



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 Issue: X Month of publication: October 2020

DOI: <https://doi.org/10.22214/ijraset.2020.31928>

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Study on the Assessment of Physical, Physico-Chemical and Chemical Characteristics of Manjeera Water

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Abstract: *Hyderabad is the capital city of Telangana State in India and is the sixth largest city in India, closely behind Bengaluru. Hyderabad Urban Agglomeration (HUA) is served by a number of natural and man-made water bodies which act as storage for irrigation water, drinking water and groundwater recharge (Chigurupati and Manikonda, 2007). The current water supply sources for Hyderabad and the surrounding areas include Osman Sagar on Musi River, Manjira Barrage on Manjira River, Himayat Sagar on Esi River, which is a tributary of Musi, Singur Dam on Manjira River and Nagarjuna Sagar on Krishna River (Singh, 2010). Hyderabad, a capital City of Telangana state, geographically situated in land locked arid zone and no perennial river but a seasonal River Musi flowing through it. There are two dams built on the Musi river that are Osman Sagar and Himayat Sagar. Both of the reservoirs constitute the major drinking water sources for Hyderabad. For longer periods, it is the capital city of so many rulers and in long run expanded to the 8500 sq.km in Telangana southern Indian State. There are 400 small and big lakes available in Hyderabad City. Out of which 169 lakes were notified by Hyderabad Metropolitan Development Authority (HMDA) for protection and conservation of water spread area. Increased population, city culture demands industrial growth that spoiled the catchment of all the lakes, which results in degradation and disappearance of lakes (Priya, 2015). Among the different sources of fresh water that can be used for drinking purpose, Manjira water, Osman Sagar water and Himayat Sagar water are the widely used resource due to quality and quantity considerations. In the present study water samples from three locations namely 1) Alcole Water, 2) Manjeera water at Sangareddy and 3) Manjeera dam water at Zahirabad and analysed for their physical and Physico-chemical and chemical parameters using standard international methods to assess the quality of water.*

Physical and chemical parameters of these water samples at three locations of the study area such as electrical conductivity, pH, total dissolved solids, Na, K, Ca, Mg, HCO₃, Cl, and SO₄ were under permissible limits of BIS standards. The result shows that these water samples are not suitable for drinking purposes and under ordinary conditions, but may be used occasionally under very special circumstances. The results indicate that Manjira water samples tested at three different locations contains calcium, magnesium and sodium bicarbonates and chlorides under BIS permissible limits. These water samples do not contain any harmful elements or substances. These waters are classified as C3S1 and C2S1. Water quality Index of these waters is ranged between 29.11 to 36.50 and it adjudged as good quality as per the guidelines stipulated by Satish Chandra et.al., (2017). These waters do not contain any Bacteria in them and they are suitable for all types house hold purposes viz., Washing clothes, utensils and bathing. These waters at all locations are suitable for drinking purpose once they are purified with suitable Reverse Osmosis System. A suitable R.O. System has to be installed for these waters to convert water in to R.O. water and make it suitable for drinking purpose.

Keywords: *Water Quality, Drinking water, Physical, Physico-chemical parameters of water, Water Quality Index*

I. INTRODUCTION

Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve a drinking-water quality as safe as practicable. Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve drinking-water that is as safe as practicable. Drinking water, also known as potable water, is water that is safe to drink or to use for food preparation. The amount of drinking water required to maintain good health varies, and depends on physical activity level, age, health-related issues, and environmental conditions (Ann C. Grandjean, 2004).

Water is vital for the existence of all life forms and is essential for all activities of human beings. Potable water is defined as the water, which is suitable for human consumption. But today due to the presence of various chemical compounds and wastes from human activities, water gets polluted and becomes unsuitable for drinking. From a public health or ecological point of view a pollutant is any biological, physical or chemical substances are in excess harmful for human consumption and other living organisms. The primary purpose of the *Guidelines for drinking-water quality* is the protection of public health. The Guidelines provide the recommendations of the World Health Organization (WHO) for managing the risk from hazards that may compromise the safety of drinking-water. The recommendations should be considered in the context of managing the risk from other sources of exposure to these hazards, such as waste, air, food and consumer products (WHO, 2004). In view of above scientific information and importance of water quality an attempt has been made to assess water quality of Manjeera water at three locations for human consumption for drinking purpose by studying physical, physico-chemical and biological parameters.

II. MATERIALS AND METHODS

For this study water samples were collected from three locations namely 1) Alcole Water, 2) Manjeera water at Sangareddy and 3) Manjeera dam water at Zahirabad.

The water samples were collected and stored in 1 liter capacity clean plastic bottles. Before collection of samples, the bottles were properly washed. Prior to collecting the samples, the containers were rinsed by the water to be sampled. The wells were duly pumped before collecting their sample so that the stagnant water, if any, is completely removed from storage within the well assembly. The major ion analyses were carried out at Iota Laboratories, Hyderabad.

A. Analytical Techniques for Major Ions

The water samples were analyzed as per the standard methods of APHA (1992); Tandon (1993) and Riazuddin et al., (2007). Values of pH were measured by a portable digital water analysis kit with electrodes. The instrument was calibrated with buffer solutions having pH values of 4 and 9. Total dissolved solids (TDS) were calculated by summing up the concentrations of all the major cations and anions. The values of electrical conductivity (EC) were measured by portable kit with electrodes in the lab.

The concentrations of Ca^{++} , Mg^{++} , Cl^- , HCO_3^- and total hardness were determined by volumetric method. Ca^{++} and Mg^{++} were determined by EDTA titration. For HCO_3^- , HCl titration to a methyl orange point was used. Chloride was determined by titration with AgNO_3 solution. Flame emission photometry has been used for the determination of Na^+ and K^+ . In this method water sample is atomized and sprayed into a burner. The intensity of the light emitted by a particular spectral line is measured with the help of a photoelectric cell and a galvanometer. Sulphate was determined by using 5% Standard Barium Chloride solution method described by Tabatabai, 1974. It involves measurement of the turbidity formed when an aliquot of a barium chloride-gelatin reagent is added to an acidified sample. The method is sensitive and accurate and permits determination of microgram amounts of sulphates present in water samples. Fluoride in these water was estimated using SPADAN'S reagent.

III. RESULTS AND DISCUSSION

It is very essential and important to test the water before it is used for drinking, and domestic use. For this study water samples were collected from three locations namely 1) Alcole Water, 2) Manjeera water at Sangareddy and 3) Manjeera dam water at Zahirabad. The results of physical. Physico-chemical parameters of these water samples are presented in Table 1 and 2. The pH was ranging between 6.92 and 7.50; E.C. was 0.310 and 0.805 dS/m. The TDS was from 198.4 to 515.20PPM. The turbidity was <0.50PPM. CO_3 0.0 in all the samples was and Bicarbonates ranged between 1.4 and 2.90 meq/Lit. Chlorides were ranged from 2.4 to 4.40 meq/Lit. Sulphates were ranged from 1.65 to 2.25 mg/Lit. Both Nitrate Nitrogen and Ammonical Nitrogen was 0.00 mg/Lit tested in all the three samples tested. $\text{Ca} + \text{Mg}$ (meq/lit) by EDTA Titration Method was ranged between 1.20 and 3.30 meq/Lit. Total Hardness as CaCO_3 (mg/Lit) and Total Alkalinity as NaCO_3 (mg/Lit) were ranged between 60 and 165 and 70 and 145 mg/Lit respectively. Residual Chlorine, Fluoride, Boron, sediment, Mineral oil, Chlorophyll content, Bacteria Faecal Coli form and Fungi were absent in all the three water samples tested. Water Quality Index of these waters is ranged between 29.11 to 36.50 and it adjudged as good quality as per the guidelines stipulated by Satish Chandra et al., (2017). All these above parameters are within the permissible limits of BIS standards. These results are in conformity with the earlier researchers as stated below.

Good quality water for drinking purpose to human society is very essential for health; the greatest danger to human health is water pollution. Many rivers and streams are highly polluted due to industrial and sewage discharge in developing countries by Jonnaladda and Mher (2001).

Seeta and Manikya Reddy (2020) investigated Algal diversity and water quality In the rivers of Telangana State. They revealed that the physico-chemical parameters analysed in all the three rivers have been compared with the standards stipulated by various national and international agencies like ISI and BIS for drinking purpose. The analysed data was compared with ISI and BIS standards that the water is clear in all the three rivers. They have concluded that all the physico-chemical parameters are well below the permissible limits. The presence of all the algae species indicates that the clean and unpolluted nature of the rivers, as they are very sensitive to pollution.

Murali Krishna Gurram et.al.(2015) investigated on the assessment of water quality scenario in parts of Hyderabad urban Agglomeration, India – AHP-GIS Modeling Perspective and revealed that the quality of water in most parts of Hyderabad city limits was good such as in Ramanthapur and Musheerabad, few places such as Miyapur and Gachibowli had excellent water quality, areas with poor water quality include Shapur Nagar and Langer Houz.

TABLE 1
Assesment of Manjira Water Quality At 3 Locations

Sl. No.	PARTICULARS OF WATER CHARACTERISTICS	ALGOLE WATER	MANJEERA WATER AT SANGAREDDY	MANJEERA DAM WATER ZAHIRABAD
1.	pH	6.92	7.50	7.38
2.	E.C. (dS/m)	0.805	0.445	0.310
3.	TDS (PPM) OR mg/Lit	515.2	284.8	198.40
4.	Turbidity (NTU units)	< 0.50	< 0.50	< 0.50
5.	CO ₃ (Carbonates) (meq/Lit)	0.00	0.00	0.00
6.	HCO ₃ (Bicarbonates) (meq/Lit)	2.90	1.70	1.40
7.	Cl (Chlorides) (meq/Lit)	4.40	3.20	2.40
8.	SO ₄ (Sulfates) (meq/Lit)	2.25	1.85	1.65
9.	Nitrate Nitrogen NO ₃ -N (mg/Lit)	0.00	0.00	0.00
10.	Ammonical Nitrogen NH ₄ -N (mg/Lit)	0.00	0.00	0.00
11.	Ca + Mg (meq/lit) by EDTA Titration Method	3.30	1.60	1.20
12.	Calcium (meq/Lit)	2.145	1.04	0.78
13.	Magnesium (meq/Lit)	1.155	0.56	0.42
14.	Na (Sodium) (meq/Lit)	0.714	0.519	0.389
15.	K (Potassium) (meq/Lit)	0.085	0.042	0.036
16.	Phosphates (PO ₄) meq/Lit	0.00	0.00	0.00
17.	SAR (Sodium adsorption Ratio)	0.556	0.580	0.502
18.	R.S.C. (Residual Sodium Carbonate Ratio)	NIL	0.10	0.20

Amrutha Kalyani et.al.,(2016) investigated the water quality index in four sites of the Cherlapally Lake during the year 2013. The following physical- chemical parameters like pH, Temperature, Turbidity, BOD, DO, Coli-form, Nitrates, Phosphates, Total solids were analyzed and compared between the WQI ratings. The parameters like BOD, DO, Coli-form bacteria were rating from 0-25, which was considered highly polluted lake. According to them the water quality standards the lake is coming under bad quality and unfit for drinking purpose.

Table 2
Assesment of Manjira Water Quality at 3 Locations

Sl. No.	PARTICULARS OF WATER CHARACTERISTICS	ALGOLE WATER	MANJEERA WATER AT SANGAREDDY	MANJEERA DAM WATER ZAHIRABAD
1.	Total Hardness as CaCO ₃ (mg/Lit)	165.0	80.0	60.0
2.	Alkalinity as NaCO ₃ (mg/Lit)	145.0	85.0	70.0
3.	Residual Chlorine (mg/Lit)	0.00	0.00	0.00
4.	Boron (B) mg/Lit	0.00	0.00	0.00
5.	Fluoride (mg/lit)	0.00	0.00	0.00
6.	Mineral Oil (mg/Lit)	NIL	NIL	NIL
7.	Sediment (mg/Lit)	NIL	NIL	NIL
8.	Chlorophyll content (mg/Lit)	NIL	NIL	NIL
9.	Feacal Coliform (MPN/100 ML)	0.00	0.00	NIL
10.	Bacteria (E. Coli (+ or -)	0.00	0.00	0.00
11.	Colour	COLOURLESS	COLOURLESS	COLOURLESS
12.	Taste	PALATABLE	PALATABLE	PALATABLE
13.	Odour	NIL	NIL	NIL
14.	Dissolved Oxygen(mg/Lit)	3.92	4.85	5.26
15.	B.O.D. (mg/Lit)	3.11	4.20	4.70
16.	C.O.D. (mg/Lit)	12.38	15.33	16.62
17.	Water Class (USDA classification)	C3 S1	C2 S1	C2 S1
18.	Water Quality Index	36.50	31.75	29.11

Gangotri Nirbhavane and Kshama Khobragade (2017) Sion Lake of Mumbai water and observed that water quality of Sion Lake is polluted by domestic sewage from the intensively urbanized catchments. Sion Lake is extensively used for washing, bathing activities, and for conducting religious rituals, idol immersion which shows eutrophication problem; hence the study was done to find out the quality of water for various physico-chemical parameters. Sion Lake is found to be more organically polluted and greater degree of eutrophication was observed.

Dhembare *et al.*, (1998), have studied on water quality and reported that living organisms should have good quality of water and the quality of water was described to assess physical, chemical and microbial characteristics of water.

IV. CONCLUSIONS

Manjira water samples tested at three different locations contains calcium, magnesium and sodium bicarbonates and chlorides under BIS permissible limits. These water samples do not contain any harmful elements or substances. These waters are classified as C3S1 and C2S1. Water Quality Index of these waters is ranged between 29.11 to 36.50 and it adjudged as good quality as per the guidelines stipulated by Satish Chandra et.al.,(2017). These waters do not contain any Bacteria in them and they are suitable for all types house hold purposes viz., Washing clothes, utensils and bathing. These waters at all locations are suitable for drinking purpose once they are purified with suitable Reverse Osmosis System. A suitable R.O. System has to be installed for these waters to convert water in to R.O. water and make it suitable for drinking purpose.

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