



IMPACT OF RELIGIO-TOURISTIC ACTIVITIES ON THE WATER QUALITY OF GANGA RIVER AND SOLID WASTE GENERATION WITHIN HARIDWAR CITY, INDIA

Sushil Bhadula and *B.D. Joshi

Department of Zoology Uttaranchal College of Science and Technology, Dehradun

*Department of Zoology & Environmental Sciences Gurukula Kangri University, Haridwar

sushil86.ntl@gmail.com

ABSTRACT: Present study was conducted to find out the impact of heavy gathering of pilgrims and their activities on the water quality of Ganga River and generation of solid waste during selected festive days round the year of 2010 and 2011. Some selected physico-chemical parameters viz. temperature, pH, transparency, turbidity, total dissolved solids, chlorides, dissolved oxygen, biochemical oxygen demand, sodium and potassium were monitored and amount of solid waste also analyzed during the study period. It was found that all the parameters showed in the Har-ki-Pauri (site II). The relative differences for temperature was 12.99% higher, pH 1.62% higher, transparency 37.08% lower, TDS 27.28% higher, DO 7.8% lower, BOD 17.24% higher, chlorides 20% higher, sodium 6.72% higher and potassium 5.05% higher at Har-ki-Pauri as compared to reference site Sapta Rishi Ashram Ghat (site-I). The pH showed minimum (1.62%) relative difference while transparency showed maximum (37.08%) relative difference at both of these study sites. Solid waste was segregated in two categories viz. biodegradable and non-biodegradable. The relative difference in the amount of Biodegradable waste was 500.42% higher and for non-biodegradable was 178.84% higher at the Har-ki-Pauri in comparison to reference site Sapta Rishi ashram Ghat.

Key words: Religio-touristic activities, Haridwar city, Ganga River, festive days, water quality, solid waste generation.

INTRODUCTION

Man does not live by knowledge alone. He is an emotional creature. Religion satiates to the spiritual curistics of man in times of his sufferings and disappointment. Religion puts faith on God and entertains the belief that some unseen power moves in mysterious ways to make even his loss meaningful. In this way religion gives release from sorrow and releases from disappointments. It helps man to bear his frustration and integrate his personality. Pilgrimage is the journey to sacred place and the pilgrims are seekers of spiritual solaces. It is surprising that there was hardly any tourist in Ladakh before 1974 but they were reported 10 thousand in 1981. During early sixties the most famous shrine of Badrinathji attracted about 40,000 devotees to the shrine, the number swelled to 1,50,000 just after completion of road to Mana in 1968 [1]. Pilgrims have some positive impacts such as direct or indirect income of the residential people, popularity of their region/spot besides these positive impacts pilgrims also have some negative impacts and creates burden on the local residents and environment by affecting the ecosystem of the concern area and its resources. Haridwar is situated on the bank of river Ganga at the foot hills of Shivalik range of mountain that constitute the outer Himalaya, at an elevation of 965ft from sea level. The position of the globe is latitude 20^o, 58' N and Longitude at 78^o, 13' E. The Ganges River leaves mountains and enters the plains at Haridwar, which literally means "Gateway (Dwar) to God (Hari)" and is also known by the names of Mayapuri, Kapila and Gangadwar. It is believed that taking bath here purifies the soul and opens the way for the ultimate freedom, Moksha. The Ganga is a major river of the Indian subcontinent rising in the Himalaya Mountains and flowing about 2,550 km generally eastward, through a vast plain, to the Bay of Bengal. The Ganga river alone drains an area of over a million square km with a population of over 451 million people living in its basin are directly and indirectly dependent upon the Ganga River. Therefore the Prime Minister of India Manmohan Singh declared on November 4, 2008 that henceforth the Ganga would be known as India's 'National River'. Millions of devotees and visitors take a dip in the holiest river Ganga during a number of festive occasions round the year like Makar Sakranti, Maha Shivratri, Basant Panchami, Ganga Dussehra, Guru Purnima, Kartik Purnima, Kanwar Mela besides Ardh-Kumbh and Maha Kumbh and other festive occasions.

As a consequence, the available places, grounds, fields and riparian city forest areas are used as latrines, toilets or as bathing sites. The municipal water points turn as quick wash places. The 4-5 Km Ganga River and canal bank are used as bathing places and source of holy water collection, too. The pilgrims also bring a lot of offering in the form of flowers, cloths, old icons of Gods and Goddess, besides last remains (ashes) of their loved ones- to dispose in the river Ganga, at Haridwar. Many times such offerings are brought in polythene carry bags. In the absence of a proper disposable system, the polythene bags are dropped in to the Ganga River. These polythene bags and other non-biodegradable materials remain either floating on the water surface or cover the river bed substratum, which is certainly hazardous to aquatic life.

In this way, pilgrimage exerts a heavy burden not only on the total sanitary and health-hygiene, infra-structure and life supporting systems of the city but on the riverine ecosystem of holy river Ganga. Therefore, it is necessary to monitor the impact of pilgrimage through scientific study, especially on festive occasions round the year on the environmental condition of city and river. Municipal sewage constitutes 80 per cent by volume of the total waste dumped into the Ganga, and industries contribute about 15 percent. The majority of the Ganga pollution is through organic waste, sewage, trash, food, and human and animal remains. Naturally, as a consequence of rise in massive number of these pilgrims and tourists, the consumption of all commodities also rises. This leads various types of pollution i.e. water, noise, solid waste, air of varying physico-chemical nature. It was being experienced for many years that the Haridwar city is experiencing a growing pressure of pilgrims and tourists to meet out their various types of routine as well as special needs. In the present study an attempt has made to find the impact of religio-touristic activities during auspicious occasions on water quality of Ganga River and solid waste generation in religious spots.

MATERIALS AND METHODS

Sampling Locations: For the water sampling two selected ghats (bathing stations) /platforms were taken which are described below:

1. Sapta Rishi Ashram Ghat
2. Har Ki Pauri
1. Sapta Rishi Ashram Ghat: (Reference site) Sapta Rishi Ashram ghat is an ancient ashram famous for having hosted seven (sapta) sages (rishis), namely, Kashyapa, Vashisht, Atri, Vishwamitra, Jamadagi, Bharadwaja and Gautam. The Sapt Rishi Ashram is Ghat located in the north of Haridwar railway station, on the right bank of the Ganga about 5 km from Har-ki-Pauri (IInd sampling point). This site is exempt from visitors load and has been treated entering point to Haridwar city for river Ganga, hence selected as a reference site
2. Har- Ki- Pauri: This Ghat/platform is world famous ghat/bathing spot believed for its spiritual vibration it is the busiest ghat/platform of the city, situated on the right bank of Upper Ganga canal about 2.5 km. away north to Haridwar railway station. During the festive days a congregation of pilgrims occurs and offers different types of offering to river Ganga and takes holy dips throughout the length (Approximate 750m) and breadth (100m) of bathing ghat at Har Ki Pauri.

Following Physico-chemical parameters were taken for the study.

1. Temperature
2. pH
3. Transparency
4. Turbidity
5. Total Dissolved Solids (TDS)
6. Dissolved Oxygen (DO)
7. Bio-chemical oxygen Demand (BOD)
8. Chlorides
9. Sodium
10. Potassium

Physico-chemical parameters for water analyzed on spot like as temperature, pH, transparency, turbidity, were done with the help of “soil and water analysis kit Model No. 191 E” and other parameters viz. TDS, DO, BOD, chlorides, sodium, potassium analyzed in the laboratory by the help of standard methods [2-3]. The solid waste was also analyzed on the basis of its composition viz. Biodegradable and Non-biodegradable. Eight festivals were taken for the study round the year and water monitoring and analysis of solid waste were conducted during pre-festive (one day before the main festive day), on festive and post festive (one day after the main festive day).

Table: 1 -Schedule for the water monitoring and solid waste analysis.

S.N.	Festivals	Year 2010	Year 2011
1.	Basant Panchami	20 January	8 February
2.	Magh Poornima	30 January	18 February
3.	Chaitra Amavasya	15 March	3 April
4.	Vrash Sakranti	14 April	14 April
5.	Baishakh Amavasya	14 May	3May
6.	Guru Poornima	24 August	13 August
7.	Shrad Amavasya	7 October	27 September
8.	Vrat Snan Poornima	21December	10 December

RESULTS AND DISCUSSION

Table -2:-Comparative table of Number of tourists/pilgrims visited Haridwar city during the year of 2010 and 2011.

S.N.	Month	Year 2010			Year 2011		
		Indian	Foreigner	Total	Indian	Foreigner	Total
1.	January	1050500	2178	1052678	545575	1929	547504
2.	February	1875750	3606	1879356	590500	2349	592849
3.	March	2450500	4890	2455390	678750	3293	682043
4.	April	3025575	2989	3028564	780275	2111	782386
5.	May	1125750	1354	1127104	1015500	1444	1016944
6.	June	1685675	979	1686654	1820750	1296	1822046
7.	July	1710550	1719	1712269	1930575	1751	1932326
8.	August	1970400	2596	1972996	1975750	2125	1977875
9.	September	995750	1775	997525	1025500	2381	1027881
10.	October	1060525	2175	1062700	1095750	2602	1098352
11.	November	975400	2358	977758	1010275	2619	1012894
12.	December	910750	2936	913686	985450	2822	988272
	TOTAL	18837125	29555	18866680	13454650	26722	13481372

Table 3 : Available infrastructure and handling capacity of Haridwar Municipality

S.N.	Components	Year-1998	Year-2011
1.	Tractor Trolley	4	18
2.	Container carrier	3	6
3.	Tipper Truck	3	9
4.	Sewer Jetting Machine	1	2
5.	Sewer Cleaning Machine	3	6
6.	Total Waste Collection/ Day	101 M. T.	250 M. T.
7.	Modern Techniques for Waste disposal	Not Available	Not Available

Water Results

In the present study wide difference was found in the water quality of the two selected ghats/platforms of Ganga River and in the different festive days, as the physico-chemical parameters are affected by mass bathing, solid waste generation and other various anthropogenic activities. The comparative analysis of physico-chemical parameters of two selected ghats/platforms are described below and also summarized in Table-4.

Temperature: The mean value for individual observation for temperature of two selected sites between 10.5-24.8⁰C for during the pre-festive day of Basant Panchami at Sapta Rishi and during the festive day Guru Poornima at Har ki Pauri, respectively, the lowest and highest value recorded.

pH: The mean value for individual observation for pH of two selected sites between 7.3-8.7 for during the pre-festive day of Guru Poornima at Har ki Pauri and during the festive day of Basant Panchami respectively, the lowest and highest value recorded.

Transparency: The mean value for individual observation for transparency of two selected sites between 4.20-72.20cm for during the festive day of Guru Poornima at Har ki Pauri and during the pre-festive day of Basant Panchami at Sapta Rishi Ashram Ghat respectively, the lowest and highest value recorded.

Turbidity: The mean value for individual observation for turbidity of two selected sites between 1-410NTU for during the pre-festive day of Basant Panchami at Sapta Rishi Ashram Ghat and during the festive day of Guru Poornima at Har ki Pauri respectively, the lowest and highest value recorded.

TDS: The mean value for individual observation for total dissolved solid of two selected sites between 145-1834 mg/l for during the pre-festive day of Basant Panchami at Sapta Rishi and during the festive day Guru Poornima at Har ki Pauri respectively, the lowest and highest value recorded.

Table 4 Physico-chemical characteristics of Ganga River water at selected Ghat during festive occasions (all value in mean for the year of 2010 and 2011)

Fes.	Days	Sapta Rishi Ashram Ghat (Reference site)										Har-Ki-Pauri									
		Temp	pH	Trans	Turb	TDS	DO	BOD	Chl	Sod	Pot	Temp	pH	Trans	Turb	TDS	DO	BOD	Chl	Sod	Pot
B.P	PF	10.50	8.4	72.20	1	145	9.0	1.2	16.7	5.3	2.9	11.50	8.5	60.71	3	197	8.3	1.5	18.9	5.6	3.1
	OF	11.00	8.5	71.50	2	205	9.0	1.4	17.0	5.5	2.9	12.10	8.7	58.12	6	263	8.0	1.7	19.7	5.8	3.1
	POF	10.50	8.5	72.00	2	178	9.1	1.2	16.5	5.4	2.8	11.80	8.6	58.00	4	221	8.1	1.6	19.4	5.6	3.0
M.P	PF	11.20	8.1	70.10	3	267	8.8	1.5	18.7	5.0	2.1	13.20	8.3	56.10	6	342	8.0	1.7	21.6	5.4	2.5
	OF	11.40	8.2	68.90	5	379	8.6	1.8	19.2	5.4	2.2	14.10	8.5	54.30	9	435	7.8	1.9	22.4	5.5	2.6
	POF	11.20	8.2	70.00	4	326	8.7	1.6	18.9	5.2	2.1	13.50	8.5	55.00	8	412	7.8	1.8	22.0	5.5	2.7
C.A	PF	15.30	8.0	64.70	7	405	8.6	1.6	19.9	5.8	2.8	17.50	8.2	53.10	12	489	7.9	1.8	23.8	6.1	2.7
	OF	15.60	8.1	64.20	8	458	8.5	1.7	20.2	5.9	3.0	18.30	8.5	44.70	18	560	7.6	2.0	25.8	6.3	2.8
	POF	15.40	8.0	64.00	8	427	8.6	1.6	20.0	5.9	2.9	18.00	8.4	48.50	16	527	7.7	1.9	24.0	6.2	2.7
V.S	PF	16.60	7.9	60.10	18	519	8.2	1.8	23.5	6.4	2.6	18.70	7.8	42.10	29	768	7.5	1.9	28.5	6.7	2.8
	OF	16.70	7.9	58.90	20	587	8.0	1.9	24.1	6.5	2.6	19.30	8.2	36.70	35	877	7.3	2.1	29.9	6.8	3.0
	POF	16.70	8.0	61.40	24	560	8.0	1.8	23.8	6.3	2.7	19.00	8.0	38.60	31	818	7.3	2.0	28.8	6.8	2.8
B.A	PF	19.70	7.7	44.80	45	672	7.7	2.0	25.7	6.4	2.8	20.20	7.5	34.70	55	852	7.4	2.2	29.7	6.6	3.0
	OF	19.80	7.9	44.00	47	698	7.5	2.2	26.1	6.6	2.9	21.00	7.7	30.50	64	967	7.1	2.4	31.0	6.7	3.2
	POF	19.70	7.7	44.10	45	683	7.7	2.0	25.9	6.5	2.6	20.80	7.6	31.20	60	912	7.3	2.4	30.2	6.6	3.1
G.P	PF	22.60	7.5	12.80	210	1512	7.4	2.1	27.8	6.4	2.7	24.10	7.3	8.40	388	1740	7.0	2.7	32.5	6.2	2.9
	OF	22.80	7.8	10.80	217	1678	7.2	2.4	28.5	6.7	3.1	24.80	7.5	4.20	410	1834	6.7	3.0	34.6	6.4	3.1
	POF	22.80	7.7	12.00	215	1600	7.4	2.4	28.2	6.5	3.0	24.30	7.7	6.30	400	1808	7.1	2.9	32.9	6.2	3.0
S.A	PF	16.20	8.1	46.44	14	546	8.3	1.5	21.4	4.2	2.2	19.70	7.9	34.50	40	730	8.0	1.9	28.4	5.0	2.4
	OF	16.50	8.1	45.10	16	578	8.2	1.7	21.7	4.3	2.4	20.40	8.2	29.10	53	838	7.8	2.0	30.5	5.2	2.5
	POF	16.40	8.2	46.00	15	553	8.3	1.7	21.5	4.3	2.3	19.90	8.0	30.70	44	803	7.9	2.0	29.7	5.1	2.4
V.S.P	PF	11.50	8.3	68.60	8	202	8.5	1.4	19.5	4.4	2.0	12.80	8.5	48.20	18	276	8.1	1.8	21.6	4.8	2.2
	OF	11.60	8.5	68.00	10	230	8.4	1.6	20.8	4.5	2.1	13.60	8.6	45.50	22	354	7.9	2.0	22.9	5.0	2.3
	POF	11.50	8.5	69.00	9	218	8.4	1.7	20.2	4.5	2.2	13.20	8.5	46.10	20	321	8.1	1.9	22.1	4.9	2.3
Mean value		15.55	8.0	54.56	39.70	567.7	8.2	1.74	21.90	5.5	2.57	17.57	8.1	39.80	72.9	722.6	7.6	2.04	26.28	5.87	2.7

[All value are in mg/l except temperature (⁰C), Transparency (cm), Turbidity (NTU) and pH.]

DO: The mean value for individual observation for dissolved oxygen of two selected sites between 6.7-9.1mg/l for during the festive day of Guru Poornima at Har ki Pauri and during the post festive day of Basant Panchami at Sapta Rishi Ashram Ghat respectively, the lowest and highest value recorded.

BOD: The mean value for individual observation for bio-chemical oxygen demand of two selected sites between 1.2-3.0mg/l for during the pre and post festive day of Basant Panchami at Sapta Rishi and during the festive day of Guru Poornima respectively, the lowest and highest value recorded.

Chlorides: The mean value for individual observation for chlorides of two selected sites between 16.5-34.6mg/l for during the post festive day of Basant Panchami at Sapta Rishi Ashram Ghat and during the festive day of Guru Poornima at Har ki Pauri respectively, the lowest and highest value recorded.

Sodium: The mean value for individual observation for sodium of two selected sites between 4.2-6.8mg/l for during the pre-festive day of Shradh Amavasya at Sapta Rishi Ashram Ghat and during the pre-festive and post festive days of Vrash Sakranti at Har ki Pauri respectively, the lowest and highest value recorded. **Potassium:** The mean value for individual observation for potassium of two selected sites between 2.0-3.2mg/l for during the pre-festive day of Vrat Snan Poornima at Sapta Rishi Ashram Ghat and during the festive day of Baisakh amavasya at Har ki Pauri respectively, the lowest and highest value recorded.

Table- 5 :Solid waste generation at two selected sites during the festive occasions (all values in mean for 2010 and 2011)

Sites	Festivals	Sapta Rishi		GROSS TOTAL	Har-Ki-Pauri		GROSS TOTAL
		Bio-deg. Waste (in Kg)	Non-Biodeg. Waste(in Kg)		Bio-deg. Waste (in Kg)	Non-Biodeg. Waste(in Kg)	
B.P	Pre. Fes.	93.300	60.200	153.5	403.700	165.200	568.9
	On Fes.	107.700	80.700	188.4	575.300	209.200	784.5
	Post Fes	99.500	72.400	171.9	502.500	177.400	679.9
M.P	Pre. Fes.	100.600	75.200	175.8	470.300	180.300	650.6
	On Fes.	125.500	92.500	218	586.700	232.600	819.3
	Post Fes	116.400	84.700	201.1	523.500	202.500	726
C.A	Pre. Fes.	120.300	88.400	208.7	505.300	199.300	704.6
	On Fes.	134.800	100.500	235.3	730.800	265.200	996
	Post Fes	124.400	94.800	219.2	548.500	239.600	788.1
B.A	Pre. Fes.	98.700	80.300	179	403.600	122.400	526
	On Fes.	100.300	100.400	200.7	569.800	202.500	772.3
	Post Fes	100.100	92.200	192.3	487.500	186.400	673.9
V.S	Pre. Fes.	139.800	96.600	236.4	574.800	200.500	775.3
	On Fes.	159.500	116.400	275.9	740.80	285.400	1026.2
	Post Fes	140.500	109.300	249.8	610.700	247.500	858.2
G.P	Pre. Fes.	157.600	110.800	268.4	688.300	189.600	877.9
	On Fes.	163.300	126.200	289.5	980.500	341.800	1322.3
	Post Fes	102.800	121.700	224.5	750.300	270.500	1020.8
S.A	Pre. Fes.	110.400	89.400	199.8	580.200	149.500	729.7
	On Fes.	100.900	100.600	201.5	656.500	270.700	927.2
	Post Fes	110.500	96.100	206.6	630.300	234.500	864.8
V.S.P	Pre. Fes.	123.300	99.400	222.7	478.800	168.400	647.2
	On Fes.	157.500	116.500	274	757.700	223.800	981.5
	Post Fes	127.800	100.500	228.3	652.400	207.300	859.7
Total		2907.5	2305.8	5213.3	14408.8	5172.1	19580.9

[Abbreviations: PF = Pre-Festive, OF = on festive, POF = Post festive, Temp = temperature, Trans = Transparency, Turb = Turbidity, Chl= chlorides Hard= hardness, Sod= sodium, Pot= potassium, B.P= Basant Panchami, M.P= Magh Poornima, C.A= Chaitra Amavasya, B.A= Baisakh Amavasya, V.S= Vrash Sakranti, G.P= Guru Poornima, S.A= Shradh Amavasya and V.S.P= Vrat Snan Poornima]

Solid waste Results

The solid waste collected during this study was divided in two categories, viz. bio-degradable and non-biodegradable components as has been summarized in to Table-5.

Biodegradable Waste: In the present study the highest amount of biodegradable waste collected was 980.500 Kg on the festive day of Guru Poornima at Har Ki Pauri (site-II) and lowest amount of biodegradable waste was found 93.300 Kg on the pre-festive day of Basant Panchami at Sapta Rishi Ashram Ghat (site-I).

Non- Biodegradable Waste: In the present study highest value of non-biodegradable waste was recorded 341.800 Kg on the festive day of Guru Poornima at Har Ki Pauri (site-II) and lowest value of non-biodegradable was found 60.200 Kg on the pre-festive day of Basant Panchami at Sapta Rishi Ashram Ghat(site-I) .

DISCUSSION

The results from data analysis of two selected ghat/platforms of Ganga canal clearly depict that the Har-Ki Pauri (site-II) is severely affected by mass gathering of pilgrims/tourists as compared to the reference site Sapta Rishi Ashram Ghat (site-I). Har-Ki-Pauri is world famous spot for the pilgrims and devotees from different part of the world and have a dip at this sacred spot for peace and penance. Har-ki-Pauri is prone to higher pilgrims activities and their impacts viz. mass bathing, lot of offerings such as flowers, ash, old icons of Gods and Goddess and last remains of dead people by their loved ones. Over the past few decades number of pilgrims along the Ganges in Particular at Har-Ki-Pauri had grown at tremendous rate while waste control and infrastructure facilities are relatively less improved. This had lead to enhance the pollution of Ganga at Haridwar. Fast urbanization, industrialization, religio-touristic activities are the main cause of Ganga river pollution [4].

The festivals such as Makar sankranti, Basant Panchami, Maha Shivaratri, Guru Poornima, Ganga Dussehra, Kanwar Mela, Maha Kumbh and Ardh Kumbh are the main occasions occurring round the year when solid waste generation gets increased manifolds.

It has been insured that seasonal variations, dumping of solid waste, lack of awareness, urbanization and social behaviour of rural communities affects the water quality negatively from time to time. This leads to serious effects on human health and has been found increase cases of various contagious as well as well water borne diseases in a study conducted during Kanwar Mela at Haridwar [5]. In the present study it was observed that the amount of DO decreased during the festive occasion of Guru Poornima and it may be due to generation of solid waste, mass bathing and pilgrim's offering in to the Ganga River at Har-Ki-Pauri. Similar results was observed that by other researchers in Nkoro River and pointed out that the DO was very low during the month of August [6] coincidently Guru Poornima was held during the same month. It was also found that approximately 39, 50,871 pilgrims/tourists visited the Haridwar city during the month of August, 2010 and 201, study period. The number of persons visited Haridwar city is directly proportional to the generation of solid waste and which leads to deterioration of water quality of river Ganga causing high turbidity, low transparency, high TDS and high BOD. Similar observations were also made by researchers who studied the water quality of the river and pointed out that the all physico-chemical and biological parameters were badly affected due to the dumping of solid waste [7]. Solid waste, mass bathing and offerings in to the Ganga river also dilute the aesthetic values of Ganga and also affect the oxygenation as well as oxygen carrying capacity of the river water.

The number of fishes and quality of water was certainly degraded due to dumping of solid waste in to the Niger delta, Nigeria [8]. High concentration of chlorides was also observed during the festive occasions in comparison to non-festive days. Similarly, the 62.20% biodegradable, 17.14% Non Biodegradable and 13.61% miscellaneous solid waste material was generated during the different festivals of Ardh Kumbh year of 2004 [9] and Hardwar city proper generated 1873.7 Kg organic matter during any normal non festive day [10]. Colonies in Haridwar city and observed that people with higher financial status of life style generates roughly twice as much solid garbage as people from slum areas [11]. The Haridwar municipality takes lot of preventive measure to keep the city and the bathing ghats/ platforms sanitarily and hygienically clean and high-quality condition, but for the flow of massive congregation during the festive days and the pressure of work on the sanitary staff, the garbage still finds pockets of accumulation all around. 20,435 Kg solid waste was generated in Hardwar city during the important six festive occasions in 1997. These data give us a bright status of solid waste generation for this holy city, during different festive occasions. Adverse impact of municipal solid waste on air and ground water due to the improper disposal of waste in [Pune city12].

The solid waste disposal site of Haridwar city is situated about 2.5km away from generation site (Har Ki Pauri) on the bank of river Ganga. The open vehicles normally used for transporting garbage from its generation site to dumping site spill the garbage in way, which again originates foul smell and traffic congestion due to slow speed as also reported by other workers from the cities of his study [13]. To manage the congregation the Haridwar municipality almost routinely reschedules its civic services related to waste collection and transportation, during the festive occasions. In addition to its regular scavenging staff of 567 workers, the municipality employs additional staff of around 175-200 persons, on contract basis to carry out extra cleaning of these places, during the festive days. Routinely there are about 15 tractor trolley, 5 container, 7 tipper truck, 2 sewer jetting machine, 5 sewer cleaning machine, and about 270 container for the daily collection and transportation to open dumping site for single trips but during the festive days, number of solid waste disposal transportation trip of vehicle is increased more than three to four times. Every city needs to implement record keeping on the health of its solid waste workers, including the informal waste pickers and recyclers. Rather than having open access of waste pickers to solid waste disposal sites, all solid waste workers should be registered and participate in a regular vaccination and health examination program.

REFERENCES

- [1] Singh, T.V. 1984. Eco development imalayas Mountain & men published by Print house Lucknow. (pp. 427-447)
- [2] APHA 1995. Standard methods for the examination of the water and waste water. American Public Health Association, New York.
- [3] Trivedi, R.K. and Goel, P.K. 1986. In: Chemical and biological methods for water pollution studies. Environ. Pub. Karad
- [4] Trivedi RC (2010). Water quality of Ganga River - An overview. Aqua. Ecosys. Health & Mgt.(pp. 347-351) 13 (4).
- [5] Saini,P.,Sharma, V. & Joshi, B.D. 2009. A random survey report about rise in water borne diseases in Haridwar city during Kanwar mela-2008. J. Env. Biosci. (pp. 215-220) 23.
- [6] Abowei, J.F.N. 2010: Salinity, Dissolved oxygen, pH and surface water temperature condition in Nkoro River, Niger Delta, Nigeria. Adv. J. food Sci. Tech. 2(1): 36-40.
- [7] Rather, G.M., Bhat. and Kanth, T.A. 2010. Impact of urban waste of Srinagar City on the quality of water of river Jehlum. Int. J. Lakes and River (pp. 17-24). 3(1).
- [8] Oribhabor, B.J. and Ogbeibu, A.E. 2010. The ecological impact of anthropogenic activities on the predatory fish assemblage of a Tidal Greek in the Niger Delta, Nigeria. Res. J. Environ. Sci. (pp. 271-279). 4(3)
- [9] Gangwar, K.K., Joshi, B.D., 2008. A preliminary study on solid waste generation at Har Ki Pauri, Haridwar, around the Ardh – Kumbh period of sacred bathing in the river Ganga in 2004. Environmentalist (pp. 297–300) 28.
- [10] Kaur S. & Joshi B.D. 2003 . Seasonal Variation in some Physico-chemical Parameters of River Ganga in and around Hardwar. Him. J. Env. Zool.(pp. 45-55) 17(1).
- [11] Sharma, V., Saini, P. and Joshi, B. D. 2010. Assessment of municipal solid waste generation and its management in the holy city of Haridwar, Uttarakhand State, India. Waste Management. 30 (4): 725-726.
- [12] Dhere, A.M., Pawar, C.B., Pardeshi, P.B. and Patil, D.A 2008. Municipal solid waste disposal in Pune city- An analysis of air and ground water pollution. Curr. Sci. (pp. 773-777) 95 (6).
- [13] Mazumdar, N.B. 1996. Municipal solid waste management: the Indian prespective. Energy Environment Monitor.12 (2): 57-69.
- [14] Farooquee, N.A., Budal, T.K. and Maikhuri, R.K. 2008. Environmental and socio-cultural impacts of river rafting and camping on Ganga in Uttarakhand Himalaya. Curr. Sci. (pp. 587-594) 94(5).