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International Journal on Environmental Sciences

International Journal on Environmental Sciences 12 (1), January-June 2021, pp. 24-31
https://doi.org/10.53390/ijes.v12i1.5
ISSN No.: 0976-4534

GEOSPATIAL TECHNIQUES AIDED STUDY OF GHAGGAR RIVER WATER QUALITY FOR DRINKING PURPOSE IN PANCHKULA DISTRICT, HARYANA, INDIA

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Research Article

Received: **28.12.2020** Accepted: **15.01.2021** Published: **24.01.2021**

ABSTRACT

Water is important for survival of living beings as well as geological and geomorphic processes on the planet Earth. In the present scenario of developmental activities both surface and groundwater are polluted and need attention for checking the pollutant sources. Ghaggar river in northern part of the country is flowing from the states-Himachal Pradesh, Haryana, Punjab, Rajasthan and finally in Pakistan. In the upper part of the Ghaggar river after entering in Haryana in Panchkula district its water quality has been assessed for drinking purpose. Eight river water samples were collected from different locations of Ghaggar River in the month of June 2019. Water samples were analyzed using Field Water Testing Kit prepared by Tamilnadu Water Supply and Drainage Board (TWAD), Chennai for chemical parameters-pH, Hardness, Chloride, Fluoride, Iron, Ammonia, Nitrite, Nitrate, Phosphate and Residual Chlorine. Results of chemical analysis of water samples were categories as per BIS drinking water standards (IS 10500:2012). In the river water samples pH ranges from 6.5 to 7.5; hardness ranges from 100 mg/l to 1170 mg/l; chloride ranges from 50 mg/l to 360 mg/l; fluoride ranges from 0.5 mg/l to 3 mg/l; iron ranges from nil to 10 mg/l; aammonia ranges from 0.5 mg/l to 5 mg/l; nitrite ranges from 0.2 mg/l to 1 mg/l; nitrate ranges from 20 mg/l to 150 mg/l; phosphate ranges from 0.5 mg/l to 1 mg/l and residual chlorine ranges from nil to 2 mg/l. The data interpretation shows that pH in all the eight water samples is desirable for drinking purpose; hardness is desirable at Bitna, Kaushalya Dam, MajriChowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and permissible at Jagatpur and non-potable at ChandiMandir; chloride is desirable at Bitna, Jagatpur, Kaushalya Dam, MajriChowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and permissible at ChandiMandir; fluoride is desirable at Bitna, Jagatpur, Kaushalya Dam, MajriChowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at ChandiMandir; iron is desirable at Bitna, Kaushalya Dam, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at Jagatpur, ChandiMandir, MajriChowk; ammonia is desirable at Bitna, Sector-28, Panchkula, Daffarpur and non-potable at Jagatpur, Kaushalya Dam, ChandiMandir, MajriChowk, Peer Muchchalla; nitrite is desirable in all the eight water samples; nitrate is desiarble at ChandiMandir, MajriChowk, Peer Muchchalla, Sector-28, Panchkula and non-potable at Bitna, Jagatpur, Kaushalya Dam, Daffarpur; phosphate is desirable in all the eight water samples and residual chlorine is desirable at Bitna, Jagatpur, Kaushalya Dam, ChandiMandir, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at MajriChowk. The study shows that river water is not suitable for drinking purpose in seven water samples except one water sample (Sector-28, Panchkula). The study is highly useful for monitoring the water quality of Ghaggar River.

Keywords: Geospatial technology, Ghaggar River, water, quality, Panchkula, Haryana.

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INTRODUCTION

Water is important for survival of livings on the planet Earth. Rivers are one of the water carriers from one place to other place. In the source areas river water is generally good but it becomes polluted when reaches in consumption areas i.e. populated and industrial areas. Rivers are the nerves of an area and need prime attention to keep them pollution free so that good quality of water may reach to people. But, the situation of water quality of rivers is alarming. Satellite remote sensing data are good source for mapping of rivers and selection of sample sites. Many workers have done good work on river water quality Olajire and Imeokparia (2001),Joshi et al. (2009), Norsaliza and Mohd (2010), Yisa and Jimoh(2010), Aggarwal and Arora (2012),Uddin et al. (2014),Asadi et al. (2017),Alssgeera et al. (2018),Gafri et al. (2018), Raj, Naveen et al. (2018).

STUDY AREA

Ghaggar River originates in Sirmour District of Himachal Pradesh and travels a length of 320 Km through the States of Haryana, Punjab and Rajasthan in India and after that in Pakistan. It enters the territory of Haryana in Panchkula District near Kalka and passes through the Panchkula district to Mohali district in Punjab and again enters in Ambala district of Haryana and then enters into Patiala district in Punjab and it again enters in Kaithal district of Haryana and then crosses to Sangrur district of Punjab and it again enters in Fatehabad district of Haryana and crosses to Mansa district of Punjab and enters in Sirsa district of Haryana and finally enters in Hanumangarh district of Rajasthan and after that in Pakistan. In the present study a small part of the Ghaggar River falling in Panchkula district have been selected for its water quality assessment for drinking purpose (Fig.1).

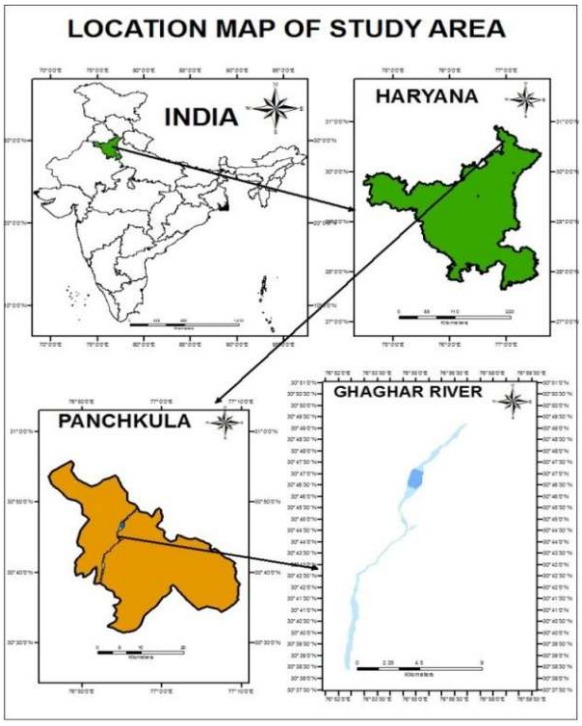

Fig.1: Location map of the study area.

OBJECTIVE

The main objective of the study was to assess Ghaggar River water qualityfor drinking purpose in Panchkula district, Haryana.

MATERIALS USED AND METHODOLOGY

Ghaggar River was digitized on Google earth satellite data in ArcGIS software. Eight water samples of Ghaggar River were collected in plastic 250 ml bottles in the month of June 2019 (Fig.2, Table 1). Geo-coordinates of sample sites were noted with the help of mobile GPS. Chemical analysis of eight water samples was done using Field Water Testing kit prepared by Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai for ten chemical parameters viz. pH, hardness, chloride, fluoride, iron, ammonia, nitrite, nitrate, phosphate and residual chlorine (Table 2). Water samples analysis results were categorized into desirable, permissible and non-potable on the basis of BIS (IS:10500:2012) Drinking Water Standards (Table 3).

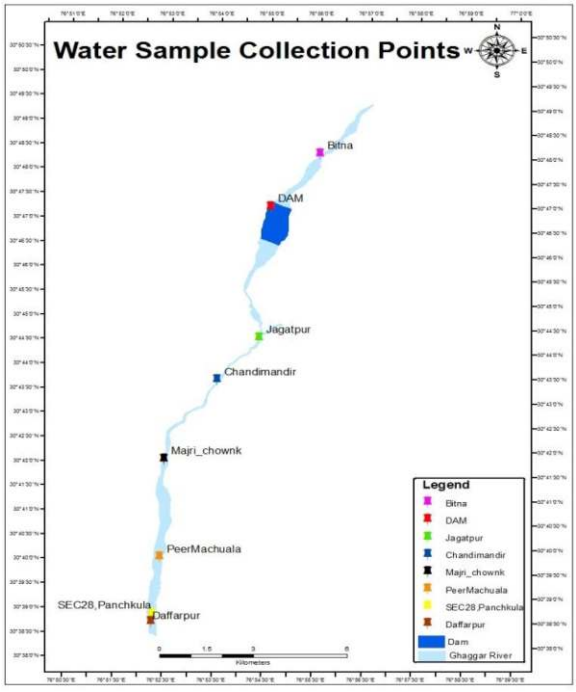

Fig.2: Location of water samples on Ghaggar River.

Table 1: Location of Ghaggar River water samples.

S. No.	Sample Locations	Latitude	Longitude
1	Bitna	30.802932^0	76.931645^0
2	Jagatpur	30.740461^0	76.909989^0
3	Kaushalya Dam	30.785095^0	76.914733^0
4	ChandiMandir	30.726251^0	76.895649^0
5	MajriChowk	30.699540^0	76.877357^0
6	Peer Muchchalla	30.666147^0	76.875203^0
7	Sector-28, Panchkula	30.646977^0	76.872468^0
8	Daffarpur	30.6442420	76.871799^0

Table 2: Results of chemical analysis of Ghaggar River water samples.

S. No.	Sample Locations	pH	Hardness (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)
1.	Bitna	7.0	200	50	1	0	0.5	1	150	1	0
2.	Jagatpur	7.5	300	230	0.5	3	5	1	150	0.5	0
3.	Kaushalya Dam	6.5	100	50	0.5	0.3	1	1	100	1	0
4.	ChandiMandir	7.5	1170	360	3	5	1	0.2	45	0.5	0.2
5.	MajriChowk	7.5	150	150	1	10	3	0.2	20	0.5	2
6.	Peer Muchchalla	7.0	150	150	1	0.5	2	0.5	45	0.5	0.2
7.	Sector 28, Panchkula	7.5	190	170	1	0.3	0.5	0.2	45	0.5	0.2
8.	Daffarpur	7.5	200	50	1	0	0.5	0.5	75	1	0.2

Table 3: BIS Drinking Water Standards (IS 10500:2012).

S. No.	Constituent	Potable		Non-Potable
		Desirable	Permissible	
1	pH	6.5 to 8.5	-	<6.5 to >8.5
2	Total Hardness (mg/l)	<200	200-600	>600
3	Chloride (mg/l)	<250	250-1000	>1000
4	Fluoride (mg/l)	<1.0	1.0-1.5	>1.5
5	Iron (mg/l)	<0.3	-	>0.3
6	Ammonia (mg/l)	<0.5	-	>0.5
7	Nitrite (mg/l)	<1.0	-	>1.0
8	Nitrate (mg/l)	<45	-	>45
9	Phosphate (mg/l)	<1.0	-	>1.0
10	Residual Chlorine (mg/l)	<0.2	0.2-1	>1.0

RESULTS AND DISCUSSION

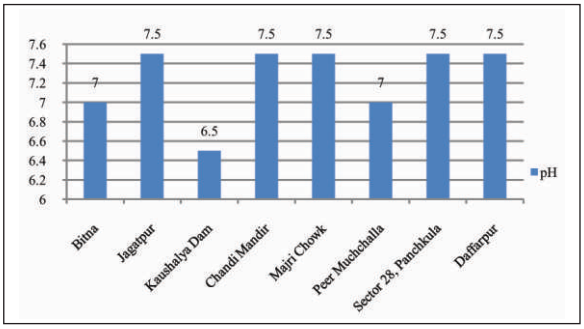

Fig.3: pH in Ghaggar River water samples.

i. pH

In the Ghaggar River water samples pH ranges from 6.5 to 7.5. pH is desirable in all the eight Ghaggar river water samples (Bitna (7), Jagatpur (7.5), Kaushalya Dam (6.5), ChandiMandir (7), Majri Chowk (7.5), Peer Muchchalla (7), Sector-28, Panchkula (7.5), Daffarpur (7.5) (Fig.3).

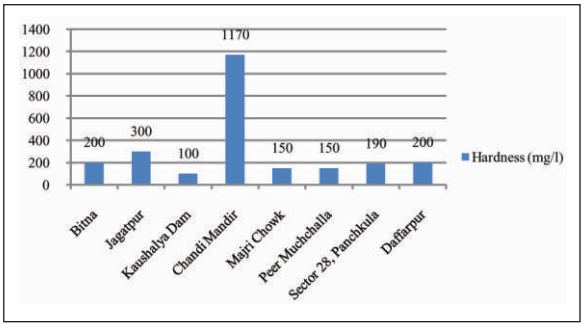

Fig. 4: Hardness in Ghaggar River water samples.

ii. Hardness

In the Ghaggar River water samples hardness ranges from 100 mg/l to 1170 mg/l. Hardness is desirable at Bitna (200 mg/l), Kaushalya Dam (100 mg/l), MajriChowk (150 mg/l), Peer Muchchalla (150 mg/l), Sector-28, Panchkula (190 mg/l), Daffarpur (200 mg/l) and permissible at Jagatpur (300 mg/l) and non-potable at Chandi Mandir (1170 mg/l)(Fig.4).

iii. Chloride

Chloride ranges from 50 mg/l to 360 mg/l in the Ghaggar river water samples. Chloride is desirable at Bitna (50 mg/l), Jagatpur (230 mg/l), Kaushalya Dam (50 mg/l), MajriChowk (150 mg/l), Peer Muchchalla(150 mg/l), Sector-28, Panchkula (170 mg/l), Daffarpur (50 mg/l) and permissible at ChandiMandir (360 mg/l) (Fig.5).

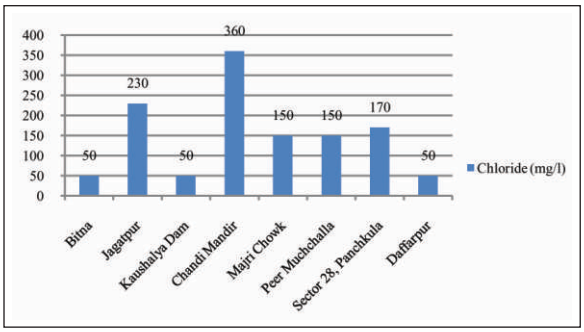

Fig.5: Chloride in Ghaggar River water Samples.

iv. Fluoride

Fluoride ranges from 0.5 mg/l to 3 mg/l in the Ghaggar river water samples. Fluoride is desirable at Bitna(1mg/l), Jagatpur(0.5mg/l), Kaushalya Dam (0.5 mg/l), Majri Chowk(1mg/l), Peer Muchchalla(1mg/l), Sector-28, Panchkula (1mg/l), Daffarpur (1mg/l) and non-potable at ChandiMandir(3 mg/l) (Fig.6).

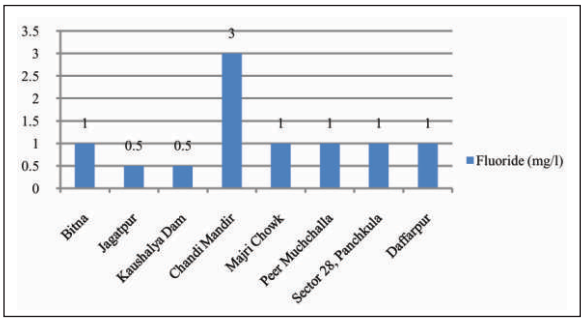

Fig.6: Fluoride in Ghaggar River water samples.

v. Iron

Iron ranges from nil to 10 mg/l in the Ghaggar river water samples. Iron is desirable at Bitna(0 mg/l), Kaushalya Dam (0.3 mg/l), Peer Muchchalla (0.5 mg/l), Sector-28, Panchkula (0.3 mg/l), Daffarpur (0 mg/l) and non-potable at Jagatpur (3 mg/l), ChandiMandir (5 mg/l), MajriChowk (10 mg/l)(Fig.7).

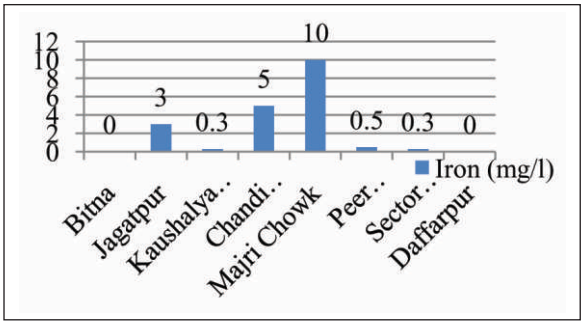

Fig.7: Iron in Ghaggar River water samples.

vi. Ammonia

Ammonia ranges from 0.5 mg/l to 5 mg/l in the Ghaggar river water samples. Ammonia is desirable at Bitna (0.5mg/l), Sector-28, Panchkula (0.5 mg/l), Daffarpur (0.5 mg/l) and non-potable at Jagatpur (5mg/l), Kaushalya Dam (1mg/l),ChandiMandir (1 mg/l),MajriChowk (3 mg/l), PeerMuchchalla (2 mg/l) (Fig.8).

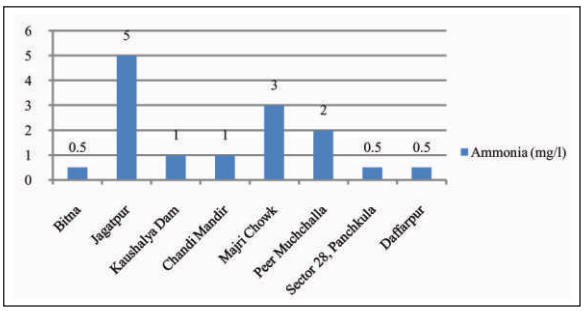

Fig.8:Ammonia in Ghaggar River water samples.

vii. Nitrite

In the Ghaggar river water samples nitrite ranges from 0.2 mg/l to 1 mg/l. Nitrite is desirable in all the eight water samples**(**Bitna (1mg/l), Jagatpur (1mg/l), Kaushalya Dam (1 mg/l), ChandiMandir (0.2 mg/l), MajriChowk (0.2 mg/l), Peer Muchchalla (0.5mg/l), Sector-8, Panchkula (0.2 mg/l), Daffarpur (0.5 mg/l) (Fig.9).

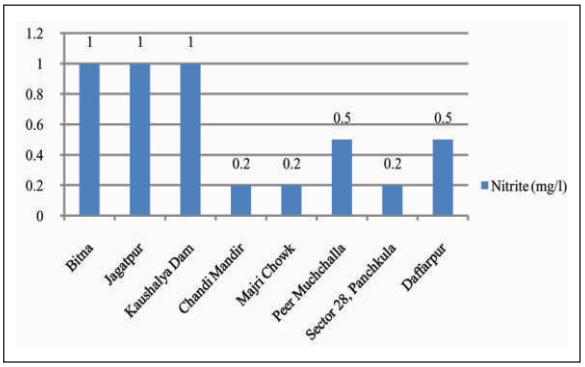

Fig. 9: Nitrite in Ghaggar River water samples.

viii. Nitrate

Nitrate ranges from 20mg/l to 150 mg/l in the Ghaggar river water samples. Nitrate is desiarble atChandiMandir (45 mg/l), MajriChowk (20 mg/l), Peer Muchchalla (45 mg/l),Sector-28, Panchkula (45 mg/l) and non-potable at Bitna (150 mg/l), Jagatpur (150 mg/l), Kaushalya Dam (100 mg/l), Daffarpur (75 mg/l) (Fig.10).

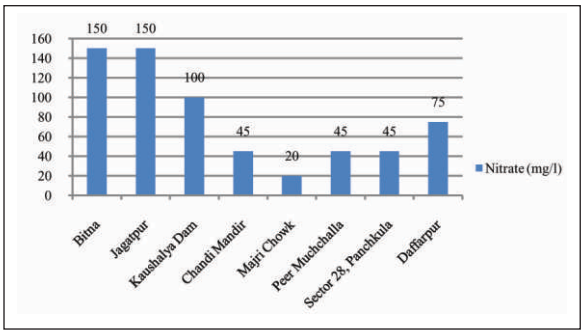

Fig. 10: Nitrate in Ghaggar River water samples.

ix. Phosphate

Phosphate ranges from 0.5 mg/l to 1 mg/l in the Ghaggar river water samples. Phosphate is desirable in all the eight samples(Bitna (1 mg/l), Jagatpur (0.5 mg/l), Kaushalya Dam (1 mg/l), ChandiMandir (0.5 mg/l), MajriChowk (0.5 mg/l), Peer Muchchalla (0.5 mg/l),Sector-28, Panchkula (0.5 mg/l), Daffarpur (1 mg/l) (Fig.11).

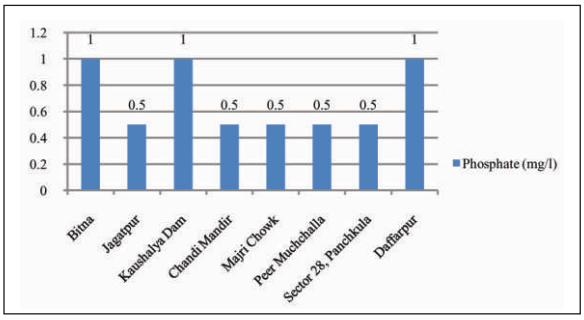

Fig. 11:Phosphate in Ghaggar River water samples.

x. Residual Chlorine

Residual Chlorine ranges from nil to 2mg/l in the Ghaggar river water samples. Residual Chlorine is desirable atBitna (0 mg/l), Jagatpur (0 mg/l),Kaushalya Dam (0 mg/l), ChandiMandir (0.2 mg/l), Peer Muchchalla (0.2 mg/l),Sector-28, Panchkula (0.2 mg/l), Daffarpur (0.2 mg/l) and non-potable at MajriChowk (2 mg/l) (Fig.12).

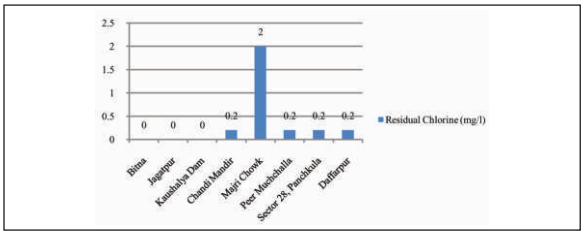

Fig.12: Residual Chlorine in Ghaggar River water samples.

GHAGGAR RIVER WATER QUALITY AT SAMPLE SITES

I. Bitna

At Bitna water sample site pH, hardness, chloride, fluoride, iron, ammonia, nitrite, phosphate, residual chlorine is desirable except nitrate (150 mg/l) which is non-potable, hence, the water is non-potable (Fig.13). Nitrate is an anthropogenic pollutant in the Ghaggar river water, therefore, source of the pollutant may be identified and closed.

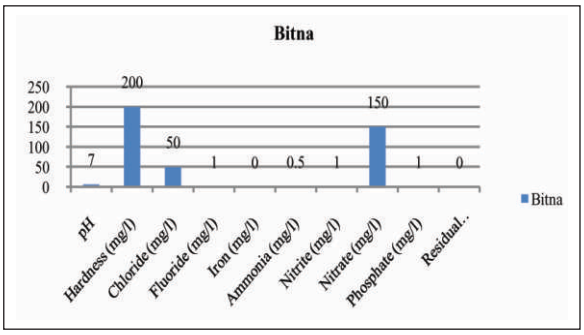

Fig. 13: Ghaggar River water quality at Bitna.

ii. Jagatpur

At Jagatpur water sample site pH,chloride, fluoride, nitrite, phosphate, residualchlorine isdesirable; hardness is permissible and iron, ammonia and nitrate are non-potable, hence, the water is non-potable (Fig.14). Iron, ammonia and nitrate in the Ghaggar river water may be due to anthropogenic reasons, therefore, source of pollutants may be identified and closed.

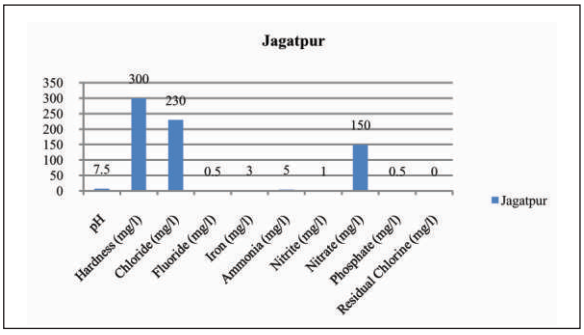

Fig.14:Ghaggar River water qu.ality at Jagatpur

iii. Kaushalya Dam

At Kaushalya Dam water sample site pH, hardness, chloride, fluoride, iron, nitrite, phosphate, residual chlorine is desirable and ammonia and nitrate are non-potable, hence, the water is non-potable (Fig.15). Ammonia and nitrate in the Ghaggar river water may

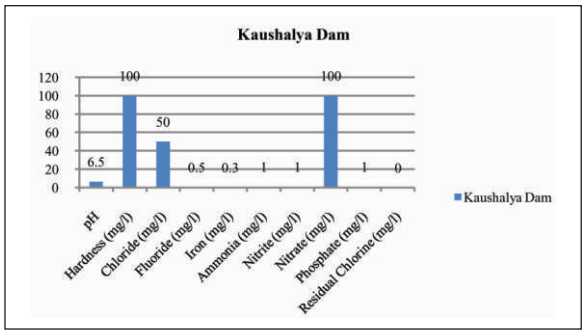

Fig.15:Ghaggar River water quality at Kaushalya Dam.

be due to anthropogenic reasons, therefore, source of the pollutants may be identified and closed.

iv. Chandi Mandir

At Chandi Mandir water sample site pH, nitrite, nitrate, phosphate, residual chlorine is desirable; chloride is permissible and hardness, fluoride, iron, ammonia are non-potable, hence, the water isnon-potable (Fig.16). Hardness, fluoride, iron, ammonia in the Ghaggar river water may be due to anthropogenic reasons, therefore, source of the pollutants may be identified and closed.

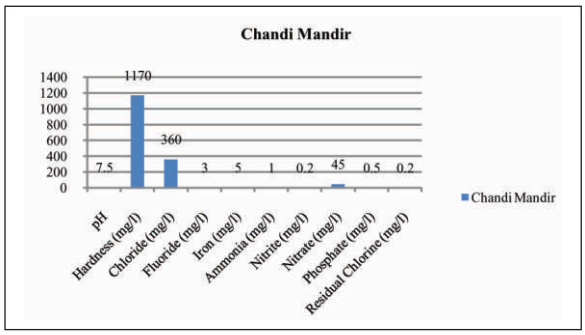

Fig.16: Ghaggar River water quality at Chandi Mandir.

v. Majri Chowk

At Majri Chowk water sample site pH, hardness, chloride, fluoride, nitrite, nitrate, phosphate, residual chlorine is desirable and iron, ammonia are non-potable, hence, the water is non-potable(Fig.17). Iron and ammonia in the Ghaggar river water may be due to anthropogenic reasons, therefore, source of the pollutants may be identified and closed.

vi. Peer Muchchalla

At Peer Muchchalla water sample site pH, hardness, chloride, fluoride, iron, nitrite, nitrate, phosphate, residual chlorine is desirable and ammonia is non-potable, hence, the water is non-potable (Fig.18).

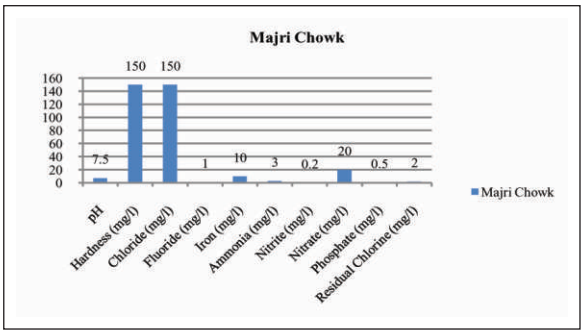

Fig.17:Ghaggar River water quality at Majri Chowk.

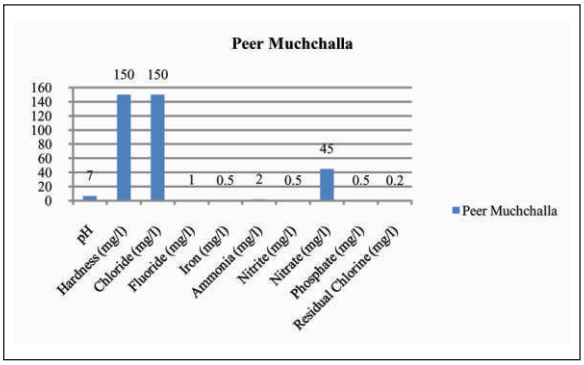

Fig.18:Ghaggar River water quality at Peer Muchchalla.

Ammonia in the Ghaggar river water may be due to anthropogenic reasons, therefore, source of the pollutants may be identified and closed.

vii. Sector-28, Panchkula

At Sector-28, Panchkula water sample site pH, hardness, chloride, fluoride, iron, ammonia, nitrite, nitrate, phosphate, residual chlorine is desirable, hence, the water is potable (Fig.19).

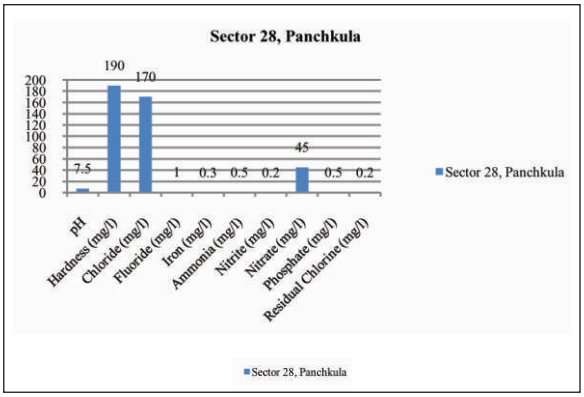

Fig.19: Ghaggar River water quality at Sector-28, Panchkula.

viii. Daffarpur

At Daffarpur water sample site pH, hardness, chloride, fluoride, iron, ammonia, nitrite, phosphate, residual chlorine is desirable and nitrate is non-potable, hence, the water is non-potable (Fig.20). Nitrate in the Ghaggar river water may be due to anthropogenic reasons, therefore, source of the pollutants may be identified and closed.

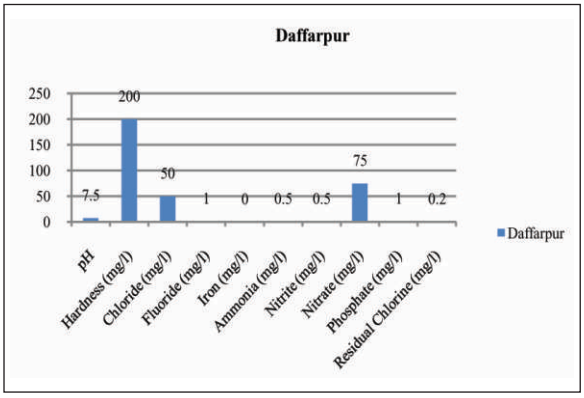

Fig.20: Ghaggar River water quality at Daffarpur.

CONCLUSIONS

In the study area, pH, nitrite, phosphate in all the eight water samples is desirable; hardness is desirable at Bitna, Kaushalya Dam, Majri Chowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and permissible at Jagatpur and non-potable at Chandi Mandir; chloride is desirable at Bitna, Jagatpur, Kaushalya Dam, Majri Chowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and permissible at Chandi Mandir; fluoride is desirable at Bitna, Jagatpur, KaushalyaDam, Majri Chowk, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at Chandi Mandir; iron is desirable at Bitna, Kaushalya Dam, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at Jagatpur, Chandi Mandir, Majri Chowk; ammonia is desirable at Bitna, Sector-28, Panchkula, Daffarpur and non-potable at Jagatpur, Kaushalya Dam, Chandi Mandir, Majri Chowk, Peer Muchchalla; nitrate is desiarble at Chandi Mandir, Majri Chowk, Peer Muchchalla, Sector-28, Panchkula and non-potable at Bitna, Jagatpur, Kaushalya Dam, Daffarpur; residual chlorine in water samples is desirable at Bitna, Jagatpur, Kaushalya Dam, Chandi Mandir, Peer Muchchalla, Sector-28, Panchkula, Daffarpur and non-potable at Majri Chowk. Ghaggar river water quality is non-potable at sample sites- Bitna, Jagatpur, Kaushalya Dam, Chandi

Mandir, Majri Chowk, Peer Muchchalla, Daffarpur and potable at Sector-28, Panchkula.

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