Indian Forester, **149** (4A) : 33-38, 2023
DOI: 10.36808/if/2023/v149i4A/169908

ISSN: 0019-4816
eISSN: 2321-094X

Assessment of Impact on Water Quality of Aquatic Resources Due to Idol Immersion

India is known for its rich culture and festivals. Festivals like Ganeshotsav and Durga Puja hold an Integral place in Indian culture. The puja and celebrations are followed by the immersion of Idols in water bodies. Central Pollution Control Board (CPCB) prepared guidelines for idol immersion in consultation with stakeholders to ensure safe and eco-friendly disposal of idols for conservation of natural resources. The revised guidelines are presently under implementation by respective States/ UTs. To assess the impact of Idol immersion and implementation of CPCB guidelines, water quality monitoring of respective water bodies was carried out during pre and post immersion. The case study of river Yamuna in Delhi stretch indicated an increase in Dissolved Oxygen (DO) levels of 24% in 2021 and 137.7% in 2022 post immersion. Concentration of Bio-Chemical Oxygen Demand (BOD) also showed a reduction of 32.4% in 2021 and 34.9% in 2022. In 2019, at immersion sites on river Yamuna in Delhi, maximum concentration of BOD of 40 mg/L was observed which has been reduced to 22 mg/L in 2022. in terms of other physico-chemical and heavy metal parameters, significant reduction in concentration levels is observed. Similar studies were carried out in other states. Improvement in terms of creation of artificiai ponds/ designated ghats for immersion of idols by local authorities, initiatives for mass awareness programmes for use of eco-friendly materials observed. in the 23rd episode of Mann Ki Baat aired on August 28th, 2016, Hon'ble Prime Minister also emphasized on the use of clay in making of Ganesh and Durga idols to prevent pollution of rivers, ponds and provide protection to aquatic life. The present paper is a compilation of case studies to assess impact of the guidelines for immersion of Idols on the water bodies, in terms of various parameters including physico-chemical and heavy metal on pre and post idol immersion activities.

Key words: Eco-friendly materials, PoP, Physico-chemical parameters and Heavy metals

Mann Ki Baat Reference: Episode 23 aired on August 28, 2016.

The paper encapsulates efforts made in enforcing eco-friendly idol immersion for sustainable future including dissemination of few case studies. The CPCB guidelines, if followed and acted upon, can help in bringing tremendous reduction in pollution caused by idol immersion.

Suniti Parashar*, Meetali Sharma, Deepty Goyal, Pradeep Kumar Mishra, Alpana Narula and Prashant Gargava
Central Pollution Control Board, Delhi
**Email: suniti.cpcb@gov.in*

Received April, 2023
Accepted April, 2023

Introduction

Idol immersion activities during some of festive occasions are causing pollution in the recipient water bodies. Non- biodegradable materials and synthetic paints used for making these idols affect aquatic life and environment. In India, many of the festivals are water centric; idols and puja materials are immersed in water bodies. The floating materials released through idol immersion in the water bodies result in eutrophication after decomposition (Das *et al.,* 2012). Careless immersion of idols in natural water bodies also blocks its flow and impedes ground for stagnation and breeding of mosquitoes (Joshi *et al.,* 2017).

The quantity and quality of these biodegradable and non-biodegradable substances deteriorates the water quality of recipient water bodies (Ujjania *et al.,* 2012). Festivals like Ganeshotsav and Durga Puja which earlier used to be limited in certain states, are now celebrated across the country. In ancient times, the idols were made using natural ingredients such as clay and/ or husk and was decorated and painted with natural colors. Paints are used for protection and providing texture to the idols (Bhattacharya *et al.,* 2014). When idols are immersed in water

bodies, the paints do not dissolve easily and impact the water quality. In due course of time, people inclined towards a substitute, Plaster of Paris (PoP), which is known to be more readily available, cheaper and economically sustainable. Idols made up of PoP are painted with synthetic paints containing heavy metals like Arsenic, Cadmium, Mercury, Lead, etc. (Gupta *et al.,* 2020). Other non-biodegradable materials like plastic accessories and thermocol are also used in decorations. In 23rd episode of Mann Ki Baat, Hon'ble PM inspired promotion of eco-friendly festival celebration.

Materials and Method

Study area

To assess the impact on water quality of water bodies due to idol immersion activity, water samples were collected at different intervals by the respective State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs) of Andhra Pradesh, Maharashtra, Telangana and Delhi from different sites of immersion (river, pond/ lake and visarjan ghats) during the festivals of Ganeshotsav and Durga Puja in the year 2021 and 2022. Ganesh Chaturthi is celebrated in the month of September and Durga Puja during the month of October. The samples were collected during September and October 2021 and 2022 at different intervals *i.e.* pre and post idol immersion. Water samples were collected and preserved at the site of immersion. Pre-immersion samples were collected 2-3 days prior to immersion activities and post immersion samples were collected a week after the immersion. Artificial ponds/ tanks were created by the local authorities for immersion of idols in Andhra Pradesh, Delhi, Maharashtra and Telangana (Fig. 1).

The present study is focused on the impact of CPCB revised guidelines (CPCB, 2020) on water quality of recipient water bodies post immersion of idols in four states viz., Andhra Pradesh, Delhi, Maharashtra, and Telangana.

Analytical parameters

Samples collected were analyzed for physico-chemical parameters viz., Dissolved Oxygen (DO), Bio-Chemical Oxygen Demand (BOD), Total Dissolved Solids (TDS), Hardness as $CaCO_3$ and Heavy Metals such as Arsenic (As), Cadmium (Cd), Copper (Cu), Lead (Pb), Chromium (Cr), Nickel (Ni), Zinc (Zn), Iron (Fe), Cobalt (Co) and Manganese (Mn). Collected samples were analyzed based on Standard Methods for the Examination of Water and Wastewater (APHA Method) by respective SPCBs/ PCCs.

Measured data was compiled and analyzed statistically to assess the impact of idol immersion on various monitored parameters in water bodies.

Result and Discussions

The analysis results of samples collected during Pre and Post immersion of idols in year 2021 and 2022 for the states viz. Andhra Pradesh, Delhi, Maharashtra and Telangana is provided in Table 5.

Delhi

In Delhi, nine locations on river Yamuna were monitored during pre and post immersion in Ganesh and Durga festival in 2021 and 2022. The average per cent variation in concentration of various parameters was calculated and provided in Table 1. As per the analysis of data of year 2021, in Delhi, one location was found complying to the Primary Water Quality Criteria for Outdoor Bathing (PWQC) w.r.t. DO *i.e.*, 5 mg/L and at another location was found complying w.r.t. BOD *i.e.,* 3 mg/L. In year 2022, three locations were found complying w.r.t. DO. None of the locations was found complying w.r.t. BOD. The results revealed significant average increase in DO level of 24% in 2021 and 137.7% in 2022 post immersion. Concentration of BOD also showed a reduction of 32.4% in 2021 and 34.9% in 2022 post immersion activities. Additionally, a decrease in maximum concentration of BOD post immersion from 40 mg/L in 2019 to 10 mg/L and 22 mg/L in subsequent years of 2021 and 2022, respectively was observed. TDS also found decreased in concentration however, the degree of reduction was lesser during 2022 than

Fig. 1: Idol immersion in artificial ponds

2021. With respect to heavy metal parameters, drop in concentration of Cr, Cu and Pb observed in 2021 post immersion, while during 2022, Zn and Fe concentration was found reduced. The increase in DO levels may be attributed to the dilution available during monsoon season, release of water from upstream. Increase in metal concentration observed during post-immersion activity may be due to agitation in river bed during monsoon season.

Table 1: Average per cent variation in concentration of parameters in Delhi post immersion of idols in year 2021 and 2022.

Parameters	2021	2022
DO (mg/L)	24.0	137.7
Conductivity (µmhos/cm)	-19.9	-
BOD (mg/L)	-32.4	-34.9
Hardness as $CaCO_3$ (mg/L)	-21.2	-
TDS (mg/L)	-19.1	-5.6
Cd (mg/L)	-8.3	0.5
Cu (mg/L)	-6.6	475.3
Pb (mg/L)	-8.3	22.2
Cr (Total) (mg/L)	50.0	25.6
Ni (mg/L)	41.7	33.3
Zn (mg/L)	42.8	-22.2
Fe (Total) (mg/L)	372.7	-25.3
Co (mg/L)	-4.2	-
Mn (mg/L)	9.3	-

Telangana

In Telangana, one location each on five different lakes where immersion of idols was carried out, were monitored during pre and post immersion in 2021 and 2022. The average per cent variation in concentration of various parameters was calculated and provided in Table 2. In year 2021, in Telangana, none of the locations were found complying to the PWQC w.r.t. DO *i.e.* 5 mg/L and BOD *i.e.* 3 mg/L, post immersion. In year 2022, in Telangana, 2 locations were found complying w.r.t. DO and no locations were found complying w.r.t. BOD parameter. The results revealed a significant average increase in DO (26.6%), BOD (7.5%), Hardness (12.1%) and TDS (3.6%) in 2021 post immersion. However, an increase in concentration w.r.t. heavy metals viz. Cd, Cu, Pb and Zn was observed. During 2022, a deterioration in water quality w.r.t. physico-chemical parameters such as DO (0.2%), BOD (104.5%), Hardness (29.0%) and TDS (29%) and a decrease in concentration of heavy metal parameters such as Cd, Cu, Pb, Zn and Mn was observed.

Table 2: Average per cent variation in concentration of parameters in Telangana post immersion of idols in year 2021 and 2022.

Parameters*	2021	2022
DO (mg/L)	26.6	-0.2
BOD (mg/L)	-7.5	104.5
Hardness as $CaCO_3$(mg/L)	-12.1	29.0
TDS (mg/L)	-3.6	22.5

*Refer Table 5 for Heavy metals concentration

Maharashtra

In Maharashtra, five locations were monitored on three rivers, one lake and one pond where immersion of idols was carried out, during pre and post immersion in 2021 and 2022. The average per cent variation in concentration of various parameters was calculated and provided in Table 3. In year 2021, in Maharashtra, all 5 locations were found complying to the PWQC w.r.t. DO *i.e.* 5 mg/L and 3 locations were found complying w.r.t. BOD *i.e.* 3 mg/L. In year 2022, 3 locations w.r.t. DO and 2 locations w.r.t. BOD *i.e.* 3 mg/L were found complying to the criteria. The results revealed a significant improvement in DO during 2021 (11.80%) and 2022 (7.68%). BOD showed improvement during post immersion in 2021 of 46.02%. TDS increased post immersion during both 2021 (36.18%) and 2022 (47.95%) indicating a deterioration.

Table 3: Average per cent variation in concentration of parameters in Maharashtra post immersion of idols in year 2021 and 2022.

Parameters*	2021	2022
DO (mg/L)	11.80	7.68
Conductivity (µmhos/cm)	30.59	86.66
BOD (mg/L)	-46.02	3.86
TDS (mg/L)	36.18	47.95

* Data for Heavy metals not available

Andhra Pradesh

In Andhra Pradesh, five locations on four Lakes/ Ponds where immersion of idols was carried out were monitored during pre and post immersion in 2021 and 2022. The average per cent variation in concentration of various parameters was calculated and provided in Table 4. In year 2021, in Andhra Pradesh, two locations were found complying to the PWQC w.r.t. DO *i.e.* 5 mg/L and one location was found complying w.r.t. BOD *i.e.* 3 mg/L. In year 2022, 3 locations w.r.t. DO and 2 locations w.r.t. BOD were found complying to the criteria. The results revealed an increase in DO levels during both 2021 (0.83%) and 2022 (13.66%). During 2021, deterioration was observed in rest of the parameters

Table 4: Average per cent variation in concentration of parameters in Andhra Pradesh post immersion of idols in year 2021 and 2022.

Year	2021	2022
DO (mg/L)	0.83	13.66
Conductivity (µmhos/cm)	31.87	4.76
BOD (mg/L)	9.84	-4.86
Hardness as $CaCO_3$ (mg/L)	15.17	-1.51
TDS (mg/L)	30.29	-0.79
As (mg/L)	4.17	10.00
Cd (mg/L)	0.00	20.00
Cu (mg/L)	10.00	6.40
Pb (mg/L)	0.00	20.00
Cr(Total) (mg/L)	0.00	25.00
Ni (mg/L)	0.00	45.00
Zn (mg/L)	49.00	-8.01

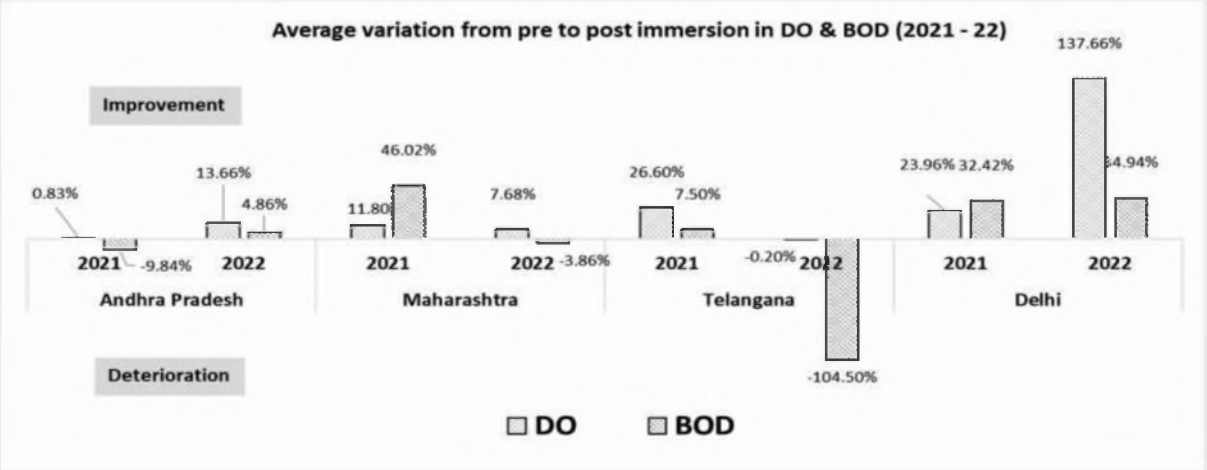

Fig. 2: Average variation in DO and BOD from pre to post idol immersion

Table 5: Range of Physico-chemical and Heavy Metal parameters Pre and Post immersion of idols during 2021 and 2022

Parameter	Phase of monitoring	Andhra Pradesh		Delhi		Telangana		Maharashtra	
		Year 2021	Year 2022	Year 2021	Year 2022	Year 2021	Year 2022	Year 2021	Year 2022
Dissolved Oxygen (mg/L)	pre	4.1 - 6.7	BDL - 7.2	BDL - 6.8	0.3 - 7.3	1 - 4.6	0.3 - 6	4.6 - 6	4.8 - 5.7
	post	4.1 - 5.8	0.2 - 7	BDL - 7.8	1.4 - 9.5	2.1 - 4.4	0.3 - 5.9	5.8 - 6.7	4.6 - 6.8
Conductivity (µmhos/cm)	pre	264 - 1609	322 - 1079	428 - 1370	-	-	-	474 - 690	280 - 610
	post	330 - 1577	311 - 857	320 - 1180	-	-	-	737 - 835	510 - 1196
Bio-chemical Oxygen Demand (mg/L)	pre	1.4 - 8.6	1.2 - 36	3 - 13	18 - 32	4 - 22	2.6 - 10	5.5 - 15	4.2 - 5.2
	post	1.8 - 7.6	1.4 - 28	BDL - 10	10 - 22	3.2 - 22	4-14	2.8 - 6.2	3 - 7.6
Hardness as $CaCO_3$ (mg/L)	pre	80 - 380	92 - 320	164 - 416	-	216 - 561	130 - 410	-	-
	post	96 - 352	64 - 256	148 - 292	-	180 - 380	192 - 458	-	-
Total Dissolved Solids (mg/L)	pre	168 - 1084	210 - 660	260 - 850	328 - 682	301 - 754	352 - 980	347 - 571	174 - 782
	post	220 - 1092	186 - 532	218 - 642	259 - 721	298 - 748	458 - 1092	560 - 626	390 - 860
Arsenic (mg/L)	pre	0.001 - 0.004	0.001 - 0.006	BDL	-	-	-	-	-
	post	0.001 - 0.003	0.001 - 0.007	BDL	-	-	-	-	-
Cadmium (mg/L)	pre	0.001	0.001	BDL - 0.06	BDL - 0.81	BDL	BDL - 0.083	-	-
	post	0.001	0.001 - 0.002	BDL	BDL - 0.61	BDL - 0.0028	BDL - 0.019	-	-
Copper (mg/L)	pre	0.001	0.001 - 0.011	BDL - 0.18	BDL - 0.89	BDL	BDL - 0.321	-	-
	post	0.001 - 0.002	0.001 - 0.006	BDL - 0.02	BDL - 0.9	BDL - 0.124	BDL - 0.004	-	-
Lead (mg/L)	pre	0.001	0.001	BDL - 0.13	BDL - 0	BDL - 0.012	BDL - 0.371	-	-
	post	0.001	0.001 - 0.002	BDL - 0.02	BDL - 0.3	BDL - 0.014	BDL - 0.078	-	-
Chromium (Total) (mg/L)	pre	0.001	0.001 - 0.002	BDL - 0.01	BDL - 0.66	-	-	-	-
	post	0.001	0.001 - 0.003	BDL - 0.02	BDL - 0.82	-	-	-	-
Nickel (mg/L)	pre	0.001	0.001 - 0.002	BDL - 0.01	BDL - 0.54	-	-	-	-
	post	0.001	0.001 - 0.004	BDL - 0.02	BDL - 10	-	-	-	-
Zinc (mg/L)	pre	0.001 - 0.005	0.004 - 0.025	0.02 - 0.57	BDL - 0.89	BDL	BDL - 1.149	-	-
	post	0.001 - 0.004	0.001 - 0.012	0.02 - 0.11	BDL - 0.82	BDL - 0.224	BDL - 0.3	-	-
Iron (Total) (mg/L)	pre	-	-	0.56 - 5.29	BDL - 2	-	-	-	-
	post	-	-	0.67 - 13.03	BDL - 0.78	-	-	-	-
Cobalt (mg/L)	pre	-	-	BDL - 0.02	-	-	-	-	-
	post	-	-	BDL - 0.01	-	-	-	-	-
Manganese (mg/L)	pre	-	-	0.06 - 0.54	-	BDL - 0.71	BDL - 2.525	-	-
	post	-	-	0.04 - 0.39	-	BDL	BDL - 0.737	-	-

- Data not available

viz., Conductivity (31.87%), BOD (9.84%), Hardness (15.17%), TDS (30.29%), As (4.17%) and Cu (10%). During 2022, average decrease in concentration of parameters such as BOD, Hardness and TDS of 4.86%, 1.51% and 0.79%, respectiveiy was observed. However, concentration of heavy metais viz., As (10%), Cd (20%), Cu (6%), Pb (20%), Cr (25%) and Ni (45%) increased.

From the case study of four states viz. Andhra Pradesh, Deihi, Maharashtra and Telangana, it is

inferred that evident impact of idol immersion on water bodies was lesser in Andhra Pradesh, Delhi and Maharashtra after revised guidelines were made effective from 01.01.2021. Continuous and concerted efforts of State Government departments with public participation resulted into improvement in water quality of recipient water bodies (Fig. 2).

Conclusion

To celebrate the religious activities in an eco-friendly manner, the use of bio-degradable materials for idol making, puja offerings, decoration and paint shall be the viable and sustainable option. The CPCB guidelines for Idol Immersion, 2020 stipulate the use of naturally occurring clay, eco-friendly water-based bio-degradable and non-toxic natural dyes for coloring idols and no use of single use plastic and thermocol materials for making of idols. The CPCB guidelines having clear division of responsibilities amongst various stakeholders viz. artisans, puja committees and local and urban authorities, if followed and acted upon, can help in bringing tremendous reduction in pollution and maintenance of water quality of water bodies post idol immersion. Floating materials and puja offerings to be collected and processed to prevent pollution in water bodies. Artificial ponds/ tanks were created by the local authorities during 2022 for immersion of idols in Andhra Pradesh (1), Delhi (65), Maharashtra (662) and Telangana (23).

For creating awareness among the stakeholders and general public, SPCBs/PCCs have increased efforts by taking innovative and interesting actions such as:

a. Replacement of temporary idols by permanent idols through Puja Committees;
b. Poster/ banner at public places, use of biodegradable idols;
c. Idol immersion only in artificially made temporary ponds;
d. Turmeric Ganesha Campaign -2021 and Seed Ganesha Campaign -2022, "Guinness World Record" for making the largest number of Ganesha idols in one place on 28/8/2022;
e. Demonstration of making Haldi Ganesha idols in Schools;
f. Issuance of guidelines to the idol manufacturers;
g. Distribution of clay Ganesh idols and involvement of academic institution for creating awareness;
h. Idols with eco-friendly colors;
I. Radio and SMS campaign, pamphlets distribution, slogans, etc. and
j. Construction of permanent dedicated idol immersion points.

Public awareness and participation are important for effective implementation of CPCB guidelines.

मूर्ति विसर्जन के कारण जलीय संसाधनों की जल गुणवत्ता का आकलन

सुनीति पाराशर, मिताली शर्मा, दीप्ति गोयल, प्रदीप कुमार मिश्रा, अल्पना नरूला एवं प्रशांत गार्गव

सारांश

भारत अपनी समृद्ध संस्कृति और त्योहारों के लिए जाना जाता है। भारतीय संस्कृति में गणेशोत्सव और दुर्गा पूजा जैसे त्योहारों का अभिन्न स्थान है। पूजा और उत्सव के बाद जल निकायों में मूर्तियों का विसर्जन किया जाता है। केंद्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) ने मूर्तियों के सुरक्षित और पर्यावरण के अनुकूल निपटान सुनिश्चित करने और प्राकृतिक संसाधनों के संरक्षण के लिए सभी संबंधितों के परामर्श से मूर्ति विसर्जन हेतु दिशानिर्देश तैयार किए हैं। वर्तमान में परिशोधित दिशानिर्देश संबंधित राज्यों/संघ राज्य क्षेत्रों द्वारा क्रियान्वयन के अधीन हैं। मूर्ति विसर्जन के प्रभाव का आकलन करने और सीपीसीबी के दिशानिर्देशों के क्रियान्वयन के लिए, संबंधित जल निकायों की विसर्जन से पहले और बाद में जल गुणवत्ता निगरानी की गई थी। दिल्ली में यमुना नदी पर केस स्टडी ने विसर्जन के बाद घुलित ऑक्सीजन (Dissolved Oxygen) के स्तर में वर्ष 2021 में 24% और वर्ष 2022 में 137.7% की वृद्धि का संकेत दिया। जैव-रासायनिक ऑक्सीजन मांग (Bio-Chemical Oxygen Demand) की सांद्रता में भी विसर्जन के बाद की गतिविधियों में वर्ष 2021 में 32.4% और वर्ष 2022 में 34.9% की कमी देखी गई, जो दिशानिर्देशों के प्रभावी क्रियान्वयन का संकेत देती है। वर्ष 2019 में, यमुना नदी के विसर्जन स्थलों पर, 40 मिग्रा/ली की अधिकतम जैव ऑक्सीजन मांग (BOD) सांद्रता पाई गई थी, जो बाद के वर्ष 2021 (10 मिग्रा/ली) और वर्ष 2022 (22 मिग्रा/ली) में कम हो गई है। अन्य भौतिक-रासायनिक और भारी धातु मापदंडों के संदर्भ में, सांद्रता के स्तर में कमी पाई गई है। इसी प्रकार का अध्ययन कुछ अन्य राज्यों में भी किया गया है। अन्य सुधारों में स्थानीय प्राधिकारियों द्वारा मूर्तियों के विसर्जन के लिए अधिक संख्या में कृत्रिम तालाबों/निर्दिष्ट घाटों का निर्माण एवं पर्यावरण के अनुकूल सामग्रियों के उपयोग के लिए जन-जागरूकता कार्यक्रमों के लिए पहलों में वृद्धि शामिल है। माननीय प्रधान मंत्री जी ने दिनांक 28 अगस्त, 2016 को प्रसारित मन की बात के 23वें एपिसोड में नदियों, तालाबों के प्रदूषण को रोकने और जलीय जीवन को सुरक्षा प्रदान करने के लिए गणेश और दुर्गा की मूर्तियों के निर्माण में मिटी के उपयोग पर भी जोर दिया। वर्तमान पेपर विभिन्न भौतिक-रासायनिक और भारी धातु मापदंडों के संदर्भ में, जल निकायों पर मूर्तियों के विसर्जन के लिए दिशानिर्देशों के प्रभाव का आकलन करने के लिए केस स्टडीज का संकलन है।

References

Bhattacharya Sayan, Arpita Bera, Abhishek Dutta and Uday Chand Ghosh (2014). Effects of idol immersion on the water quality of Indian water bodies: Environmental health perspectives. *International Letters of Chemistry, Physics and Astronomy*, 234-263.

CPCB (2020). Revised Guidelines for Idol Immersion, *Central Pollution Control Board*. https://cpcb.nic.in accessed on 20/04/2023

Das Kaushik Kumar, Tanuja Panigarhi and R.B. Panda (2012). Idol Immersion Activities cause Metal Contamination in River Budhabalanga, Balasore, Odisha, India. *International Journal of Modern Engineering Research (IJMER)*, **06**: 4540- 4542.

Joshi Akshay, Niharika Shivhare, Naman Patel and Shifa Khan

(2017). Surface water quality assessment during idoi immersion. *International Journal of Engineering Sciences and Research*, 413-419.

Ruhi Gupta, Runak Jana, Sumit Kumar, Susmita Bakshi (2020). Water pollution due to idol immersion in water bodies of Kolkata. *International Research Journal of Engineering and Technology (IRJET)*, **03**: 5423-5427.

Ujjania N.C., Chaitali and A. Mistry (2012). Environmental Impact of Idol Immersion on Tapi River (India). *International Journal of Geology, Earth and Environmental Sciences*, **02**: 11-16.

Acknowledgement

The authors express their gratitude to Shri Tanmay Kumar, Chairman, CPCB for encouragement and constant guidance. The authors also acknowledge the contribution of States Pollution Control Boards/ Pollution Control committees and Regional Directorates of CPCB for conducting desired monitoring. The authors also record their thanks to all the officials who provided the co-operation in preparation of this paper directly/ indirectly.