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Assessment of ground water quality and river water near different Ghat at Allahabad and kaushambi district Uttar Pradesh, India

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Abstract *–The ground water quality and river water at different ghat at Allahabad district is deteriorating fast test region may be the three most polluted river Ganga, Yamuna, Sarawati. Ganga river pollution, river has been extensively study's with regard to some selected parameters in ten locations at rajapur, mahanduri, rasulabadghat, mahaveerpuri ,shivkutti , govindpuri ,solari ,daragangghat , lawinkala ,Chatkhana . In Allahabad, India.Premsoon and location wise variation of ground water quality and river water near different ghat mainly potential hydrogen(pH),electivity conductivity(EC),total dissolved solid(TDS) , chloride, total hardness, calcium hardness ,Mg hardness ,alkalinity dissolved oxygen ,temperature ,premonsoon during period of 2018 .The study result revealed the highest level of changed in ground water quality and river water near different ghat during premonsoon. The statistical analysis revealed a most of the relationship is a positive correlation between ground water quality and river water near different ghat in different water quality parameters.*

Keywords*-Water quality, Ganga River, Yamuna River, pollution, correlation.*

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I. Introduction

River place important role in integrating and organizing landscapes and shape the geomorphocial setting of basins. Ganga river is subjected to multiple use for irrigation, industrial water supply, bathing, drinking, and industrial effluents it is only nature source for sustaining all forms of life in Allahabad, the chemistry of river water is dictated by supply of various elements from nature and human sources .rain fall plays and important role in changing the water quality of the ganga and Yamuna river. The climate of the Allahabad region is humid subtropical climate type with three defined season's e.g. premonsoon, postmonsoon, monsoon. Annual average temperature in Allahabad usually between 28.3ºC.

River water quality and ground water near the different ghat is the composite several interrelated parameters which are subject to location and pre-monsoon variations and also affected by volume of water flow in ganga river and ,Yamuna river pollution in Allahabad stretch is increasing interest in the Allahabad houses colony the because of their public health impact and water diseases .In order to study the effect of ground water and river water in different ghat at Allahabad continuous monitoring and assessment are required .

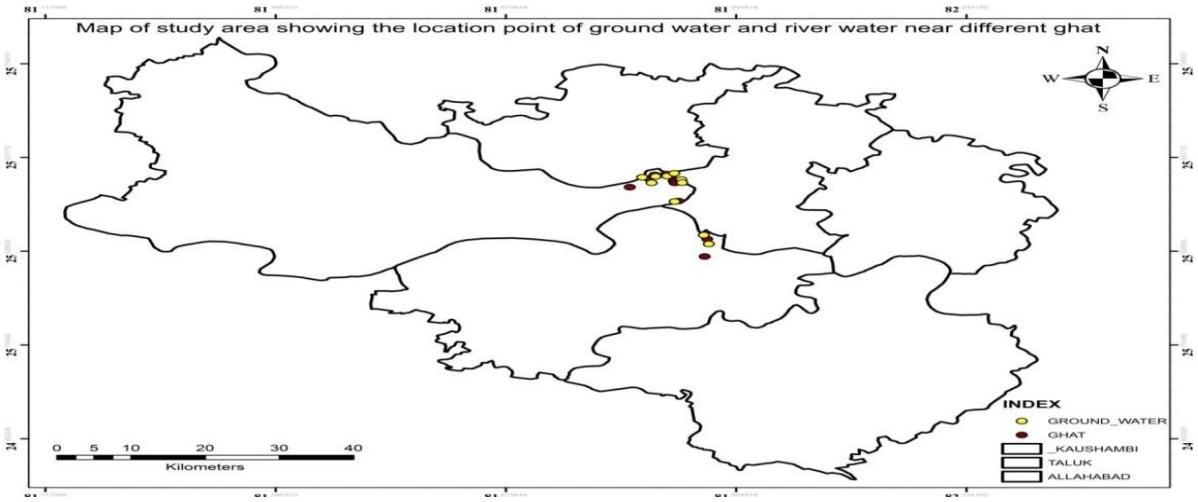
II. Study Area

The Allahabad and kaushambi district is located in the central part of India .my study area lies between 25.15ºN to 82.58º E. Kaushambi which was till resentally a part of North West the northern part of Allahabad district popularly known as Ganga par. The climate of Allahabad and kaushambi district is typical humid subtropical. Allahabad experiences different seasons with climate varying from extreme hot to extreme cold .It has three seasons; hot dry summer, warm humid monsoon and cool dry winter. The rainfall Allahabad and kaushambi district generally decreases from the southeast to the northwest.

SITE	LAT/LONG SURFACE WATER	DISTANCE	LAT /LONG GROUND WATER	DISTANCE
RAJAPUR	25º28'27.32" N , 81º49'32.86"E	11.5 KM	25º29'47.94''N,81º50'27.56''E	11 KM
MENDAORI	25º29'38.56" N ,81º50'55.88" E	13.7 KM	25º29'03.52''N,81º51'08.52'' E	13.2 KM
RASULABAD GHAT	25º30'07.82" N ,81º51'21.96" E	12.8 KM	25º30'9.57'' N,81º51'22.02''E	12.2 KM
MAHAVEERPURI	25º30'14.49" N ,81º52'12.53" E	14.5 KM	25º30'14.49 N, 81º52'12.53'' E	14 KM

SHIVKUTTI	25°30' 01.38"N ,81°52'32.94" E	12.3 KM	25º30’20.43’’N, 81º52’47.11’’E	11.7 KM
GOVINDPURI	25°29' 17.40"N , 81°52'44.67"E	8.5 KM	25º29’28.88’’N, 81º53’17.57’’E	8.0 KM
SOLARI	25°29'02.49"N ,81°52'49.34" E	9.5 KM	25º29’4.66’’ N, 81º53’21.27’’ E	9.0 KM
DARAGANG GHAT	25°26'33.86' N , 81°53'05.02' E	8.5 KM	25º26’33.86’’ N,81º53’05.02’’ E	8.0 KM
LAWYANKALA	25°19'.02" N ,81°55'.06" E	22 KM	25º21’.55.03’’N, 81º54’0.56’’ E	21.5 KM
CHATKHAHNA	25°21'22.63"N ,81°55'10.80" E	23 KM	25º20’43.27’’N, 81º55’18.49’’E	22.5 KM

List of study area location point



Google map of study area with site location point of river water (pink colour) near different Ghat and ground water (Yellow colour).

III. Material Methodology

Parameters	**Chemical**
pH	Buffer solution 4.0, 7.0 9.0 ,potassium chloride , distilled water
Temperature	Mercury thermometer
EC(mmhos/cm)	potassium chloride ,distilled water
Dissolved oxygen (mg/l)	Manganous sulphate solution ,Alkali iodide-azid reagent ,sulphuric acid H2so4 conc. , Starch indicator , stock sodium thiosulphate,standard sodium thiosulphate
Total hardness (mg/l)	Ammonium chloride ,Ammonium hydroxide ,EDTA (Disodium salt of EDTA), Erichrome black T ,Magnesium Sulphate
Calcium Hardness (mg/l)	Ammonium purpurate ,Sodium chloride , sodium hydroxide ,EDTA (disodium salt of EDTA)
MAGNISUM HARDNESS (mg/l)	BY Difference total hardness and calcium hardness
Alkalinity (mg/l)	Standard Sulphuric acid ,phenolphtalein ,Mixed indicator, Bromocresol green , Methyl red
Chloride (mg/l)	Silver nitrate ,phenolphaleinindicatar ,Sodium Chloride , Potassium chromate.

The water sample was collected in plastic bottle from 1 liter and ½ liter .width across the river water and hand pump. at each of 10 locations for physicochemical and metals . All samples were collected from different sampling location and test was conducted in the Environmental Science Laboratory at SHUATS for further Analysis .the Sample was analyzed as per standard method for surface water and ground water at room temperature .First analysis of surface water in Dissolved oxygen . the maximum time period .one parameter was were determined by the temperature in the field of Mercury thermometer used in the analysis .During the present study physicochemical parameter like (pH ,EC ,TDS ,DO, Total hardness ,Calcium hardness ,Magnesium hardness ,Alkalinity ,and Chloride) was analyzed in Environmental laboratory.

Parameter Was Analysis As Per Standard Method Of Water And Waste Water Examine.

	Parameters	Methods
1	Temperature (0c)	Mercury thermometer
2	pH	Digital pH meter
3	EC (mmhos/cm)	Digital Conductivity meter
4	TDS(mg/l)	Digital TDS meter
5	Dissolved Oxygen (mg/l)	Wrinkle's method
6	Biological Oxygen Demand (mg/l)	Wrinkle's method
8	Total Hardness (mg/l)	EDTA Titrimetric
9	Ca.Hardness (mg/l)	EDTA Titrimetric
10	Mg. Hardness(mg/l)	By Difference
11	Total Alkalinity (mg/l)	Titration method (neutralizing with standard H2so4)
12	Chloride (mg/l)	Argentometric method

IV. Result and discussion

The ground water quality and surface water different ghat were applied to enter grant various water quality parameters were respect to as single frame showing a clear image of water quality of Allahabad and kaushambi district. The variations in water quality in post monsoon 2018 was noticeable.

Table 1to table 8 indicates season wise water quality data of the month of March to June which is indicated unsuitable for drinking purposes in the case of all different ghat of Allahabad district it is due to the high concentration of total alkalinity and high total hardness the lowest value of TDS and electric conductivity (EC). There for it can be concluded that the water quality of the different ghat is not expectable for bathing purpose.

The interpretation of data of physicochemical characteristics' of the ground water quality and surface water of different ghat has been made with the help of statistical tool (Table no 9). most of the chemical and biological process to any water body, it regulated temperature average value of air temperature of different ghat and ground water varied between 32ºC to 42ºC during the period of post monsoon. During the study period highest temperature 42ºC was recorded during the June of the 2018 and lowest temperature 32ºC in March during the study area water of different ghat and ground water was mortally alkaline and the value of pH fluctuated between 6.7 to 8.41.During the study pH shows positive correlation with ground water and surface water (r=0.55)

In different ghat TDS value found between 331 to 727.The minimum value was recorded month of2018. The statistical computation indicates EC water temperature, TDS, Chloride, alkalinity is a positive relationship. DO is one of the most stable form of oxygen.

Throw out the study of the dissolved oxygen significant correlation with river water and ground water. In Turn Total hardness provides value on between lowest 2.3 mg/l and highest 12 mg/l .during the present study calcium values ranged between lowest 1.0 mg/l and highest 4.1 mg/l . Ganga and Yamuna river magnesium highest value 4.3 mg/l and lowest 2.8 mg//l and Alkalinity conform most of the face negative correlation with ground water and surface water in Allahabad and kaushambi District.

Present study results clearly revealed that water of different ghat is polluted and should not been drinking, irrigation etc. Therefore ground water quality is better than different ghat and should be drinking irrigation.

SITE/ SURFACE WATER (March)	PH (mg/l)	EC (mg/l)	Chloride (mg/l)	Al (mg/l)	TH (mg/l)	Ca hardness(mg/l)	Mg hardness(mg/l)	DO (mg/l)	Temp (ºC)	TDS (mg/l)
Rajapur	7.75	0.41	1.5	2	2	2	1.6	4.1	33	189.8
Mahanduri	7.66	0.38	1	1.5	1.5	1.3	0.3	3.9	34.4	179.2
Rasulabadghat	7.2	0.44	1.2	1.8	2	2	0.4	3	34.2	196.9
Mahaveerpuri	7.32	0.91	1.2	3	4	2.8	3.2	2.5	29.7	0.338

Shivkutti	8.03	0.41	1	1.5	1.2	2	4.1	4.4	29.7	178.2
Govindpuri	7.58	0.42	0.75	1.7	2	2	2.1	3.4	29.5	179.3
Solari	8.14	0.42	1.4	1.6	1.8	2	2.8	3.7	31.2	172.3
Daragangghat	7.83	0.67	1.2	2.1	2.5	2.5	3.7	2.8	32.3	291
Lawinkala	8.41	0.63	1.5	2	2	2	1.97	2.7	33.4	277
Chatkhana	8.35	0.64	1.3	2.1	3	1.1	2.3	3.2	34.5	278
Max	8.41	0.91	1.5	3	4	2.8	4.1	4.4	34.5	291
Min	7.2	0.38	0.75	1.5	1.2	1.1	0.3	2.5	29.5	0.338
mean	7.82	0.552	1.1917	2	2.3	1.97	2.239	3.4	32.16	186.11

Table 1 physicochemical parameter in surface water in month of march (12 march 2018).

SITE/GROUND WATER March	PH (mg/l)	EC (mg/l)	TDS (mg/l)	Chloride (mg/l)	TH (mg/l)	Ca hardness (mg/l)	MG HARDNESS (mg/l)	Alkalinity (mg/l)	Temp (^oC)	DO (mg/l)
Rajapur	7.34	0.92	385	1.2	6	4.4	1.6	3	28.3	1.5
Mahanduri	7.46	0.64	277	1.1	3.5	3.2	0.3	5	28.3	1.4
Rasulabadghat	7.25	0.49	211	1.2	3.2	2.8	0.4	4	29.4	2.4
Mahaveerpuri	7.33	0.97	403	1.4	6.5	3.3	3.2	4.5	29.3	2.1
Shivkutti	7.91	1.35	501	2	9	4.9	4.1	5.1	29.5	3.2
Govindpuri	7.4	1.04	432	1.5	6.5	4.4	2.1	3	30.3	2.9
Solari	7.47	0.66	278	1.3	4.9	2.1	2.8	2.9	31.2	3.1
Daragangghat	7.36	0.77	324	1	6.1	2.4	3.7	6.5	33.2	3
Lawinkala	7.75	0.73	311	1.2	6.1	4.13	1.97	3.2	34.4	2
Chatkhana	7.34	0.69	305	1.5	6.3	4	2.3	3.4	34.2	1.7
Max	7.91	1.35	501	2	9	4.9	4.1	6.5	34.4	3.2
Min	7.25	0.49	211	1	3.2	2.1	0.3	2.9	28.3	1.4
Mean	7.41	0.847	344.9	1.36	5.85	3.55	2.23	4.16	30.9	2.325

Table 2 physicochemical parameter in ground water in month of march (12 march 2018)

SITE/ SURFACE WATER(April)	PH (mg/l)	EC (mg/l)	CHLORIDE (mg/l)	Al (mg/l)	BOD (mg/l)	TH (mg/l)	Ca hardness(mg/l)	Mg hardness (mg/l)	DO (mg/l)	Temp (^oC)	TDS (mg/l)
Rajapur	7.94	0.47	1.2	2	2.3	3	2	0.9	2.2	33	194.7
Mahanduri	8.64	0.42	2.1	2.5	2.1	3.2	1.4	2	3.2	34.4	187.6
Rasulabadghat	7.96	0.51	1.7	5	2	6	2	4	1.2	34.2	208
Mahaveerpuri	7.22	0.48	1.6	2	2.1	3.5	3	0.4	3.2	29.7	331
Shivkutti	8.74	0.81	1.6	2	0.4	3.3	1.7	1.4	5.2	29.7	197.7
Govindpuri	7.6	0.45	1.5	2	1	3.1	1.8	1.5	5.3	29.5	187.3
Solari	8.47	0.44	2.2	1.5	0.5	2.1	2	0.1	3.7	31.2	174.4
Daragangghat	8.22	0.65	1.8	1.5	1	2.5	1.1	1.3	4	32.3	301
Lawinkala	8.69	0.61	1.7	1.8	0.2	2.4	1	1.4	5	33.4	278
Chatkhana	8.61	0.63	1.9	2.5	1.9	3.5	2	1.4	5.4	34.5	284
max	8.74	0.81	2.2	5	2.3	6	3	4	5.4	34.5	331
Min	7.22	0.42	1.2	1.5	0.2	2.1	1	0.1	1.2	29.5	174.4
Mean	8.18	0.553	1.725	2.441	1.333	3.39	1.83	1.57	3.75	32.18	237.43

Table -3 physicochemical parameter in surface water in month (12 April 2018)

SITE/GROUND WATER (April)	PH (mg/l)	EC (mg/l)	TDS (mg/l)	CHLORIDE (mg/l)	TOTAL HARDNESS (mg/l)	Ca hardness (mg/l)	Mg hardness (mg/l)	Al (mg/l)	Temp (°C)	Do (mg/l)
Rajapur	7.2	0.89	251	1.1	6	4.3	3.2	4	28.3	1.3
Mahanduri	7.73	0.65	197	1.4	3	3.3	0.7	2.5	28.3	1.5
Rasulabadghat	7.57	0.48	203	1.6	4	2.9	2.1	2.6	29.4	2
Mahaveerpuri	7.65	0.87	156	1.3	2.5	3.2	0.4	2	29.3	2.4
Shivkutti	6.82	1.98	702	2.2	11	4.4	7.9	7.4	29.5	3
Govindpuri	6.54	1.96	727	4.5	12.5	2.1	8.5	6	30.3	2.8
Solari	7.71	1.06	415	1.4	6.5	2.3	3.8	3.5	31.2	3
Daragangghat	7.34	0.67	257	1.4	4	4.11	1	3.1	33.2	2.6
Lawinkala	7.23	0.75	295	1.2	4.7	3.9	1.5	3.5	34.4	1.9
Chatkhana	6.76	1.09	433	1.5	7.5	4.2	3.3	5	34.2	1.7
Max	7.73	1.98	727	4.5	12.5	4.4	8.5	7.4	34.4	3
Min	6.54	0.48	156	1.1	2.5	2.1	0.4	2	28.3	1.3
Mean	7.235	1.0717	376.58	1.93333	6.391	3.434	3.442	4.08	30.9	2.208

Table no 4 physicochemical parameter in ground water in month (12 April 2018)

SITE/ SURFACE WATER (May)	PH (mg/l)	EC (mg/l)	CHLORIDE(mg/l)	Al (mg/l)	BOD (mg/l)	Total hardness (mg/l)	Ca hardness (mg/l)	Mg hardness (mg/l)	DO (mg/l)	Temp (°C)	TDS (mg/l)
Rajapur	7.94	0.47	1.2	2	2.3	3	2	0.9	2.2	33	194.7
Mahanduri	8.64	0.42	2.1	2.5	2.1	3.2	1.4	2	3.2	34.4	187.6
Rasulabadghat	7.96	0.52	1.7	5	2	6	2	4	1.2	34.2	208
Mahaveerpuri	7.22	0.48	1.6	2	2.1	3.5	3	0.4	3.2	29.7	331
Shivkutti	8.74	0.81	1.6	2	0.4	3.3	1.7	1.4	5.2	29.7	197.7
Govindpuri	7.6	0.45	1.5	2	1	3.1	1.8	1.5	5.3	29.5	187.3
Solari	8.47	0.44	2.2	1.5	0.5	2.1	2	0.1	3.7	31.2	174.4
Daragangghat	8.22	0.63	1.8	1.5	1	2.5	1.1	1.3	4	32.3	301
Lawinkala	8.69	0.61	1.7	1.8	0.2	2.4	1	1.4	5	33.4	278
Chatkhana	8.61	0.63	1.9	2.5	1.9	3.5	2	1.4	5.4	34.5	284
max	8.74	0.81	2.2	5	2.3	6	3	4	5.4	34.5	331
Min	7.22	0.42	1.2	1.5	0.2	2.1	1	0.1	1.2	29.5	174.4
Mean	8.171	0.557	1.725	2.44	1.333	3.39	1.83	1.54	3.75	32.16	237.4

Table no 5 physicochemical parameter in surface water in month of (12 May 2018)

SITE/GROUND WATER (May)	PH (mg/l)	EC (mg/l)	TDS (mg/l)	CHLORIDE (mg/l)	TH (mg/l)	Ca hardness (mg/l)	Mg hardness (mg/l)	DO (mg/l)	Al (mg/l)	Temp (°C)
Rajapur	7.87	0.94	253	1.2	4.3	4.2	0.1	1.3	3.8	38
Mahanduri	7.73	0.67	197	0.5	3.1	3.2	-0.1	1.4	1.9	38
Rasulabadghat	7.83	0.48	206	1.1	5.9	2.9	3	2.1	2.5	38
Mahaveerpuri	7.87	0.89	157	1.2	3.8	3.1	0.7	2.5	1.9	38
Shivkutti	7.57	1.27	704	1.5	8	4.3	3.7	2.8	7	38
Govindpuri	7.6	1.01	726	2.1	11	2	9	2.6	6.5	41
Solari	8.02	0.59	412	1.4	4.8	2.2	2.6	3.2	3.5	42
Daragangghat	7.9	0.76	255	0.5	3.8	2.1	1.7	2.6	3.1	44
Lawinkala	8.67	0.71	293	1	2.5	3.9	-1.4	1.8	3.5	44
Chatkhana	8.57	0.68	431	1.2	3.7	3.8	-0.1	1.6	5	45
Max	8.67	1.27	726	2.1	11	4.3	9	3.2	7	45
Min	7.57	0.48	157	0.5	2.5	2	-1.4	1.3	1.9	38
Mean	7.989	0.813	376.42	1.191	5.36	3.16	2.233	2.2	3.96	40.75

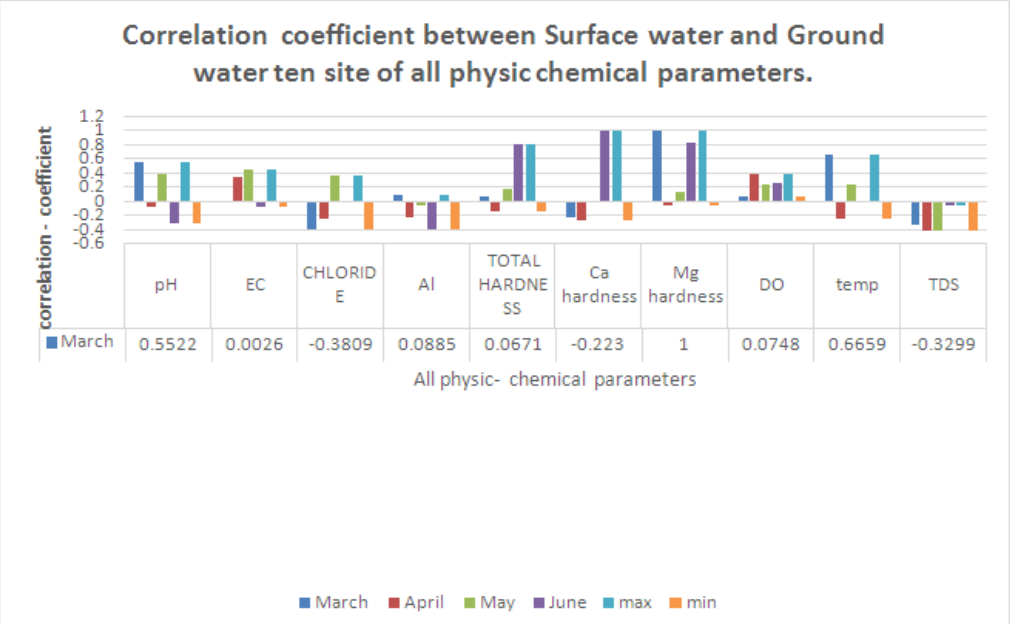
Table -6 physicochemical parameter in ground water in month of (12 May 2018)

SITE/SURFACE WATER (June)	PH (mg/l)	EC (mmhos/cm)	CHLORIDE (mg/l)	Al (mg/l)	BOD (mg/l)	T H (mg/l)	Ca hardness (mg/l)	Mg hardness (mg/l)	DO (mg/l)	Temp (°C)	TDS (MG/L)
Rajapur	7.93	0.52	1.4	2	2.3	3.2	2.1	1.1	2.1	41	193
Mahanduri	8.62	0.57	2.2	2.4	2.2	3.1	1.5	1.6	3.2	44	187
Rasulabadghat	7.92	0.51	1.7	5.1	2	6	2.1	3.9	1.2	43	207
Mahaveerpuri	7.22	0.82	1.4	2	2.2	3.8	3	0.8	3.2	44	331
Shivkutti	8.75	0.47	1.6	1.9	0.4	8	1.7	6.3	5.3	45	195.1
Govindpuri	7.5	0.46	1.8	1.8	0.8	11	1.9	9.1	5.2	42	185.9
Solari	8.43	0.41	2.2	1.7	0.4	4.8	2.1	2.7	3.5	44	174.2
Daragangghat	8.21	0.82	1.5	2	1	4	1.2	2.8	3.9	43	297
Lawinkala	8.59	0.63	1.4	1.7	0.2	2.4	2	0.4	4.9	42	268
Chatkhana	8.61	0.62	2	2.5	1.8	3.7	2.1	1.6	5.1	45	293
Max	8.75	0.82	2.2	5.1	2.3	11	3	9.1	5.3	45	331
Min	7.22	0.41	1.4	1.7	0.2	2.4	1.2	0.4	1.2	41	174.2
Mean	8.14	0.58	1.73	2.49	1.31	5.28	1.99	3.316	3.675	43.25	236.37

Table -7 physicochemical parameter in surface water in month of 12 JUNE 2018)

SITE/GROUND WATER (June)	PH (mg/l)	EC (mg/l)	TDS (mg/l)	CHLORIDE (mg/l)	TH (mg/l)	Ca hardness (mg/l)	Mg HARDNESS Mg/l)	DO (mg/l)	Al Mg/l)	Temp (°C)
Rajapur	7.22	0.94	381	1.2	5.7	2.1	3.6	1.4	4	44
Mahanduri	7.79	0.65	278	1.4	2.9	1.5	1.4	1.5	2.2	45
Rasulabadghat	7.62	0.48	202	1.5	3.8	2.1	1.7	2.2	2.6	43
Mahaveerpuri	7.7	0.96	402	1.3	2.8	3	-0.2	2.4	7.2	44
Shivkutti	6.94	1.27	498	4.8	11.2	1.7	9.5	2.8	6.2	44
Govindpuri	7.19	1.02	428	4.2	11.4	1.9	9.5	2.7	6.1	42
Solari	7.2	0.61	274	1.4	6.5	2.1	4.4	3.2	3.5	38
Daragangghat	7.12	0.72	323	1.9	4.2	1.2	3	2.5	3.1	45
Lawinkala	7.19	0.69	311	1.2	4.6	2	2.6	1.8	3.5	43
Chatkhana	7.4	0.67	303	1.8	6.7	2.1	4.6	1.7	4.8	43
max	7.79	1.27	498	4.8	11.4	3	9.5	3.2	7.2	45
Min	6.94	0.48	202	1.2	2.8	1.2	-0.2	1.4	2.2	38
Mean	7.34	0.813	341.67	2.22	6.16	1.99	4.117	2.233	4.38	42.83

Table -8 Physicochemical parameter in ground water in month og (12 june 2018)



V. Conclusion

In this study, the chemical quality of ground water indicates that ground water is better for drinking, irrigation, etc. chemical analysis shows that ground water is of excellent quality than river water near different Ghat. The nature quality of ground water depends largely upon the geological and characteristics and climate conditions.

Most of the chemical analysis is the correlation coefficient was often negative between ground water and river water near different Ghat. Understanding the seasonal variation and interrelationship of the selected parameter may be help full in routing analysis of ground water and river water quality.

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