CHEMICAL POLLUTION ASSEMENTS OF MUSI RIVER WITH SEASONAL VARIATION – 5 YEARS STUDY

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Abstract:
Most of the industrialization in India was at the banks of rivers to fulfil its water needs for companies. MUSI river was not exceptional among that, most of urban industrialization at river banks, such that risk assessment's needed for the level of contamination in river water which effects soil and agricultural also. The

Key words: Chemical additions, quality assessment, recent survey.

1.0 Introduction

The study area is in hard rock terrain where groundwater is available under water table conditions. Water table fluctuates in an undulating fashion generally following the topography. Open wells are dug to weathered rock, and tube wells penetrate the fractured portion in which water is under semi-confined conditions There seems to be a connection between weathered layers and fractured. Risk Assessment Studies of the Musi River layers, as it was observed that whenever over-pumping through tube wells occurs, near-by dug wells become dry. The water table is situated in the weathered zone and the fractured zone with greater thickness. The aquifers have greater thickness on the left bank, therefore in general the left bank is more susceptible to ground water pollution. In addition, the right side is underlain by both fractured rock and solid basement.

2.0 Objectives:

1. To study the hydro geochemistry trends.
2. To study the heavy metals in musi command area.
3. To analyze the musi river water during pre and post monsoon period.

3.0 Literature review

The various on hydrogeochemistry of water quality have been carried out by various members. Laluraj et al.(2005) have been studied ground water chemistry of shallow aquifers in the costal zones of Cochin and concluded the ground water present in the shallow aquifers of some of the stations were poor in quality and beyond the potable limit as per the standard by World Health Organization (2004). Rapid increase of urbanization and industrialization leads to deterioration in hydrogeochemistry of ground water quality. Srinivas et al. (2000) and Jha and Verma (2000) have reported the degradation of the water quality in Hyderabad and Bihar, Respectively, Patnaik et al (2002) have studied water pollution generated from major industries similarly, waste pollutants or effluents. Discharged into streams may enter the aquifer body downstream. This also affects the ground water geochemistry. The studies on trace metals have been carried out (Jangir et al. 1990; Sharma et

al.)Sharma et al (2004) Singh and Chandel (2003, 2006) pollution problems in ground water and industrial waste water have been studied.

Materials and Methods:

Water drawn from the bore well, initially 5 minutes was discarded and sample bottles were filled to the brim under overflowing conditions. The purpose of the triplicate samples is to ensure the precision of samples and analysis. All groundwater samples were collected at a depth of 10–24m immediately after sampling, nitric acid (1.0 mg/L) was added to all the samples as a preservative.

A few samples were collected in duplicate for reconfirmation of the results and also for validation of the results and to know the instrument efficiency. The accuracy of the chemical analysis was verified by calculating ion –balance errors. The Chemical analysis results of water samples were further subjected to statistical analysis and Minimum, Maximum, Average and Quintile percentages are given in Table Based on the Cation and Anion percentage, the ground water in the study area is categorized as "Na-Ca and HCO_3-CI-SO_4'' in the order of dominance for the all sampling periods.

5.0 Results and Dicussion:

TABLE: 7.10-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN PRE MONSOON 2015

Pre Monsoon 2015						
	Min	Max	Avg	Q25	Q50	Q80
TDS	190	1709	717.8	465.5	638	1273.5
Na	10	387	106.1	55.3	90	198
K	3	60	6.43	5	5	8.5
Ca	16	216	69.4	48	64	112
Mg	5	107	37.05	19	29	73
HCO3	61	527	251.7	181.3	245	398.5
Cl	10	570	121.7	50	90	260
SO4	11	270	68.6	34	54	135
NO3	0.15	70	12.6	4.71	9.53	24
F	0.34	4.06	1.676	1.22	1.635	2.58

TABLE: 7.11-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Post Monsoon 2015						
	Min	Max	Avg	Q25	Q50	Q80
TDS	180	3238	765.6	496.5	672	1267
Na	16	833	113.2	72.5	93	177.6
K	4	26	6.6	5	5	9.4
Ca	7	336	72.8	34	64	131.2
Mg	0	192	45.1	19	39	87.4
HCO3	30	560	241.4	192	245	340
Cl	10	1110	146.6	70	100	300
SO4	6	318	78.6	44	61	147.4
NO3	0.1	92	16	6.75	11	31.7
F	0.22	2.72	0.9	0.515	0.83	1.53

TABLE: 7.12-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

PRE MONSOON 2016						
	Min	Max	Avg	Q25	Q50	Q80
TDS	162	2055	573.9	407.3	547.5	1206.2
Na	18	339	98.9	56	84.5	182.3
K	6	32	6.47	5	6	8.1
Ca	8	392	70.6	32	64	120.8
Mg	5	112	32.4	10	24	78
HCO3	36	477	221.3	140.5	224.5	360.3
Cl	10	780	126.6	50	88	251.9
SO4	10	288	71	36.25	55.5	152.5

NO3	0.2	383	37.7	8.41	26	69.1
F	0.28	2.55	1.028	0.645	0.97	1.655

TABLE: 7.13-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN POST MONSOON 2016

Post Monsoon 2016						
	Min	Max	Avg	Q25	Q50	Q80
TDS	209	1853	715.3	495	603	1162.4
Na	10	331	96.3	58.5	87	168.4
K	5	27	6.8	5	6	9.9
Ca	24	320	85.6	56	72	136
Mg	0	136	32.25	15	29	58
HCO3	66	515	257.7	203.8	253.5	364.9
Cl	5	530	106.3	5.75	80	219
SO4	7	377	70	38	60	130.6
NO3	0.25	104	17.3	6.44	10.5	44.95
F	0.23	2.44	1.013	0.633	0.915	1.8

TABLE: 7.14-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Pre Monsoon 2017						
	Min	Max	Avg	Q25	Q50	Q80
TDS	237	1805	695.1	465	637	1137
Na	3	383	109.3	58	92	215.6
K	4	26	6.71	5	6	6
Ca	16	240	79	48	72	136
Mg	0	73	27.54	15	24	49

HCO3	50	500	231.7	159.3	230	360.6
Cl	10	660	126.1	60	100	230
SO4	3	445	64.2	31	51	123.6
NO3	0.1	95	14.38	3.6	9.2	35.7
F	0	3	1.052	0.73	1	1.852

TABLE: 7.15-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Post Monsoon 2017						
	Min	Max	Avg	Q25	Q50	Q80
TDS	232	1850	655.9	458	568	1062.8
Na	27	355	100	63	93	146
K	1	13	3	2	2	4
Ca	24	264	66.2	32	64	115.2
Mg	10	78	31.86	19	29	55
HCO3	90	515	187.9	130	156	276
Cl	20	430	126.6	70	110	208
SO4	14	530	76.7	37	57	120.4
NO3	0.4	70	10.53	2.425	7.28	17.74
F	0.16	2.1	0.884	0.5	0.73	1.62

TABLE: 7.16-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Pre Monsoon 2018						
	Min	Max	Avg	Q25	Q50	Q80
TDS	180	1722	654.7	474	623	1003.2

Na	14	368	90.2	54.3	78.5	147.4
K	1	28	4.67	2	3	10.1
Ca	8	176	67.2	40	72	104
Mg	0	209	35.65	19	34	63
HCO3	26	440	192.8	138.5	183	284.4
Cl	10	620	127.3	70	110	220
SO4	1.7	440	70	39.25	60	120.1
NO3	0.15	66.5	11.64	4.525	9.58	26.05
F	0.21	2.6	0.898	0.51	0.84	1.51

TABLE: 7.17 -STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Post Monsoon 2018						
	Min	Max	Avg	Q25	Q50	Q80
TDS	236	2672	819.6	540	774	1122.4
Na	19	259	102	57	105	149.6
K	0	10	2.76	2	2	4.6
Ca	32	520	108.8	64	96	168
Mg	10	122	36.4	19	29	61
HCO3	90	475	278.5	216	282	378.2
Cl	20	1100	153.2	60	110	212
SO4	10	370	90.6	45	70	151

NO3	0.41	26	11	3.48	10.1	24.15
F						

TABLE: 7.18-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Pre Monsoon 2019						
	Min	Ma	Avg	Q25	Q50	Q80
TDS	254	1810	701.1	467	637	1137
Na	3	376	110.3	68	92	205.6
K	4	26	6.71	5	6	6
Ca	16	270	79	58	72	236
Mg	0	63	26.54	15	1	59
HCO3	6	500	241.7	179.3	230	370.6
Cl	10	650	126.1	50	100	240
SO4	3	446	64.2	31	51	123.6
NO3	0.1	95	14.38	3.6	9.2	35.7
F	0	3	1.042	0.63	1	1.832

TABLE: 7.19-STATISTICAL ANALYSIS OF CHEMICAL PARAMETERS MUSI RIVER BASIN

Post Monsoon 2019						
	Min	Max	Avg	Q25	Q50	Q80
TDS	180	3138	775.6	486.5	662	1257
Na	15	873	113.2	71.5	83	167.6
K	4	26	6.6	5	5	9.4
Ca	7	236	62.8	24	64	121.2

Mg	0	182	45.1	19	79	87.4
HCO3	30	570	261.4	182	245	330
Cl	11	1120	146.6	75	100	330
SO4	6	328	78.6	45	61	147.4
NO3	0.1	82	26	6.75	11	41.7
F	0.22	2.62	0.9	0.615	0.83	1.53

7.9 Correlation Matrix

Correlation analysis is a bivariate method that describes the degree of relationship between two variables. For this purpose, Spearman's rank correlation coefficient has been calculated using quality parameters of ground water samples of the study area presented in Table. The correlation coefficient value will always be between -1.0 and +1.0 a positive value corresponds to an increasing and negative value corresponds to a decreasing monotonic trend between wo water quality parameters. A high correlation coefficient (near 1 or -1) means a good relationship between two variables and its value around zero means no relationship between them.

Table 7.20: Correlation coefficient matrix of chemical data MUSI river basin 2015-2019

Correlation coefficient Matrix of chemical data Musi River Basin									
Pre monsoon 2015									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.44	-0.12	0.31	0.69	0.66	0.7	0.72	0.14
Mg		1	0.09	0.67	0.77	0.32	0.66	0.83	0.28
K			1	0.17	0.1	0.08	-0.13	-0.14	-21
HCO3				1	0.54	0.2	0.42	0.7	0.43
Cl					1	0.39	0.81	0.94	0.2
NO3						1	0.63	0.55	0.12
SO4							1	0.86	0.18
TDS								1	0.34
F									1

Table 7.21 -Correlation coefficient matrix of chemical data MUSI river basin Post monsoon 2015

Post monsoon 2015									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.08	-0.04	0.1	0.58	0.53	0.65	0.61	-0.26
Mg		1	0.05	0.43	0.5	0.36	47	0.59	0.05
K			1	0.1	0.07	0.02	0.1	0.09	-0.11
HCO3				1	0.3	0.09	0.28	0.53	0.15
Cl					1	0.3	0.88	0.94	-0.12
NO3						1	0.47	0.48	-0.13
SO4							1	0.91	-0.15
TDS								1	-0.07
F									1

Table: 7.22 Correlation coefficient matrix of chemical data musi river basin pre monsoon 2016

Pre monsoon 2016									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.043	0	0.25	0.76	0.64	0.67	0.75	-0.06
Mg		1	0.12	0.5	0.77	0.4	0.72	0.84	0.05
K			1	0.08	0.08	0.04	0.08	0.1	-0.07
HCO3				1	0.28	0.25	0.31	0.54	0.26
Cl					1	0.43	0.84	0.93	0.03
NO3						1	0.57	0.58	0.02
SO4							1	0.89	0.05
TDS								1	0.07
F									1

Table: 7.23-Correlation coefficient matrix of chemical data musi river basin post monsoon 2016

Post monsoon 2016									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.08	-0.04	0.1	0.58	0.53	0.65	0.61	-0.26

Mg		1	0.05	0.43	0.5	0.36	47	0.59	0.05
K			1	0.1	0.07	0.02	0.1	0.09	-0.11
HCO3				1	0.3	0.09	0.28	0.53	0.15
Cl					1	0.3	0.88	0.94	-0.12
NO3						1	0.47	0.48	-0.13
SO4							1	0.91	-0.15
TDS								1	-0.07
F									1

Table: 7.24-Correlation coefficient matrix of chemical data musi river basin pre monsoon 2017

Pre monsoon 2017									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.06	0.04	0.24	0.59	0.57	0.6	0.72	-0.1
Mg		1	0.1	0.29	0.56	0.2	0.34	0.53	0.18
K			1	0.16	0.22	-0.07	0.25	0.23	-0.11
HCO3				1	0.25	-0.12	0.07	0.49	0.01
Cl					1	0.4	0.57	0.87	0.06
NO3						1	0.41	0.51	0.06
SO4							1	0.77	0.04
TDS								1	0.07
F									1

Table: 7.25-Correlation coefficient matrix of chemical data MUSI river basin post monsoon 2017

Post monsoon 2017									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.56	0.13	0.27	0.75	0.32	0.79	0.81	-0.15
Mg		1	0.3	-0.1	0.83	0.39	0.55	0.7	-0.38
K			1	0.17	0.33	0.19	0.11	0.35	-0.12
HCO3				1	0.22	-0.09	0.17	0.51	0.13
Cl					1	0.26	0.78	0.92	-0.22
NO3						1	0.01	0.28	-0.05

SO4							1	0.8	-0.17
TDS								1	-0.14
F									1

Table: 7.26- Correlation coefficient matrix of chemical data musi river basin pre monsoon 2018

Pre monsoon 2018									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.13	0.07	0.32	0.33	0.51	0.45	0.45	-0.07
Mg		1	0.12	0.32	0.8	0.31	0.62	0.8	0.07
K			1	0.08	0.14	0.13	0.21	0.2	0.02
HCO3				1	0.32	0.24	0.13	0.57	0.18
Cl					1	0.25	0.68	0.92	0.12
NO3						1	0.19	0.43	-0.05
SO4							1	0.72	0.01
TDS								1	0.15
F									1

Table: 7.27- Correlation coefficient matrix of chemical data musi river basin post monsoon 2018

Post monsoon 2018									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.77	0.74	-0.19	0.95	0.24	0.88	0.92	-
Mg		1	0.55	0.05	0.85	0.35	0.69	0.87	-
K			1	-0.26	0.8	0.17	0.56	0.72	-
HCO3				1	-0.2	0.19	-0.08	0.1	-
Cl					1	0.18	0.83	0.95	-
NO3						1	0.21	0.32	-
SO4							1	0.88	-
TDS								1	-
F									-

Table: 7.28- Correlation coefficient matrix of chemical data MUSI river basin pre monsoon 2019

Pre monsoon 2019

	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.043	0	0.24	0.75	0.63	0.66	0.74	-0.06
Mg		1	0.12	0.5	0.76	0.4	0.72	0.83	0.05
K			1	0.08	0.08	0.04	0.08	0.1	-0.08
HCO3				1	0.28	0.25	0.32	0.53	0.29
Cl					1	0.43	0.83	0.92	0.03
NO3						1	0.56	0.59	0.02
SO4							1	0.89	0.04
TDS								1	0.06
F									1

Table: 7.29 -Correlation coefficient matrix of chemical data musi river basin post monsoon 2019

Post monsoon 2019									
	Ca	Mg	K	HCO3	CI	NO3	SO4	TDS	F
Ca	1	0.44	0	0.23	0.68	0.67	0.78	0.78	-0.11
Mg		1	0.12	0.48	0.66	0.45	0.55	0.82	0.14
K			1	0.001	-0.05	0.1	0.02	-0.03	-0.17
HCO3				1	0.35	0.11	0.26	0.57	0.27
Cl					1	0.54	0.86	0.93	-0.02
NO3						1	0.5	0.65	-0.02
SO4							1	0.86	0
TDS								1	0.007
F									1

TABLE: 7.30 - AVERAGE VALUES (MG/L EXCEPT PH) OF CHEMICAL PARAMETERS DURING STUDY PERIOD.

	Pre monsoon 2015	Post monsoon 2015	Pre monsoon 2016	Post monsoon 2016	Pre monsoon 2017	Post monsoon 2017	Pre monsoon2018	Post monsoon2018	Pre monsoon 2019	Post monsoon 2019
pH	8	7.89	7.89	8	7.74	8.19	8.07	7.87	8.06	7.88
TDS	717.8	765.6	673.9	715.3	695.1	655.9	654.7	660.5	662.64	61.56
Na	106.1	113.2	98.9	96.3	109.3	100	90.2	89.5	87.88	85.63
K	6.43	6.6	6.47	6.8	6.71	3	4.67	5.9	5.8	4.97
Ca	69.4	72.8	70.6	85.6	79	66.2	67.2	55.89	56.9	47.78
Mg	37.05	45.1	32.4	32.25	27.54	31.86	35.65	32.66	33.64	31.76
Cl	121.7	146.6	126.6	106.3	126.1	126.6	127.3	100.1	128.98	121.54
SO4	68.6	78.6	71	70	64.2	76.7	70	60.88	62.89	61.65
HCO3	251.7	241.4	221.3	257.7	231.7	187.9	192.8	176.77	188.76	178.66
NO3asN	12..6	16	37.7	17.3	14.38	10.53	11.64	8.9	8.12	7.65
F	1.676	0.9	1.028	1.013	1.052	0.884	0.898	0.666	9.65	8.76

6.0 Conclusions

Understanding the groundwater quality is very important as it is the major factor determining its suitability for domestic, agricultural and industrial purposes. The data revealed that there were considerable variations in the examined sample from different sources with respect to their chemical characteristics. Elevated TDS concentration > 1000 mg/l could be clearly seen in the watershed during the study period. This may be due to leaching of solid waste in the industrial area and also disposal of effluent and its interaction with ground water. In 2018, TDS in post-monsoon is less than the pre-monsoon due to good rain fall. The analysis from most of the Data sets is TDS is highly correlated with CI, So_4 and Mg. Chloride concentration >250 mg/l was also reported in downstream, Shake pet, Uppal and adjacent to areas. Sulphate (SO_4) concentration was reported elevated and confined to industrial areas of MUSI during the study period. The Nitrate as Nitrogen was exceeding 10 mg/l indicates impact of urban solid waste disposal practices; also indicate maturity of urbanization in the respective areas and its non-scientific sewerage disposal practices.

6.0 References

1. *Nair, A., Abdalla, G., Mehmed, I., & Premkumar, K. (2005). Physicochemical parameters and correlation coefficient of ground waters of north-east Libiya. Pollution Research, 24(1), 1–6.*

2. Sunitha, V., Sudarshan, V., & Rajeshwara Reddy, B. (2005). Hydrochemistry of groundwater, Gooty area, Anantpur district, Andhra Pradesh, India. Pollution Research, 24(1), 217–244.

3. *Ensink JHJ, Blumenthal UJ, Brooker S (2008) Wastewater quality and the risk of intestinal nematode infection in sewage farming in Hyderabad, India. Am J Trop Med Hyg 79(4):561–567*

4. Yoon CG, Kwun SK, Ham JH (2001) Effects of treated sewage irrigation on paddy rice culture and its soil. Irrig and Drain 50:227–236

5. Kumar RM (2003) Financing of wastewater treatment projects. Infrastructure development finance corporation and confederation of Indian industries. Water Summit 2003

6. Kurien V (2004) India's milk revolution - Investing in rural producer organizations. The World Bank, Gujarat Lakshminaruyana JS,

7. Otaki M, Okuda A, Tajima K, Iwasaki T, Kinoshita S, Ohgaki S (2003) Inactivation differences of microorganisms by low pressure UV and pulsed xenon lamps. Wat Sci Tech 47:185–190