

Assessment of Physico-Chemical Properties of Ground Water in Aligarh City

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ABSTRACT

Rapid urbanization and industrial boom is the new reality of modern world. The increasing population is eventually turning agricultural land or forest into concrete jungle. Hence the water bodies are one among others to be encroached by this process. As the water bodies are disappearing overtime and population is increasing, there is a huge stress on ground water. Apart from the demands of ground water, various anthropogenic activities are making water unsuitable for drinking. The present study focused on the physico-chemical concentration of ground water in Aligarh city because the city is mainly dependent on its ground water for its domestic and industrial usage.

KEYWORDS: Ground water; physicochemical properties; Human health; Aligarh city

How to cite this paper: Dr. Mansoor Alam Siddiqui | Md Mainul Sk | Md Ali Jinnah | Rukhsar Anjum "Assessment of Physico-Chemical Properties of Ground Water in Aligarh City"

Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-2, February 2021, pp.917-924, URL: www.ijtsrd.com/papers/ijtsrd38585.pdf



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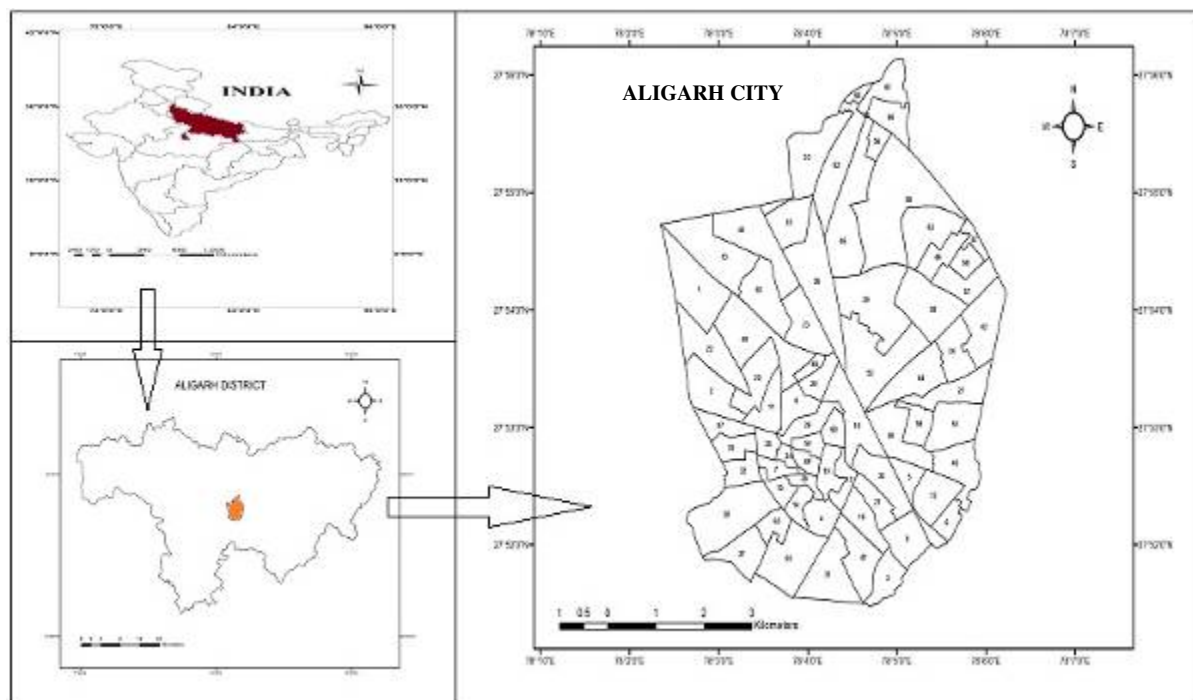
INTRODUCTION:

Water is the utmost basic essence of life, without which life can't be imagined but unfortunately the present world is becoming blind to see the impact of excessive exploitation of water resources (CIA, 2014). Due to over excretion of water, not only the water table, but also the water quality has become degradable (Ullah et al., 2009). It is estimated that around one third of the world's population uses groundwater for the purpose of drinking and today more than half the world's population depends on groundwater for survival (Khan, 2018). The water quality of Aligarh has a drastic change in its properties at present (Anwar and Vanita, 2014). In the very past, Aligarh city has observed an increasing growth, which has taken heavy toll of the groundwater resources in the city (Jamal and Ajmal, 2020). For the purpose of analyzing the water quality, the present data has been collected from various spots with suitable sampling method. The main study is based on the total dissolved solids, chemical oxygen demand, turbidity, Electrical conductivity, total dissolved solid, total suspended solid, chloride, turbidity, Alkalinity, Sulphate, carbonate, bicarbonate, sodium and potassium. Apart from that, the destruction of ground storage, the open storage of water is

also losing its quality and anthropogenic activity is the reason behind this has been found (Elbeih, 2015). The main motive behind this study is to access the water quality and to provide suitable remedies to come up with this situation after all water is life (Ajmal and Uddin, 1986).

Study area:

Aligarh city is the administrative division of Aligarh district, one among other seventy districts in Uttar Pradesh (U.P), India. The city lies at 27.30 N latitude and 79.40 E longitudes. The Municipal area is having seventy wards. The area comes under the tropical monsoon climate region where maximum temperature of 46 degree in summer and minimum of 4 degree in winter is observed. The average wind speed is 9.3km/hr. The city receives most of its rainfall from the south-west monsoon wind however; there is no fixed average rainfall data available due its unpredictable nature. The study area comes under the category of class-I Indian cities with the population of 874,408 in 2011 census. The area comes under older alluvial soil group. The city is consists of three layer aquifer system out of which only first layer is 0.00 to 122.00m which is suitable for domestic water usage.



Methodology:

In order to collect the water samples during pre and post monsoon season in 2017, 1L plastic bottles were used. Before obtaining the sample, bottles were thoroughly rinsed off by distilled water (Parween and Fatima, 2015). Most of the samples were collected from the tube wells which stores the water in Municipality water tank then distributes in the surrounding region and few samples were drawn from the private water suppliers so that entire city can be covered. Samples like pH, Temperature, Turbidity, D.O were analyzed within six hours after collecting the sample and the rest of the samples were stored in refrigerator for further analysis. The analysis of SO_4 , Na, CO_3 , HCO_3 and K were done as per the Guideline of BIS (BIS, 1991) from Analysis Laboratory Agra and the rest of the analysis were performed at the laboratory of Environmental Engineering, Dept. of Civil Engineering, A.M.U. and they were done by the following methods:

S. No.	Parameters	Methods
1	pH	pH meter
2	Turbidity	Neflometer
3	EC	Conductivity meter
4	TDS	Filtration method
5	TSS	Evaporation method
6	Alkalinity	Indicator methods
7	D.O	Wrinkle's method
8	Sodium	IS:3025(Part 45)-1993
9	Potassium	IS:3025(Part 45)-1993
10	Sulphate	IS:3025(Part 24)-1986
11	Carbonate	IS:3025(Part 51)-2001
12	Bi Carbonate	IS:3025(Part 51)-2001

Sample serial Numbers are in this following order:

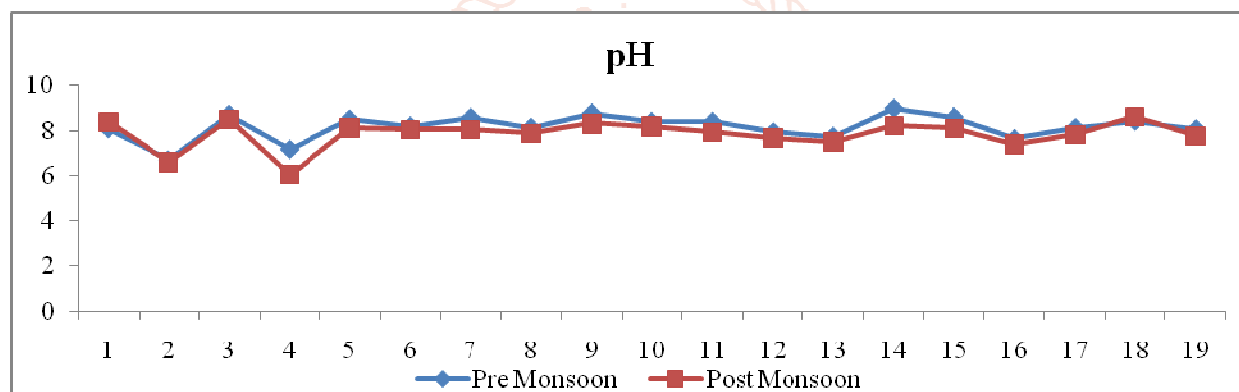
No.	Place	No.	Place
1	Double tankey coloney, Shahjamal	11	Dodhpur chauraha
2	Avas Vikas coloney	12	Near Student Union hall
3	Koil office, Numaish/shifted little bit	13	Press colony
4	Malkhan Singh Hospital	14	Duda colony, Sootmill
5	Jumma Masjid, Upparkot	15	B.S.J hall
6	Dhobi Ghat, Jamalpur	16	J.N.M.C
7	Shiwalik Ganga Phase IV	17	Mulla para
8	Vaishno Royal apartment, Ramghat road/ surendra nagar	18	Kali Deh
9	Gandhi Eye Hospital	19	Patel Nagar
10	Ambedkar Park, Jiwangarh		

Results and Discussion:

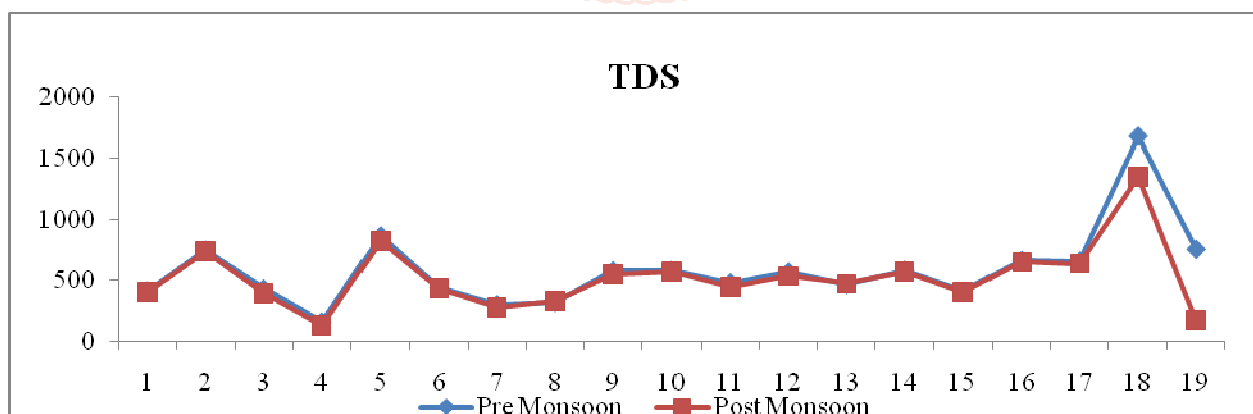
The trace of Physicochemical elements were found in this study varies zero to unsuitable amount. However for the sustenance of better human health, the presences of these chemicals are essentials (APHA, 1998) but excess of them might cause some health problems.

Parameters	BIS (1991)	WHO
Magnesium	30 - 100	-
Calcium	75 - 200	100
Chloride	250 -1000	250
Sulphate	200 - 400	400
Sodium	-	200
TDS	500-2000	500
pH	6.5-8.5	6.5-9.2
Turbidity	1 - 5	0
D.O	6	9
BOD	2	0
Alkalinity	200-600	0
TH	300 - 600	-
Bicarbonate	300 - 600	-
EC	-	750

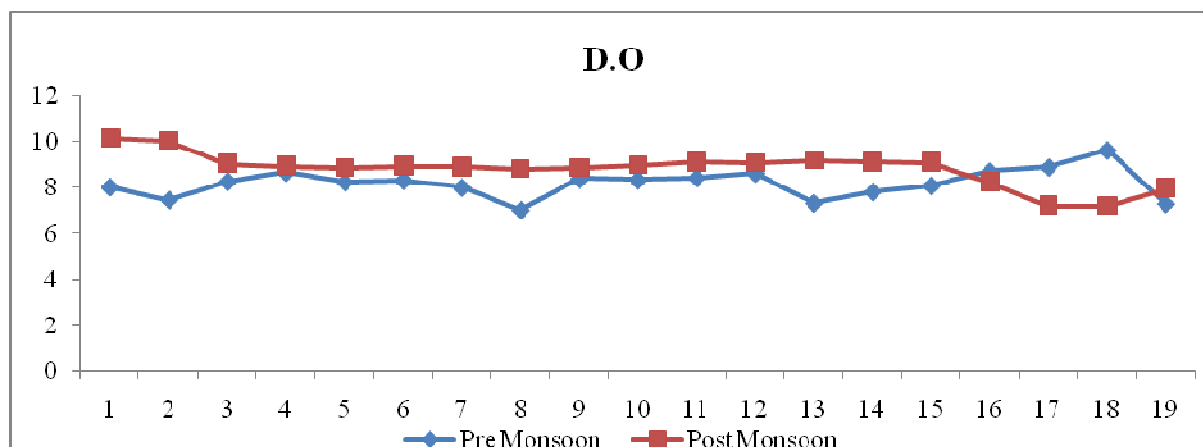
pH: As per the BIS guideline, the ideal pH should be 7, less than 7 is considered as acidic and more than 7 is alkaline (Ashfaq and Ahmad, 2014). In Post monsoon season, except sample no.1, every sample has decreasing trend in pH value. However, minimum value during pre-monsoon season has been found 6.71 at sample no.2 and maximum 8.98 at sample no.14 and during post monsoon season, minimum value 6.62 has been found at sample no.2 and maximum 8.62 at sample no.18.



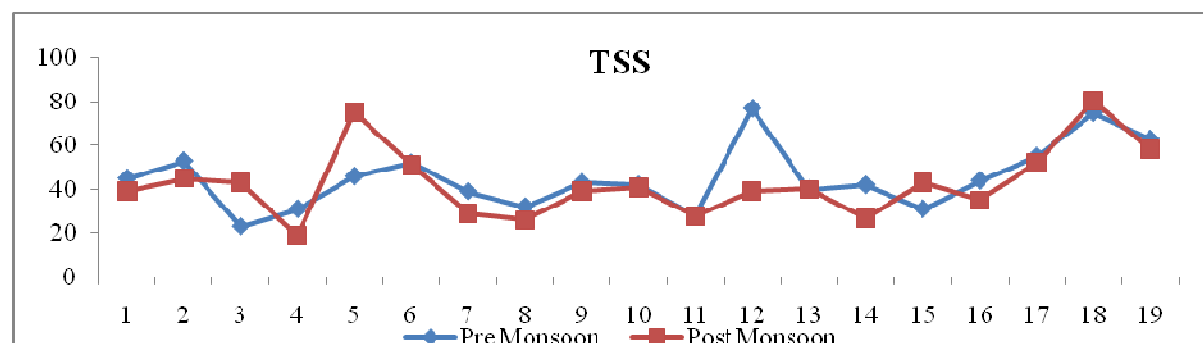
TDS: Total dissolved solids are needed in human body because they bring with them various other required minerals but exceeding the limit can cause health issues. During pre-monsoon season, minimum value 159mg/l has been found at sample no.4 and maximum 756mg/l at sample no.19 and during post monsoon season, minimum value 7.79mg/l has been found at no.19 and maximum 8.62mg/l at 18 has been found.



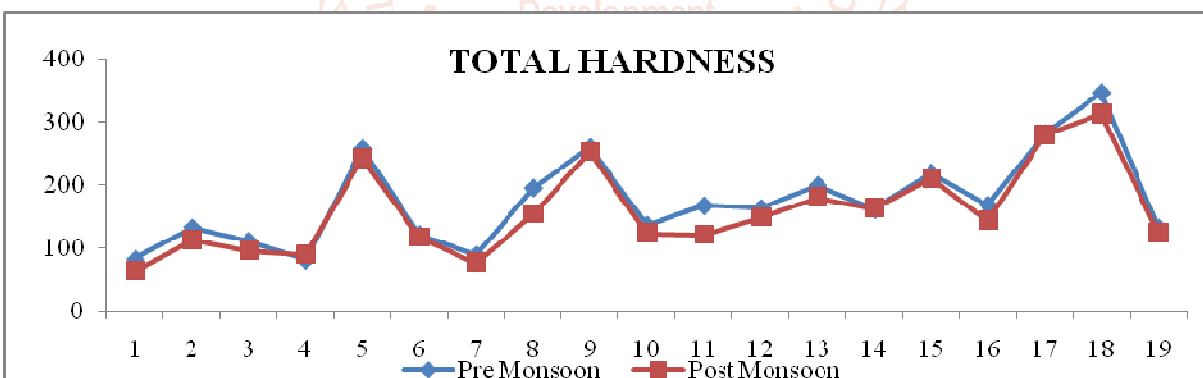
D.O: The presence of D.O is a good sign of water quality but excess of it might indicate the too much interference of organic substances. In this study we found minimum concentration of D.O of 7.4mg/l at sample no.8 and maximum 9.65mg/l at no.18 during pre-monsoon season and minimum value 7.21mg/l at sample no.18 and maximum 10.18mg/l at no.1 during post monsoon season.



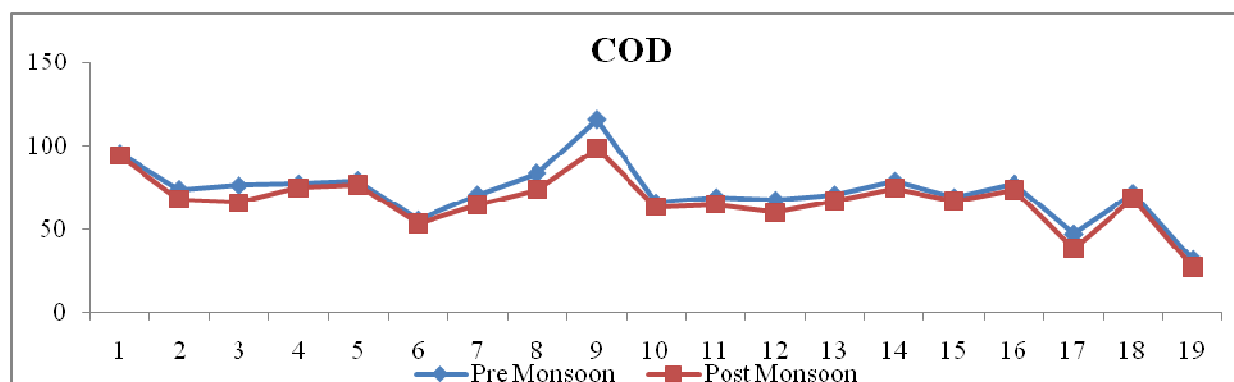
TSS: The presence of Total suspended solids in drinking water is not a good sign however we can consume a certain amount as per BIS permissible limit. In this study, Minimum concentration of 31mg/l has been found at sample no.4 and maximum amount 75mg/l at no.18 has been found during pre-monsoon season and during post monsoon season, minimum 19 mg/l concentration has been found at sample no.4 and maximum 80mg/l at no.18.



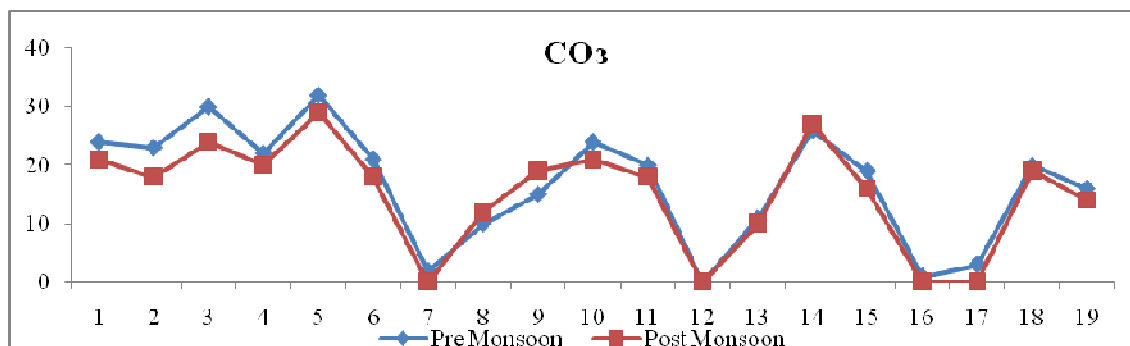
Total Hardness: Hardness does not particularly have any direct effect on human health but it can make water unsuitable for domestic and industrial use (Anwar and Aggarwal, 2014). In the present study minimum concentration 80mg/l has been found at sample no.3 and maximum 345mg/l at no.18 in pre monsoon season while at post monsoon season, minimum concentration 62mg/l has been found at sample no.1 and maximum 312mg/l at no.18.



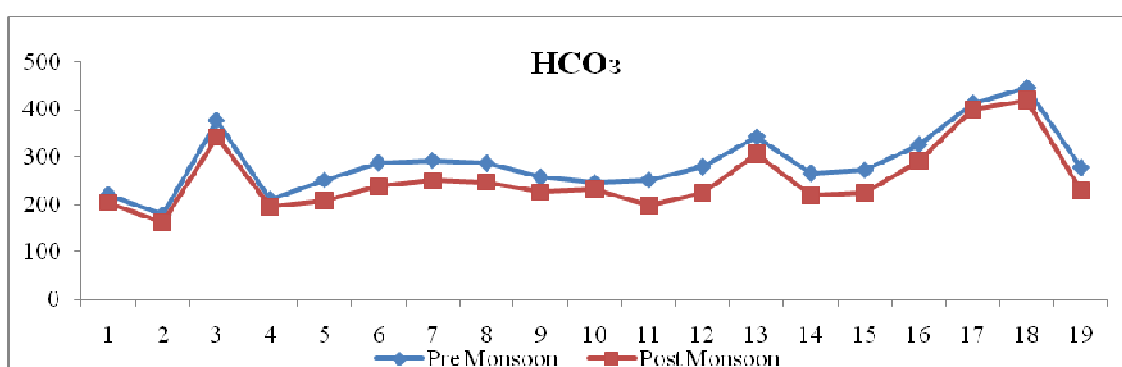
COD: The presence of high COD indicate very less presence of Oxygen which is not suitable for a healthy water quality standard. During pre-monsoon season, minimum value 31.5mg/l has been recorded at sample no.19 and maximum 115.2mg/l at no.9 and during post monsoon, minimum 27.3mg/l was at sample no.19 and maximum 98.3mg/l at no.9.



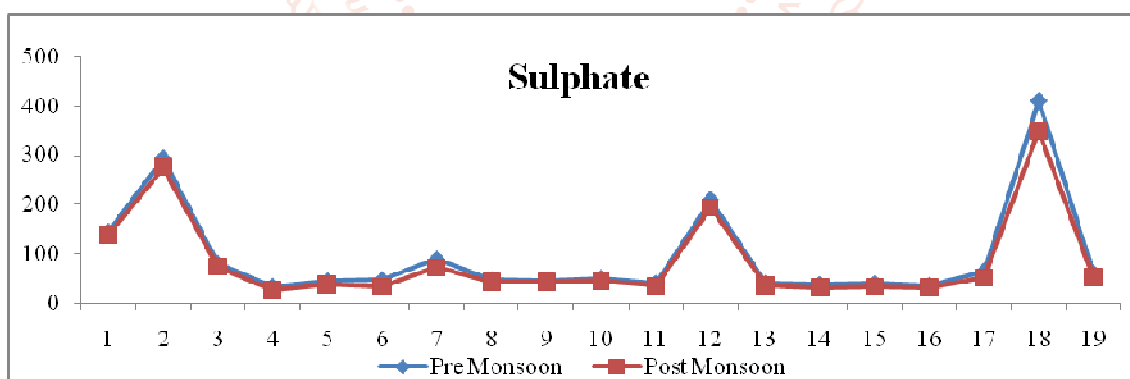
CO₃: The presence of carbonate is pretty important in drinking water because, it always has the tendency to mix with Calcium or Sodium which makes the water unsuitable for drinking purpose. The present study shows minimum 0mg/l presence of carbonate at sample no.12 and maximum 32mg/l at no.5 in pre monsoon season while in post monsoon season, minimum presence of 0mg/l has been found at sample no.7, 12, 16, 17 and maximum 29mg/l at no.5.



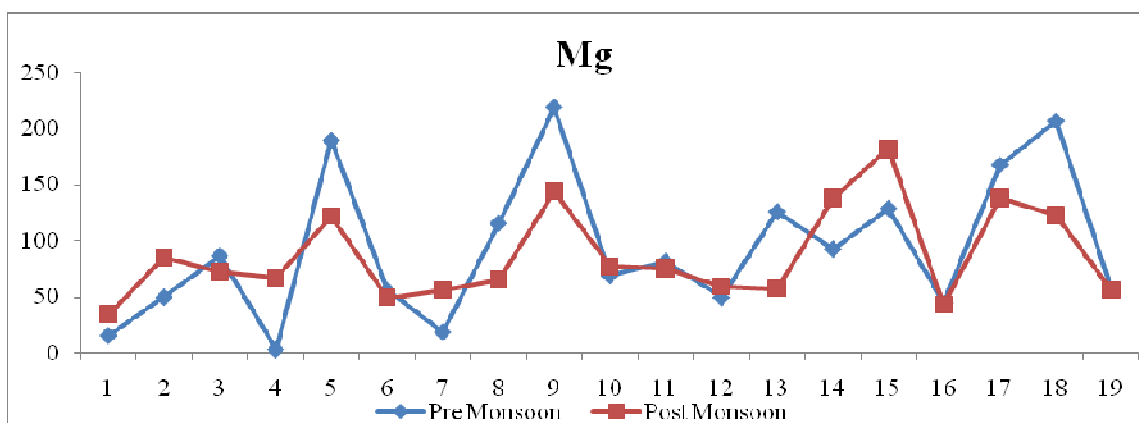
HCO₃: Bi-carbonate is another physicochemical which get mixed with other organic and inorganic substances and make the water unsuitable for drinking purpose. The minimum value 178mg/l was found at sample no.2 and maximum 445mg/l at no.18 in pre monsoon season while, in post monsoon season, minimum value 162mg/l was found at no.2 and maximum 419mg/l at no.18.



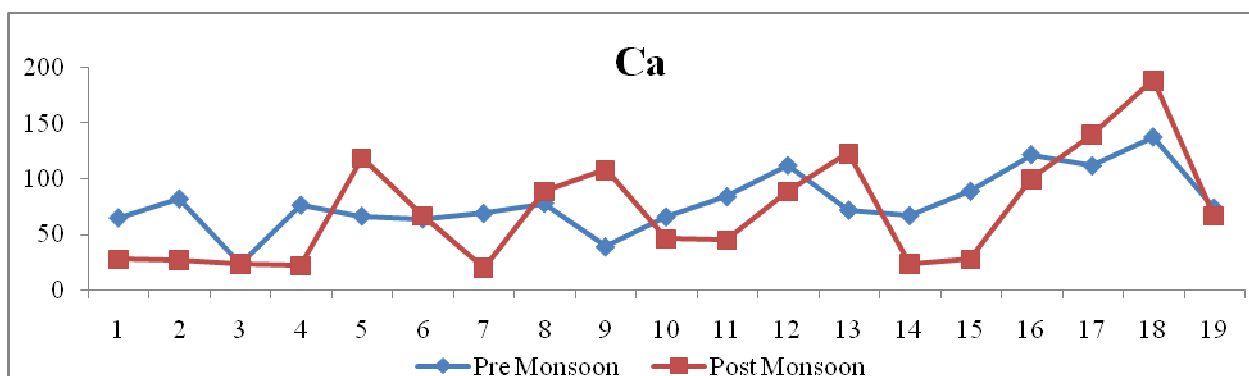
SO₄: The presence of Sulphate can be injurious to health if it crosses its permissible limit. In present case, minimum concentration of 34mg/l has been found at sample no.4 and maximum 410mg/l at no.18 in pre monsoon season and in post monsoon season, minimum concentration of 26mg/l has been found at sample no.4 and maximum 350mg/l at no.18.



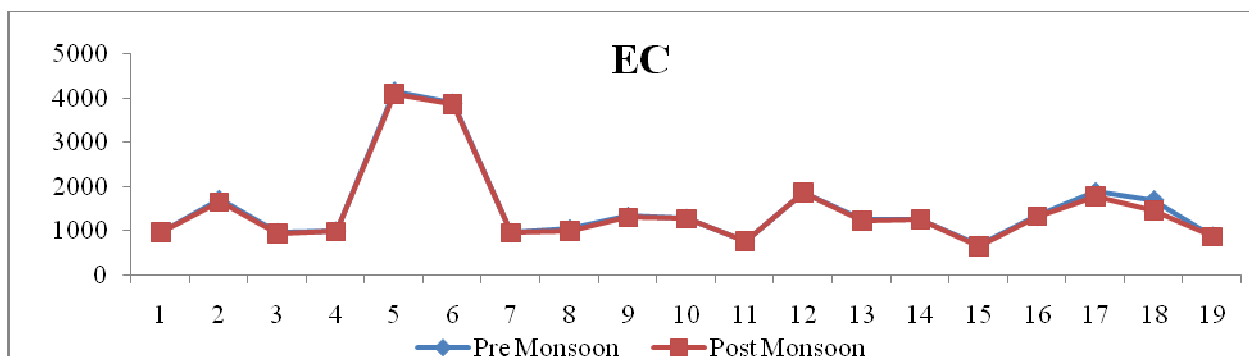
Mg: Magnesium is beneficial for human body functioning. The study shows minimum concentration 3.5mg/l at sample no.4 and maximum 219.3mg/l at no.9 during pre-monsoon and minimum value of 34mg/l at sample no.1 and maximum 182mg/l at sample no. 15 during post monsoon season.



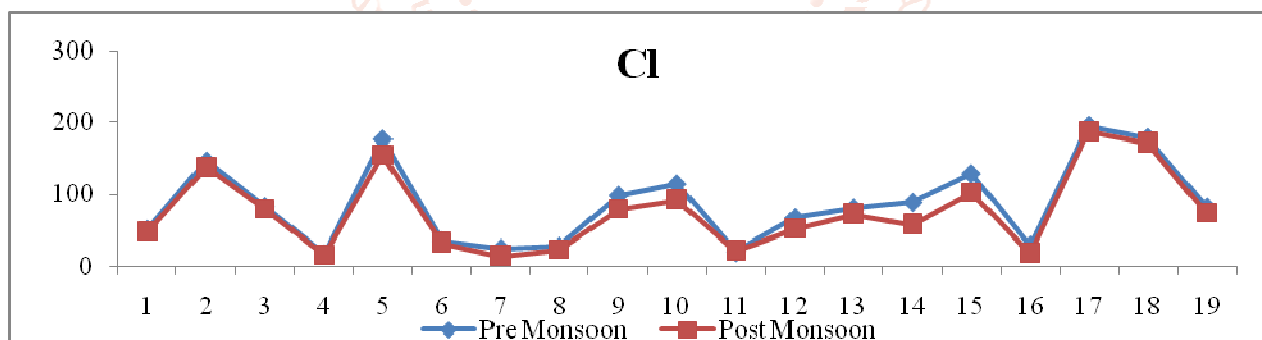
Ca: Like Magnesium, Calcium is also needed in our body. The study shows minimum concentration of 23mg/l at sample no.3 and maximum 138mg/l at no.18 during pre-monsoon and minimum value of 20mg/l at sample no.7 and maximum 189mg/l at sample no.18 during post monsoon season.



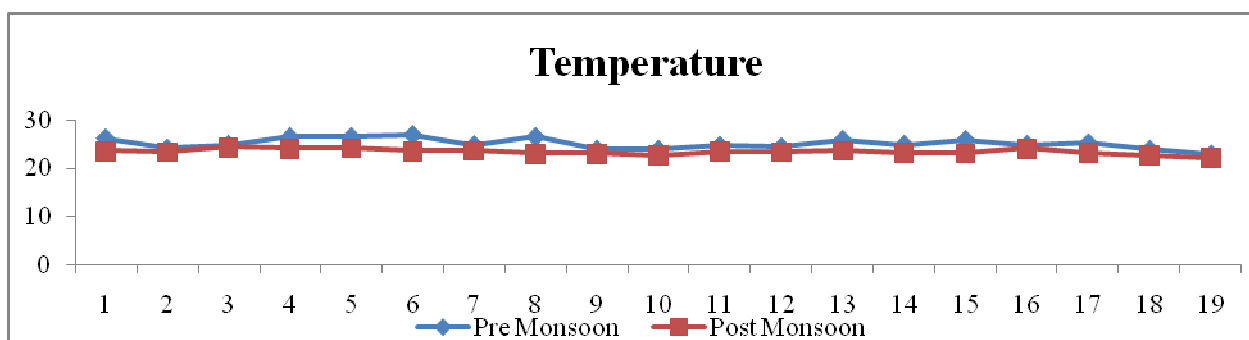
EC: Electrical conductivity is related with the presence of salts in. The study shows minimum concentration 68.8 μ mhos/cm at sample no.15 and maximum 78.98 μ mhos/cm at no.5 during pre-monsoon and minimum value 59.98 μ mhos/cm at sample no.12 and maximum 76.78 μ mhos/cm at sample no.5 during post monsoon season.



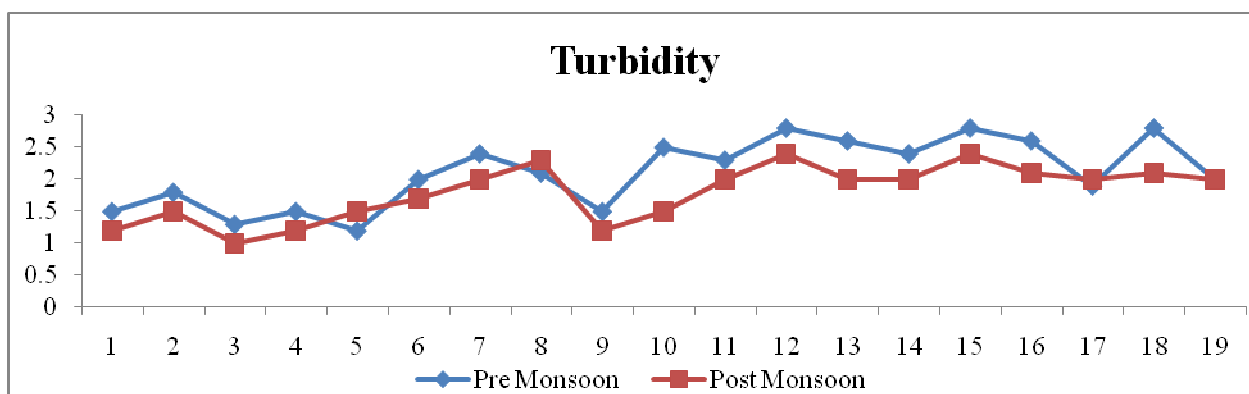
Cl: The presence of Chloride is related to the salt concentration hence beyond the permissible limit, the taste of salt is objectionable. The study shows minimum concentration of 23.99mg/l at sample no.7 and maximum 178.23mg/l at no.18 during pre-monsoon and minimum value of 13.64mg/l at sample no.7 and maximum 172.11mg/l at sample no.18 during post monsoon season.



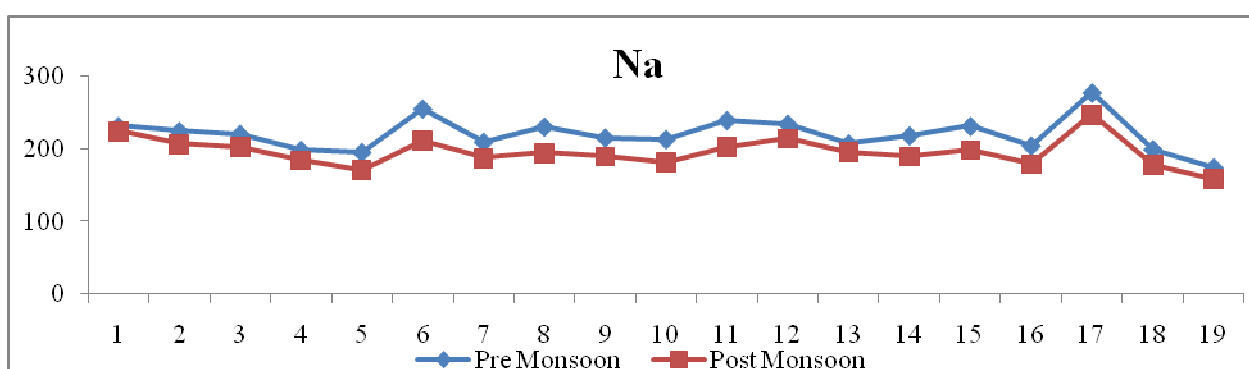
Temperature: One of the most important factors of water quality is temperature which determines various other factors. The study shows minimum 23 $^{\circ}$ temperature at sample no.19 and maximum 26.6 $^{\circ}$ C at no.4,5,8 during pre-monsoon and minimum value 22.2 $^{\circ}$ C at sample no.19 and maximum 24.4 $^{\circ}$ C at sample no.3 during post monsoon season.



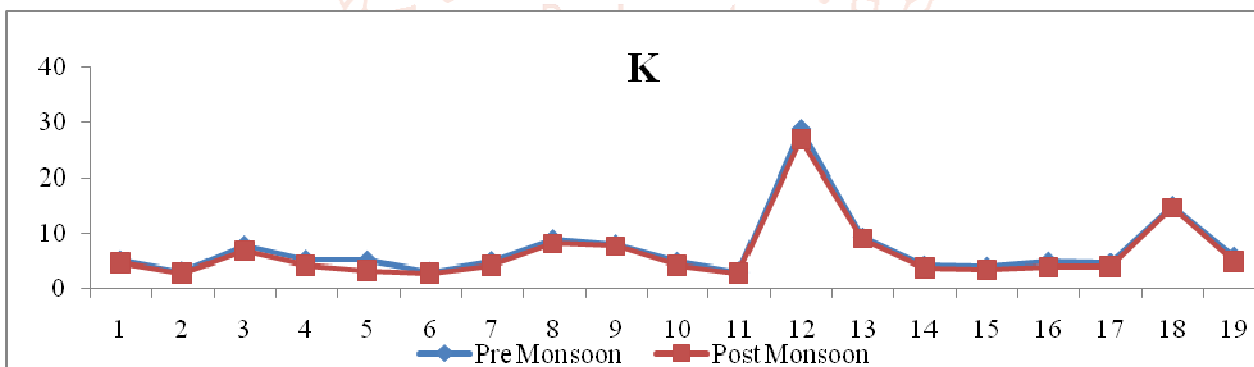
Turbidity: The clarity of water depends on turbidity. The study shows minimum concentration of 65NTU at sample no.17 and maximum 210NTU at no.12, 15, 18 during pre-monsoon and minimum value 1NTU at sample no.3 and maximum 2.4NTU at sample no.12, 15 during post monsoon season.



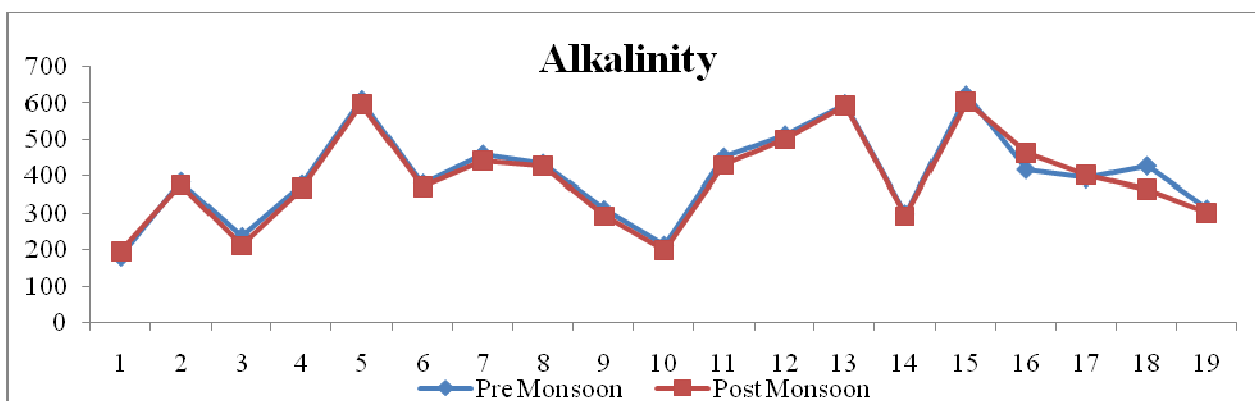
Na: The presence of Sodium describes the abundance of salt in water. The study shows minimum concentration of 175mg/l at sample no.19 and maximum 278mg/l at no.17 during pre-monsoon and minimum value of 159mg/l at sample no.19 and maximum 248mg/l at sample no.17 during post monsoon season.



K: The study shows minimum concentration of 3.01mg/l at sample no.6 and maximum 28.8mg/l at no.12 during pre-monsoon and minimum value of 2.74mg/l at sample no.11 and maximum 14.65mg/l at sample no.18 during post monsoon season.



Alkalinity: The presence of Alkalinity is considered as hard which comes with bitter taste in water. In present case, minimum concentration 180mg/l has been found at sample no.1 and maximum 623mg/l at no.15 in pre monsoon season and in post monsoon season, minimum concentration 196mg/l has been found at sample no.1 and maximum 605mg/l at no.15.



Conclusion:

The present study clearly reveals that all the water sources chosen for study, few of them are not managed suitably for the utilization of water. Based on the location, The Industrial areas like Upperkot, damp areas like Kali deh, commercial areas like Dodhpur showed very poor quality of drinking water whereas the rest of the water samples after some treatment or purification, can be considered as fit for drinking and domestic use.

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