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Study on Physico-chemical Parameters of Holy Pond Water in Soron Town (District Kasganj), North India

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Abstract

Eleven physical and chemical parameters like pH, TDS, total alkalinity, total hardness, chloride, fluoride, sulphate, nitrate, calcium, magnesium and iron were analysed in water samples drawn from 4 cornered and marked sites during monsoon (M), post-monsoon (PSM), winter (W) and pre-monsoon (PRM) season during 2017-18. Cornered and marked of holy pond is situated in Soron region. The present study revealed that pH, total hardness (TH), total alkalinity (TA), chloride, sulphate and nitrate were found to be within the prescribed standard norms. Fluoride concentration in samples from site P_1 and P_3 were found to be slightly higher than the desired limit but still under permissible limit laid down by BIS. Even Iron concentration were determined to be higher then permissible limit in all the samples from all the four sites. The higher concentration of TDS, iron, calcium and magnesium may be due to disposal & subsequent deposition of suspended particulate matter from activities of the pilgrims regarding holy procedures involving the pond water. These latter concentrations were maximumally found in the Badriya site P_1 situated in the west direction of the holypond.

Keywords: Physico-Chemical Parameters, Water Quality, Pond.

Introduction

The quality of water is of vital concern for the mankind since it is directlylinked with human welfare and as well as for the irrigation of crops. With therapid advancement in civilization and industrialization, the water is becomingday by day polluted and is rendered unsuitable for drinking and irrigation. Thisproblem is assuming alarming proportions and looms large on the horizons of developing countries. The major sources of water pollution are domestic wastes from urban and rural areas, and industrial wastes which are discharged into natural water bodies.

Review of Literature

Water, a most important and basic resources life saver for living beings (Chaurasia and Agrawal, 2002, Ravichandran, C., *et al.* 2002).

The analysis of water both in term of quality and quantity either in rivers, ponds or gram water (Moharir, A. *et al.* 2002) is essential for the very existence of mankind (Razak *et al.,* 2009; Visa and Jimoh, 2010; Rao *et al.,* 2012; Jena *et al.,* 2013). Uses of water for drinking, bathing, fisheries, irrigation and other domestic purposes is prominent these days even. Lack of hygiene awareness among mankind, uses of inefficient methods and technology have led to a large volume of water wastage in all domestic, agriculture and industrial areas (Rathod *et al.* 201 1; Mehta, 2011; Nkansah and Ephrain, 2009; Bhuvana and Ramesh 2012). Water pollution is rendering the available water unsafe for consumption. In India even today most of the population depends on surface water. Uttar Pradesh state is enriched with a lot of ponds and rivers. Major portion of the population of this state dependent on pond water for their daily water needs. Rain water is collected in the ponds through runoff from surface and gets polluted by various personal and industrial activities (Manivaskam, N. 1996).

In the present study four directional sampling sites, namely P1 (Badriya), P2 (Chandan Chowk), P3 (Chakra Teerath) and P4 (Kasganj Gate) in Soron region, (Kasganj) were selected around the periphhery of the experimental pond with an area of (1500mx500m). Location of sampling sites with respect to geographical direction of the pond is given in table 1.

Table 1

Sampling Site	Location Name	Direction Geographical
P1	Badariya	W
P2	Chandan Chowk	E
P3	Chakra Teerath	N
p4	Kasganj Gate	S

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Aim of the Study

The holy pond in Soron town bears an extreme religious significance. Lakh of pilgrims from peripheral areas visit this pond to perform all religious activities with full zeal, leading to pond water pollution and the subsequent health relative problems that may creep in and above all the lack of initiatives taken by the district board to keep water clean and maintain the health and hygiene. So with this standpoint the present study was undertaken to maintain pond water quality across the pond boundaries annually.

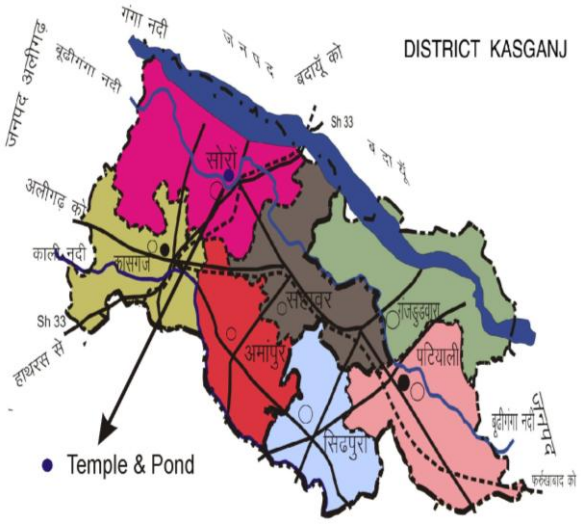
Materials and Methods

Study Area

Soron is a birthplace of great Indian poet TULSIDAS and is a well known pilgrimage spot, also known as SHUKAR KSHETRA. It is located at coordinates 27.88^0N 78.75^0E at an average elevation of 179m (587 feet) above sea level. Soron Shukar Kshetra is a city and a municipal board in Kasganj district in state Uttar Pradesh (North India). Huge no. of pilgrims gather here on Hindu auspicious occasions, like Deepawali, Sharad-Poornima, Makar Sankranti and Ramanavami with tremendous worship, celebrations and taking a bath in holy pond.

Sample Collection

Surface water samples from four directional cornered and marked sites of selected pond were collected in pre-cleaned polythene bottles. The water samples were collected 4 times in a year in different season's viz. monsoon (M) (June-Aug), post monsoon (PSM) (Sep-Nov), winter (W) (Dec-Feb) and pre-monsoon (PRM) season (March-May) from all the marked sites of the pond. They were preserved, marked and analysed according to standard methods (APHA, 1992) in table-3. The pH was measured using pH meter (SYSTRONIC 335) while total dissolved solids and turbidity were measured by conductivity meter (systronics-model 304) and turbidity meter (ELICO CL-52) respectively. Chloride and fluoride were measured argentometrically and by ion selective method respectively whereas sulphate, and nitrate were determined spectrophotometrically, while total hardness, total alkalinity, calcium and magnesium were measured titrimetricaly. Analysis for iron in water was done by atomic absorption spectrophotometer (Perkin Elmer 130).



Result and Discussion

The observation of analysed parameters in the collected water samples from each site are given in table 2. pH has no direct adverse effect on health, however, large pH values enhances the scaling in water heating appliances and even reduces germicidal potential of chloride. Higher pH also initiates the formation of haloalkanes which are toxic (Jena *et al.,* 2013). The pH values of selected water samples of present study ranged from 7.12 to 7.82 which are within the prescribed norms of standards but slightly alkaline in nature. Except TDS, total hardness, alkalinity, chloride, sulphate, nitrate, and fluoride were found well within the permissible prescribed norms of BIS. Calcium and Magnesium concentration in the site P_1, P_2 and P_4 found slightly higher than desired limit but under permissible limit of BIS. A positive correlation of pH with fluoride indicates that high alkaline nature of water formats leaching of fluoride and thus effect the concentration of fluoride in water (Salve *et al.,* 2007). The iron concentration ranged from 0.52 to 1.26 mg/L which is higher than desired limit in all of the sampling stations.

As per Sullivan, R.J. (1969) the presence of iron in atmosphere may be attributed to emission from the iron and power industry, thermal power plant and incineration. On the same grounds, the higher concentration of TDS, iron, calcium and magnesium may be due to dissolution and deposition of source activities performed by pilgrims on account of bathing and discarding worship material as well as idol matter in pond water. Even studies by Dey and Dutta (2018) for pond water in Durg, India was carried out due to excessive fecal contamination and human/animal unhygienic habits regarded usage of water and rendering it unfit for further uses in cooking and drinking purpose and leading an indication to protect the affected and concerned living beings. The iron concentration found in the Badariya site P_1 of the pond which is situated in the west direction was greater than other locations due to frequent and large number of such activities being performed in the preferred entry gate at Badariya. With such increased concentrations, both precipitation and dissolution is found, which results in decreasing pond clarity and encouraging iron as well as other ion parameters alongwith bacteria which affect fish and water both. Higher level of iron provides yellowish green colour to the pond water and even causes staining when the water is used for holy purpose. Even rippling effect of water due to bathing and other activities may carry out migration of mineral matter across other pond boundaries, resulting in pond water pollution in the sacred pond, which could be harmful for the concerned pilgrim, further more, the studies performed by Sajitha and Vijayamma (2016) scouted for water quality index of pond water in Athiyannor, where the quality qualified well for its essential human uses and messaging out authorities to protect such small water bodies and human beings.

Conclusion

It might be therefore suggestible that some regulated norms should be laid down for such activities like discarding worship materials. It should be taken care of that, pilgrims must abide by such norms in order to minimize the pollution of this religious and pious pond, and besides this maintaining its historical significance for the masses. Furthermore a periodic water quality monitoring is essential to save guard the concerned humans.

Acknowledgement

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Table 2. Analysis Result of Physico-Chemical Parameter of Selected Pond with Four Chosen Location

	Site P1						Site P2					
Para meters	Pre monsoon	Monsoon	Post Monsoon	Winter	Average	sd	Pre monsoon	Monsoon	Post Monsoon	Winter	Average	sd
pH	7.92	7.80	7.70	7.50	7.73	0.177	7.10	7.30	7.32	7.40	7.28	0.127
TDS	702	666	614	678	665	37.148	428	418	440	400	421.5	16.921
Cl^-	142	136	122	131	132.7	8.460	168	153	169	160	162.5	7.505
SO_4^-	81	63	64	64	68	8.679	76	82	42	64	66	17.663
TA	188	167	124	160	159.7	26.638	106	104	158	162	132.5	31.806
TH	201	188	145	204	184.5	27.333	296	188	154	204	210.5	60.693
NO_3	13	10	6.4	11	10.1	2.764	14	12	6.5	10	10.62	3.198
Mg	22	33	22	31	27	5.830	26	30	21	32	27.25	4.856
Ca	22	58	48	63	47.7	18.264	42	39	44	37	40.5	3.109
Fe	1.01	0.99	1.26	1.05	1.08	0.213	0.84	0.80	1.04	0.60	0.82	0.180
F	1.27	1.01	0.96	1.11	1.08	0.136	0.98	0.94	0.54	0.74	0.80	0.202

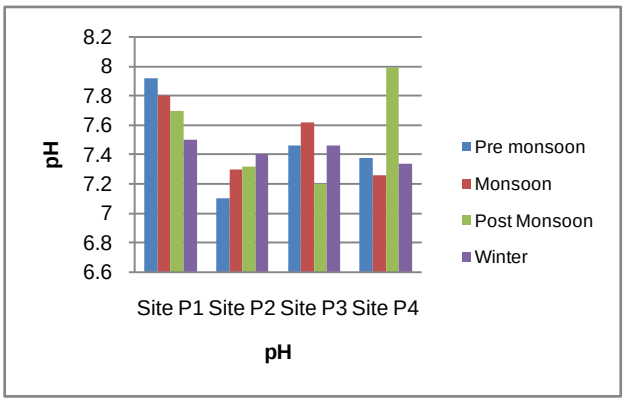
	Site P3						Site P4					
Parameters	Pre monsoon	Monsoon	Post Monsoon	Winter	Average	sd	Pre monsoon	Monsoon	Post Monsoon	Winter	Average	sd
pH	7.46	7.62	7.20	7.46	5.6	0.173	7.38	7.26	7.99	7.34	7.492	0.335
TDS	556	522	498	548	531.0	26.356	498	442	414	492	461.5	40.410

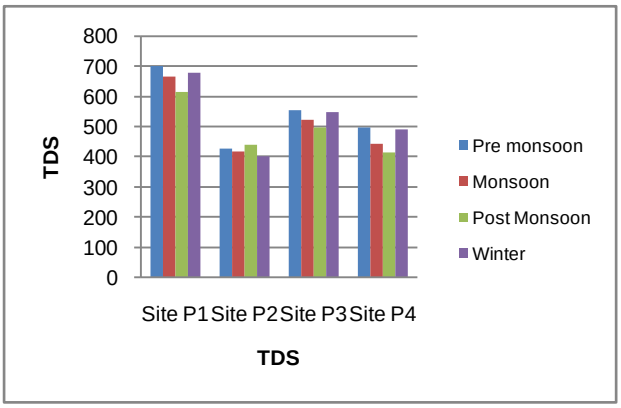
Cl^-	142	117	114	116	122.2	13.225	99	105	92	112	102.0	8.524
SO_4^-	14	96	22	86	54.5	42.469	92	75	44	84	73.7	21.013
TA	180	147	121	162	152.5	24.959	148	138	132	154	143.0	9.865
TH	228	178	160	196	190.5	29.000	218	152	140	193	175.7	36.179
NO_3	14	7.4	4.2	10	8.9	4.145	8	5	3.4	7	5.8	2.055
Mg	24	28	35	32	29.7	4.787	26	39	36	22	30.7	8.057
Ca	63	34	30	44	42.7	14.728	46	33	30	40	37.2	7.182
Fe	0.95	0.86	1.15	0.80	0.9	0.152	0.82	0.83	0.94	0.60	0.79	0.142
F	0.34	0.90	0.56	0.30	0.5	0.274	1.36	1.21	0.62	1.13	1.08	0.321

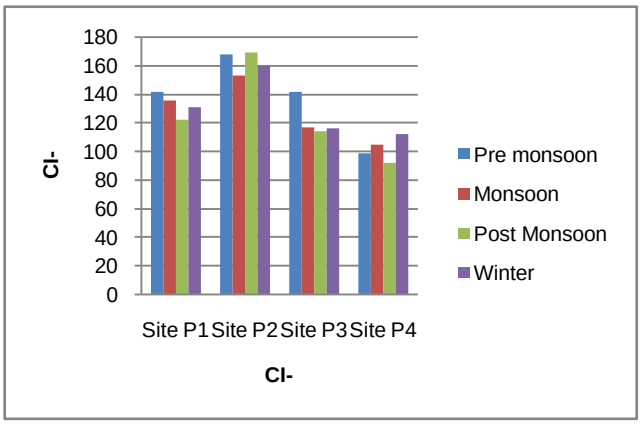
Table 3 : Parameters and Methods Employed in The Physicochemical Examination of Water Samples

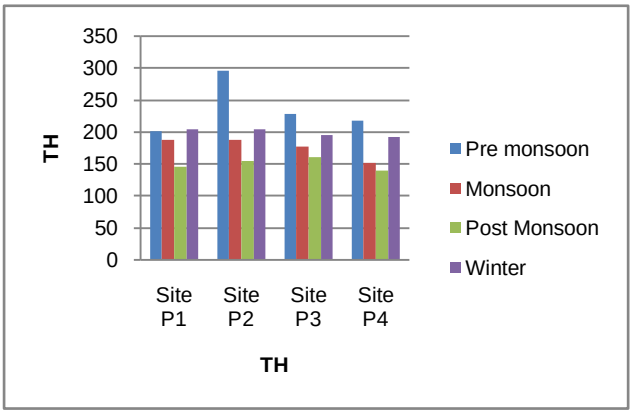
S.No.	Parameters	Unit	Method Employed
1.	pH	-	Digital pH meter
2.	Total alkalinity	mg/L	Titrimetric method (with H2SO4)
3.	Total Hardness	mg/L	Titrimetric method (with EDTA)
4.	Calcium Hardness	mg/L	Titrimetric method
5.	Magnesium Hardness	mg/L	Titrimetric method
6.	Chloride	mg/L	Titrimetric method (with AgNO3)
7.	Nitrate, Sulphate	mg/L	Spectrophotometric method
8.	Fluoride	mg/L	Ion Selective Electrode method
9.	Total Dissolved Solids	mg/L	Digital TDS-meter
10.	Electrical Conductivity	µS/cm	Digital conductivity meter
11.	Iron	ppm	Atomic absorption spectrophotometer

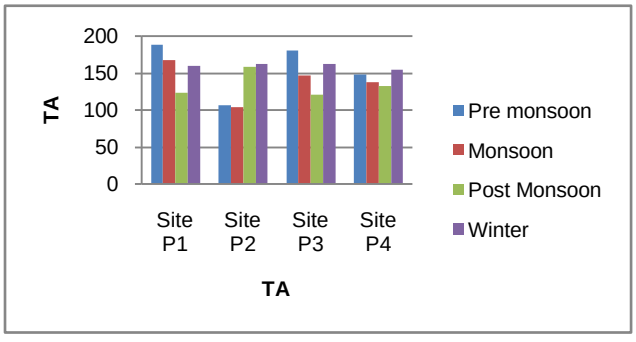
*Except pH all parameters are measured in mgL-1.

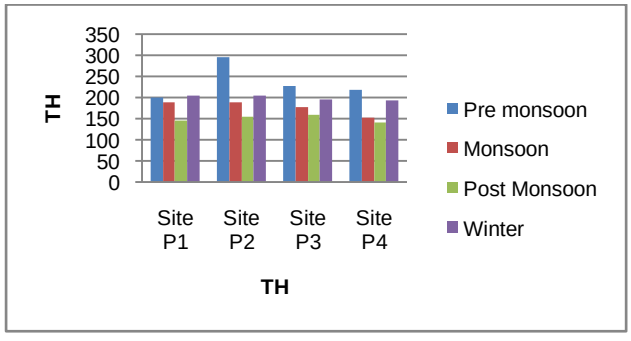


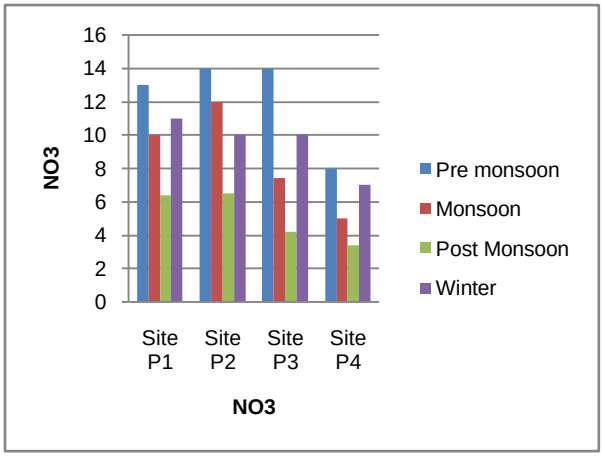








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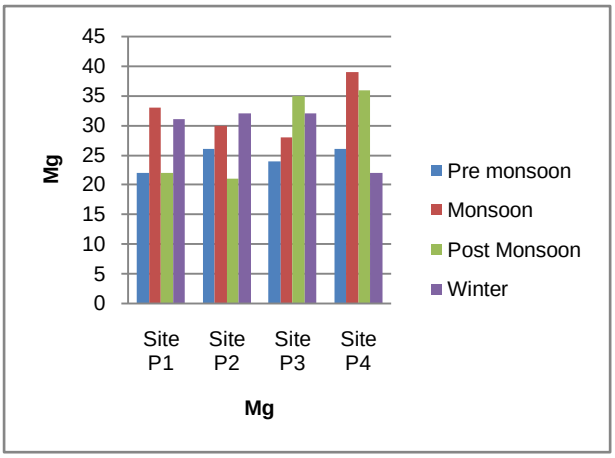
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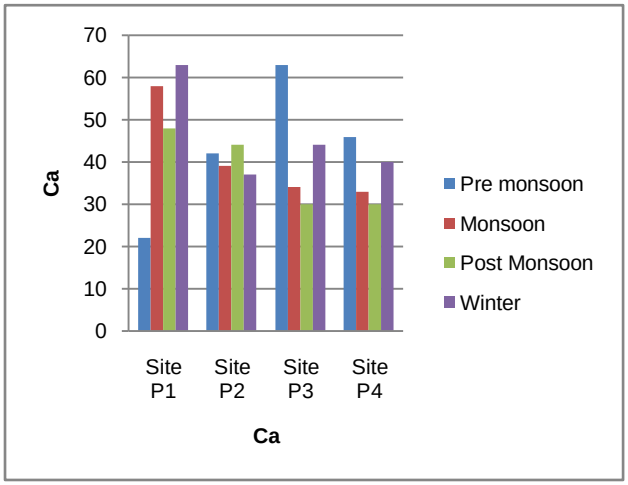
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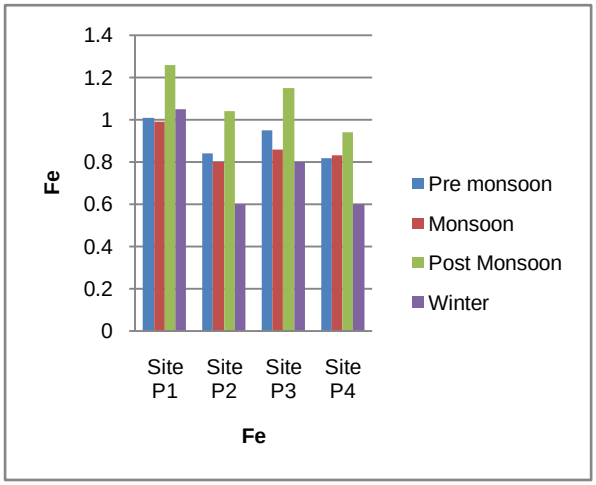
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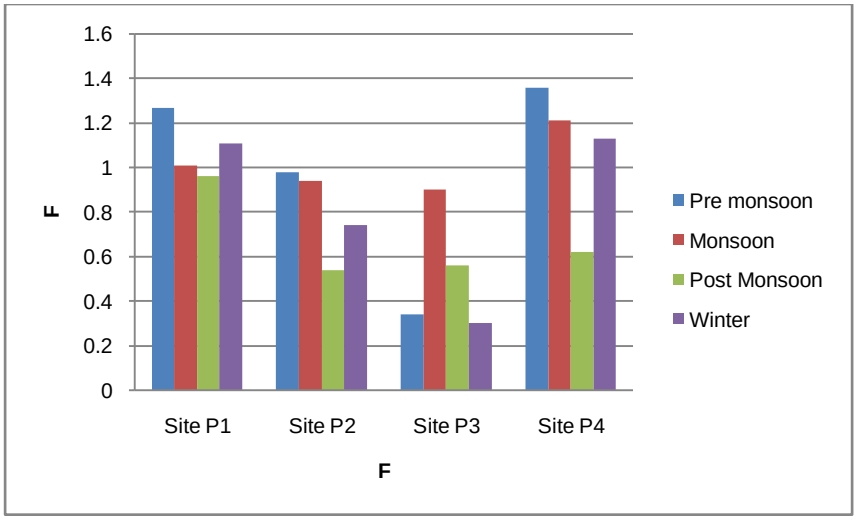
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