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Impact of Lockdown on Health of the Yamuna river at Delhi Stretch, India

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ABSTRACT

Present study points out the impact of Lockdown on the health of the Yamuna river at Delhi stretch by comparing pre-lockdown and Post-lockdown period by studying the reports of pollution monitoring agencies. Delhi segment of the Yamuna is highly polluted, where alongwith domestic sewage a huge quantity of industrial waste is being discharged continuously without proper treatment. Pre lockdown (March 2020) water quality parameters at three sampling stations named as Palla, Nizammuddin Bridge and Okhla barrage U/s in Delhi were, pH were 8.7, 7.3 and 7.2, DO were 17.1 mg/L, not detected in later two sites, BOD were 7.9 mg/L, 57 mg/L and 27 mg/L and COD were 28 mg/L, 90 mg/L and 95 mg/L respectively and post-lockdown period (April 2020) the pH was 7.8, 7.2 and 7.1, DO was 8.3 mg/L, 2.4 mg/L and 1.2 mg/L BOD was 2 mg/L, 5.6 mg/L and 6.1 mg/L and COD were 6 mg/L, 16 mg/L and 18 mg/L respectively. The study of these parameters at three sampling stations reveals that the lack of industrial pollutants discharging due to nationwide lockdown for COVID-19 pandemic had positive effect on water quality of this river. Water quality could be maintained by planned establishment of industries and setup of ETP with without gap between generation and treatment.

Figures : 06 References : 19 Tables : 03
KEY WORDS : Industrial Pollution; Lockdown Impact; Physicochemical Health; Yamuna river.

Introduction

The Yamuna river is largest tributary of river Ganga, covers a distance of 1376 km over north India from its origin to its confluence. Yamunanagar, Sonipat, Panipat, Delhi, Mathura, Agra and several other large and industrial cities are located on its banks. The Yamuna river is one of the most contaminated rivers of India[5,15]. The major pollutants of this river are untreated or partially treated domestic sewage, industrial effluents and agricultural runoff. A study revealed that due to industrialization in the towns along the Yamuna river basin, all the industrial effluent treated or untreated find its way into it[14]. Industries like paper and pulp, textile, chemical, fertilizers, leather, pharmaceuticals, sugar, oil refineries, food industries, thermal power *etc.* have been set up in many cities in the Yamuna basin. Many of these but not all industries have proper treatment facilities, discharge untreated or partially treated industrial effluents containing toxic and organic effluents into the river, which deteriorate the water quality. In lower stretch, especially in Delhi segment the Yamuna

TABLE-1 : Segments of the Yamuna river

No.	Segment	Reach	Length (km)
1	The Himalayan Segment	From origin to Tajewala Barrage/Hathnikund	172km
2	The Upper Segment	Tajewala Barragae/Hathnikund to Wazirabad Barrage	224km
3	The Delhi Segment	Wazirabad Barragae to Okhla Barrage	22km
4	The Eutrophicated Segment	Okhla Barrage to Chambal Confluence	490km
5	The Diluted Segment	Chambal Confluence to The Ganga Confluence	468km

(Source: CWC, 2009)

TABLE-2 : Water Quality Assessment of the Yamuna river at Delhi Stretch

Sr. No.	Sampling Stations	BOD mg/l		% Reduction
		Pre-lockdown Period April, 2019	Post-lockdown April, 2020	
1	Palla	1.7	2.8	-
2	Surghat	2.8	3.8	-
3	Palton Pool	19	33	-
4	Kudesia Ghat	24	25	-
5	ITO Bridge	28	22	21
6	Nizamuddin Bridge	20	16	20
7	Agra Canal, Okhla Bridge	24	16	33
8	Agra Canal (Jaitpur)	23	17	26
9	D/S Okhla Barrage after meeting Shahdara Drain	28	23	18

(Source: DPCC, April 2020)

becomes a drain[1,12]. Industrial effluents play important role (around 15%) in polluting Yamuna river[3]. Because of COVID-19 pandemic as the number of patients increased gradually, the Prime minister of India proclaimed nationwide lockdown on March 24, 2020 and all the human activities, institutions and industries were shut down. In this review article the impact of Lockdown on the Physicochemical health of the Yamuna specially at Delhi stretch was analyzed by comparison of pre lockdown and post-lockdown reports of pollution monitoring agencies on the Yamuna[10,11,19].

Analysis

2.1 Segmentation of the river Yamuna on the basis of hydrology and ecology the whole journey of the river Yamuna (1376 km) can be divided into five segments[2]. The segmentation of the Yamuna river is given in Table-1 & Fig. 1. Different studies showed that in comparison Delhi segment is most polluted[6-9]. Contribution[3] of Delhi in pollution load of Yamuna river is 79%. The pollution contribution percentage of big cities located on the bank of Yamuna has been depicted in Fig. 2.

2.2 Yamuna river at Delhi Stretch After travelling a distance of 224 km from Hathnikund, Yamuna enters Delhi at Palla village. At Wazirabad it is trapped by Wazirabad barrage to fulfill drinking water requirement of Delhi and allowed no water to flow down in major part of the year. After 22 km downstream from Wazirabad barrage the Yamuna water is again trapped by Okhla barrage at Okhla where mostly water diverted to Agra canal for irrigation purpose. 16 drains including Najafgarh drain discharging their waste water in the Yamuna between Wazirabad downstream to Okhla Upstream. 04 drains including Shahdara drain discharges Yamuna in downstream of Okhla Barrage while 03 drains discharge their waste water directly into Agra Canal and Gurgaon Canal. Najafgarh drain is the biggest source of pollution in the Yamuna river[6]. Najafgarh drain and Shahdara drain cause toxicity level up to 60% to 100%. Total installed capacity of waste water in Delhi is 3149.3 MLD and there are 41 STPs out of which 33 STPs are operational with 2801.27 MLD capacity[9]. While actual utilization of treatment capacity is 2254 MLD. Thus gap between generation and treatment of waste water in Delhi is 895 MLD. There are 28117 industrial units in Delhi state. Total industrial effluent

TABLE-3 : Water Quality Parameters of the Yamuna river at Delhi Stretch

Parameter	Primary Water Quality Criteria for out door Bathing (PWQC)	Pre-lockdown		Post-lockdown		
		March 2019	April 2019	March 4/3/20	April 6/4/20	Remark
1- Sampling Station- Palla						
pH	6.5-8.5	8.1	8.7	8.7	7.8	Complying to PWQC in lockdown period
Conductivity, (µS/cm)	-	531	440	668	273	Decrease 59.13%
DO, (mg/l)	5.0	10.0	8.2	17.1	8.3	Complying to PWQC, Decrease 51.46%
BOD, (mg/l)	3.0	1.8	8.8	7.9	2.0	Complying in lockdown period, Decrease 74.69%
COD, (mg/l)	-	14	26	28	6	Decrease 78.57%
2- Sampling Station- Nizamuddin Bridge						
pH	6.5-8.5	7.1	7.2	7.3	7.2	Complying to PWQC
Conductivity, (µS/cm)	-	1140	1140	1369	460	Decrease 66.4%
DO, (mg/l)	5.0	1.9	1.0	-	2.4	Not Complying but improved
BOD, (mg/l)	3.0	21	18	57	5.6	Not Complying but decrease 90.18%
COD, (mg/l)	-	81	71	90	16	Decrease 82.22%
3- Sampling Station- Okhla (U/s)						
pH	6.5-8.5	7.2	7.3	7.2	7.1	Complying to PWQC
Conductivity, (µS/cm)	-	914	1230	861	488	Decrease 43.32%
DO, (mg/l)	5.0	0.9	1.9	-	1.2	Not Complying to PWQC
BOD, (mg/l)	3.0	20	19	27	6.1	Not Complying but Decrease 77.41%
COD, (mg/l)	-	66	67	95	18	Decrease 81.05%

(Source: CPCB, 2020)

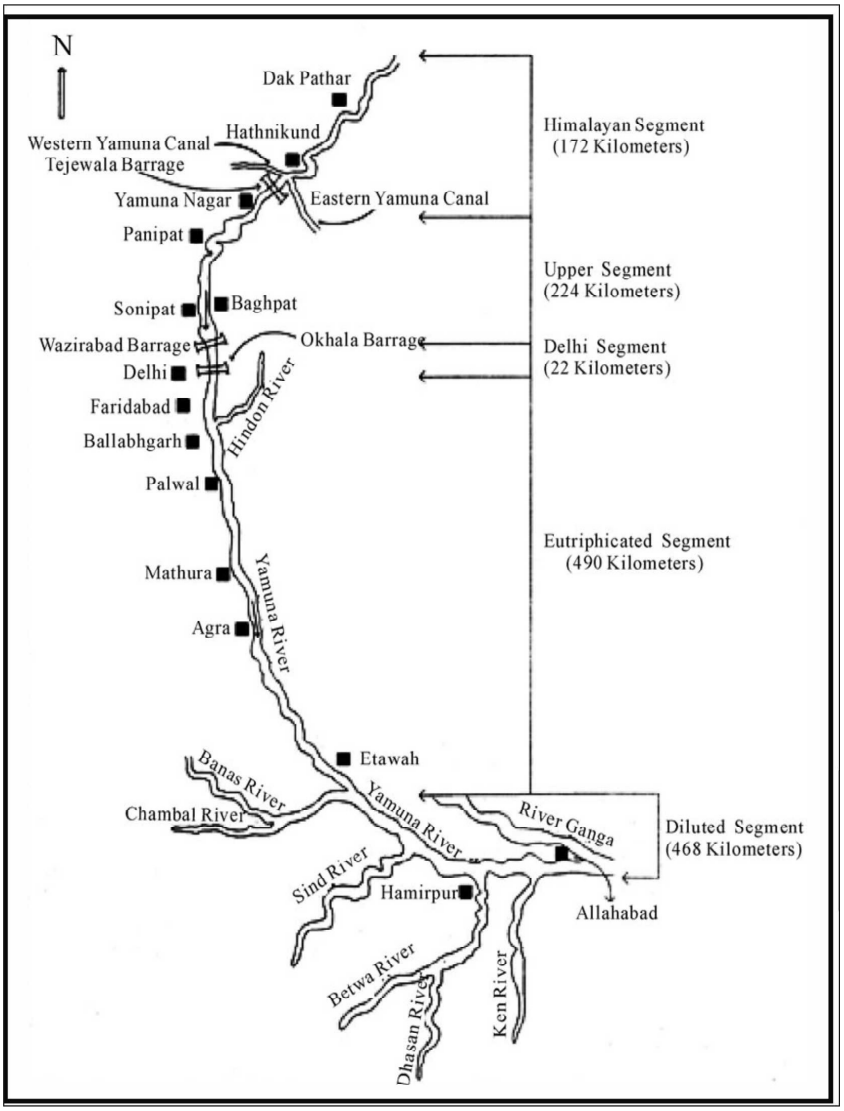

Fig. 1 : Segmentation, location of Tributaries and big Cities along the Yamuna river

generation from these industries is 35.98 MLD.

2.3 Assessment of Lockdown Impact on Water quality of the Yamuna river at Delhi Stretch

Assessment of Lockdown effect on water quality of the river was studied by data of samples obtained in Post-lockdown period and comparing it with Pre-lockdown period/previous year data of the same month. To the assessment of lockdown effect, Delhi Pollution Control Committee (DPCC) has taken samples from 9 sampling stations while CPCB has taken samples from 3 sampling stations *i.e.,* Palla, Nizamuddin Bridge, Okhla upstream (U/s) in the Yamuna in Post-lockdown period. Obtained data and their comparison with previous month/year data are given in Tables-2(a) and 2(b) and Comparison of Water Quality Trend of river Yamuna with respect to pH, DO, BOD and COD as observed during Pre-lockdown and Post-Lockdown period (Figs. 3-6) are depicted.

Result and Discussion

At Palla sampling station[10] in Pre-lockdown period (4 March 2020) water quality showed pH (8.7), EC (668 µs/cm), BOD (7.9 mg/L), DO (17.1 mg/L) and COD (28 mg/L) whereas in Post-lockdown period it showed pH (7.8), EC (273 µs/cm), BOD (2 mg/L), DO (8.3 mg/L) and COD (6 mg/L). Thus there is marked improvement in water quality of the river which showed considerable decrease in concentration of parameters *i.e.,* EC (59.13 %), BOD (74.69 %), DO (51.46 %) and COD (78.57 %). While as per report[10] no reduction in pollution level was at this site. However, water quality is complying with Primary Water Quality Criteria of Bathing Standard (PWQC). At Nizamiddin bridge sampling station during Pre- lockdown (4 March 2020) water quality showed pH (7.3), EC (1369 µs/cm), BOD (57 mg/L), DO (not detected), and COD (90 mg/L) whereas Post-lockdown period it showed pH

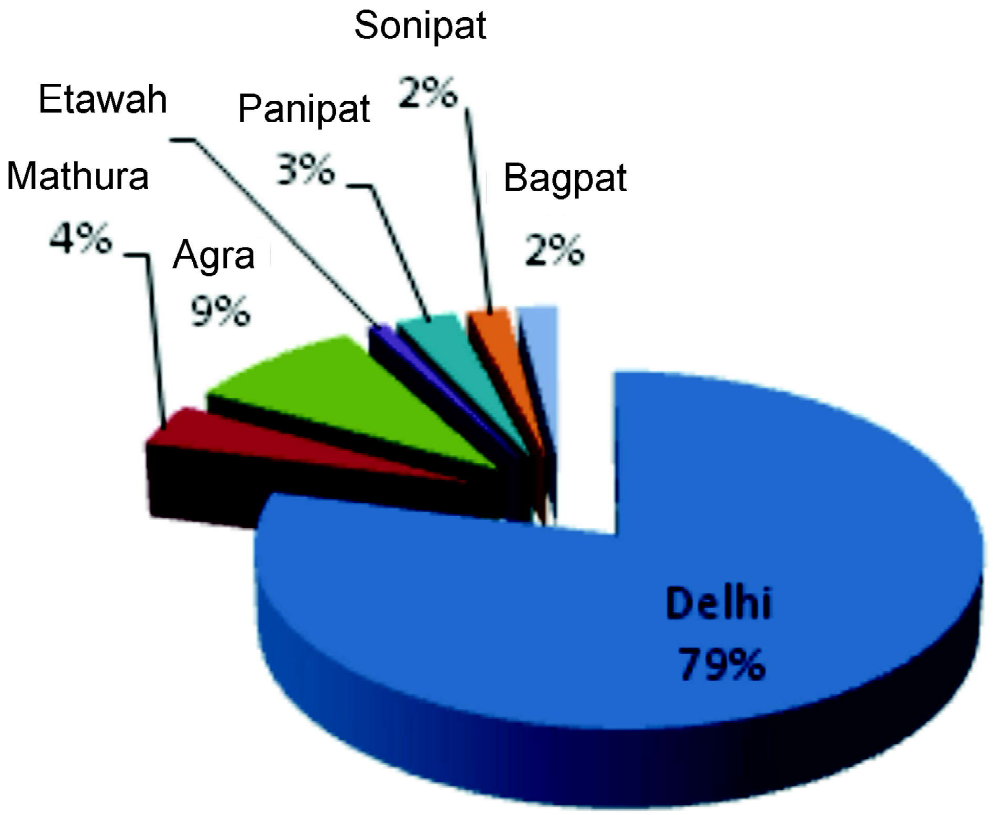

Fig. 2: City-wise contribution of pollution load in the Yamuna river

(7.2), EC (460 µs/cm), BOD (5.6 mg/L), DO (2.4 mg/L) and COD (16 mg/L). Results show that parameters are not complying to the PWQC with respect to DO and BOD while there is a substantial decrease in concentration of studied parameters. EC reduced 66.40 %, BOD reduced 90.18 % and COD reduced 82.22 %. However only 20% reduction in pollution level at this site was found out[10]. At Okhla (U/s) sampling site during Pre-lockdown period (4 March 2020), water quality showed pH (7.2), EC (861 µs/cm), BOD (27 mg/L), DO (not detected), and COD (95 mg/L) whereas during Lockdown period it showed pH (7.1), EC (488 µs/cm), BOD (6.1 mg/L), DO (1.2 mg/L) and COD (18 mg/L). Result is not complying to PWQC with respect to DO and BOD. But there is considerable decrease in concentration of studied parameters *i.e.,* EC reduced 43.32%, BOD reduced 77.41 % and COD reduced 81.05 %. There is 33% reduction in pollution level at this site during lockdown (DPCC, April 2020). Water quality trend in Palla, Nizamuddin bridge and Okhla since 2011 to 2016 showed that DO and BOD level complied to PWQC at Palla. But in other two sites value of these parameters always violated the primary water quality criteria[7-9].

Due to Lockdown impact because of COVID-19 pandemic industries of Delhi are nonoperational hence total discharge of waste water (industrial and domestic sewage) is expected to be around 2990 MLD as against of 3026 MLD during the Pre-lockdown period, which showed 36 MLD reduction in waste water discharge. Reduction of industrial effluent discharge in river is also confirmed from marked reduction in COD levels. As per report[11] there is about 4 times increase in fresh water availability in first week of April than in first week of March 2020 from D/s of Wajirabad barrage due to release of more fresh water from Wajirabad barrage. Due to lockdown effect no human activities polluted river water like bathing, washing of cloths, religious activities, throwing flower and other worship wastes *etc.* were observed.

Conclusion

Impact of Lockdown shows significant improvement in water quality & health of the Yamuna river in comparison to Pre-lockdown period. Water quality parameters pH, EC, DO, BOD and COD become complying to Primary Water Quality Criteria in less polluted segment of the river while in high polluted segment of the river there is considerable decrease in concentration of these parameters. There is 20% to 90% reduction in BOD and COD, though DO level is still low in high polluted segment of the river. This is the result of lacking industrial effluents discharge due to closure of industries, dilution effect due to discharge of more fresh water and absence of human

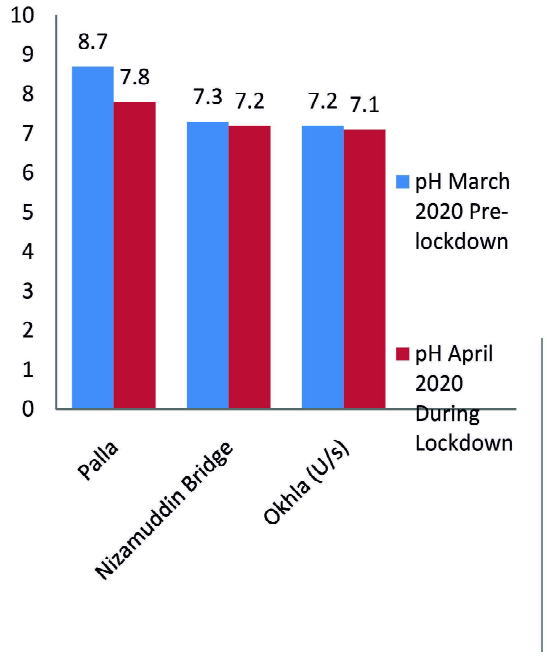

Fig. 3 : Water quality of river Yamuna with respect to pH (Pre-Lockdown & Post-Lockdown period)

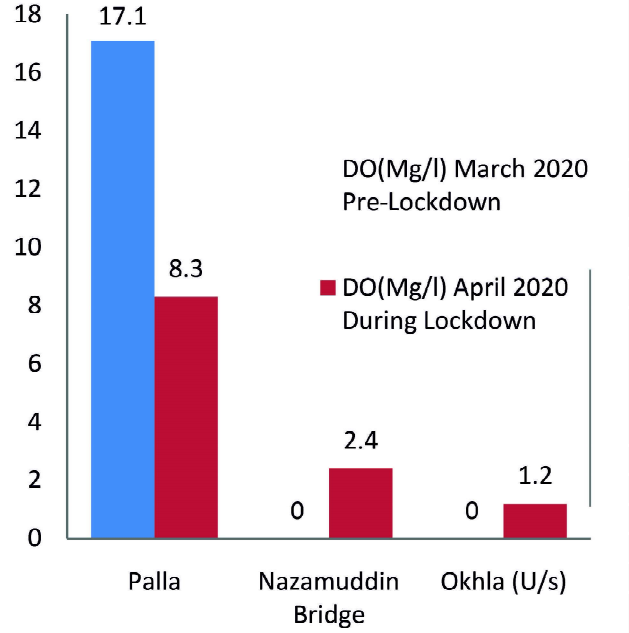

Fig. 4 : Water quality of river Yamuna with respect to DO (Pre-Lockdown & Post-Lockdown period)

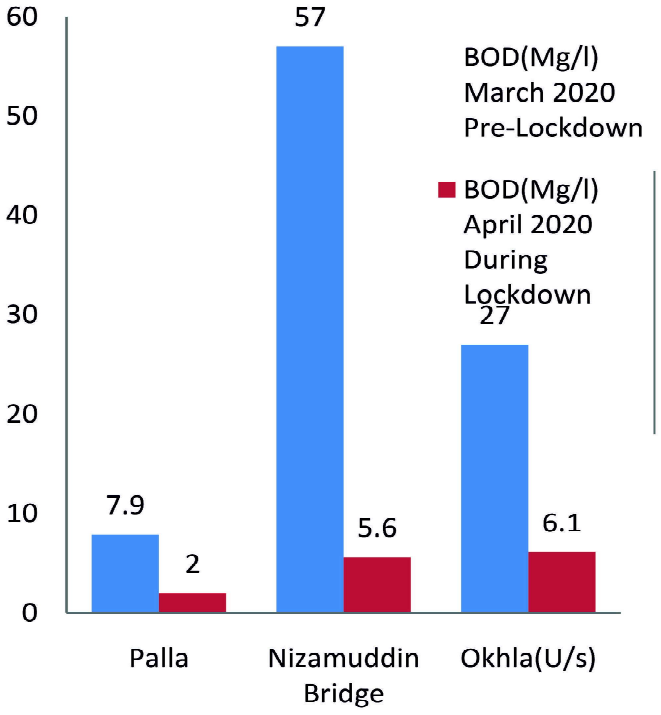

Fig. 5 : Water quality of river Yamuna with respect to BOD (Pre-Lockdown & Post-Lockdown period)

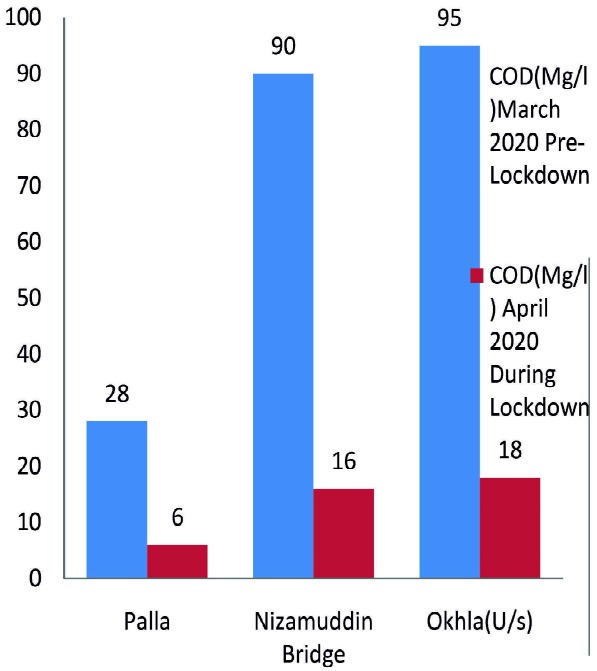

Fig. 6 : Water quality of river Yamuna with respect to COD (Pre-Lockdown & Post-Lockdown period)

activities like bathing, washing and dumping of solid wastes including worship waste or immersion of idols made of POP and toxic paints.

Future Needs: Pristine status of river Yamuna can be maintained by-

1- Assuring the availability of adequate fresh water in the river to maintain self-cleaning capacity by reducing use of river water by applying other options for water source like compulsory water harvesting in all buildings.

2- By essential filling of gap between sewage generation and treatment system.

3- Industries should have compulsory effluent treatment plants (ETPs) and industrial effluents should be controlled according to the relevant effluent standards established by CPCB and it is necessary for the usefulness of investments under YAP- I, YAP-II for the control of pollution in the Yamuna river.

4- There should be encouragement scheme for recycling and reuse of treated waste water.

5- Control dumping of solid waste and instream use activities of human beings.

6- Public awareness program and water conservation practices are also required. It can be implemented with the help of community participation through information, education and communication.

References

1. Ali I, Jain CK. Pollution potential of Toxic Metals in the Yamuna River at Delhi, India. *Journal of Environmental Hydrology.* 2001; **9**: 1-9pp.
2. Central Water Commission, "Yamuna Basin Organization". 2009; http://www.cwc.nic.in/regional/delhi/welcome.html
3. CPCB, Water quality status of Yamuna River (1999-2005), Central Pollution Control Board, Assessment and Development of River Basin Series, ADSORBS/41/2006-07.
4. CPCB, Status of water quality in India. published by Central Pollution Control Board (CPCB 2009), New Delhi, India.
5. CPCB, Status of water quality in India, published by Central Pollution Control Board (CPCB 2010), New Delhi, India.
6. CPCB, Annual Report, Water quality status of River Yamuna, published by Central Pollution Control Board (CPCB 2014–2015), New Delhi, India.
7. CPCB, Annual Report, Water quality status of River Yamuna, published by Central Pollution Control Board (CPCB 2015–2016), New Delhi, India.
8. CPCB, Annual Report, Water quality status of River Yamuna, published by Central Pollution Control Board (CPCB 2016–2017), New Delhi, India.
9. CPCB, Annual Report, Water quality status of River Yamuna, published by Central Pollution Control Board (CPCB 2017–2018), New Delhi, India.
10. CPCB, report on ''ASSESSMENT OF IMPACT OF LOCK DOWN ON WATER QUALITY OF RIVER YAMUNA – DELHI STRETCH", published by Central Pollution Control Board (CPCB 2020), New Delhi, India, 20-4-2020.
11. DJB report http://delhijalboard.nic.in/home/delhi-jal-board-djb April,2020
12. Hindu, "Delhi reduces Yamuna to a sewage drain," New Delhi, 2002 /06/25/stories/2002062506380400.htm
13. http://www.dpcc.delhigovt.nic.in/Analysis_report_RY2020
14. Jain CK. Metal fractionation study on bed sediments of River Yamuna, India, *J. Water Research*. 2004; **38**: 569-578pp.
15. Misra AK. A River about to Die: Yamuna, *J. Water Resources and Protection.* 2010; **2**: 489-500.
16. Report on Yamuna. 2005; Government of NCT Delhi.
17. "Water Quality of River Yamuna during the Lockdown", Yamuna Pollution Monitoring Committee (YPMC) report, 21.04.2020, https://yamuna-revival.nic.in
18. "Yamuna Action Plan," YAP I, http://yap.nic.in/about-yap. 1993.
19. "Yamuna Action Plan," YAP II, http://www.wwfenvis.nic.in/pdf/yam.pdf 2003.