IMPACT OF IDOL IMMERSION ON WATER QUALITY OF AQUATIC BODIES -2019

STATE POLLUTION CONTROL BOARD, ODISHA

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1. Introduction

Idol immersion of deities after culmination of puja is a religious practice of Hindu festivals in India. Large size idols are being worshiped by the peoples in Ganesh Puja, Durga Puja, Kali Puja, Biswakarma Puja, Gajalaxmi and are ultimately immersed alongwith the puja offerings in water bodies like rivers, ponds etc. Since these pujas are mostly celebrated in monsoon or post monsoon seasons, and the flow in rivers are high during this period, immersion of idols and puja offerings in the rivers usually have no significant impact on the water quality. However, with the increase in number and size of idols, use of alternate materials other than clay for making the idols, use of synthetic paints and varnishes rather than natural dyes to decorate the idols in present years and decreased flow in rivers, the probability of contamination of water after immersion of idols in water bodies, has been increased. Besides these, dumping of puja left-overs such as vastras on idols, flowers, decorating materials (made of paper and plastic), etc. in water bodies during this immersion process has also increased the risk of contamination of water bodies. This, in turn, may affect the aquatic ecosystem at the immersion sites as well as its down-streams.

With this background, Central Pollution Control Board (CPCB) has prepared the "Guidelines for Idol Immersion" for implementation during immersion of idols in aquatic bodies to minimize the pollution load.

2. Guideline for Idol Immersion

In compliance of the directions of the Hon'ble High Court of Bombay in the matter of PIL W.P. No. 13251325/2003 Janahit Manch Vs the State of Mahrashtra and others, the Competent Authority in CPCB has constituted a Committee, vide Order No. A-22011/1/90-Mon dated 10.02.2009, to formulate Guidelines for immersion of idols in natural stream. "Guidelines for Idol Immersion" (PROBES/136/2010) developed by the CPCB encompasses the roles of local bodies/ authorities, Puja Committee Organisers and State Pollution Control Board or Pollution Control committees for implementation of the Guideline to minimize the impact of idol immersion activities on the aquatic bodies.

(a) General Guidelines for idol immersion

- Use of traditional clay for making idols should be encouraged.
- Use of water soluble, non-toxic natural dyes should be encouraged to colour the idols rather than painting of idols.
- Worship materials like flowers, decorating materials, should be removed before immersion of idols. All biodegradable matters should be disposed separately for recycling or composting. All non-biodegradable matters should be collected separately for disposal in separate landfills.
- Mass awareness programmes should be conducted to aware the Public on ill effects of idol immersion.
- All idols should be immersed in an identified area on the surface water bodies which is cordoned, barricaded and preferably lined with synthetic liner. After immersion, the liner should be removed to collect the dumped materials for final disposal at appropriate places.

(b) General Guidelines for Local bodies/ Authorities

- Local bodies/ Authorities should identify adequate number of idol immersion spots to avoid overcrowding and to reduce pollution load on the water bodies. Such spots should be notified and informed to the Puja Committees through awareness programmes.
- At the immersion of sites, burning of solid wastes so generated during the immersion of idols, should be prohibited.
- Within 48 hours of idol immersion, the left over materials at the immersion sites should be collected by the local bodies for final disposal at appropriate places.
- In case of immersion of idols in rivers and lakes, arrangements may be made for construction of temporary confined ponds with earthen bunds for the purpose of immersion of idols. After the completion of immersion, supernatant water may be allowed to flow as usual after checking for colour and turbidity. Lime may be allowed to the temporary confined pond.
- Mass awareness programmes may be conducted to educate the people on ill effects of toxic idol immersion.

c) Role of State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs)

- Concerned SPCB/ PCC should conduct water quality monitoring of water bodies at the immersion sites preferably in Class-I cities (having population more than one lac), at three stages i.e. Pre-immersion, during immersion and post-immersion. For ascertaining water quality, 12 numbers of physico-chemical parameters such as pH, DO, BOD, COD, Conductivity, Turbidity, TDS, Total Solids, Chromium, lead, zinc and copper may be analysed and results posted on the SPCB's website.
- SPCB/ PCC shall help to local administration in preparing material for mass awareness for the purpose.

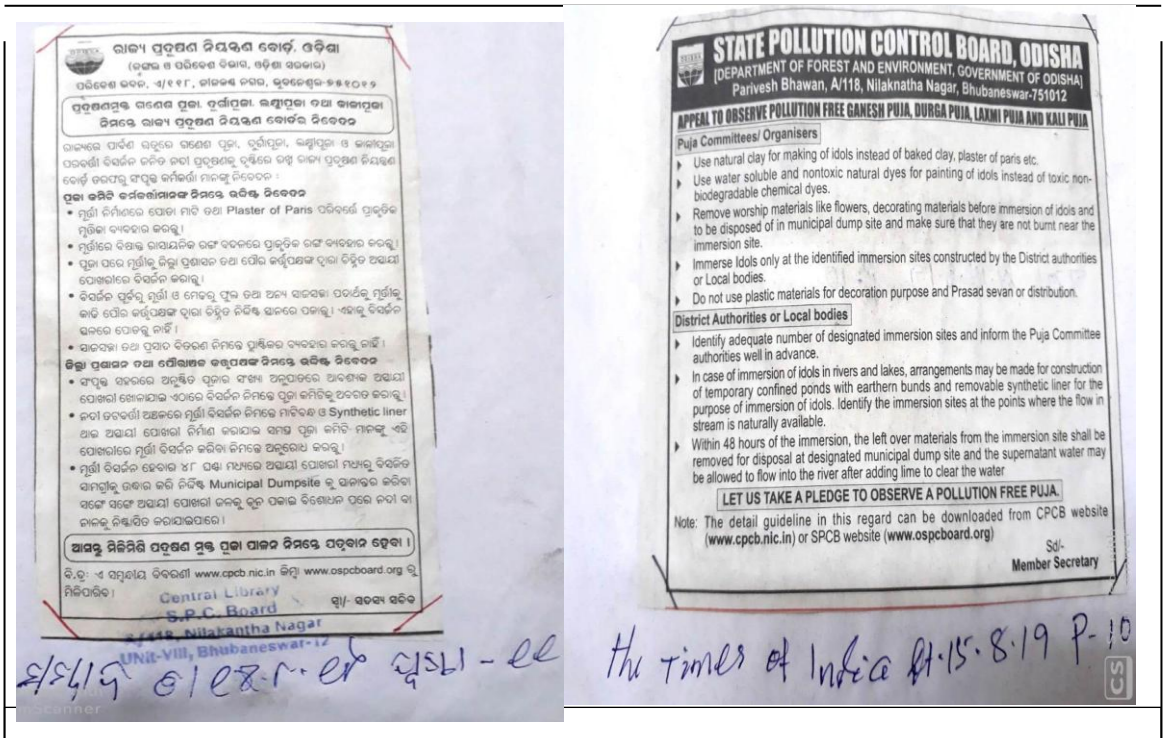
3. Actions taken by the State Pollution Control Board, Odisha

Ganesh Puja, Biswakarma Puja and Durga Puja, Kali Puja Gajalaxmi puja are celebrated in massive scale in most of the cities of the State of Odisha. After culmination of puja celebrations, the idols are generally immersed on a single day as decided by the Puja Committee Organisers, at the designated sites of the rivers flowing along the cities. In some places, idols are immersed in ponds, canals and sea in absence of any river nearby. Since last decade, Board has been taking proactive steps to implement the Guidelines for Idol Immersion at all places. Besides these, Board is also conducting the water quality monitoring of three major rivers i.e. Kathajodi river along Cuttack city; Kuakhai river and Daya river along Bhubaneswar city ; and Mangala river along Puri city to assess the impact of idol immersion.

In the year 2015, Hon'ble High Court of Orissa have intervened in this matter and vide their order dated 07.10.2015 directed the State Pollution Control Board, Odisha to render necessary assistance to the District Collectors and ensure strict compliances of the Guidelines for Idol Immersion during the Durga Puja and other pujas to follow thereof. In compliance to the order, the Board made an intensive approach to ensure the implementation of the Guidelines in all the urban local bodies of the State.

To minimize the impact of idol immersion on the water quality, the State Pollution Control Board, Odisha has taken following steps as recommended in the Guideline for idol immersion.

- Informed all the District Collectors and authorities of urban local bodies of the State prior to Ganesh Puja and Durga Puja to implement the Guidelines of Immersion in their areas of jurisdiction.
- Created public awareness through Public Notice on safe Idol immersion practices in Local Newspapers and in Board's website and through public address system (Fig.1).
- Made several meetings with the local bodies/ authorities, Puja Committee Organizers to create awareness on ill impacts of Idol immersion in water bodies.
- Coordinated with the local bodies/ authorities for construction of temporary immersion ponds near rivers as prescribed in the Guideline
- Conducted water quality assessment of the water body in three stages i.e. Pre-immersion. During immersion and post-immersion in Class-I cities such as Bhubaneswar, Cuttack and Puri.



ରାଜ୍ୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ବୋର୍ଡ, ଓଡ଼ିଶା
(ପରିବେଶ ଓ ପରିବେଶ ବିଭାଗ, ଓଡ଼ିଶା ସରକାର)
ପରିବେଶ ଭବନ, ଏ/୧୧୮, ନୀଳକଣ୍ଠ ନଗର, ଭୁବନେଶ୍ୱର-୭୫୧୦୧୨

ପ୍ରଦୂଷଣମୁକ୍ତ ଗଣେଶ ପୂଜା, ଦୁର୍ଗାପୂଜା, ଲକ୍ଷ୍ମୀପୂଜା ଓ କାଳୀପୂଜା ନିମନ୍ତେ ରାଜ୍ୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ବୋର୍ଡର ନିବେଦନ

ରାଜ୍ୟରେ ପାର୍ବଣ ସମୂହରେ ଗଣେଶ ପୂଜା, ଦୁର୍ଗାପୂଜା, ଲକ୍ଷ୍ମୀପୂଜା ଓ କାଳୀପୂଜା ପରବର୍ତ୍ତୀରେ ବିସର୍ଜନ ଜନିତ ନଦୀ ପ୍ରଦୂଷଣକୁ ଦୃଷ୍ଟିରେ ରଖି ରାଜ୍ୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ବୋର୍ଡ ଏପରସ୍ଥ ସଂପୃକ୍ତ ଜନସାଧାରଣ ମାନଙ୍କୁ ନିବେଦନ :

ପୂଜା ଉପାଧି ଦର୍ଶକମାନଙ୍କ ନିମନ୍ତେ ଉଚିତ୍ ନିବେଦନ

- ମୂର୍ତ୍ତୀ ନିର୍ମାଣରେ ପୋଡା ମାଟି ତଥା Plaster of Paris ପରିବର୍ତ୍ତେ ପ୍ରାକୃତିକ ମୂର୍ତ୍ତିକା ବ୍ୟବହାର କରନ୍ତୁ ।
- ମୂର୍ତ୍ତୀରେ ବିଷାକ୍ତ ରାସାୟନିକ ରଙ୍ଗ ବଦଳରେ ପ୍ରାକୃତିକ ରଙ୍ଗ ବ୍ୟବହାର କରନ୍ତୁ ।
- ପୂଜା ପରେ ମୂର୍ତ୍ତୀକୁ ନିଜ ପ୍ରତିଷ୍ଠାନ ତଥା ପୌର କର୍ତ୍ତୃପକ୍ଷଙ୍କ ଦ୍ୱାରା ଚିହ୍ନିତ ଅସ୍ଥାୟୀ ପୋଖରୀରେ ବିସର୍ଜନ କରାନ୍ତୁ ।
- ବିସର୍ଜନ ପୂର୍ବରୁ ମୂର୍ତ୍ତୀ ଓ ମୋଡରୁ ପୁଜ ତଥା ଅନ୍ୟ ସାଜସଜ୍ଜା ପଦାର୍ଥକୁ ମୂର୍ତ୍ତୀକୁ ଜାଡି ପୌର କର୍ତ୍ତୃପକ୍ଷଙ୍କ ଦ୍ୱାରା ଚିହ୍ନିତ ନିର୍ଦ୍ଦିଷ୍ଟ ସ୍ଥାନରେ ପକାନ୍ତୁ । ଏହାକୁ ବିସର୍ଜନ ସ୍ଥଳରେ ପୋତନ୍ତୁ ନାହିଁ ।
- ସାଜସଜ୍ଜା ତଥା ପ୍ରସାଦ ବିତରଣ ନିମନ୍ତେ ପ୍ଲାଷ୍ଟିକର ବ୍ୟବହାର କରନ୍ତୁ ନାହିଁ ।

ଜିଲ୍ଲା ପ୍ରଶାସନ ତଥା ପୌରାଞ୍ଚଳ କର୍ତ୍ତୃପକ୍ଷଙ୍କ ନିମନ୍ତେ ଉଚିତ୍ ନିବେଦନ

- ସଂପୃକ୍ତ ସହରରେ ଅନୁଷ୍ଠିତ ପୂଜାର ସଂଖ୍ୟା ଅନୁପାତରେ ଆବଶ୍ୟକ ଅସ୍ଥାୟୀ ପୋଖରୀ ଖୋଳାଯାଇ ଏଥାରେ ବିସର୍ଜନ ନିମନ୍ତେ ପୂଜା କମିଟିକୁ ଅବଗତ କରାନ୍ତୁ ।
- ନଦୀ ଜଡବର୍ତ୍ତୀ ଅଞ୍ଚଳରେ ମୂର୍ତ୍ତୀ ବିସର୍ଜନ ନିମନ୍ତେ ମାଟିବନ୍ଧ ଓ Synthetic liner ଥାଉ ଅସ୍ଥାୟୀ ପୋଖରୀ ନିର୍ମାଣ କରାଯାଇ ସମସ୍ତ ପୂଜା କମିଟି ମାନଙ୍କୁ ଏହି ପୋଖରୀରେ ମୂର୍ତ୍ତୀ ବିସର୍ଜନ କରିବା ନିମନ୍ତେ ଅନୁରୋଧ କରନ୍ତୁ ।
- ମୂର୍ତ୍ତୀ ବିସର୍ଜନ ହେବାର ୪୮ ଘଣ୍ଟା ମଧ୍ୟରେ ଅସ୍ଥାୟୀ ପୋଖରୀ ମଧ୍ୟରୁ ବିସର୍ଜିତ ସାମଗ୍ରୀକୁ ଉଦ୍ଧାର କରି ନିର୍ଦ୍ଦିଷ୍ଟ Municipal Dumpsite କୁ ସାଜାସ୍ତର କରିବା ସଙ୍ଗେ ସଙ୍ଗେ ଅସ୍ଥାୟୀ ପୋଖରୀ ଜଳକୁ କୁଳ ପଡାଇ ବିଶୋଧନ ପରେ ନଦୀ ବା ନାଳକୁ ନିଷ୍କାସିତ କରାଯାଇପାରେ ।

ଆସନ୍ତୁ ମିଳିମିଶି ପ୍ରଦୂଷଣ ମୁକ୍ତ ପୂଜା ପାଇଁ ନିମନ୍ତେ ପଦକ୍ଷେପ ନେବା ।

ବି.ଦ୍ର: ଏ ସମ୍ବନ୍ଧୀୟ ବିବରଣୀ www.cpcb.nic.in କିମ୍ବା www.ospcboard.org ରୁ ମିଳିପାରିବ ।

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STATE POLLUTION CONTROL BOARD, ODISHA
[DEPARTMENT OF FOREST AND ENVIRONMENT, GOVERNMENT OF ODISHA]
Parivesh Bhawan, A/118, Nilaknatha Nagar, Bhubaneswar-751012

APPEAL TO OBSERVE POLLUTION FREE GANESH PUJA, DURGA PUJA, LAXMI PUJA AND KALI PUJA

Puja Committees/ Organisers

- Use natural clay for making of idols instead of baked clay, plaster of paris etc.
- Use water soluble and nontoxic natural dyes for painting of idols instead of toxic non-biodegradable chemical dyes.
- Remove worship materials like flowers, decorating materials before immersion of idols and to be disposed of in municipal dump site and make sure that they are not burnt near the immersion site.
- Immerse Idols only at the identified immersion sites constructed by the District authorities or Local bodies.
- Do not use plastic materials for decoration purpose and Prasad sevan or distribution.

District Authorities or Local bodies

- Identify adequate number of designated immersion sites and inform the Puja Committee authorities well in advance.
- In case of immersion of idols in rivers and lakes, arrangements may be made for construction of temporary confined ponds with earthern bunds and removable synthetic liner for the purpose of immersion of idols. Identify the immersion sites at the points where the flow in stream is naturally available.
- Within 48 hours of the immersion, the left over materials from the immersion site shall be removed for disposal at designated municipal dump site and the supernatant water may be allowed to flow into the river after adding lime to clear the water

LET US TAKE A PLEDGE TO OBSERVE A POLLUTION FREE PUJA.

Note: The detail guideline in this regard can be downloaded from CPCB website (www.cpcb.nic.in) or SPCB website (www.ospcboard.org)

Sd/-
Member Secretary

The Times of India Pt. 15.8.19 P-10

Fig. 1 Appeal to Public to observe pollution free Ganesh puja, Durga Puja, Laxmi Puja and Kali Puja through Public Notice on Newspapers

(a) Actions taken for implementation of the Guideline during immersion of Idols in Rivers

Generally idols are immersed in flowing waters. In such cases, the Guideline has prescribed to construct temporary ponds having earthen bunds along the river bank for use as idol immersion spots. The ponds are to be lined with removable synthetic liner at its bottom well in advance of the idol immersion. The said liner along with remains of the idols are to be removed within 48 hours of idol immersion. The left over-materials are to be collected by the local bodies for disposal in municipal dumpsites.

In Urban local bodies like Cuttack, Bhubaneswar, etc., temporary immersion ponds were constructed on the bank of the rivers by the district administration much before the day of idol immersion. Location of the idol immersion sites and route map were also informed to the Puja committee authorites. The temporary ponds were lined with removable synthetic liner. Within 48 hours of idol immersion, the left-overs were removed and transported to the designated municipal dumpsites of the respective areas for disposal. The pond water was then treated with lime and allowed to settle prior to ultimate discharge into rivers. Fig. 2 depicts the temporary idol immersion ponds constructed on the bank of Kuakhai river along Bhubaneswar. The idols and puja left - overs were removed from the pond by the Bhubaneswar Municipal authorities within 48 hours of idol immersion and disposed at Bhubaneswar Municipal dumpsites.

Fig. 2 Temporary immersion pond on the bank of Kuakhai river along Bhubaneswar

In Bhubaneswar, three such temporary idol immersion ponds were created along Kuakhai river and Daya river. Earlier Puja Committees used to immerse idols in Kuakhai and Daya river and also at other natural water bodies in Bhubaneswar. However, during 2019, Bhubaneswar Municipal Authority had made it mandatory to immerse the idols at the temporary immersion ponds only on one day after Durga Puja for a better management of immersion left-over waste.

Similarly, in Cuttack, ten such temporary immersion ponds were created by the district administration along Mahanadi and Kathajodi rivers. In other Class-I cities of the State, temporary idol immersion ponds were created and the immersion guidelines were strictly followed. However, in some cities like Sambalpur etc. temporary immersion areas are made by cordoning a portion of the river on its bank for idol immersion. These temporary ponds were also lined with removable synthetic liner so as to facilitate the removal of dumped materials as per the Guideline.

Temporary idol immersion ponds were also created in other cities of the State for immersion of idols.

(b) Actions taken for implementation of the Guideline during immersion of Idols in Ponds

In absence of rivers in the cities, idols are immersed in the ponds. In such cases, the Guideline has prescribed to use a corner of the pond as idol immersion spot and is to be lined with removable synthetic liner at its bottom well in advance of the idol immersion. The said liner along with remains of the idols are to be removed within 48 hours of idol immersion. The left over-materials are to be collected by the local bodies for disposal in designated dumpsites.

Temporary immersion ponds were created in the urban local bodies like Keonjhar, Angul, Bhadrak, Balangir etc, by cordoning a corner of the pond or abandoned quarry. The temporary ponds were lined with removable synthetic liner. Within 48 hours of idol immersion, the left-overs were removed and transported to the designated dumpsites of the respective areas for disposal.

4. Actions taken by the Puja Committee Organsiers

In the year 2019, action taken by the Puja Committee Organisers in Odisha are as follows.

- Took various initiatives to make the puja plastic free to follow the ban of Plastic by Odisha State Government.
- Hundreds of volunteers were engaged in the puja pandals to create awareness among the devotees for not using plastic in daily life.
- Prasads were distributed in saal leaves instead of using any kind of plastic plates etc.
- Moreover, in case any devotee comes up with plastic bags to carry the prasad, the volunteers dumped those in the eco-friendly dustbins that have been installed in the pandals and instead offer them prasad in plates made of 'saal leaves'.
- The committees also preferred natural colours instead chemical colours on idols.
- In the state of Odisha people make idols mostly with natural clay. Use of plaster of paris for such purpose is not that much prevalent. However, with the continuous pursuance of State administration with the Organisers of Puja Committees, awareness has been created to observe eco-friendly Ganesh Puja and pandals. Notable examples are
    1. Making of a 46 feet tall idol of Lord Ganesh in the State Capital Bhubaneswar, made up of bio-degradable material. On the day of immersion, water from a tanker is sprayed on the idol so that the material will get mixed with the existing soil on the ground.
    2. In Sambalpur, Ganesh idol was made with raw bananas and bamboos. At the end of 10 day long festivities, bananas were distributed among the poor and needy.

    Such examples are increasing with the growing concern for aquatic environment by the civic societies in the State.

- Immersed idols on the next day of Durga Puja from 7.30 PM onwards at the designated temporary idol immersion ponds. (Fig. 3) Within 48 hours of the

immersion, the idols and the puja left overs in the pond were removed by the Puja Committee Organisers with the help of Municipal officials. (Fig. 4). These wastes were then transported to the municipal dumpsites for disposal.

Fig. 3 (a) Immersion of Idols in temporary immersion ponds

Fig. 3 (b) Removal of idols and puja left-overs from the temporary immersion ponds

Fig. 4 Collection of idols and puja left overs near the immersion pond for final disposal at the municipal solid waste dumpsite

Fig. 5 Condition of temporary immersion ponds after 48 hours of immersion

Condition of the temporary immersion ponds after 48 hours of immersion are depicted in Fig. 5. Water of these ponds were allowed to settle and then treated with lime prior to discharge into river.

In Bhubaneswar, these idol immersion ponds were filled with sand by the Bhubaneswar Municipality as a precautionary measure (Fig. 6).

Fig. 6 Condition of temporary immersion ponds after 48 hours of immersion

5. Water Quality Standard

Evaluation of water quality status is carried out basing upon the use of a particular segment of water body, wherein each use has been assigned with tolerance limits for some defined criteria parameters. As per designated best use classification of surface water bodies by CPCB, water quality is usually assessed in respect of five broad categories as described in Table-1.

Table-1 Use Based Classification

Class	Use
A	Drinking water source without conventional treatment, but after disinfection.
B	Organised outdoor bathing
C	Drinking water source with conventional treatment followed by disinfection.
D	Fish culture and wild life propagation
E	Irrigation, Industrial cooling or controlled waste disposal

Water quality parameters relevant to the above uses are given in Table-2.

Table - 2 Primary Water Quality Criteria

Parameter	Quality Criteria				
	Class– A	Class – B	Class – C	Class – D	Class – E
pH	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.0
Dissolved Oxygen (DO) (mg/l) minimum	6.0	5.0	4.0	4.0	-
Biochemical oxygen Demand (BOD) (mg/l) Max	2.0	3.0	3.0	-	-
Total Coliform (TC) (MPN/100 ml) Max	50	500	5000	-	-
Free Ammonia-N (mg/l) Max	-	-	-	1.2	-
Electrical Conductivity (EC) (microSiemens/cm) Max	-	-	-	1000	2250
Sodim Absorption Ratio (SAR) Max	-	-	-	-	26
Boron (B) (mg/l) Max	-	-	-	-	2.0

Besides these, IS 2296-1982 prescribes tolerance limits for other parameters as listed in Table-3 for above mentioned designated uses of surface water bodies.

Table-3 Tolerance limits for other parameters

Parameter	Tolerance limits (mg/l)				
	Class-A	Class-B	Class-C	Class-D	Class-E
Total Dissolved Solids (TDS), max	500	--	1500	--	2100
Lead (Pb), max	0.10	--	0.10	--	--
Cadmium (Cd), max	0.01	--	0.01	--	--
Chromium (VI) (Cr^{6+}), max	0.05	0.05	0.05	--	--
Iron (Fe), max	0.3	--	50	--	--
Copper (Cu), max	1.5	--	1.5	--	--
Zinc (Zn), max	15	--	15	--	--

5. Water Quality Assessment

To assess the impact of idol immersion on water bodies, the Board had conducted water quality assessment studies during Durga Puja in three Municipal areas like Cuttack, Bhubaneswar and Puri where the Puja is celebrated in massive scale.

As per the Guidelines, water quality monitoring was conducted in three stages i.e. pre-immersion, during- immersion and post- immersion period of Durga Puja. The physico-chemical parameters as recommended by Central Pollution Control Board (CPCB) for such studies, such as pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Conductivity (EC), Turbidity, Total Dissolved Solids (TDS), Total Solids (TS), and metals (cadmium, chromium, iron, lead, zinc and copper) were analysed in the water samples and compared with the tolerance limits for Class A (Drinking water source without conventional treatment but after disinfection) and Class C (Drinking water source with conventional treatment followed by disinfection) Inland surface water quality. The variation in concentration of different parameters at the immersion sites are compared with the values at the upstream and downstream of immersion sites to assess the impact of idol immersion.

From the water quality data, it has been observed that

- Turbidity and Suspended solids in Kathajodi river along Cuttack city and in Daya river along Bhubaneswar in during-immersion period was observed to be higher in comparison to the pre- and post-immersion period. This may be attributed to the increase in suspended materials on the water body during immersion of idols. Whereas, no significant change was observed in case of turbidity and Suspended solid values in Kuakhai river along Bhubaneswar and Musa river along Puri city.
- Dumping of puja materials and left-overs into the water body disrupts the oxygen level of water body and therefore increase in BOD and COD values at the immersion site on the day of idol immersion were also observed. By the time of post-immersion monitoring, the river water rejuvenates itself due to continuous flow of water, which is indicated by lowering of BOD values and other parameters in Kuakhai and Daya rivers along Bhubaneswar city. However, BOD values of the river water at all these monitoring locations remained well within the tolerance limit of 3.0 mg/l during all the three phases of monitoring.
- BOD values in Musa river in Pre-immersion period was more than the tolerance limit of 3.0 mg/l. Immersion of idols in the Musa river has increased the BOD level significantly.
- During immersion period increase in the conductivity and total dissolved solid at the immersion site in comparison to the upstream and downstream stations may be ascribed to the leaching of dissolved materials form the puja materials and idols immersed in the water body.
- Variation in concentrations of heavy metals such as cadmium, lead, copper and hexavalent chromium during the period of study was not significant.
- Concentration of heavy metals such as cadmium, chromium, iron, lead, zinc and copper in both during-immersion and post-immersion period remain much below the tolerance limit for most beneficial uses of water. This may be correlated to the very slow leaching process of heavy metals from the synthetic paints and other materials used in the idols in natural conditions of water bodies.

- Further, because of the preventive measures taken by the district administration not to allow the water of idol immersion ponds to flow into the river, water

quality of downstream stations in during-immersion and Post-immersion periods mostly remained well within the tolerance limits of the designated use.

- From the study, it may be concluded that all the parameters specified for the study remained within the tolerance limit for designated class of the river i.e. Class-C (Drinking water source with conventional treatment followed by disinfection) even after immersion of idols) excepting few cases. Concentration of heavy metals such as cadmium, chromium, iron, lead, zinc and copper remain much below the tolerance limits and no significant impact is exerted on the heavy metal concentration of the water bodies due to immersion of idols. Though some of the physical and chemical parameters like Turbidity, electrical conductivity, TDS and BOD shows higher values during-immersion period in comparison to the pre-and post-immersion period, but still remained much below the tolerance limit. Further, immersion of idols in the temporary immersion ponds has minimized the probability of contamination of the main course of river water.

Table- 4 Impact of idol immersion during Durga Puja on water quality of Kathajodi river at Cuttack

Period of monitoring	Location*	pH	DO, mg/l	BOD, mg/l	COD, mg/l	EC, µS/cm	Turb. NTU	TDS, mg/l	TS, mg/l	Cd, mg/l	Cr^{6+}, mg/l	TCr, mg/l	Fe, mg/l	Pb, mg/l	Zn, mg/l	Cu, mg/l
Pre-Immersion (30.09.2019)	Location-1	7.1	7.1	1.6	12.7	144	40	88	161	0.0008	<0.002	0.014	0.416	0.007	0.137	0.008
	Location-2	7.2	7.6	1.9	20.0	151	37	96	181	0.0028	0.003	0.031	0.651	0.016	0.14	0.01
	Location-3	7.4	7.5	1.6	12.7	149	37	92	167	0.0027	0.003	0.025	0.606	0.006	0.148	0.007
During-Immersion (10.10.2019)	Location-1	6.7	7.6	1.8	18.5	182	45	116	190	0.0009	<0.002	0.012	0.161	0.007	0.018	0.008
	Location-2	6.8	7.4	2.3	22.2	221	55	136	230	0.003	<0.002	0.014	1.294	0.012	0.140	0.01
	Location-3	7.1	7.3	2.2	22.2	169	60	190	278	0.0028	<0.002	0.012	1.134	0.009	0.087	0.009
Post-Immersion (15.10.2019)	Location-1	6.9	7.8	1.0	9.3	178	40	112	186	0.0006	0.008	0.025	0.378	0.008	0.016	0.004
	Location-2	7.6	7.7	2.0	18.6	198	37	128	209	0.0014	0.011	0.03	0.424	0.012	0.137	0.006
	Location-3	7.3	8.8	1.9	18.6	186	36	116	195	0.0008	0.011	0.028	0.504	0.009	0.038	0.003
Tolerance limits for Class-C inland surface waters (IS : 2296-1982)		6.5-8.5	4 or more	3 or less	-	-	-	1500	-	0.01	0.05	-	50	0.1	15	1.5

* Location-1 : Upstream of Immersion pond at Naraj Barrage
* Location-2 : Immediate downstream of Immersion pond (Puri ghat)
* Location-3 : Downstream of Immersion pond near Khan nagar

Table- 5 Impact of idol immersion during Durga Puja on water quality of Kuakhai river at Bhubaneswar

Period of monitoring	Location*	pH	DO, mg/l	BOD, mg/l	COD, mg/l	EC, µS/cm	Turb. NTU	TDS, mg/l	TS, mg/l	Cd, mg/l	Cr^{6+}, mg/l	TCr, mg/l	Fe, mg/l	Pb, mg/l	Zn, mg/l	Cu, mg/l
Pre-Immersion (30.09.2019)	Location-1	7.4	7	1.3	12.7	155	39	88	166	0.0011	0.002	0.012	0.327	<0.001	0.112	<0.001
	Location-2	7.5	7.1	1.6	12.7	154	36	104	190	0.0016	0.005	0.027	4.664	0.007	0.128	0.005
	Location-3	7.5	7.2	1.9	20	153	40	92	185	0.0016	<0.002	0.016	1.608	0.008	0.125	0.005
During-Immersion (10.10.2019)	Location-1	7	7.3	1.4	13	211	39	230	310	0.0008	<0.002	0.014	0.743	0.003	0.008	0.003
	Location-2	7	7.5	2.4	24.1	218	55	196	295	0.0015	<0.002	0.017	2.116	0.006	0.022	0.003
	Location-3	7.5	6.8	2.1	20.4	207	50	208	304	0.001	<0.002	0.017	1.476	0.009	0.016	0.004
Post-Immersion (15.10.2019)	Location-1	7.2	6.2	1.6	16.7	159	38	96	171	0.0011	<0.002	0.017	0.413	0.006	0.014	0.003
	Location-2	7	5.5	1.8	18.6	402	40	244	326	0.0015	0.016	0.028	2.192	0.012	0.048	0.014
	Location-3	7.4	7.8	1.6	16.7	184	40	116	189	0.0016	0.013	0.023	0.983	0.01	0.014	0.011
Tolerance limits for Class-C inland surface waters (IS : 2296-1982)		6.5-8.5	4 or more	3 or less	-	-	-	1500	-	0.01	0.05	-	50	0.1	15	1.5

Table- 6 Impact of idol immersion during Durga Puja on water quality of Daya river at Bhubaneswar

Period of monitoring	Location*	pH	DO, mg/l	BOD, mg/l	COD, mg/l	EC, µS/cm	Turb. NTU	TDS, mg/l	TS, mg/l	Cd, mg/l	Cr^{6+}, mg/l	TCr, mg/l	Fe, mg/l	Pb, mg/l	Zn, mg/l	Cu, mg/l
Pre-Immersion (30.09.2019)	Location-1	7.5	6.9	1.7	18.2	153	40	96	168	0.0023	<0.002	0.011	0.482	0.008	0.024	0.005
	Location-2	7.5	6.9	1.7	18.2	157	40	104	172	0.0026	<0.002	0.016	1.906	0.015	0.044	0.006
	Location-3	7.4	6.5	1.6	16.4	167	50	100	174	0.0026	<0.002	0.016	1.867	0.006	0.027	0.003
During-Immersion (10.10.2019)	Location-1	7.8	8.1	1.2	14.8	178	40	231	301	0.0006	<0.002	0.011	0.017	0.003	0.036	0.004
	Location-2	7.8	6	2.1	22.2	187	55	212	301	0.0011	<0.002	0.019	1.433	0.009	0.039	0.006
	Location-3	7.4	6	1.9	20.4	172	55	186	264	0.0009	<0.002	0.017	0.752	0.007	0.027	0.004
Post-Immersion (15.10.2019)	Location-1	7.2	7.7	1.6	20.5	168	36	108	178	0.0007	0.008	0.022	0.012	0.004	0.011	0.003
	Location-2	7.4	7.7	1.8	22.3	178	40	116	188	0.0009	0.012	0.028	0.021	0.005	0.014	0.005
	Location-3	7.5	7.7	1.2	13	163	50	104	180	0.0014	0.011	0.027	0.021	0.005	0.014	0.004
Tolerance limits for Class-C inland surface waters (IS : 2296-1982)		6.5-8.5	4 or more	3 or less	-	-	-	1500	-	0.01	0.05	-	50	0.1	15	1.5

* Location-1 : Upstream of Immersion pond near Daya bridge

* Location-2 : Immediate Downstream of Immersion pond

* Location-3 : Downstream of Immersion pond

Table- 7 Impact of idol immersion during Durga Puja on water quality of Musa river at Puri

Period of monitoring	Location*	pH	DO, mg/l	BOD, mg/l	COD, mg/l	EC, µS/cm	Turb. NTU	TDS, mg/l	TS, mg/l	Cd, mg/l	Cr^{6+}, mg/l	TCr, mg/l	Fe, mg/l	Pb, mg/l	Zn, mg/l	Cu, mg/l
Pre-Immersion (30.09.2019)	Location-1	7	5.2	1.6	18.2	162	80	104	250	0.0015	<0.002	0.012	0.033	0.004	0.002	0.001
	Location-2	Not monitored														
	Location-3	7	5.9	2.1	21.8	197	90	124	287	0.0022	<0.002	0.016	1.199	0.009	0.039	0.005
During-Immersion (10.10.2019)	Location-1	7.7	5.3	1.6	14.8	264	14	481	525	0.0009	0.006	0.019	0.253	0.004	0.007	0.003
	Location-2	Not monitored														
	Location-3	7.8	5.3	1.8	18.5	286	23	376	436	0.0011	0.011	0.041	0.319	0.008	0.011	0.007
Post-Immersion (15.10.2019)	Location-1	7.6	6.4	2.7	13	197	36	116	154	0.0021	0.009	0.02	0.013	0.005	0.018	0.001
	Location-2	Not monitored														
	Location-3	7.3	6.1	3.3	22.3	195	36	132	170	0.0048	0.016	0.034	1.168	0.013	0.043	0.007
Tolerance limits for Class-C inland surface waters (IS : 2296-1982)		6.5-8.5	4 or more	3 or less	-	-	-	1500	-	0.01	0.05	-	50	0.1	15	1.5

* Location-1 : Upstream of Immersion point near Musa river
* Location-2 : At immersion point
* Location-3 : Downstream of Immersion point

Table- 7 Water quality of idol immersion ponds one day after the immersion of idols during Durga Puja

Period of monitoring	Location*	pH	DO, mg/l	BOD, mg/l	COD, mg/l	EC, µS/cm	Turb. NTU	TDS, mg/l	TS, mg/l	Cd, mg/l	Cr^{6+}, mg/l	TCr, mg/l	Fe, mg/l	Pb, mg/l	Zn, mg/l	Cu, mg/l
During-Immersion (10.10.2019)	Location-1	6.9	0.5	13.2	59.2	368	75	213	520	0.0014	0.009	0.037	1.931	0.011	0.023	0.006
	Location-2	7.3	1.9	10.6	68.5	388	70	531	772	0.0018	0.009	0.034	0.721	0.018	0.094	0.016
	Location-3	7.8	5.2	5.4	42.6	323	55	522	682	0.0023	0.011	0.048	1.762	0.006	0.111	0.011

* Location-1 : Idol immersion pond near Kuakhai river at Bhubaneswar
* Location-2 : Idol immersion pond near Daya river at Bhubaneswar
* Location-3 : Idol immersion pond near Mangala River at Puri

6. Recommendations

- Guidelines of Idol Immersion should be strictly followed by the Puja Committee Organisers during the immersion of idols.

- Puja Committee Organisers should promote the construction of idols from clay only and colouring of the idols with natural colours.

- Adequate number and size of ponds shall be designated for idol immersion and shall be informed to the Puja Committee Organisers.

- Municipal authorities shall cooperate the Puja Committee Organisers for removal of the left-over materials of the idol immersions from the immersion sites within 48 hours of immersion and transportation of these debris to the dumpsites.

- Treatment of temporary immersion pond with lime and discharge of the settled water to main river channel within four days of idol immersion.

- Burning of left-over materials of idol immersion on the banks of river should be prohibited.

- Public awareness shall be given more thrust on the ill-impacts of idol immersion and implementation of the Guidelines.

- Public awareness should be created to limit the size of idols and number of idols in a locality in order to decrease the wasteload in the form of puja left-overs.
