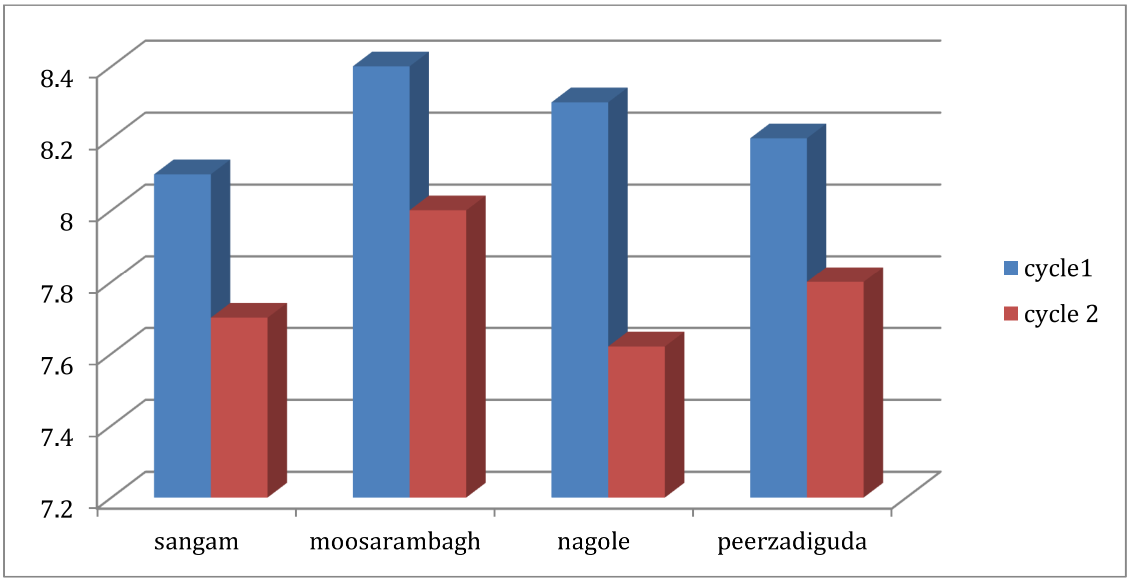
Bore Well Water Samples:

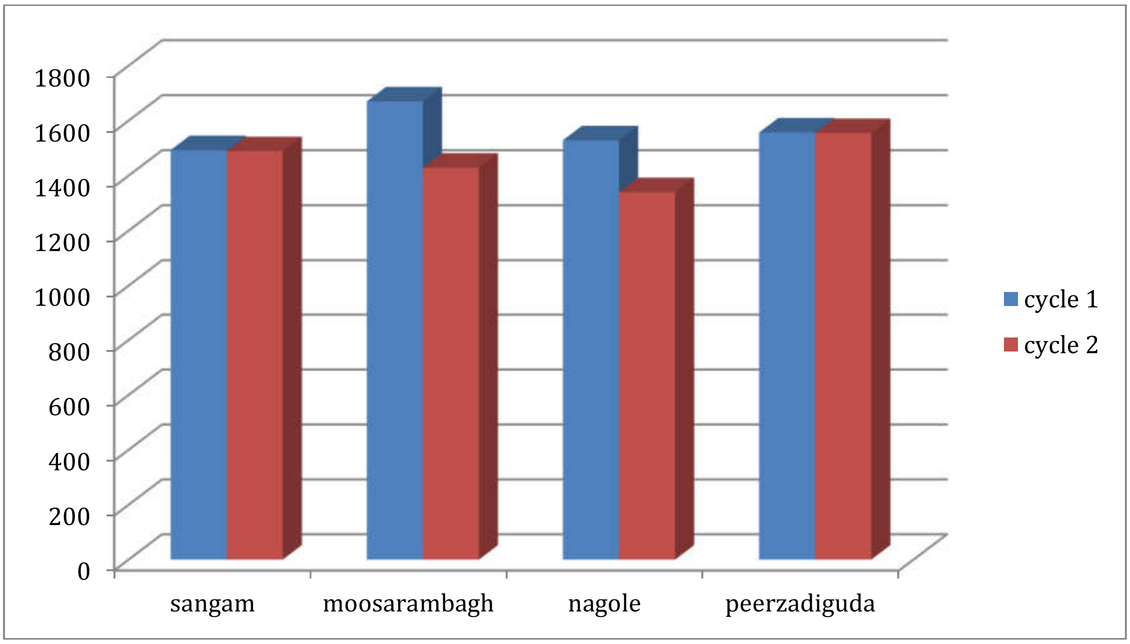
s.no	parameters	Sangam	moosarambagh	nagole	pguda
1	pH	7.5	7.5	7.3	7.6
2	TDS(mg/l)	1168	1126	1980	2150
3	Turbidity(mg/l)	6.2	5.9	7.56	9.25
4	Alkalinity(mg/l)	280	248	220	272
5	TH(mg/l)	330	327	351	338
6	Chlorides(mg/l)	152	132	205	203
7	Sulphates(mg/l)	245	233	345	303
8	Nitrates(mg/l)	2.8	2	5	3.5

Graphical Representation:

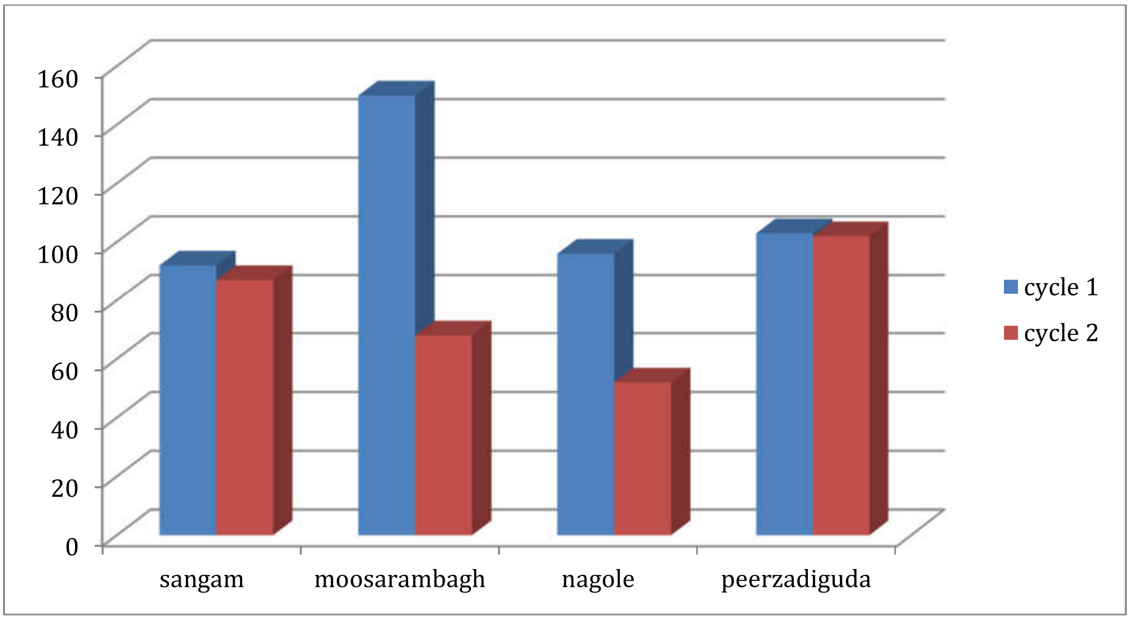
Musi River water samples:

pH

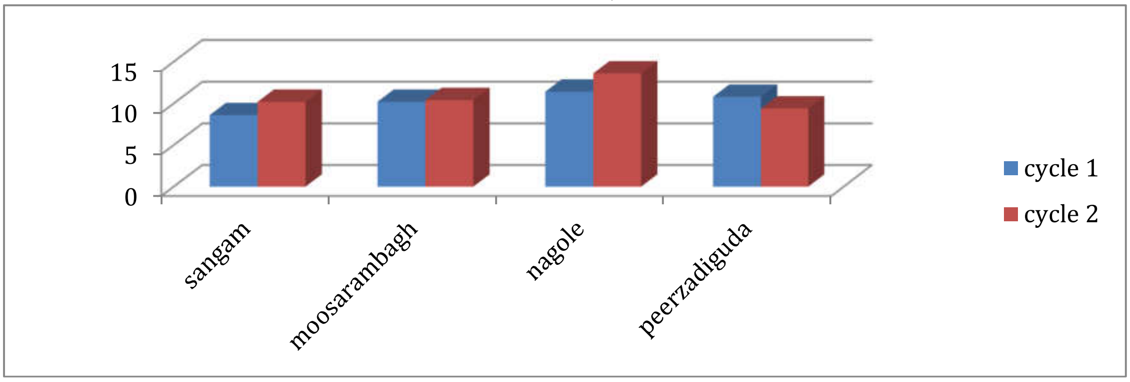




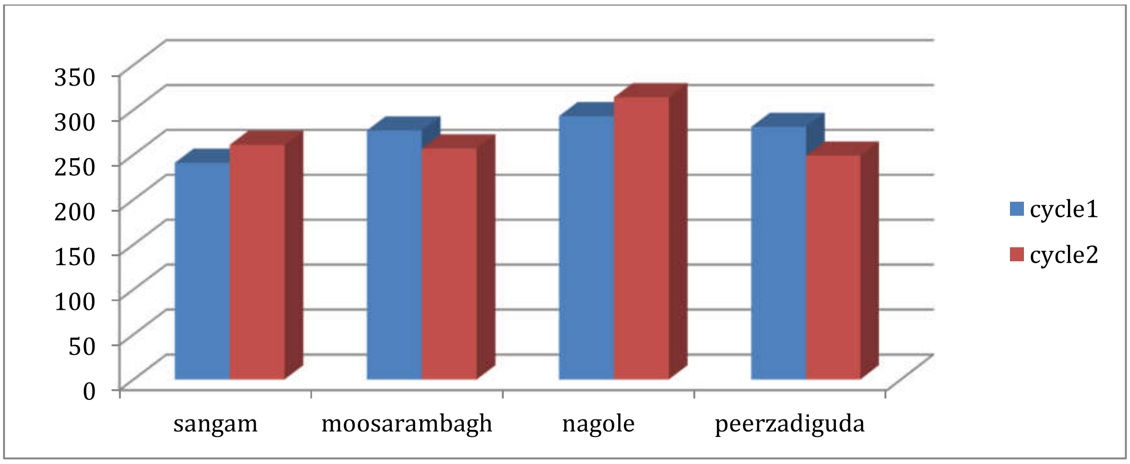
Conductivity



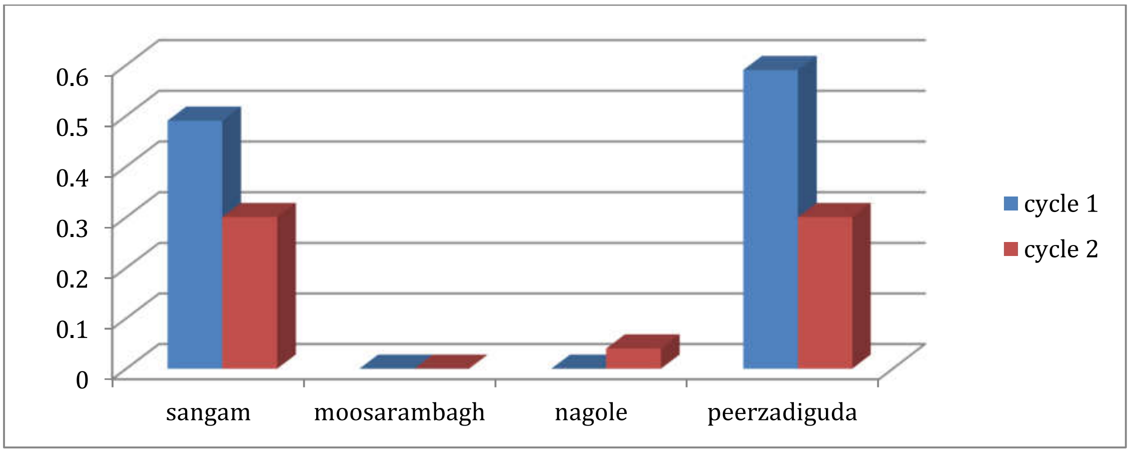
Turbidity



DO

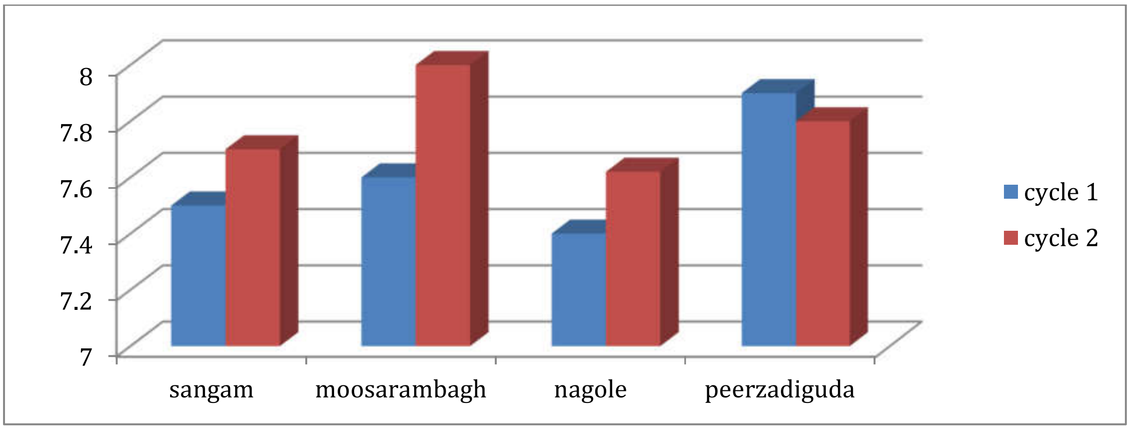


BOD

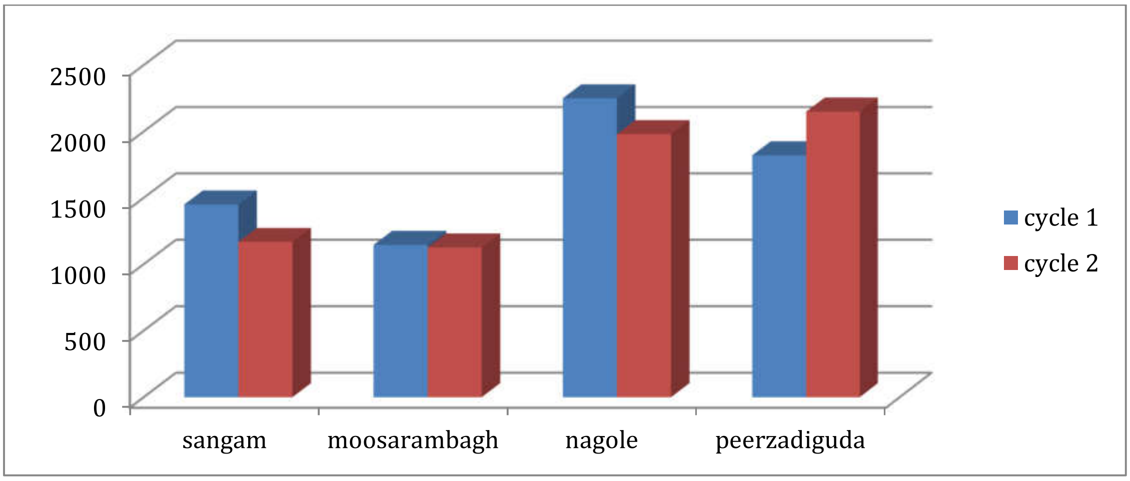


Boron

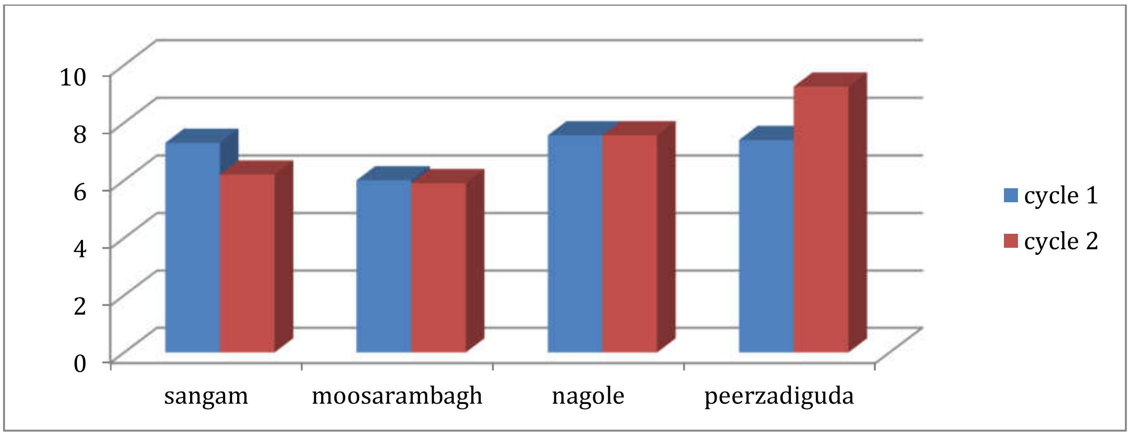
Bore Well Water Samples:



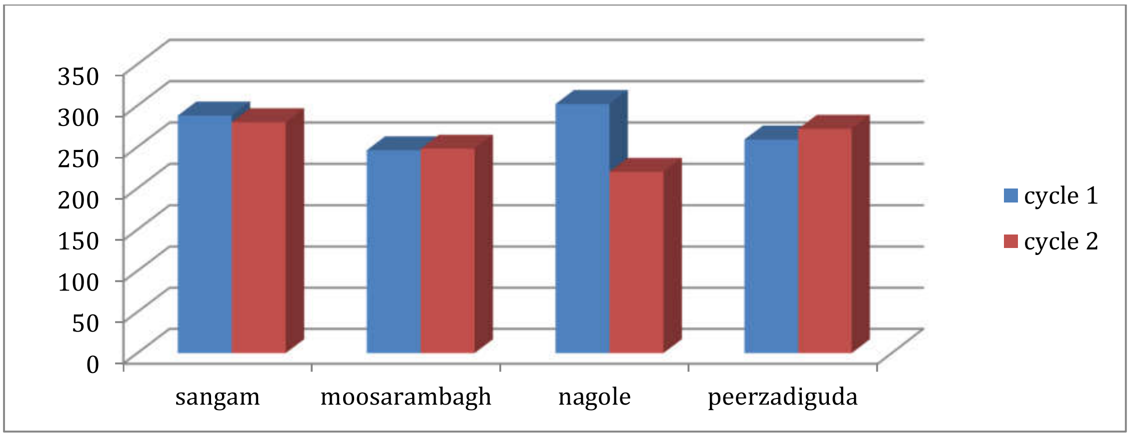
pH



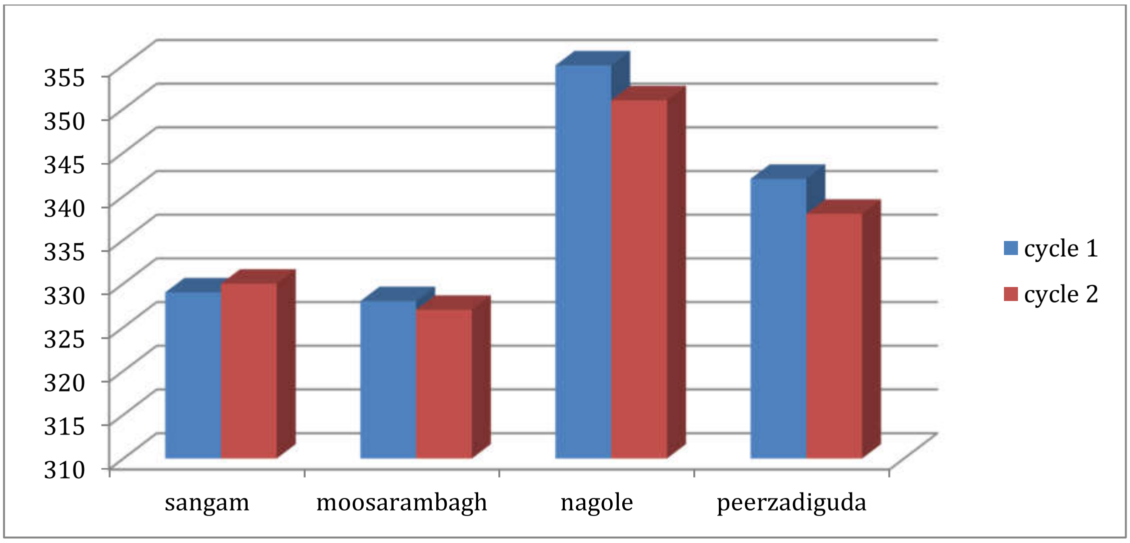
TDS



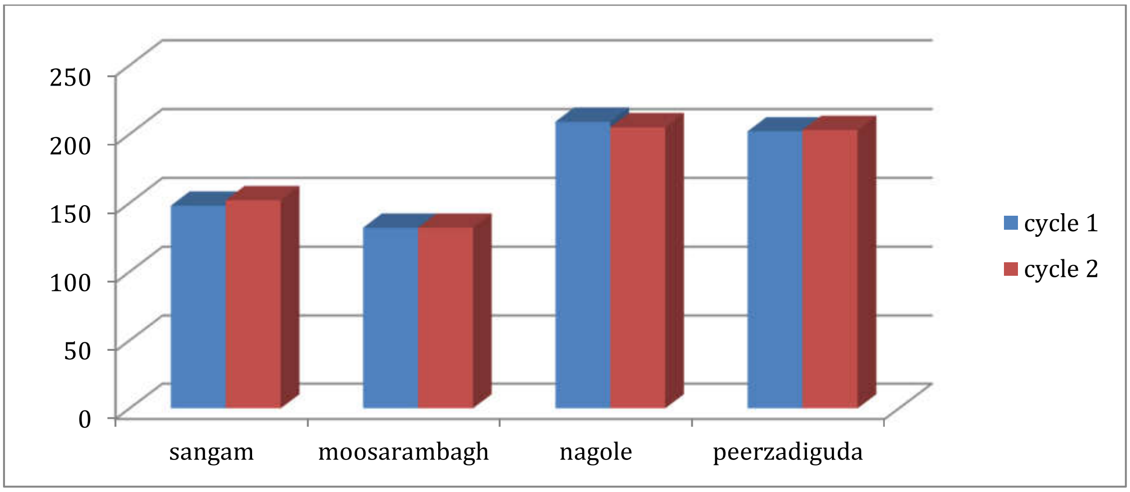
Turbidity



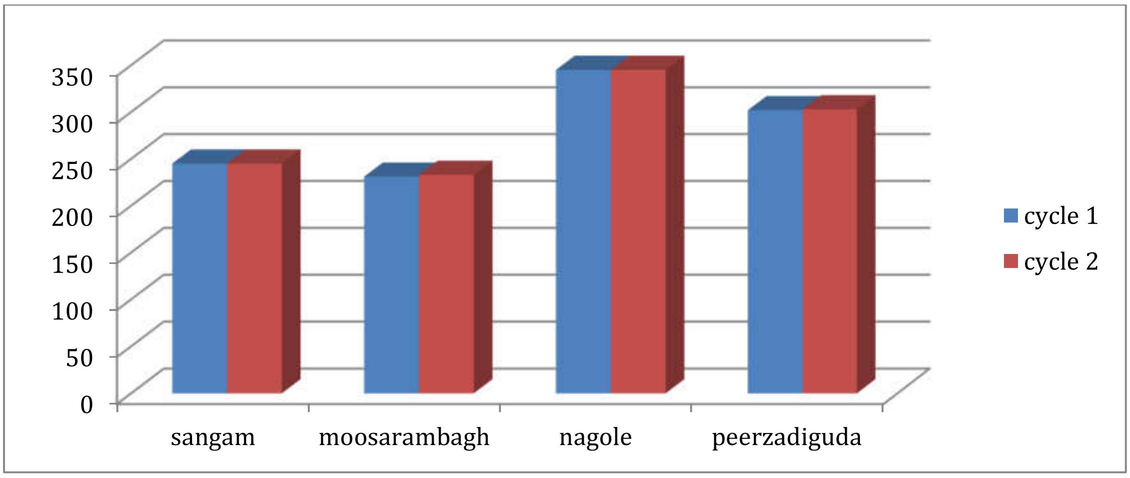
Alkalinity



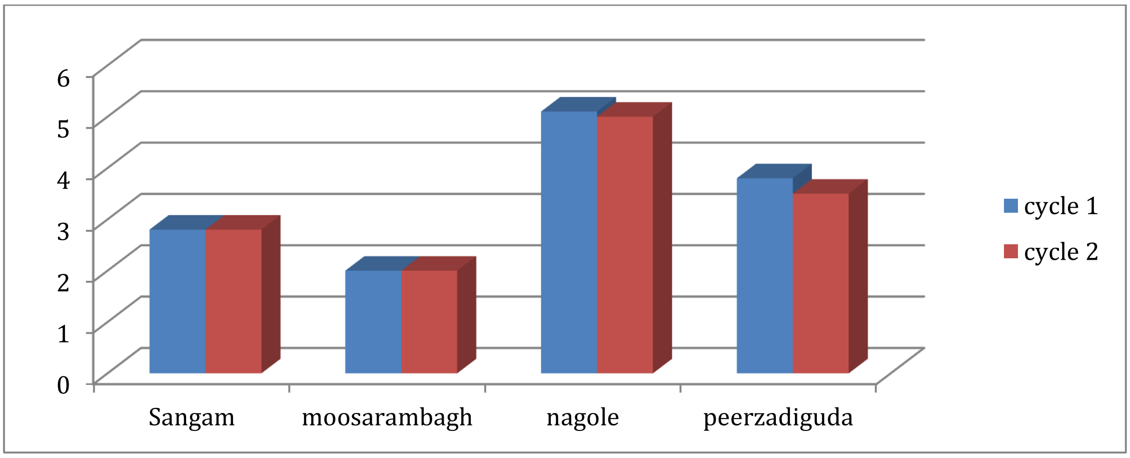
Total Hardness



Chlorides



Sulphates



Nitrates

***CONCLUSIONS*:**

The city of Hyderabad disposed of very large quantities of untreated domestic sewage into the dry bed of the Musi River.

Sewage disposal had a mixed impact on downstream users. Poor water quality had a negative impact on farmer health and possibly crop productivity, though increased reliability and availability of irrigation water also had a positive impact on local livelihoods.

The eventual aim should be the treatment of wastewater before it is used in agriculture in and around Hyderabad.

However in the meantime additional health protection measures like regular treatment programmes with anthelmintic medication and improvements in local water supply and sanitation should be implemented.

Discussions :

The following methods should be used to prevent or reduce water pollution:

Treatment of sewage: Sewage should be treated in sewage-treatment plants, which allow only clean water to be discharged into Musi River.

Treatment of industrial wastes: Industrial wastes must be treated to remove harmful substances (mainly chemicals) and only then should the wastes be discharged into a river.

Limited use of pesticides and fertilizers: Pesticides and fertilizers must be used in limited quantities. This will reduce the amounts of these chemicals in the runoff from agricultural land.

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