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Review on Contamination of Indian Rivers

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ABSTRACT

In the present world water contamination is a genuine risk in the light of restricted crisp water accessibility and expanding age of waste water being released ashore or into streams, lakes, water bodies or ocean in this manner dirtying the new water accessible in waterways, lakes, water bodies, and ground water. In India the water contamination situation is similarly basic presenting incredible danger to human wellbeing, oceanic life, vegetation and natural parity. In this paper the contamination of different rivers has been discussed clearly by the help of considerable references and with special reference to India. Various standard categories of pollutants have been explained. The substances which are equipped for making any physical, synthetic or organic change in the water body are called as contaminants or water pollutants. The Indian rivers are highly prone to heavy metals viz., Mn, Co, Cu, Cr and Cd. Water contamination is a disturbing issue worldwide and should be tended to in a supported way. Innovative work structure is to be reinforced where new imaginative advances with money related achievability ought to be worked out and set up. The conduit water is used for both abstractive and in stream uses like water framework, private water supply, mechanical, etc. It has been presented to over abuse, both in sum and quality. As the gigantic population of India is dependent on the stream, it is of centrality to spare its water quality. The stream is sullied by both point and non-point sources, where National Capital Territory (NCT) – Delhi is the huge benefactor, trailed by Agra and Mathura. Residential sources contribute of about 85% of the all-out contamination. If the prevailing conditions of Indian rivers remain same for longer period of time the consequences will be harsh and have to face the scarcity of water in coming years.

Keywords: *Water pollution, contaminants, heavy metals, Indian rivers, Ganga, Yamuna, industrials wastes, agricultural wastes, sewage.*

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INTRODUCTION

India is filthy rich in its natural heritage. It comprises of beautiful mountains, hills & water bodies. Water is the most essential and important component of life as there is no existence without it & rivers being the lifeline and waterways being the existence line of our economy and cultural diversity.Major concern of our county and furthermore abroad is water pollution as it has resulted in large number of problems. It has influenced human and creature wellbeing as well as the economy of the nation. This is due to the use of contaminated drinking water; humans suffer from severaldifferent water borne diseases. The different ways are introduced for contamination of Sea-going framework, for example, enduring of rocks, filtering of soils, disintegrations of vaporized particles and anthropogenic exercises like use of metal based things; mining etc. the increased use of metal based fertilizers in agricultural processes has resulted in the ascent of centralization of metal poisons in rivers due to water run-off. Millions of people have died due to the polluted water which causes the water borne diseases. The garbage's generated due to some activities out of which 30% of trash isn't gathered and 70% is gathered and afterward packed and stored in landfills or the available space in near to surrounding localities which are washed away and mixed in with nearby water bodies by heavy precipitation which ultimately results in the contamination of water bodies. From the gathered trash just 18% is dealt with and the measure of sewage created every day is 38 billion liters. From these 38 billion liters total of sewage dumped in streams daily is 26 billion liters The primary dirtying wellsprings of stream waters are sewage and mechanical squanders as per the ongoing data sent by CAG department (Comptroller and auditor general of India . Out of the all waste water produced just 12% is treated before being released directly into various sources of water . At the end of the 2025 world's population will suffer due to scarcity of water.

About 6000 to 7000 km^3 of water is annually required. The reserve ground water globally is about 8000000 km^3. The process of precipitation and percolation is the reason of this surplus amount of water being brought into the ground annually. Due to the limited rainfall from last few yearshasresulted in the lowering of water table. Further the landfill wastes which are disposed in an uneven manner result in the ground water deterioration due to leachate generated in landfills which percolates in the ground water. Therefore, the scarcity of water is occurring depending on regional water balance, controlled by vegetation cover, percolation, soil composition, precipitation and climate. A separate use of surface and ground water in a good manner after due consideration of factors influencing water must be planned. Thus, there is a need of using the water in a planned manner and recycling of water should also be considered. The water levels in the perennial rivers also go down at tail end of the summer season which is not an issue from water stockpiling perspective yet in addition from contamination perspective.

The monitoring of water quality of Carious water resources in the country is carried organization ie Central Pollution Control Board (CPCB) with support from State Pollution Control Board (SPCB). From the recent data (2011) it has beenobserved from the years that the organic pollution constitutes the major portion of the pollution in our rivers. So due to the lack of proper disposal system and management the Indian rivers have become the most highly polluted rivers.

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RIVER POLLUTION IN INDIA

Contamination of water in India has now reached a life-threatening point. The rivers of India have now contaminated to a large extend. It was brought in the notice by Union Government in 2017 that among 445 Indian rivers 275 riverstretchesarepolluted.Thewater in these rivers was very much unfit for consumption and was containing bacteria and pollutants like, Pb, Mn, and Zn etc. According to the water organization the international company working in the water sector, Indian rivers constitute 5% of the world's water but carry 35% of globalsediments. The top most polluted rivers in India are: -

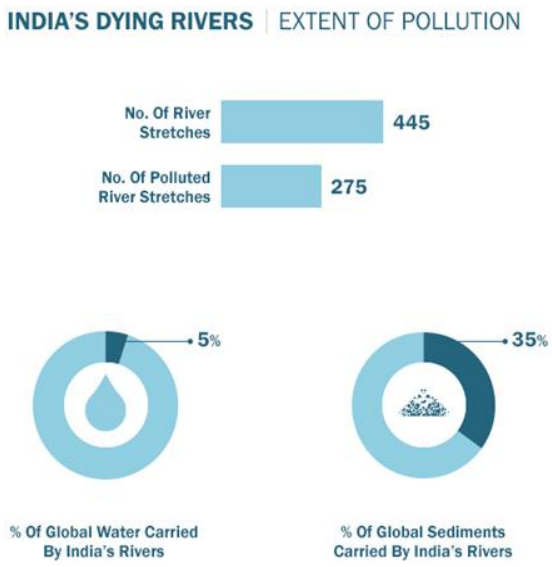

Image Source: - NDTV.com

Ganga: - The Ganga in the Varanasi is getting polluted by 30 drains which empty their wastes in this river. Even additional efforts have been made for cleaning it butstill the level of pollution in ganga river is higher than the WHO's permissible limits. The contamination or the level of pollution in river Ganga has been studied by number of scientists. The characterization of Ganga River on the basis of physic-chemical interaction was studied by Shukla in Mirzapur and Varanasi. Both the studies came to a common conclusion that the physic-chemical properties of River Ganga has gone down continuously and still it is following the same trend. The River Ganga and Varuna were studied by Shukla for bacteriological pollution in 1992 and 1998 respectively. From there results it was concluded that there is a presence of large number of pathogens and non-pathogens exceeding the permissible limits. In the above study none of the rivers were found pollution free. This is so much disgusting for country like India were Rivers are treated like Goddess.

Yamuna: - The river ranks in the top 10 most polluted rivers of the world along with the Ganga and Delhi

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dumping the most waste in Yamuna. All the efforts in making the river clean are failing and it is becoming the vastsewage.

Sabarmati: - The River Sabarmati in Ahmadabad was declared as third polluted river in the country by CPCB in (2010). A fecal bacterium E-Coli was present in higher quantity in the river.

Damodar: - It is one of the most polluted river of India. This river flows through West Bengal and Jharkhand having bunch of factories on its banks which discharge maximum waste into the river.

SOURCES OF POLLUTION

The three most dominant sources from which the emission of pollutants takesplace:

1. The sewage water that is discharged into the river. Washing of clothes at the river banks is a common scene in India. The detergents which are used for cleaning action of clothes have toxic chemicals which contaminate the river. Defecating near the river banks is yet another problem which is contributing to the river pollution. The conditions are made worse by local administration and operators of sewage collection tankers which dump their collected waste in the rivers.
2. The untreated industrial wastes discharged in the river are the main reason of river pollution. Many industries which are constructed on river banks discharge their waste in the river. Some of them use the modern techniques to restrict the emission of pollution to great extend and some of the industries does not have such considerations and violate the environmental safety standards.
3. The use of agricultural fertilizers, organ chlorine pesticides and insecticides on agricultural land where from the surface run off takesplace.

These three major sources make the river water unfit for consumption. Apart from these sources several causes of river pollution are discussed below: -

i. **Garbage dumping:-**
As the population is increasing day by day near the river banks and resulting in hasty dumping of non-biodegradable waste especially plastics which is in turn adding to the water pollution of rivers.

ii. **Cremation and Last Rites:-**
Sincere Hindus attach a lot of importance to life after death. So, these cremations in rural India are mostly located on the river banks. Varanasi, commonly known as Kashi is one such example of cremations which is located right on the bank of river Ganga. These human cadavers cause severe waterpollution.

iii. **SandDredging: -**
This is the process of collecting high quality sand from the deep of the rivers. High quality sands are used for construction process. During the process of sand dredging the engine of the boats release too many oils, lubricants in the river. Thus, it results in the river pollution to a largeextend.

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The aquatic system almost contains 1500 substances (pollutants) which include Alkalis and acids, heavy metals e.g. Pb, Mn, Cu, anions (sulphite, sulphide, cyanide), agriculture wastes, gases (chlorine, Ammonia), organic wastes (formal dehydes, phenols). Considerable researches have been done on the type of pollutants present in the river by the scientists. They have shown a positive test for containing a large number of pollutants like heavy metals (Pb, Mn, Cu, Zn, Cd) in river Ganga & pharmaceuticals in Yamuna.

CONTAMINATION STATUS OF SELECTED RIVERS

River Ganga

The Ganges River is one of the biggest rivers of our country that runs through the major cities like Patna, Kanpur, Allahabad, Varanasi and Kolkata covers a distance of 2700 km. India being an agricultural country had undergone reckless industrialization and economic development in past few years. Excessive fertilization, industrialization and urbanization have resulted in widespread use of dichlorodiphenyltrichloroethane (DDT's), hexachlorocyclohexanes (HCH's) and heavy metals. As per the recent studies observed that the concentration of DDT's and HCH's has reached up to the saturation level in river Ganga. It has gone higher than the permissible limits, although it has been banned in many countries but as far as India is concerned it is not only used in agriculture but also for the control of diseases like black fever, malaria. After the application of these OCP's having the possessions of volatile and non-degradable they get mixed with the run-off and get discharged into therivers.

In the whole journey of 2700 km, the Ganges River receives about 13000 million liters sewage per day which is generated from 120 urban communities and municipalities and still adding. Also, the villages located in Ganga basin discharge about 260 MLD of wastes and about 3300 MLD of sewage is released into primary stem of Ganges River rest is released in various tributaries. The Ganga River contains different concentration ofDDT'sand HCH's at different tributaries. Some of them are: -

1. At Devprayag, Rishikesh, Haridwar in Uttrakhand the concentration of DDT's and HCH's was (ND, 7.24) for Devprayag, (1.01, 5.5) for Rishikeshand (0.19, 5.2) for Haridwarrespectively.
2. In Kannauy of Uttar Pradesh, the concentration of DDT's and HCH's was 0.05-0.12 and 0.1-1respectively.
3. In Kanpur of Uttar Pradesh, the concentration of DDT's and HCH'swas 0.2 and 0.36 respectively.
4. In Allahabad of Uttar Pradesh, it was found 0.08-2.21 and 1.23-3.5 respectively.
5. In Varanasi of Uttar Pradesh it was foundtointherangeof0.1-1.9and0.2-0.7Respectively.

Per fluorinated compounds (PFC's) pollutions in our country is relatively low when compared to other countries. From the recent studies and tests carried out on the stretch of River Ganga showed low

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concentration of (PFC's). From these studies it was revealed that the total emission of PFC was 3300- 7400 Mt from 1960 to 2004. Earlier studies reported that the main factor for deteriorating the Ganga water is sewage and industrial wastes but later on it was observed that the concentration of heavy metals has crossed the permissible limits. So, for determining the concentration of heavy metals, Ganges River was investigated at Varanasi, India. The experimental area included 20 km stretch of the river from which 12 sampling stations were selectedforinvestigation. The sub surface samples were collected from all the above 12 stations and were analyzed for determination of heavy metals like Cd, Pb, Zn, Cu and Cr. The data which was achieved after analyzing showed that mid-stream water of Ganga River in Varanasi in invariably polluted by heavy metals. In winters the higher concentration of Cd, Ni, Cu, Cr and Pb were recorded and in summers Zn constituted the most among the heavy metals. The concentration of various heavy metals was in the order of Zn > Ni> Pb > Cu > Cd.

Also, in Bhagalpur (downstream end of Patna of about 240 km), Zn concentration in the Ganga River was found to be 880µgL^{-1}, Ni as 120 µgL^{-1} and that of Cr it was found to be109 µgL^{-1}. So, in both the cases it is concluded that Zn concentration is very high in Ganga River. Average Concentrations of Metals (µg g-1) or (µg ml-1) in Various Matrices Collected from the River Ganges and Its Tributaries in India are shown below in table1.

Location	*Source and Sampling year*	*Matrix*	*Pb*	*Fe*	*Cd*	*Cr*	*Cu*	*Zn*	*Ni*	*Co*	*Hg*	*As*
Varanasi	7 km stretch of River Ganges (2001-2002)	Water (n=18)	0.36	61.40	0.014	0.11	0.22	0.724	0.166	ND	0.0002	ND
Bhagalpur	~ 8 km stretch of River Ganges (2006-2007)	Water (n=18)	ND	ND	ND	0.17	0.04	0.242	0.038	ND	ND	ND
Kolkata	30 km stretch of Hooghly River (2002-2003)	Water (n=10)	0.004	1.03	0.0001	0.013	ND	0.019	0.003	0.002	BDL	0.002
Varanasi	7 km stretch of River Ganges (2001-2002)	Sediment (n=18)	68.83	20950	2.07	48.62	32.65	158.7	52.96	ND	0.067	ND
Bhagalpur	~ 8 km stretch of River Ganges (2006-2007)	Sediment (n=18)	ND	ND	ND	0.05	0.03	0.278	0.028	ND	ND	ND
Kolkata	30 km stretch of Hooghly River (2002-2003)	Sediment (n=10)	14.77	30560	0.934	14.42	ND	65.24	18.39	8.587	0.225	3.941
Varanasi	7 km stretch of River Ganges (2001-2002)	Benthos (n=30)	7.85	2790	2.08	0.66	55.8	110.40	1.12	ND	0.118	ND
Varanasi	7 km stretch of River Ganges (2001-2002)	Fish (n=77)	2.25	340.17	3.32	7.29	7.34	62.85	4.36	ND	2.638	ND
Varanasi	7 km stretch of River Ganges (2010-2012)	Fish (n= NA)	ND	65.56	ND	7.98	17.50	22.8	3.62	ND	ND	ND
Patna	7 km stretch of River Ganges (1988-1992)	Fish (n= 12)	0.70	410.0	0.080	ND	6.30	160.0	1.900	ND	ND	ND

Table 1: Average Concentrations of Metals (µg g^{-1}) or (µg ml^{-1}) in Various Matrices Collected from the River Ganges and Its Tributaries in India.

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River Yamuna

The Yamuna River being the life jacket of Delhi is the most polluted river in India. TheYamuna River stretches over a distance of about 1370 km. It is observed that 85% of contamination is due to industrial and domestic sources. The water quality of the river is getting to the worst condition day by day because of the untreated domestic and industrial effluents. Among these pollutants, heavy metal concentrations are going above the permissible limits. Heavy metals like Pb, Cu, Cd, Zn, Ni, Cr and As have adverse effects in all aspects on flora and fauna. The present condition of river is at much risk and need to take steps in cleaning the river and prevent for the contamination. So before knowing the rate of contamination of river, it is important to know the cause and sources of pollution in a particular river.Untreated sewage industrial effluents, dead bodies and garbage dumping constitute the major part of pollution in Yamuna River. Delhi being the capital of the nation is the significant patron of the stream which is pursuedby Matura and Agra in discharging the waste in the river. As per the research reports given by the Central Pollution Control Board, Central Water Commission, Delhi Pollution Control Committee, and State Pollution Control Board that the Yamuna River was investigated at 19 different locations and observed that the river is also getting polluted by organic pollutants. The level of organic pollution has increased significantly at Delhi. This is due to the higher population at the river banks, anthropogenic activities, garbage dumping, untreated wastes, dead bodies, and poor sanitation. The river does nothave the fresh water flow for about 11 months i.e. nearly a year.

In 2012, Yamuna River was called as a poisoned river by the research conducted by TERI. It showed the higher level of the toxic metals in the water at different locations. It was found the concentration or Ca, K, Mg &Na were too high as compared to other metals and not even in the maximum allowable limits mentioned by WHO. Due to the presence of such pollutants, have adverse effect of the aquatic life that will sooner or later vanish off. In 2014, it was seen that the concentration of heavy metals in the fish were much higher than the permissible one from which we can imagine the situation of Yamuna river. On the festivals the disposal of idols in the river has become a serious issue in view of rich utilization of Lead and Chrome based paints. Expanded utilization of mortar of Paris influences living life forms as well as defiling the natural state of the stream.In 2013 – 2015, sampling of river Yamuna was done. The samples were taken in a pre-monsoon, monsoon, and post-monsoon season in 2013 to 2015. The sampling was done with view that seasons affect the rate of contaminants in the river to a great extent. It was found that the concentration of heavy metals was primarily influenced by pH and temperature. Talking about the seasons, it was observed that all the parameters showed higher concentration in pre- monsoon than monsoon and at last post- monsoon. So, it acquired a trend i.e. pre- monsoon > monsoon > post-monsoon.Inall the heavy metals Nickel was present at higher concentration of 0.9550 mgL^{-1} followed by monsoon having concentration of Nickel in the range of 0.3501 mgL^{-1} and least value of 0.0553 mgL^{-1} in post-monsoon.

River Gomti

It streams in the northern piece of India and is one of significant tributary of waterway Ganga. It extends over a separation of around 730 km in Indo – Gangetic alluvial district before converging with Ganga River. The stream gets the contamination from its catchment region of around 24700 km^2. It also includes the agricultural runoff, untreated waste water from Luck now, Sultanpur, and Jaunpur towns and from some of the industries

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constructed near the banks of the river. The Gomti River investigated in 2009 and after that in 2010. The samples for both the investigations were collected from different locations along the river stretch. In this paper the condition in 2009 and 2010 will be discussed below.

In 2009 investigation was done on the presence of phthalic acid esters (PAEs) in Gomti River. These are well known environmental pollutants and are used for inducing the plasticity of plastic products. These basically represent a class of organic compounds having chemical composition of di-alkyl or alkyl aryl esters. These are used in several things like wall coverings, floors, lubricants etc. in order to increase their flexibility and durability. So, during this study the sediment samples were collected from 30 different locationsofGomti river in order to know thedistribution and concentration of 5 dominating PAEs that are di-methyl phthalate (DMP), di-ethyl phthalate (DEP), di-butyl phthalate (DBP), di-(2- ethylhexyl) phthalate (DEHP), and di- octyl phthalate (DOP). It was found DEHP was present is higher concentration in the range of 0.10 –0.55µgkg^{-1} constitutes 93.3% samples and that of DOP they were present in about 36.7% samples. Different concentration levels were found for different PAEs i.e. for DMP, DEP, DBP and DOP were10.54, 4.6, 10.33 and 5.11µgkg^{-1}respectively.In 2010 another investigation was done to know the distribution of Polycyclic Aromatic Hydrocarbons (PAH's). These are the organic whose structural composition consists of two or more fused aromatic rings of carbon and hydrogen atoms. These are normallyfound in the environments from anthropogenic activities such as combustion and agricultural wastes. Depending on the vapor pressure, they can be present in the gaseous phase. Among more than 100 PAH's, 16 PAH's have been categorized by United States Environmental Protection Agency (USEPA). During these investigations, the sampling was done for about 2 years in which almost 100 samples were collected from 10 different locations by EKMAN sediment sampler and analyzed for 16 PAH's. The concentration of these 16 PAH's was found to lie in the range of 0.05 and 85 µgL^{-1}, 10.4 ±19.94µgL^{-1} and 6 ± 3711 ng^{-1} respectively. Different concentrations of PAH's in the sub-surface water and bad sediments of the Gomti river during winter season, summer season, and monsoon season are given in the tables 2, 3 & 4below:

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Table 2 PAHs concentration levels in the surface water and bed sediments of the Gomti River in winter season

PAH	Water (µg/L)			Sediments (ng/g dw)		
	Min–max	Mean ± SD	Median	Min–max	Mean ± SD	Median
Nap	BDL–1.47	0.30 ± 0.47	0.07	BDL–415.19	58.90 ± 104.07	9.58
Acy	BDL–65.85	6.76 ± 16.48	0.26	BDL–838.21	252.36 ± 325.50	85.49
Fl + Ace	BDL–2.67	0.24 ± 0.66	0.04	BDL–116.94	28.53 ± 36.23	14.57
Ph	BDL–1.08	0.26 ± 0.35	0.11	BDL–54.15	7.21 ± 14.52	1.87
An	BDL–0.86	0.08 ± 0.22	BDL	BDL–76.32	14.44 ± 22.64	3.34
Fla	BDL–3.19	0.27 ± 0.79	0.02	BDL–190.78	28.84 ± 61.45	7.84
Py	BDL–0.42	0.06 ± 0.11	BDL	BDL–60.08	15.27 ± 20.01	5.60
BaA + Chr	BDL–5.76	0.49 ± 1.44	0.02	BDL–1,569.94	112.01 ± 390.56	5.25
BkF	BDL–2.22	0.17 ± 0.55	BDL	BDL–43.28	5.78 ± 10.34	2.87
BbF	BDL–0.53	0.06 ± 0.15	BDL	BDL–92.12	13.16 ± 27.48	0.46
BaP	BDL–3.41	0.25 ± 0.85	BDL	BDL–231.35	31.81 ± 66.58	0.33
DahA InP + BghiP	BDL–4.70 BDL–1.04	0.37 ± 1.18 0.11 ± 0.29	BDL 0.01	BDL–640.79 BDL–350.73	92.27 ± 180.15 26.31 ± 87.01	1.55 0.12
∑PAHs	0.06–75.57	9.44 ± 19.21	1.80	524–3,365.13	687.10 ± 937.96	235.34

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Table 3 PAHs concentration levels in the surface water and bed sediments of the Gomti River in summer season

PAH	Water (μg/L)			Sediments (ng/g dw)		
	Min–max	Mean ± SD	Median	Min–max	Mean ± SD	
	Median Nap	BDL–537		0.82	1.58 ± 0.19	BDL–
660.32		105.74 171.68	28.92			
Acy	BDL–82.67	13.78 ± 26.94	1.44	4.92–2,726.40	732.22 ± 968.11	220.85
Fl + Ace	BDL–2.39	0.47 ± 0.79	0.16	BDL–96.21	29.88 ± 30.93	21.97
Ph	BDL–0.95	0.15 ± 0.24	0.05	BDL–35.96	4.12 ± 8.69	1.44
An	BDL–0.65	0.09 ± 0.18	0.01	BDL–22.23	6.43 ± 6.66	4.18
Fla	BDL–2.00	0.20 ± 0.51	0.03	0.17–146.62	19.09 ± 38.61	5.60
Py	BDL–0.43	0.07 ± 0.13	0.01	BDL–185.93	16.65 ± 45.84	3.42
BaA + Chr	BDL–0.06	0.02 ± 0.02	0.01	0.56–204.56	32.73 ± 58.49	8.43
BkF	BDL–0.06	0.01 ± 0.02	BDL	BDL–222.71	20.97 ± 57.79	1.69
BbF	BDL–0.04	0.002 ± 0.01	BDL	BDL–245.30	20.96 ± 60.55	0.92
BaP	BDL–0.08	0.02 ± 0.02	0.02	BDL–77.37	13.59 ± 22.27	3.22
DahA	BDL–0.21	0.04 ± 0.06	BDL	BDL–849.46	101.46 ± 234.65	BDL
InD + BghiP	BDL–0.36	0.04 ± 0.09	0.01	BDL–109.70	14.71 ± 27.55	4.72
PAHs	0.32–84.21	15.72 ± 26.69	4.82	51.45–3,722.87	1,118.55 ± 1,346.09	492.79

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Table 4 PAHs concentration levels in the surface water and bed-sediments of the Gomti River in monsoon season

PAH	Water (µg/L)			Sediments (ng/g dw)		
	Min–max	Mean ± SD	Median	Min–max	Mean ± SD	
	Median Nap	0.05–H.76		1.60	3.50 ±0.28	
	BDL–211.67	38.46± 63.04	2.99		±	
Acy	BDL–26.26	3.30 7.37	0.07	BDL–435.49	68.23 121.67	6.28
Fl + Ace	BDL–1.01	0.21 ± 0.31	0.07	BDL–112.51	18.19 ± 33.60	2.05
Ph	BDL–1.39	0.17 ± 0.35	0.02	BDL–11.73	2.12 ± 3.35	0.66
An	BDL–0.22	0.03 ± 0.06	BDL	BDL–4.63	1.10 ±1.37	0.92
Fla	BDL–0.68	0.11 ± 0.20	0.02	BDL–4.96	1.64 ± 1.42	1.03
Py	BDL–0.04	0.01 ± 0.01	BDL	BDL–92.59	7.48 ± 22.81	1.45
BaA + Chr	BDL–0.87	0.08 ± 0.21	0.02	BDL–1.63	0.58 ± 0.36	0.51
BkF	BDL–0.09	0.02 ± 0.04	BDL	BDL–11.90	4.84 ± 3.57	4.19
BbF	BDL–0.06	0.004 ±0.02	BDL	BDL–BDL	–	–
BaP	BDL–1.10	0.073 ± 0.27	BDL	BDL–2.40	0.41 ± 0.68	
	BDL					
DahA	BDL–0.40	0.09 ± 0.14	BDL	BDL–1,184.29	142.85 ±318.11	39.80
InD + BghiP	BDL–2.33	0.15 ± 0.58	BDL	BDL–0.96	0.21 ± 0.35	BDL
PAHs	0.25–41.02	5.83 ± 10.57	1.53	21.32–1,199.28	286.10 ± 324.57	158.86

COMPONENTS OF POLLUTED WATER

1. Temperature: It is the temperature which assumes an indispensable job in the investigation of water quality as it legitimately influences the different segments like pH, BODalong with DO and has the limit of self-sanitization of the waterway. Variation in temperature of water sources results in the need of more oxygen for respiration in case of organisms because at higher temperature, metabolic activities of orgasms increase. The metabolic function of enzymes also gets reduced whenever the temperature goes above 35° C. As the temperature of water goes on fluctuating this affects different species in the process of photosynthesis because different species need different temperature for their optimum photosynthesis. Due to this, the dissolved oxygen concentration increases but leads to reduction of quantity of carbon dioxide in dissolved medium.The fluctuations in the temperature of water take place due to the industrial discharge. Some industries discharge the untreated hot water in the rivers thus not affecting the water qualities only but also results in the deterioration of aquatic ecosystem which results in the thermal pollution.Hence, temperature affects various essential parameters such as electrical conductance of water, pH, and dissolved oxygen.

2. PH: By terminology, it is defined as the negative logarithm of H^+ concentration present in water or sample. Every organism has its own specific pH for their survival thus, it is a parameter which is essential

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for maintenance and management for both flora and fauna. The PH value of river water does not remain constant throughout the year, as it changes due to several factors with change of season. The decomposition of some organic matters in the river results in low PH atthebottomthereisanemissionof$CO_2$and some acids during decomposition. As per the reports in 2003, Sheikh and Yarangi said that in rainy seasons the pH is due to suspension of atmospheric carbon dioxide and attenuation of alkalinesubstances.

3. Turbidity: It may be defined as transparency and cleanness of any river. When the pollutants discharge from their sources and percolate into the river they affect the aquatic life in the river by reducing the Dissolved oxygen content which causes suffocation to the aquatic life. The turbidity is basically affected by suspended particulate matters which are present in the river. In 2001, Mitchel and Furnas designed an instrument called river logger which measures the suspended particulate matter in thewater.So, turbidity of Indian Rivers mainly depends on the seasons. In rainy seasons the rain water erodes the soil from its position and these soil particles reach to the river by means of surface run-off which ultimately affects the turbidity of the river. So in general turbidity is high monsoon as compared winters and summers. In summer and winter seasons it is low because of settling of floating particles take place which makes the river water look clean. As the turbidity is high due to higher concentration of impurities present in river water so these impurities have the tendency to encapsulate more heat and thus the riverwater gets advancement in temperature.

4. DO, BOD & COD: These terms are related to the presence of oxygen content and use of oxygen for chemical and biological processes in a river. Dissolved oxygen is the total oxygen concentration present in 1 liter of water in a dissolved form. BOD is the oxygen required for biochemical processes and COD is the oxygen spent for complete oxidation processes in the water body. Tiwari et al, derived a direct relationship between BOD and COD in river Ganga. In 2000,Mittakand Ratra, from their studies concluded that BOD and COD in rivers are directly and indirectly affected by the toxic metals. As discussed above turbidity affects the dissolved oxygen content in rivers because in higher turbid rivers the soar radiations are restricted by these impurities. They do not allow the solar radiations to go deep into the river which results in the lowering of dissolved oxygen content. The dissolved oxygen concentration does not remain same for more than 24 hours in any river because it depends on the change of season as temperature, pH, turbidity, respiration varies with season. The concentration of dissolved oxygen in rivers is additionally influenced because of the release of mining, mechanicalwastes; sewage and anthropogenic activities like open defecation in river bed and picnic. As per the investigation in 2008, 700 million Indian did not have propertoilet.

5. Organic Matter: The concentration of organic pollution in a river is commonly expressed by BOD. The presence of organic and inorganic carbon in the river affects the eutrophication that ultimately changesthechemical composition of the river. Various studies have been done regarding the same issue which include of presence of particular organic compounds are responsible for specific odor (Ma et al, 2001), seasonal variation in organic content are found in the rivers, some of the selected microorganisms have been seen absorbing organic phosphates. The organic content also gets increased due to the dead plants inwater.

CONCLUSION

In the light of above study, I came to the conclusion that the level of contamination of Indian rivers have reached to the alarming stage and needs an immediate concern to control the rate of contamination. The quality of water in India is moresevere.According to the Indian philosophers, they believe that "Thoughtofa person depends on the type of food and water to which he is fed". Same is the case with the rivers if we ingest the contaminated toxic pollutants to the person or river, it will definitely result in a disturbance of normal physiology. So present study concludes that the Indian rivers are largely polluted due to the contaminants

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discharged from various birthplaces like mines, industries, agricultural wastes, medical wastes and anthropogenic activities. The Indian rivers are dealing with DDT's, HCH, HCB, PAE's and heavy metals. If the conditions of the rivers will remain same for longer period, it will forsure result in shortage of water inIndia.So, it's a time to move towards the sustainable development with high remedial and management system. We are so selfish that we did not even think about those generations which have still to appear in this world. At last, everyone should be noticed that ours is not the last generation to vanish on this planet, remember, coming generations can be our sons, daughters and grandsons.

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