A STUDY ON CHEMICAL ANALYSIS OF WATER SAMPLES FROM MUSI RIVER AND GROUND WATER SAMPLES

By

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ABSTRACT

Hyderabad is the 5th largest city in India. It has twin cities Viz., Hyderabad and Secunderabad with its suburbs extending up to 16 miles. The core cities, together with its nine surrounding municipalities are covering an area of 500 square km. The Hyderabad city discharges about 600 million litres per day untreated sewerage water into Musi River. A stretch of 13 Km from Nagole /Uppal IDA to Prathap Singaram is chosen as the study area as it is surrounded by more than 25 industries and their effluents are directly drawn into Musi River (IOSR-JESTFT 2012) [1]. The Musi River water is used for irrigation during its course of travel which leads to adverse effects on both flora and fauna. The bore well water samples in the radius of 1 km are collected at ten distant places at certain intervals along the Musi River to know the quality parameters. The collected samples are tested in the Telangana State Ground Water Department (GWD) to access the quality. The chemical analyses data for both Musi River and bore well water samples are obtained from the GWD for study and interpretation including its impact. Rainfall data of Uppal Mandal for 10 years beginning 2005 onwards is also collected from weather station of Acharya N G Ranga Agricultural University, Rajendra Nagar, and Hyderabad for further studies. It is worthy to note that only Nitrates are recorded as high in all the samples when compared to the BIS standards otherwise, the remaining parameters are in the normal range [4]. Among 10 stations, 8 stations are having high Nitrate (NO_3 as N) values in which the highest Nitrate value of 35.40 mg/lts is observed from station-5 of R-Krishnaiah Nagar (V), Hayath Nagar (M) and station-9 i.e. of Submerged Well situated within the radius of 1 km from Thimmaiguda (V), Ghatkesar (M). Further, it is observed that bore well water samples of 1, 3, 6 and 9 are witnessed with moderate concentration of EC, TDS, Cl, Cam TH and NO_3 whereas Musi River sample collected near R-Krishnaiah Nagar is witnessed with moderate to high concentrations of EC, TDS, Cl, Na, K, TH and NO_3. The objective of the article is to minimize the impact of effluents and industrial wastes discharged by the industries by establishing more treatment plants.

Keywords: Musi River, Chemical, USSL, Drainage, Quality, Rainfall, Nitrate.

INTRODUCTION

Water is the most important natural resource and essential for life, as it provides habitat for diverse type's 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. Once on the ground, water picks up things rapidly, and becomes contaminated.

Over the years, water pollution has emerged as an important issue in India as most of the rivers are polluted, which are having substantial negative impact on human health and aquatic life. The varieties of fish grown in a sewage pond would need to change if the quality deteriorated, and fishing would have to be stopped entirely if the water quality deteriorated substantially [2]. Health problems can ensure for agricultural workers due to pathogenic bacteria, viruses and parasites present in the

wastewater as well as for consumers of wastewater-irrigated particularly if the produce is not cooked before it is consumed.

1. Literature Survey

The Musi River was known as Muchukunda river in olden days, and the precise reason for the change of name is not known. There are many bridges across the river in Hyderabad. The oldest bridge, Puranapul was build during the reign of Ibrahim Qutub shah in 1579 A.D. Nayapul near High Court was added later.

Hyderabad stands on the banks of Musi River, which divides into old city and new city. The river Musi originates in Anantagiri hills near Vikarabad, Ranga Reddy district and flows due east for its course. It joins the Krishna River at Vadapally in Nalgonda district after covering a distance of about 240 km (Figure 1). Nizam Osman Ali Khan VII built a flood control system on the river. Two dams namely Osman Sagar and Himayat Sagar were built in 1920 & 1927 across the river Musi and on its tributary, in the upstream side respectively. These lakes prevented the flooding of the River Musi and are major drinking water sources for Hyderabad city.

The Musi River was the cause of frequent flood devastation of Hyderabad city until the early decades of the 20th century. On Tuesday 28 September 1908, Hyderabad witnessed disastrous floods of the River Musi, flowing through the city. In one day, 17 inches of rainfall was recorded and the water level at Afzalgunj was about 11 feet (3.4 m) high. These floods caused huge devastation to Hyderabad and killed around 15,000 people (Figure 2) and (Figure 3). The modern era of the development of the twin cities began soon after these floods in 1908 and necessitated planning as development.

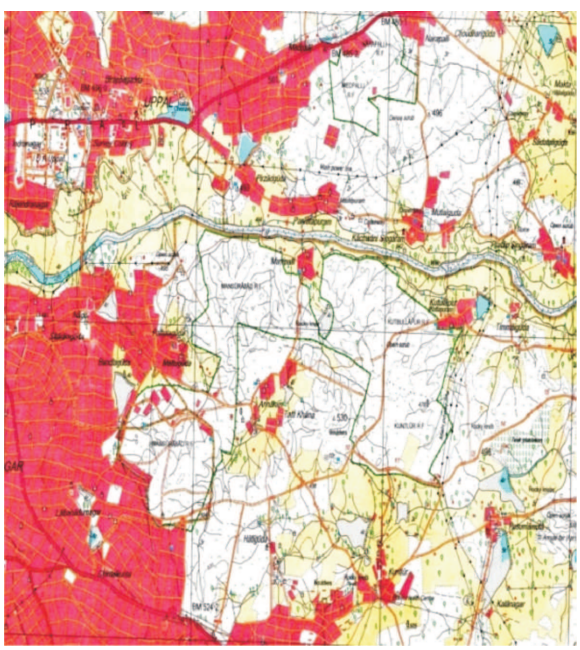

Figure 1. Shows the flow of Musi River from Uppal IDA to Prathap Singaram and other parts of city

Musi River is a tributary of River Krishna in the Deccan Plateau flowing through Telangana state in India. During its course in the city of Hyderabad, a number of industries which include Uppal IDA (Industrial Development Area), Jeedimetla IDA, Patancheruvu IDA etc are established due to urbanization and the effluents from the industrial waste are being dumped since then. The river water downstream of the cities remains highly polluted, considered as a major disaster to Hyderabad & Secunderabad areas.

Researchers of Environmental Toxicology division of Osmania University (Article-Sep 07,2015) [2], have found high levels of heavy metals like cadmium, chromium, nickel, lead, iron, manganese and zinc in spinach (bachhalikura), thotakura, chukkakura, okra (benda), mint

Figure 2. Panoramic View of Hyderabad After Great Floods, with Afzal Gunj bridge and Musi River on the Left

Figure 3. shows the Great Floods of Musi River which devastated the city of Hyderabad

(pudina), coriander (kothimira) and tomato grown on the outskirts of the city. The contamination was found to be above the maximum residue limits set by the World Health Organization. The main reason behind this is said to be the usage of Musi River water, which is highly contaminated with industrial effluents and municipal sewage for irrigation. The researchers pointed out that the toxic metals may cause cardiovascular, nervous and bone diseases apart from vomiting, diarrhea, stomachache, anemia, cancer, ulcers (G Subba Rao and G Sri Harsha 2015) [3].

A 13 km stretch of Musi River, was selected for the water quality assessment from Nagole /Uppal IDA to Prathap Singaram. By using Survey of India topo sheet, E44M11 or 56 K/11 samples were collected as the area is surrounded by more than 25 industries and their effluents are directly drawn into Musi River.

This stretch of the river was selected as it had no tributaries, restricted surface run-off and more industrial effluents. On this stretch ten sample points, approximately 1 km apart from each other were selected and denoted as MR (Musi River) samples and ten other bore well samples were collected near by the range of 0.5 km and denoted as BW (Bore Well). The selection of sample points are based on reasonable access to the Musi River, the possibility to collect samples during which the study of sampling and laboratory procedures and testing of samples during December 2015 to March 2016.

2. Aim of the paper

In recent years, no studies have carried out about the contamination of Musi River by the discharge of effluents from the industries especially from Nagole /Uppal IDA to Prathap Singaram in Ghatkesar Mandal, RR Dist.

3. Objective

The objective of the article is to carry out the investigations by collecting Musi River water samples from Nagole /Uppal IDA to Prathap Singaram to know the concentration of elements or compounds.

4. Methodology Adopted

Musi River water samples were collected in a sterile 5 litre plastic container and stored in a dark light and analyzed within 4 weeks of collection. In the area, under investigation the parameters like pH, Electrical Conductivity, Total dissolved solids, Alkalies, Total Hardness, Calcium, Magnesium, Chlorides, Nitrates, Sulphates, Carbonates, Bi-Carbonates and Fluorides are studied to know the quality of Musi River water as well as underground water through bore wells.

5. Experimental Investigations & Results

The studies reveal that only Nitrates are recorded as high in all the samples when compared to the BIS standards otherwise, the remaining parameters are in the normal range. Among 10 stations, 8 stations are having high Nitrate (NO_3 as N) values in which the highest Nitrate value of 35.40 mg/lts is observed from station-5 of R-Krishnaiah Nagar (V), Hayathnagar (M) and station-9 i.e. of Submerged Well situated within the radius of 1 km from Thimmaiguda (V), Ghatkesar (M).

Further, it is observed that bore well water samples of 1, 3, 6 and 9 are witnessed with moderate concentration of EC, TDS, Cl, Ca, TH and NO_3 whereas Musi River sample collected near R-Krishnaiah Nagar is witnessed with moderate to high concentrations of EC, TDS, Cl, Na, K, TH and NO3. [Refer Table No:1 & 2] *Analytical Lab: Ground Water Department, Hyderabad, Telangana State.

The drainage pattern indicates the sub-dendritic drainage and the movement of the drainage from the villages or urban areas directly into the Musi River.

Rainfall data of Uppal Mandal for 10 years beginning 2005 onwards is collected from weather station of Acharya N G Ranga Agricultural University, Rajendra Nagar, Hyderabad. However, the recharge of the river is lesser in the recent five years when compared to the previous years of 2005 to 2008.

The plotting of SAR values in USSL diagram indicates that all the samples have low SAR value. Out of 10 bore well samples, two samples lie in C4-S1 field and remaining 8 samples in C3-S1 whereas Musi River samples lie one sample in C4-S2 and C3S2 and 8 samples in C3-S1. The C3-S1 field in USSL diagram is considered as good water category for irrigation use. This implies that no alkali hazard is anticipated to the crops. The remaining 16 water samples occurred within C3–S1 category. If the SAR value is greater than 6 to 9, the irrigation water will cause permeability

Analytical Report of Water samples collected from the MUSI RIVER flowing from Uppal to Pratap Singaram stretch, Ranga Reddy (Dist) for the month of Nov 2015-2016

Sl No	Lab No	Village	Mandal	Latitude	Longitude	pH at 30°C	Sp Conductance at 25°C mic.siecm	TDS (mg/lit)	Co3-	HCO3	Cl	F	No3	So4	Na	K	Ca	Mg	TH as $CaCO_3$ (mg/lit)	SAR	Classification	RSC (meq/L)	Classification
									mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l					
BIS Permissible limits						6.50 to 8.50	<750 = Good 750–1500 = Safe 1500-2250= permissible >3000= US	500 -2000	200 -600	200 -600	250 -1000	1.0 -1.5	10 -16	200 -400	No guide lines	No guide lines	75 -200	30 -100	200 -600	0-10 = Excellent 10-18 = Good 18-27 = Doubtful		0–1.25 (PS) 1.26–2.50 = MR 2.5 above = US	
1	2	3				4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	541	Surya nagar Colony, Uppal	Uppal	17.397033	78.561148	6.93	1454	931	0	370	160	0.51	11.50	80	160	22	64	49	360	3.66	C3S1	0.20	PS
2	542	Lakshmi Narsimha Colony, Nagole	Uppal	17.386553	78.569368	7.07	1564	1001	0	400	160	0.68	12.50	100	208	29	72	29	300	5.23	C3S1	2.00	MR
3	543	Peerza diguda	Ghatkesar	17.386873	78.601818	7.12	1408	901	0	320	170	0.74	17.50	72	176	22	72	29	300	4.42	C4S2	0.40	PS
4	544	Parvath apuram	Ghatkesar	17.385027	78.617118	7.26	1518	972	0	361	160	0.87	12.50	115	164	23	88	39	380	3.67	C3S1	-0.37	PS
5	545	R-Krishnaiah Nagar	Hayathnagar	17.384577	78.621823	7.17	2352	1505	0	430	300	0.92	23.00	220	269	97	120	44	480	5.33	C4S2	-1.00	PS
6	546	Marripally	Hayathnagar	17.385027	78.665836	7.10	1450	928	0	330	170	0.78	21.00	70	176	23	120	5	320	4.28	C3S1	0.20	PS
7	547	Kotlapur	Hayathnagar	17.379434	78.663778	7.20	1437	920	0	348	160	0.78	17.50	72	165	21	48	53	340	3.89	C3S2	0.17	PS
8	548	Muthyala guda	Ghatkesar	17.380696	78.667198	7.14	1314	841	0	267	200	0.80	5.95	77	136	22	72	39	340	3.21	C4S2	-1.46	PS
9	549	Thimmai guda	Ghatkesar	17.380112	78.668041	7.31	1290	826	0	247	210	0.91	4.30	77	142	18	96	19	320	3.45	C3S2	-1.46	PS
10	550	Pratap Singaram	Ghatkesar	17.392481	78.655351	7.35	1330	851	0	240	190	1.02	19.30	78	141	20	88	29	340	3.32	C4S4	-1.99	PS

Table 1. Chemical Analysis of water samples collected from Musi River

Sl No	Lab No	Type of Pump	Location	pH at 30°C	Sp Conduc tance at 25°C mic.siecm	TDS (mg/lit)	Co3-	HCO3	Cl	F	No3	So4	Na	K	Ca	Mg	TH as CaCO3 (mg/lit	SAR	Classi -fication	RSC (meq/L)	Classi -fication
							mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l					
BIS Permissible limits				6.50 to 8.50	<750 = Good 750–1500 = Safe 1500-2250= permissible >3000= US	500 -2000	200 -600	200 -600	250 -1000	1.0 -1.5	10 -16	200 -400	No guide lines	No guide lines	75 -200	30 -100	200 -600	0-10 = Excellent 10-18 = Good 18-27 = Doubtful		0–1.25 (PS) 1.26–2.50 = MR 2.5 above = US	
1	2	3		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	551	Bore Hole Hand Pump	Gouda Sangam, Uppal	7.93	2410	1542	0	282	400	1.43	9.56	300	310	3	136	49	540	5.80	C4S1	-5.15	PS
2	552	Sub merged Bore Pump	Near by House	7.67	1057	676	0	131	160	0.99	11.65	120	124	4	96	5	260	3.34	C3S1	-2.58	PS
3	553	Sub merged Bore Pump	Near by House	7.68	2220	1421	0	318	370	1.30	18.40	186	238	4	88	92	600	4.22	C4S2	-5.64	PS
4	554	Sub merged Bore Pump	Near by House	7.51	1104	707	0	227	160	1.02	5.98	70	53	2	136	24	440	1.10	C3S1	-4.27	PS
5	555	Sub merged Bore Pump	Near by House	8.19	88	56	0	12	10	0.06	2.33	9	2	1	8	5	40	0.11	C4S2	-0.56	PS
6	556	Sub merged Bore Pump	Near by House	7.86	2490	1594	0	207	540	0.43	31.55	145	126	3	272	73	980	1.75	C3S1	-15.45	PS
7	557	Sub merged Bore Pump	Near by House	7.87	1762	1128	0	219	320	0.52	17.00	136	187	2	120	44	480	3071	C3S2	-5.23	PS
8	558	Sub merged Bore Pump	Near by House	7.76	1291	826	0	176	190	0.80	24.00	105	114	3	96	39	400	2049	C4S2	-4.48	PS
9	559	Sub merged Bore Pump	Near by House	7.48	1789	1145	0	162	300	0.56	35.40	167	93	2	200	49	700	1052	C3S2	-10.76	PS
10	560	Sub merged Bore Pump	Near by House	7.62	1212	776	0	209	160	0.88	17.20	100	105	3	104	29	380	2034	C4S4	-3.42	PS

Table 2. Chemical Analysis of Water Samples Collected from Bore Wells

problems on shrinking and swelling types of clayey soils (Saleh, et al. 1999) [6].

Both the Musi River water samples and Bore Well water samples are plotted in US Salinity Diagram and concluded that all the water samples are belonging to C3-S1 class which is marked as high specific conductance area.

The study area is witnessed by a number of industries which in turn releasing effluents on large quantities of untreated domestic sewage into the Musi River. Sewage disposal had a mixed impact on downstream of Musi. Poor water quality especially Nitrates had a negative impact on human beings/agriculture possibly crop productivity, though increased reliability and availability of Musi irrigation water also had a positive impact on local livelihoods [5]. For most of the farmers, agriculture is their sole livelihood to ban the use of Musi River for irrigation that would be highly undesirable. The eventual aim should be the treatment of wastewater before it is used in agriculture around the banks of Musi. However, in the mean time additional health protection measures like regular treatment programmes with anthelmintic medication and improvements in local water supply and sanitation should be implemented. The natural remediation efficiency of the river system aided by the construction of irrigation infrastructure, particularly weirs, was high and comparable to the treatment efficiency of a well designed waste stabilization pond system. Hyderabad municipal council intends to invest large amount of money into wastewater treatment technology. The processes currently taking place in the Musi River could be taken into consideration before large scale investments are undertaken in wastewater treatment technology in Hyderabad, as complementary technology could save money and land in the city.

It has been found that the pollution has been given rise four major problems namely, pollution of drinking and irrigation water, large incidence of diseases like diarrheic, skin allergies, malaria, eye diseases, pediatric problems diseases etc suffered by the people in and around the study area, and impact on the live stock and cropping pattern in some of the villages. Studies conducted by a team members of IV year students, Dept of Civil Engg NNRG, Hyderabad have concluded that the water is highly polluted with Nitrates and the presence of a few parameters such as BOD, COD, TDS, Nitrates, phosphors, Total Hardness, PH, chloride, etc in some of the villages have forced people to buy water from outside, resulting extra burden on their family budget. Fish population has disappeared in Prathap Singaram is notable worthy point. The Musi water where it is available and abundant highly polluted and found that the paddy, vegetables grown in the area is also highly contaminated. The water quality for non-farm activities are also adversely affected because of pollution. In addition, milk production is also affected from the cattle population. At the same time it is equally important initiative urgent measures in the study area for providing relief to the victims of pollution. At the village level itself it is necessary to identify the sources of pollution and provide remedial measures. It is necessary to give top priority provision of safe, drinking water and improving the medical facilities for the affected people. Similarly measures have to initiative macro and micro level to improve the soil conditions, the quality of irrigation and drinking water provide for growth of lively hood in the non-farming sectors like poultry, dairy at village level industries.

Conclusion and Recommendation

Water pollution can cause great harm and hence it should be prevented or reduce it as far as possible. 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 run-off from agricultural land.

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