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Estimation of ground water quality for pre and post monsoon season in physicochemical parameters of Gorakhpur District, U.P., India

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Abstract

In this study groundwater quality for physico-chemical parameters of premonsoon and post monsoon season of Gorakhpur district has examined. For this analysis ground water samples are collected from twenty sampling sites. It has been found that the conc. of all ground water parameters are higher in premonsoon season than post monsoon season. The physico-chemical parameters which are detected in study are Temperature, pH, EC, Turbidity, TDS, Total Hardness, Alkalinity, Nitrate, Fluoride, Arsenic.

Keywords: Groundwater, pre monsoon, post monsoon, arsenic.

Introduction

Environmental Pollution is become clamorous in all over the world. Pollution has become a challenges for entity of human being in this earth .For centuries man has been disturbing the balance of nature for their profit and affluence but now nature has started its revenge. Water has special physical and chemical properties for living being to depend on it. The following quote from Szent Gyorgyi illustrates this point of view "That water function in varieties of ways within the cell cannot be disputed life originated in water, is thriving in water. Water beings its solvent and medium. It is the matrix of life[1]."

Pure drinking water is necessary for life on this earth for safe metabolic activities and functioning of all organs of the body. Surface water is very useful for most of the human consumption, because it is easily available with the exclusion of arid and semi-arid regions, where ground water may be the only depended source of water. Water resources in coastal areas assume a special significance since any development activity will largely depend upon availability of freshwater to meet industrial, domestic, and agricultural requirements is increases the dependency upon spring water for meeting the freshwater demand. Ground water quality and decrease in ground water level is increases day by day because only of overexploitation by human being in different season[2].

Ground water quality plays an important role in groundwater protection and quality conservation. Hence, it's vital to assess the groundwater quality not just for its present use, but also from the point of view of a possible source of water for future consumption[3].

Environmental condition includes all the influences, situations and surroundings within the atmosphere or backgrounds of humans that may affect health and safety. Pollution of water is due to increased human population, industrialization, use of fertilizers in agriculture and manmade activity[4].

Continuous worldwide population progress has cited a huge compression on planet earth's finite resource of water. In several countries, that are a collective struggle for water use between agriculture, industry and domestic needs, threatens commercial progress, food security, livelihoods, poverty lessening and also the reliability of ecosystems. Increasing demand for groundwater may be a specific anxiety as, in various areas; groundwater production exceeds the extent of sustainability[5]. Discordance over water isn't any stranger to the urban environment and also the calculation of a rural aspect enhances an unwanted level of difficulty to the mission at hand.

River runs through urban areas are have pollution burden because of the discharged of untreated municipal sewage and tiny scale industries waste which raise in concentration of heavy metals in water and sediments of river. Heavy metals have single importance in eco-toxicology and also hypothetically fatal for aquatic environment[6].

Pollution of heavy metals within the aquatic environment has observed by researcher and scientists worldwide because of its abundance, perseverance and environmental toxicity[7].

Excess of impurities both organic and inorganic yield huge load, which distorted water quality and badly affected the rich biodiversity of the rivers[8].

The metals which are known toxic to the aquatic life and aquatic system are Lead, Cadmium, Mercury, Copper, Zinc, Iron, and Arsenic. Industrial waste like oil, milk dairy, and other industrial and sewage waste are discarded within the river[9].

World's highest concentration of arsenic is presently observed to be located in Bangladesh and province State of India. It's reported that about 46 million people of Bangladesh are believed to be victims of this problem among which 0.2 to 0.27 million people may die because of the identical reason. Similarly 4 million people in India also are littered with the identical problem[10].

Arsenic mobilization within the water residing in aquifers may are caused by over withdrawal of groundwater during cultivation. Generally, arsenic is out there in much higher concentration in groundwater compared to surface water. The widespread use of arsenic contaminated groundwater in irrigation for a prolong period of your time could elevate its concentrations in dirt and eventually into vegetations for instance, rice plants and rice grains[11].

World Health Organization has set 0.01 milligram per liter (10 parts per billion) because limit for the protection of water for drinking purposes. Nepal, including India and Bangladesh, has adopted the limit of fifty ppb. Lack of experience and knowledge of the implementation, economic consideration and technical ability to live arsenic concentration below 50 ppb within the field are main reasons behind the national standard. Very cheap standard currently set for acceptable arsenic concentration in drinkable is implemented by Australia, which includes a national standard of seven ppb[12].

Arsenic and its health effect: Chronic arsenic poisoning, or arsenicosis, is usually defined by the classical dermal stigmata, along with internal disorders within the presence of known arsenic exposure. Groundwater contaminated with arsenic is that the major source of both human and animal exposure to arsenic. Chronic exposure to arsenic can cause skin, lung and bladder cancers[13]. Arsenic is an environmental toxicant with wide distribution in rock, soil, water and air.

Arsenic compound is categorized into two form inorganic arsenic and organic arsenic. Inorganic arsenic is generally rich in groundwater used for drinking in many countries everywhere the planet (e.g. Bangladesh, Chile and China), while organic arsenic compounds (such as arsenobetaine) are mostly found in fish, which as a result may produce to human exposure[14].

Arsenic origins hyper pigmentation, keratosis, weakness, anaemia, burning sensation of eyes, solid swelling of legs, liver fibrosis, chronic lung disease, gangrene of toes, neuropathy, carcinoma and other clinical manifestations. But abdominal pain, the occurrence of all other clinical indicators tested (e.g., pigmentation, keratosis, hepatomegaly, weakness, nausea, lung disease and neuropathy) were found to be pointedly higher in arsenic exposed people (water arsenic >0.05 mg/L) compared to manage population (water As level <0.05 mg/L)[15].

Areas of our planet with a big presence of inorganic arsenic are identified, particularly in Asia and other non-European countries. In Europe, the degree of arsenic within the environment are quite low, with the exception of some areas with particular terrestial formation or process[16].

Materials and methods

Sampling: For this study, groundwater samples are collected from 20 site of the district. The samples taken during August 2015 to July 2016 were analyzed for various Physico-chemical parameters. For sample collection firstly wash the bottle with water then filled with sample after collection of the samples, the samples are preserved and shifted to the laboratory for physico-chemical analysis.

Sampling location of the study sites: For sampling of groundwater in the Gorakhpur city total twenty sites are selected. Gorakhpur district is divided in to seven Tehsils and fourteen blocks. Water samples are collected from these blocks. The study sites are summarized in Table-1.

Methodology: pH, EC, Turbidity, Alkalinity, Fluoride, TDS, Total hardness, Nitrate, and mainly Arsenic compared with standard values recommended by World Health Organizatio and Indian Standards Institution. The physicochemical parameters of water samples were analyzed in accordance to standard analytical methods[17].

Table-1: Shows the study sites of sample collection.

1.	Pipraich	2.	Medical collage
3.	Mohaddipur	4.	Badhalganj
5.	Miya bajar	6.	Sardar nagar
7.	Khajni	8.	Basaratpur
9.	Rajghat	10.	Uruwa bazaar
11.	Maniram	12.	Golghar
13.	IIIT	14.	Gorakhnath
15.	Jungle kauria	16.	Taramandal
17.	Khorabar	18.	Sahjanva
19.	Pipiganj	20.	Bichhiya colony

Results and discussion

The physicochemical properties of the Gorakhpur city and its adjoin area were studied throughout the year, from august 2015 to July 2016 in reference to the following parameters:

The temperature of ground water was recorded to be minimum 17^0C during January 2015 in site 16 and maximum temperature (32.0) during May 2016 in site 4.

The conductivity of groundwater was recorded to be minimum (870) during post monsoon season (January) 2015 at the study site 4 and maximum (1780) was found during pre monsoon season (March) 2016 at the study site 8.

The pH of the groundwater was recorded to be minimum (6.1) during January 2016 at the study sites 5 and maximum pH (8.4) was found during May 2015 at site 8. The permissible limit of pH prescribed by ISI is 6.5 to 8.4, therefore the values of pH were found within the permissible limit of prescribed standards regarding the groundwater.

The TDS of ground water was recorded to be minimum (241 mg/l) during post monsoon season (December) 2016 at site 3 and the maximum TDS (868mg/l) was found during pre monsoon season (February) 2015 at site 11. The permissible limit of TDS prescribed by ISI is 500mg/l. The minimum TDS was recorded within the permissible limit and the maximum TDS was beyond the permissible limit of prescribed standards.

The turbidity of the ground water was found to be minimum 3.1 during post monsoon season (December) 2015 in site 14 and maximum (8.0) at site 12 during post monsoon season (May) 2016. The permissible limit of turbidity prescribed by ISI is 5 NTU. Therefore, the value of turbidity was recorded with in the permissible limit.

The total hardness of the groundwater was found to be minimum 212mg/l at site 16 during post monsoon season and maximum 678mg/l during January 2016 at site 2. The value of total hardness was found to be highest in winter season due to low temperature thus the impurities remains concentrated.

The alkalinity of the groundwater was found to be minimum 210mg/l during February 2015 at site 1 and maximum 691 during May 2016 at site 9. The permissible limit of alkalinity prescribed by ISI is 600mg/l. Therefore, the value of alkalinity was recorded with in or near by the permissible limit. The value of alkalinity was found to be highest in summer season due to high temperature thus the impurities remains concentrated.

The nitrate of the groundwater was found to be minimum 10 mg/l during December 2016 at site 2 and maximum 48 during May 2015 at site 8. The permissible limit of nitrate prescribed by ISI is 45mg/l. Therefore, the value of nitrate was recorded with in the permissible limit. The value of nitrate was found to be highest in winter season due to high temperature thus the impurities remains concentrated.

The fluoride of the groundwater was found to be minimum 0.11mg/l during November 2016 at site 12 and maximum 0.95 during March 2015 at site 11. The permissible limit of fluoride prescribed by 1.0mg/l. Therefore, the value of fluoride was recorded with in the permissible limit. The value of alkalinity was found to be highest in winter season due to low temperature thus the impurities remains concentrated.

The arsenic of the ground water was found to be minimum 0.001mg/l during post monsoon season (December) 2016 at site 6 and maximum 0.061mg/l during post monsoon season (March) 2015 at site 12. The permissible limit of arsenic prescribed by ISI is 0.05mg/l. Therefore, the value of arsenic was recorded with in or near the permissible limit. The value of arsenic was found to be highest in winter season due to low temperature thus the impurities remains concentrate.

Table-2: Physico chemical characteristics of ground water collected from different sampling location in winter and summer seasons (2015-2016).

Sampling sites	Turbidity (NTU)		Nitrate (mg/l)		Temp. (^{0}C)		Arsenic (mg/l)		pH	
	Summer	Winter	Summer	Winter	Winter	Summer	Winter	Summer	Winter	Summer
S.N. 1	6.225	5.775	23.75	21.5	23.35	24.75	0.049	0.05825	7.125	7.1
S.N.2	5.875	5.625	23.75	20.5	23.8	25.225	0.019	0.033	7.6	7.425
S.N.3	6.7	5.875	26.25	20.5	23.325	25.85	0.01175	0.015	7.45	7.6
S.N. 4	6.075	6.05	24.25	20.5	23.4	25.45	0.029	0.02725	7.7	7.375
S.N.5	5.775	5.525	19.5	21	22.075	25.425	0.02775	0.03225	7.725	7.125
S.N.6	5.7	5.125	21	21.25	21.9	25.5	0.01075	0.015	6.925	7.5
S.N.7	5.425	5.675	25.75	22.75	22.1	25.775	0.002025	0.016	6.725	7.15
S.N.8	6.225	6.125	26.5	21	22.025	25.95	0.04175	0.0485	8.075	7.35
S.N.9	6.425	5.5	22.5	20	21.975	25.75	0.02325	0.032	7.2	7.5
S.N.10	6.225	5.975	19.75	20.75	22.35	25.5	0.024	0.0235	7.65	7.625
S.N.11	6.475	5.675	24.75	21.75	19.575	25.5	0.03825	0.044	7.175	7.475
S.N.12	6.6	4.825	24.25	22.25	21.8	25.55	0.0555	0.0555	7.525	7.05
S.N.13	6.075	6.05	24.75	22	22.15	25.275	0.03775	0.038	7.725	7.625

S.N.14	6.125	6.05	25.75	23	23.025	25.575	0.01575	0.02825	7.6	6.625
S.N.15	5.825	5.8	24.25	22	22.075	25.625	0.0195	0.02	7.8	7.65
S.N.16	5.35	5.25	21.25	22.25	22.75	25.125	0.014	0.01475	6.875	6.775
S.N.17	5.7	5.5	20.25	20.75	22.85	25.675	0.01175	0.01275	6.95	7.45
S.N. 18	6.25	5.7	23.75	22.5	22.775	25.7	0.05	0.053	7.625	7.3
S.N.19	6.65	5.725	24	20.25	22.625	25.825	0.012	0.01225	7.25	7.55
S.N.20	6.725	5.6	22.75	22.75	22.6	25.375	0.0091	0.0125	7.725	7.325
MAX.	6.725	6.15	26.5	23	23.8	25.95	0.0555	0.05825	8.075	7.65
MIN.	5.35	4.85	19.5	20	19.575	24.75	0.002025	0.01225	6.725	6.625

Table-2: Physico chemical characteristics of ground water collected from different sampling location in winter and summer seasons (2015-2016).

Sampling sites	EC(μs)		TDS(mg/l)		Total hardness (mg/l)		Alkalinity (mg/l)		Fluoride (mg/l)	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
S.N. 1	1404	1187.25	575	507.25	351	458.25	461.75	321.75	0.6125	0.615
S.N.2	1364.5	1219	571.5	483.5	543.25	374.75	470	399.5	0.6325	0.6175
S.N.3	1236	1288.5	561	364.5	460.5	413.75	437	399.5	0.685	0.57
S.N. 4	1454.25	1248.75	617.25	464.25	532.75	455.25	355.75	381.75	0.5125	0.535
S.N.5	1315	1291.25	563	477.5	389.5	444.75	391.5	369	0.78	0.6725
S.N.6	1389.25	1391.25	641.75	460.25	427.25	543.5	425	405.25	0.77	0.5925
S.N.7	1562.5	1510	606.25	459.5	454	404.25	425.75	376.5	0.545	0.605
S.N.8	1456.25	1425.75	647.75	394.75	455.25	487.5	439.25	375	0.6075	0.6175
S.N.9	1540	1344	607.5	392	534.75	424.25	398.25	458.25	0.56	0.5675
S.N.10	1541	1461	618.75	418	340.75	436.75	390.5	374.25	0.7725	0.52
S.N.11	1526.25	1465.5	662	479	483	515.25	351.25	413.25	0.865	0.5825
S.N.12	1425	1485	707.75	445.75	373	540	401	505	0.7075	0.425
S.N.13	1564	1392.5	639	434.75	466	482.75	402.75	428.5	0.6375	0.55
S.N.14	1528.75	1463	559.25	452.25	353.5	509.25	414.5	461.25	0.65	0.5975
S.N.15	1351.25	1265	626.25	419.25	507.75	347.25	478.25	412.5	0.605	0.595
S.N.16	1554.75	1448	662	434.75	280.75	420	450.5	384.75	0.665	0.5925
S.N.17	1501.75	1563.25	628.5	375	433.25	522.25	461	366.25	0.68	0.55
S.N. 18	1503.75	1576	736.25	392.75	445.25	417.5	393	442	0.63	0.5975
S.N.19	1421.25	1384.5	581	460.5	394.25	462.25	437.25	362	0.4575	0.6
S.N.20	1448	1578.75	623	465	444.75	520.5	471	396.5	0.6475	0.6175
MAX.	1564	1578.75	736.25	507.25	543.25	543.5	478.25	505	0.865	0.6725
MIN.	1236	1187.25	559.25	364.5	280.75	347.25	351.25	321.75	0.4575	0.425

Conclusion

From this study the following conclusion were find out. Gorakhpur is situated at the Tarai belt of Uttar Pradesh. So water table is not deep, so the chances of groundwater pollution are high. In most of the sampling sites alkalinity were found above the permissible limit (200mg/l) prescribed by BIS , which presents that the groundwater of the many sampling sites is alkaline in nature .The value of pH is near about the permissible limit (6.5-8.5) so it is slightly alkaline. Total hardness, TDS values were also high in most of the sampling sites, which presents that groundwater of study area is hard.

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