

Study of Yamuna River Water and Its Nearby Drinking Water Sources in North Delhi

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ABSTRACT

The Condition of River Yamuna is getting poor day by day in Delhi. Abandoned dhobi Ghats, their Tubs and Kilns Assemble on the boundary of the river and causes major amount of River Pollution. This Study is about Quality of Yamuna River Water and its nearby Drinking Water Sources in Delhi. In this Study we collected the Samples of Yamuna River and its nearby Drinking Water Sources from the people living on the boundaries of Yamuna. The areas in which the Samples taken were Kashmere Gate, Shastri Park and Geeta Colony. We mainly Studied 14 Parameters of Water Testing that were: DO, BOD, COD, TSS TDS, pH, Temperature for Yamuna River and Chlorine, Chloride, Calcium, Calcium Hardness, Total Hardness, Magnesium, Total Coliform Test for Drinking Water Sources. The Results are Compared with General Standards for Discharge of Environmental Pollutants of Inland Surface water by CPCB and BIS Standards of Drinking Water and they Show high Variability. The Levels of BOD were 31, 34 And 32 mg/L and COD Levels are 260, 300 and 300mg/L. The Total Hardness of Drinking Water Sources were 122,318 and 414 mg/L and Other Parameters also show some variability.

Keywords: Drinking Water Quality, North Delhi, Surface Water Quality, Yamuna River

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I. INTRODUCTION

Lakes, Ponds, Rivers, Wetlands are Known as Surface Water Resources. Precipitation is the Natural Recharging Source for The Surface Water and It also Maintain the Hydrological Cycle. Groundwater and Surface Water are not isolated Components of the Hydrologic System, but they interact with Each Other [1]. Drinking Water is that which is safe for Drinking and Food Purpose. The Requirements Of Drinking Water varies as it depends on the Physical activity , Age ,Health Issues And Conditions of Environment[2].For Drinking, People in Rural areas mostly Consume Ground Water Resources Like Wells, Hand Pumps. In Urban Cities Like Delhi People get Delhi Jal Board Supply. Yamuna River is one of the Important River of the India. It gets originated from the Yamunotri Glacier of the lower Himalayas in the Mussoorie Range and at an Elevation of 6,320m above Mean Sea Level in the Uttarkashi District of Uttarakhand, India. In Delhi, Yamuna travels a Distance of About 46 Km. Though Its Stretch Between Wazirabad Barrage to Downstream Okhla Barrage is less than 2% of the entire river stretch but It receives Around 70% of The Total Pollution Load causing Severe Pollution to the river [3]. 21 Major Wastewater Drains are Present in Nct-Delhi, Out of which 18 Drains Join Yamuna River and rest of them Joins Agra/Gurgaon Canal. In the Year 2015

And 2016, the Average of Drains in terms of Discharge was Calculated as 34.8 m³/s and 34.3 m³/s respectively [3]. The BOD Load average for these two Years was 164 Tons/Day (TPD) and 178 Tons/Day respectively and Najafgarh Drain was Considered as the Biggest Polluted Stretch after Shahdara Drain [3]. In Delhi, People Living in “Jhuggis” nearby Yamuna and Its Boundaries Mostly Use Hand Pumps or Delhi Jal Board Supply for Drinking And Cleaning Purposes. So this Paper is about to Study the Yamuna River Quality and Its Nearby Drinking Water Quality from different Sources in North Delhi.

II Areas of Study

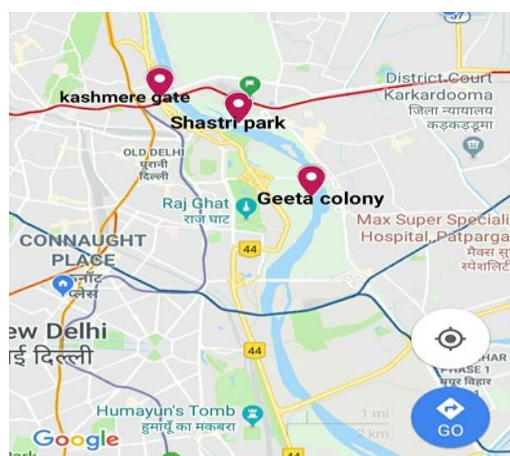
North Delhi is known as Administrative District of National Capital Territory of Delhi in India. The Population of North Delhi is 779,788(2001 Census) and Covers an area of 59km². It has a Population Density of 13,019 Persons per km². The Samples were Collected From Kashmere Gate, Shastri Park and Geeta Colony in Summer months from May-July of 2017. At least 3 Samples were Collected from each site.

Table I. Sampling Sites in North Delhi

S.no.	Location	Surface water sources	Drinking water sources
1.	Kashmere gate	Yamuna river	Nearby water tank
2.	Shastri park	Yamuna river	Hand pump
3.	Geeta colony	Yamuna river	Delhi Jal board supply

Table II. General Standards for Discharge of Environmental Pollutant of Inland Surface Water by CPCB

S.no.	Parameters	Methods	Standards(By CPCB)	Abbreviations
1	Biochemical Oxygen Demand	Titrimetric	30mg/L	BOD
2	Chemical Oxygen Demand	Titrimetric	250 mg/L	COD
3	Total Suspended Solids	Gravimetric	100mg/L	TSS
4	pH	Digital PH meter	5.0-9.0°C	pH
5	Temperature	Mercury Thermometer	shall not exceed 5°C above the receiving water temperature	Temp.
6	Dissolved Oxygen	Titrimetric	5mg/L	DO



Source: (Google Map)

Figure1: Sampling Sites at North Delhi

II. METHODOLOGY

Collection of Samples and Analysis were as per the Standard Protocols throughout the Experiments. Apparatus and Glassware's Used in the Laboratory were Of Borosilicate Glass (Caliberated Glasswares), Instruments and Chemicals Pvt. Ltd (Inco), Supertech (An ISO 9001:2008 Company And Thermo Scientific And Genexy Etc). All the Water Parameters were studied as Per the Protocol of General Standards For Discharge Of Environmental Pollutant Of Inland Surface Water By CPCB And BIS Standards Of Drinking Water Is 10500: 2012 As Shown in Table II and III Below.

Table III. BIS Standards of Drinking Water Is 10500: 2012

S.no.	Parameters	Methods	BIS Standards (Acceptable Limit)	Abbreviations
1.	Total dissolved solids	Gravimetric	500mg/L	TDS
2.	CHLORIDE	Titrimetric	250mg/L	
3.	CHLORINE	Chlorine Test kit	-	
4.	CALCIUM	Titrimetric	75mg/L	
5.	CALCIUM HARDNESS	Titrimetric	-	
6.	TOTAL HARDNESS	Titrimetric	200mg/L	
7.	MAGNESIUM	Titrimetric	30 mg/L	
8.	TOTAL COLIFORM TEST	Coliform Bottles	Must not be detectable in any 100 ml sample. In the case of large supplies, where sufficient samples are examined, must not be present in 95% of samples taken throughout any 12 month period.	

III. RESULTS AND DISCUSSION

The Parameters of Drinking Water are Compared with BIS and with Acceptable Limits(mg/L) [4]. The Parameters of Surface Water Are Compared with General Standards for Discharge of Environmental Pollutant of Inland Surface Water by CPCB [5].

Table IV. Proposed Classification of Water Quality [6].

Classification	Excellent C ₁	Acceptable C ₂	Slightly polluted C ₃	Polluted C ₄	Heavily polluted C ₅
Class index (score)	1	2	4	8	16
Parameters	Concentrations limit/ranges				
Turbidity (NTU)	5	10	100	250	>250
pH	6.5-7.5	6.0-6.5 and 7.5-8.0	5.0-6.0 and 8.0-9.0	4.5-5.0 and 9.0-9.5	<4.5 and >9.5
DO(%)	88-112	75-125	50-150	20-200	<20 and >200
BOD(20°C) (mg/L),max	1.5	3	6	12	24
TDS (mg/L),max	500	1,500	2,100	3,000	>3,000
Hardness CaCO ₃ (mg/L),max	75	150	300	500	>500

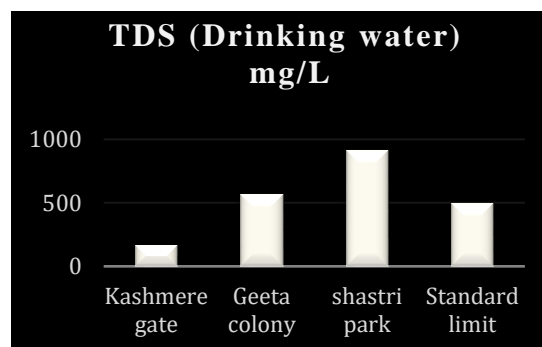


Figure4: TDS of Drinking Water

The TDS of Kashmere Gate, Geeta Colony and Shastri Park Surface Water were Reaching above The Acceptable Limits of General Standards For Discharge Of Environmental Pollutant of Inland Surface Water By CPCB, It Implies that Surface Water is highly Polluted there Due To Large Scale Dumping Of Religious, Holy Things Like Idols And Discharge Of Detergents And Soaps in to River [7]. The TDS of Kashmere Gate Drinking Water is Below the Standard Limit and can be used for Consumption, While The TDS of Geeta Colony and Shastri Park Drinking Water were Quite High, The Drinking Water Of Geeta Colony is from Delhi Jal Board and The Reason Of High Value of TDS Of Geeta Colony Drinking Water can be due to Chlorination Activities, Corrosiveness of Pipes etc [8]. While the Hand Pump was the drinking Sources for The People Living in the Jhuggis, near to the Shastri Park Stretch of Yamuna which indicated Contamination of nearby Ground Water also

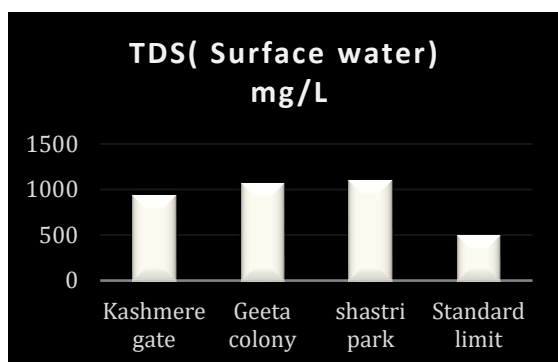


Figure3: TDS of Surface Water

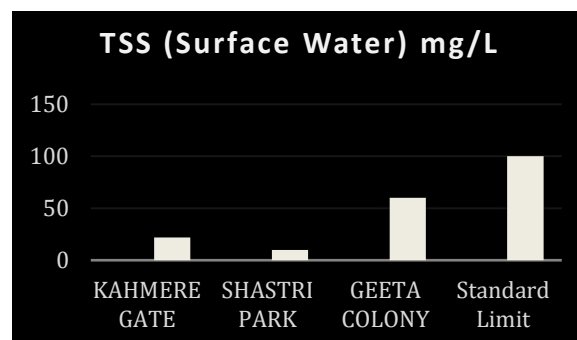


Figure5: TSS of Surface Water

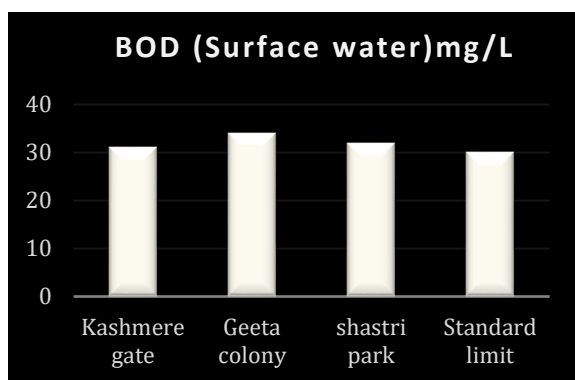


Figure 6: BOD of Surface Water

The TSS of Geeta Colony Surface Water is higher from Kashmere Gate And Shastri Park Because of Presence of Cremation Activities Over There. The BOD Levels of Kashmere Gate, Geeta Colony, And Shastri Park were High i.e 31, 34 And 32mg/L Respectively [9]. It Implies that Yamuna River Stretch is heavily Polluted there (Table IV).

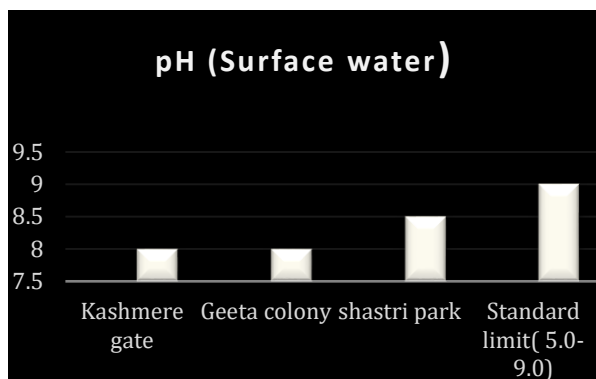


Figure7: pH of Surface Water

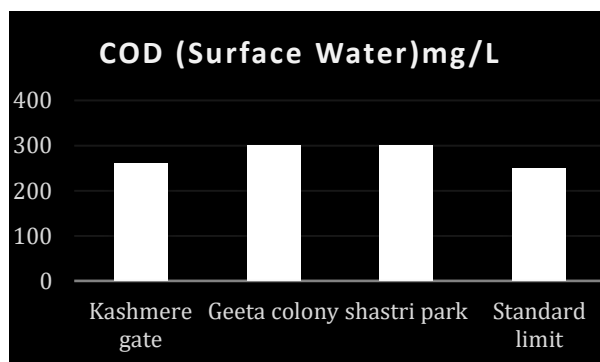


Figure8: COD of Surface Water

The pH of Surface Water Varies from 8 To 8.5 In the pH meter. The COD Levels of Kashmere Gate, Geeta Colony, Shastri Park Places were too High It Implies that the Industrial Effluents, Sewage Effluents, Domestic Waste Water, Solid Wastes were Too High in the River [10].

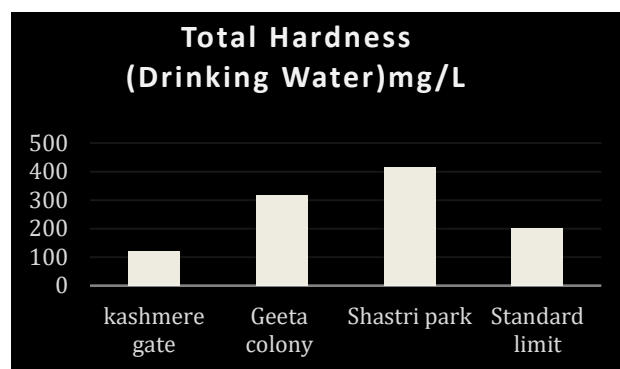


Figure9: Total Hardness of Drinking Water

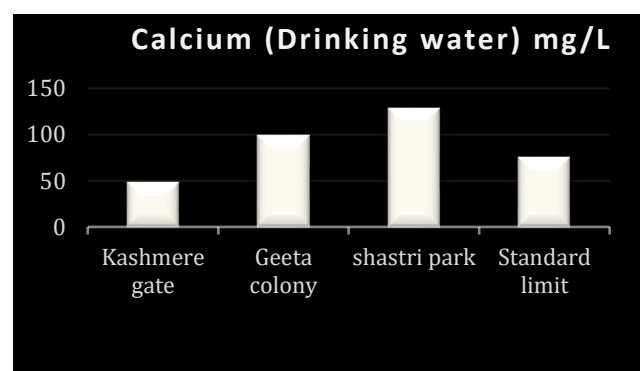


Figure10: Calcium Levels of Drinking Water

The Total Hardness of Geeta Colony Drinking Water and Shastri Park Drinking Water were High According to the Acceptable Limits of BIS (Fig.1). The Calcium amount of Geeta Colony and Shastri Park Drinking Water were Quiet high, and Kashmere Gate was Below the Standard Limits. Inadequate intakes of Calcium have Been associated with Increased Risks Of Osteoporosis, Nephrolithiasis (Kidney Stones), Colorectal Cancer, Hypertension And Stroke, Coronary Artery Disease, Insulin Resistance And Obesity [11].

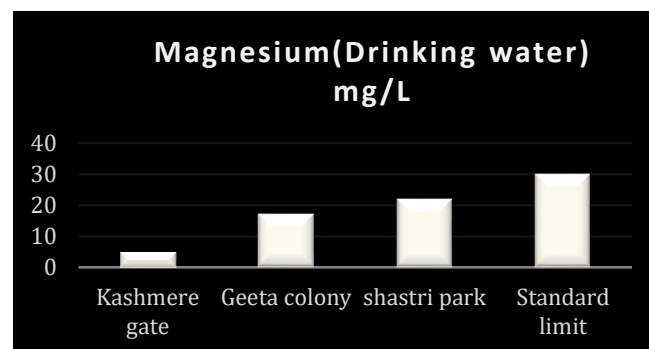


Figure11: Magnesium of Drinking Water

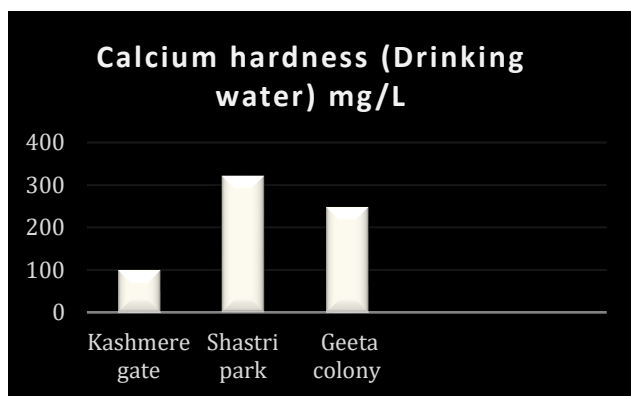


Figure12: Calcium Hardness of Drinking Water

The Magnesium Levels were Below the BIS Standard Limits. The Calcium Hardness of Kashmere Gate, Shastri Park And Geeta Colony Were 98, 320 And 248 mg/L Respectively

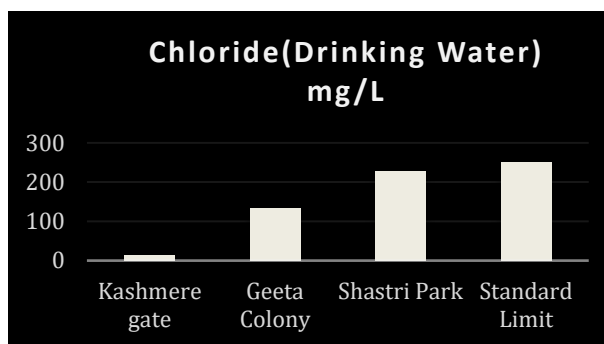


Figure13: Chloride of Drinking Water

The Chloride Levels of all the Places are Under the Acceptable Limits. Chlorine is Being added in Drinking Water to Remove Bacterial Impurities at Geeta Colony and Kashmere Gate [12].

The Temperature of River was in the range from 30°C to 34°C The Total Coliform was Found in Kashmere Gate and Shastri Park Drinking Water except Geeta Colony. Sewage Discharges and Improperly Treated Septic can be Main Source of Pathogens in Drinking water [13]. The Dissolved Oxygen was not found in all these Places Due to Pollution of Surface Water [14].

IV. CONCLUSION

The pH of Sites Geeta Colony, Shastri Park And Kashmire Gate Surface Water Lies in the Desirable Range of CPCB Guidelines of Inland Surface Water. DO was almost zero In all these Places. The BOD Range of these three Sites were above the Standard Limits According to CPCB Guidelines, The COD Range Of Kashmere Gate, Shastri Park, Geeta Colony Sites exceeds The CPCB Guidelines Hence it also not meet the Oxygen Required for the Digestion of Chemicals Present in

the River. The TDS of the Drinking Water Sources of Geeta Colony and Shastri Park is Quite High. The TDS of Geeta Colony Surface Water found to be High From Kashmere Gate and Shastri Park. The Calcium Levels of Kashmere Gate Drinking Water is Suitable but not for Geeta Colony and Shastri Park. The Magnesium Levels are Suitable for all these Sites. The Chloride Limit of Drinking Water Lies within the Desirable Limits. The Total Hardness of Geeta Colony and Shastri Park not meet the BIS Guidelines. Calcium Hardness for Drinking Water were 98,320 And 248 mg/L. The Total Coliform was found in Kashmere Gate and Shastri Park Drinking Sources. Chlorine Need to be added to Remove the Impurities or Bacterial Formation in Kashmere Gate and Geeta Colony Drinking Water Sources. There is emergency need for Strict Actions to be taken on The Yamuna River Cleanliness Because the People Living Nearby to its Boundary and Consuming this Impure Water For their Households can face Serious Health Issues in Future And Cleanliness of Drinking Water Should Be Maintained.

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REFERENCES-

- [1]. Marios Sophocleous, Interactions Between Groundwater and Surface Water: the State of the Science, Hydrogeology Journal, Vol. 10, 2002, Pp. 52–67.
- [2]. A. C. Grandjean, Water Requirements, Impinging Factors and Recommended Intakes, Work. Pap. No. 3, 2004, Pp. 25–40.
- [3]. CPCB, Water Quality Status In Delhi Stretch of Yamuna River , 2015,Pp. 1–4.
- [4]. BIS, Indian Standard Drinking Water Specification (Second Revision), Bur. Indian Stand., Vol. Is 10500, May, 2012, Pp. 1–11 .
- [5]. M. Sawal , General Standards for Discharge of Environmental Pollutants, Environ. Rules, Vol. 2, No. 174, 1986, Pp. 545–560.
- [6]. D. Katyal, A. Qader, A. H. Ismail, And K. Sarma, Water Quality Assessment of Yamuna River in Delhi Region Using Index Mapping, Interdiscip. Environ. Rev., Vol. 13, 2012, Pp.170–186.
- [7]. A. K. Misra , A River About To Die", Journal Of Water Resource And Protection, Vol.2 No.5, 2010,Pp. 489-500.

- [8]. WHO, Total Dissolved Solids in Drinking-Water, Background Document For Development Of Who Guidelines For Drinking Water Quality, Heal. Criteria Other Support. Inf., Vol. 2, 1996, Pp.1-7.
- [9]. D. S. Bhargava, Most Rapid BOD Assimilation in Ganga and Yamuna River , Journal Of Environmental Engineering, American Society Of Civil Engineers, Vol. 109, No. 1, 1983, Pp. 174-188.
- [10]. Hindu, Delhi Reduces Yamuna to a Sewage Drain, New Delhi, 2002.
- [11]. M. P. Thomas, Calcium and Magnesium in Drinking-Water: Public Health Significance, International Journal of Environmental Studies, Vol. 67, No. 4, 2010, Pp.612-613.
- [12]. J. E. Dyksen, C Spencer, R Hoehn, J Clement, And J Brandt-Edwards (Project #2940), Long- Terms Effects of Disinfection Changes On Water Quality, 2007.
- [13]. New Brunswick, "Coliform Bacteria – Total Coliforms & E.Coli," Facts Drink. Water-Coliform Bact. 2010, Pp.1-4.
- [14]. M. Sharma And S. Chaudhry, "Impact Of Industrial Pollution on Yamuna River: A Review Impact Of Industrial Pollution On Yamuna River: A Review," Iind Int. Conf. Environ. Manag. Hyderabad (Icem 2010), No. November 2015, Pp. 512–521.

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