Effect of Sewage Farming On Ground Water Quality in Latur City

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Abstract – Sewage farming is truly basic in India since start of the most recent century; the use of sewage water for irrigation system has been perceived in India because of intense lack of fresh water for irrigation system. The study area chose is being utilized sewage water for irrigation system from long time because of deficiency of Fresh water for irrigation system.

The study was done to research the impacts of sewage farming on ground water were investigated different parameters of ground water and sewage water . The samples of ground water and sewage water gathered from individual study region, The gathered ground water were analyzed for parameters like pH, Hardness, sulphate, TDS, phosphate,BOD,COD,DO,EC.The results investigated by Correlation and Regressions, have been utilized to establish relation between sewage farming and ground water quality.. The investigation uncovers that the groundwater quality status of the study region is poor, and it needs to be protected from the dangers of contamination by giving certain level of treatment to sewage water before irrigation use.

Index Terms – Sewage farming, Groundwater, Water quality standards, Water quality characteristics, Correlation co-efficient, Regression analysis.

1. INTRODUCTION

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities. Among the various environmental challenges of that India is facing this century, fresh water scarcity. The population increase has not only increased the fresh water demand but also increased the huge volume of wastewater generated. The volume of wastewater generated by domestic, industrial, and commercial Sources have increased with population, urbanization, improved living conditions, and economic development.

The use of untreated sewage water in agriculture is a growing practice in many parts of the world. It is being looked upon as a valuable and reliable resource in water scarce communities. Wastewater is usually rich in nutrients and the use results in high yields without the need for artificial fertilizers. But with the use of untreated wastewater follows a number of associated ground water pollution risks.

It has been reported that irrigation with sewage or sewage mixed with industrial effluents results in saving of fertilizer and leads to higher crop productivity, over the normal water irrigation. but sewage water carries toxic waste so direct use of sewage water for irrigation have negative impacts on ground water, therefore there is need to investigate impacts of sewage farming on ground water .

The objectives of this study was to determine effect of sewage farming on ground water quality and to discuss the suitability of ground water for human consumption based on computed ground water characteristics, quality assessment through correlation and regression analysis.

2. MATERIALS AND METHODS

Description of study area

Latur city is situated 636 meters above the mean sea level. The Latur city is located in Marathwada region of Mahrashtra state and location between 18° 24′ 0″ N, 76° 33′ 36″ E.

Methodology:

The analysis was carried out for 22 different ground water and sewage water samples for following parameters -pH, Hardness, sulphate, TDS, phosphate, BOD,COD,DO,EC

Co-efficient of Correlation (r)

The mathematical models used to estimate water quality require two parameters to describe the realistic groundwater situation. Correlation analysis measures the closeness of the relationship between chosen independent and dependent variables. This analysis attempts to establish the nature of the relationship between the variables and there by provides a mechanism for prediction of forecasting. The relationship of water quality Parameters on each other in the data of water analyzer was determined by calculating correlation co-efficient

'r', by using the following formula.

$$r = \frac{n \Sigma (xiyi)-(\Sigma xi).(\Sigma yi)}{\sqrt{[\, n\Sigma xi^2 - (\Sigma xi)^2 \,][\, n \Sigma yi^2 - (\Sigma yi)^2 \,]}} \quad (1)$$

Where, x (x=values of x-variable) and y (y=values of y-variable) represents two different water quality parameters.

n=number of data points.

3. RESULTS AND DISCUSSION

Correlation is the mutual relationship between two variables. Direct correlation exists when increase or decrease in the value of one parameter is associated with a corresponding increase or decrease in the value of other parameter. In this study, the numerical values of correlation coefficient , R for the nine ground water quality parameter are analyzed and it is found that the there is strong correlation between pH of Ground Water and pH of Sewage water (r = .930 i.e. there is more than 92 % association),

TH of Ground water &TH of Sewage water (r = 0.9977), TDS of Ground water &TH of Sewage water (r = 0.9297), TDS of Ground water &TDS of Sewage water (r = 0.97), TH of Ground water &PO4 of Sewage water (r= 0.83) ,

BOD of Ground water &COD of Sewage water (r= .88), COD of Ground water &COD of Sewage water (r= .88) ,

DO of Ground water &DO of Sewage water (r = 0.90) , and also some week correlation were observed.

Table 1:-Characteristics of Ground Water

PH	**TH**	**TDS**	**SO4**	**P04**	**BOD**	**COD**	**DO**	**EC**
8.14	640	1754	118.6	0.51	10.86	22	5.73	1.01
7.38	494	1492	31.7	0.24	14.80	30	5.72	1.65
7	888	1948	103.3	0.21	17.77	36	5.71	0.87
7.07	524	1508	83.4	0.25	8.88	18	5.52	1.03
7.09	674	1492	40.6	0.22	11.84	24	5.55	0.95
7.1	678	1726	79.68	0.3	16.78	34	5.56	0.48
8.12	590	1502	69.38	0.26	15.79	32	5.32	0.5
7.05	788	2006	92.51	0.35	19.74	40	5.54	1.01
7.07	760	1934	89.2	0.34	18.75	38	5.78	0.93
7.4	850	2164	99.7	0.38	20.73	42	5.76	1.35
7.39	840	2138	98.53	0.37	17.77	36	5.85	0.65
7.36	650	1655	76.38	0.29	10.86	22	5.73	0.95
7.38	690	1756	81.04	0.31	8.88	18	5.83	1.33
7.09	760	1934	89.2	0.34	9.87	20	5.66	1.09
7.07	730	1858	85.7	0.32	12.83	26	5.42	1.1
7.12	770	1960	90.37	0.34	14.80	30	5.83	0.9
8.14	820	2087	96.2	0.36	15.79	32	5.84	0.63
7.32	860	2189	100.86	0.38	17.77	36	5.23	0.71
7.28	826	2102	96.97	0.37	11.84	24	5.74	1.33
7.15	724	1843	84.93	0.32	10.86	22	5.72	1.01
7.14	636	1619	74.63	0.28	7.90	16	5.64	0.63
7.07	680	1731	79.87	0.3	12.83	26	5.87	0.53

Table 2:-Characteristics of Sewage Water.

PH	TH	TDS	SO4	PO4	BOD	COD	DO	EC
6.67	286	240	177.00	0.61	360	672	0.31	1.90
5.85	238	235	233.00	0.67	435	420	0.73	1.85
6.20	398	245	146.00	0.81	525	582	0.53	1.95
5.89	240	209	114.25	0.65	573	364	0.36	1.96
5.91	309	207	55.62	0.57	364	486	0.38	1.81
5.92	311	240	109.15	0.78	515	688	0.39	0.91
6.77	271	209	95.04	0.68	485	648	0.20	0.95
5.88	361	279	126.73	0.91	606	809	0.38	1.92
5.89	349	269	122.19	0.89	576	769	0.57	1.77
6.17	390	301	136.58	0.99	636	730	0.55	1.57
6.16	385	297	134.97	0.97	545	729	0.62	1.24
6.13	298	230	104.63	0.76	333	445	0.53	1.81
6.15	317	244	111.01	0.81	573	364	0.61	1.53
5.91	349	269	122.19	0.89	303	405	0.47	1.07
5.89	335	258	117.40	0.84	394	526	0.28	1.09
5.93	353	272	123.79	0.89	454	607	0.61	1.71
6.78	376	290	131.78	0.94	485	648	0.61	1.20
6.10	394	304	138.16	0.99	545	729	0.13	1.35
6.07	379	292	132.84	0.97	364	486	0.53	1.53
5.96	332	256	116.34	0.84	333	445	0.52	1.92
5.95	292	225	102.23	0.73	542	324	0.46	1.20
5.89	312	240	109.41	0.78	394	526	0.64	1.01

Table 3:-Correlation Co-efficient of different parameters.

	PH	TH	TDS	SO4	PO4	BOD	COD	DO	EC
PH	**0.93**	-0.14	0.01	0.24	-0.13	-0.06	0.23	-0.15	-0.16
TH	0.08	**1.00**	0.82	-0.07	**0.83**	0.20	0.52	0.05	-0.07
TDS	0.09	**0.93**	**0.97**	0.16	0.93	0.25	0.56	0.09	-0.09
SO4	0.35	0.61	0.59	0.09	0.55	0.19	0.46	-0.17	-0.01
PO4	0.35	0.35	0.61	0.29	0.41	-0.03	0.47	-0.13	-0.04
BOD	0.11	0.55	0.54	0.23	0.51	0.54	**0.88**	0.00	-0.02
COD	0.11	0.55	0.54	0.23	0.51	0.54	**0.88**	0.00	-0.02
DO	-0.01	0.15	0.20	0.21	0.17	-0.09	-0.11	**0.90**	0.19
EC	-0.28	-0.10	0.11	0.49	0.01	-0.10	-0.32	0.32	0.54

Computation of regression line for various parameters

TDS vs TH

Step 1: Find $X \cdot Y$ and $X.X$ as it was done in the table below.

X	Y	X·Y	X·X
1754	286	501644	3076516
1492	238	355096	2226064
1948	398	775304	3794704
1508	240	361920	2274064
1492	309	461028	2226064
1726	311	536786	2979076
1502	271	407042	2256004
2006	361	724166	4024036
1934	349	674966	3740356
2164	390	843960	4682896
2138	385	823130	4571044
1655	298	493190	2739025
1756	317	556652	3083536
1934	349	674966	3740356
1858	335	622430	3452164
1960	353	691880	3841600
2087	376	784712	4355569
2189	394	862466	4791721

2102	379	796658	4418404
1843	332	611876	3396649
1619	292	472748	2621161
1731	312	540072	2996361

Step 2: Find the sum of every column:

$\sum X$=40398, $\sum Y$=7275, $\sum X \cdot Y$=13572692, $\sum X2$=75287370

Step 3: Use the following equations tofind *a* and *b*:

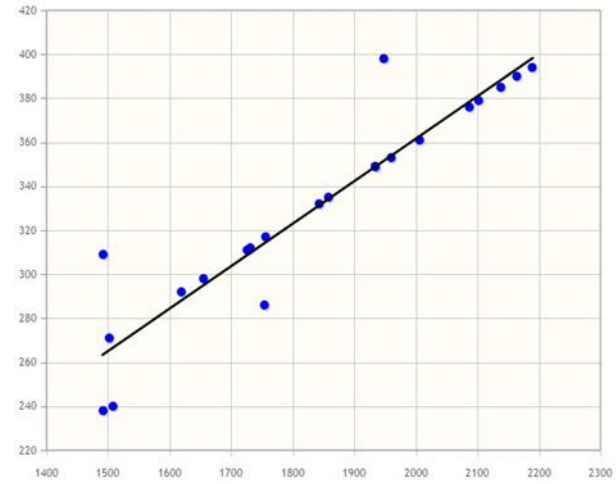
$$a = \frac{\sum Y \cdot \sum X^2 - \sum X \cdot \sum XY}{n \cdot \sum X^2 - (\sum X)^2} = \frac{7275 \cdot 75287370 - 40398 \cdot 13572692}{22 \cdot 75287370 - 40398^2} \approx -24.42$$

$$b = \frac{n \cdot \sum XY - \sum X \cdot \sum Y}{n \cdot \sum X^2 - (\sum X)^2} = \frac{22 \cdot 13572692 - 40398 \cdot 7275}{22 \cdot 75287370 - (40398)^2} \approx 0.193$$

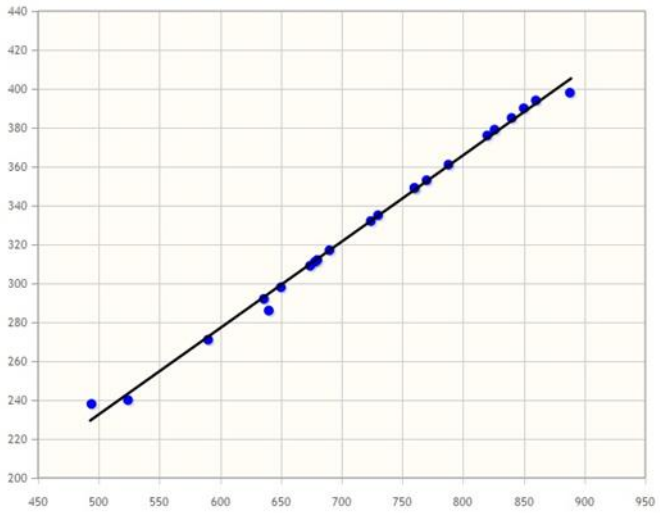
Step 4: Substitute *a* and *b* in regression equation formula

$$y = a + b \cdot x$$

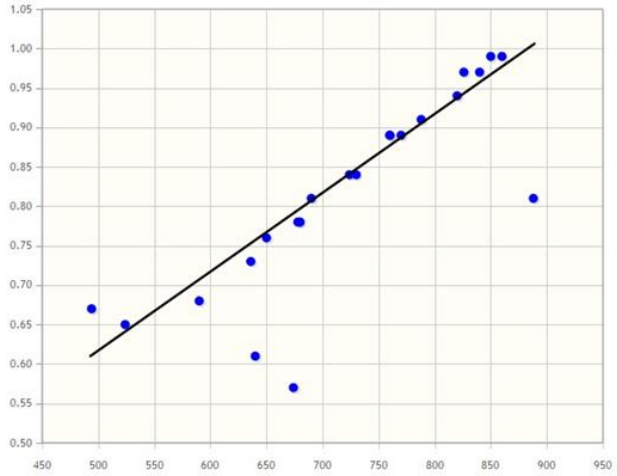
$y = -24.42 + 0.193 \cdot x$



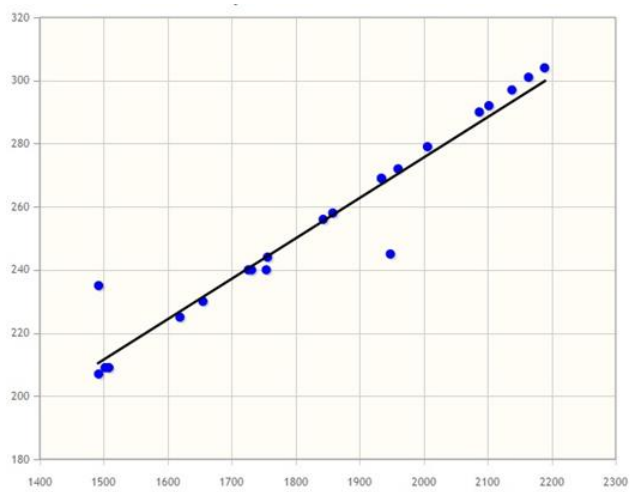
TH VS TH



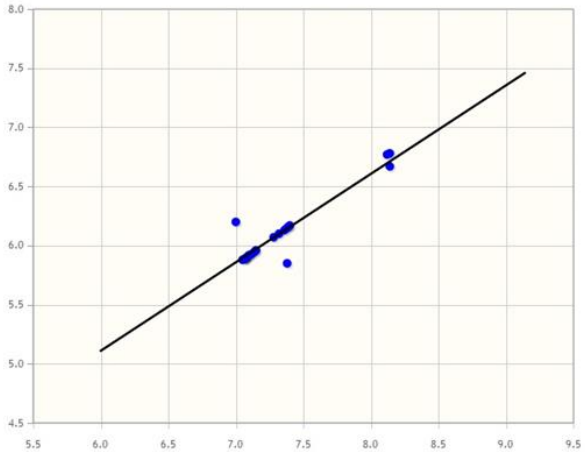
TH VS PO4



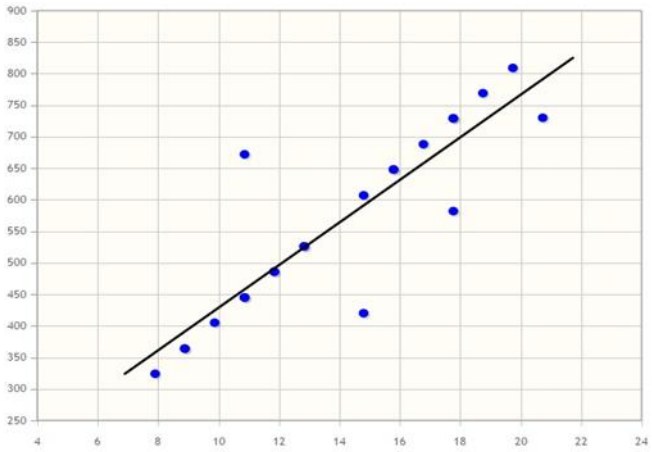
TDS VS TDS



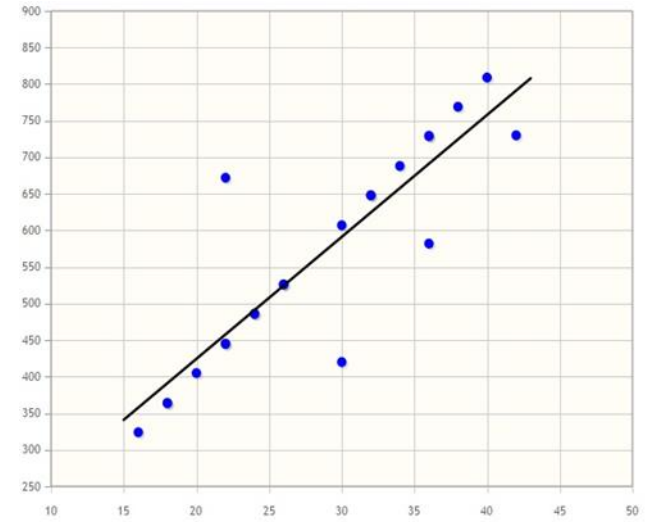
PH VS PH



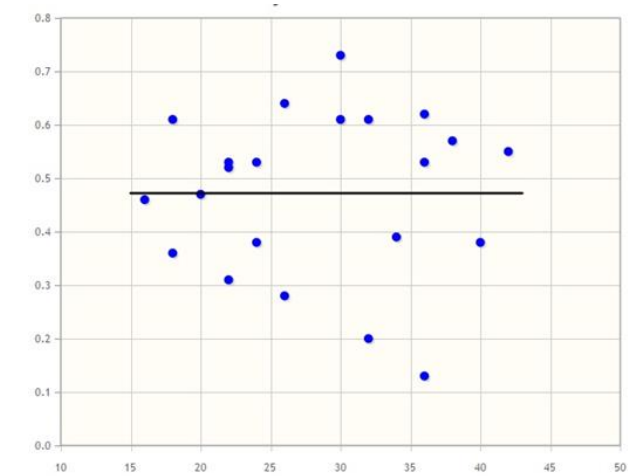
BOD VS COD



COD VS COD



COD VS DO



4. CONCLUSION

In the present study from analysis conclusion have been drawn for Latur City, the sewage farming have effects on ground water quality and Most of the parameters of ground water is not safe for consumption . Study shows that there is possible contamination of groundwater due to percolation of surface sewage water by sewage water irrigation.

In the light of correlation regression study, we can conclude that all the parameters are more or less correlated with each other, especially

Strong correlations observed between of Ground water and pH of Sewage water, TH of Ground water & TH of Sewage water, TDS of Ground water & TH of Sewage water, TDS of Ground water & TDS of Sewage water, TH of Ground water & PO4 of Sewage water, BOD of Ground water & COD of Sewage water, COD of Ground water & COD of Sewage water, and DO of Ground water & DO of Sewage water.

The correlation and regression analysis is very useful to establish relation between sewage farming and ground water quality.

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