

DISCLAIMER

*In compliance of the order passed by Hon. National Green Tribunal (NGT) on 9th May, 2013 in the matter of Application No. 65/2012 (T_{CH}). MPCB has prepared the said report “**Post Idol Immersion impact on water quality to ascertain water pollution potential of idols made up of Plaster of Paris and Others**” and draft “**Guidelines for Immersion of Ganesh Idols**”. This is submitted to the Principal Secretary, Department of Environment, Govt. of Maharashtra for necessary action.*

MPCB is following prevailing guidelines issued by Central Pollution Control Board (CPCB) for immersion of idols.

Issued with approval of Member Secretary, MPCB

Date: 03.04.2014

*(Dr. A. R. Supate)
Principal Scientific Officer*

Study of
“Post idol immersion impact on water quality to ascertain
water pollution potential of idols made up of
Plaster of Paris and others”



Ganesh idol made up of Plaster of Paris



Ganesh idol made up of “Shadu”



Eco-Ganesh / idol made up of Shadu and paper pulp



MAHARASHTRA POLLUTION CONTROL BOARD
Central Laboratory, Navi Mumbai



27th Aug., 2013

MAHARASHTRA POLLUTION CONTROL BOARD
Central Laboratory, Navi Mumbai

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MAHARASHTRA POLLUTION CONTROL BOARD

Central Laboratory, Navi Mumbai

“To study post idol immersion water quality and to ascertain water pollution potential of idols made up of Plaster of Paris and others.”

REPORT

1. Objective:

“To study post idol immersion water quality and to ascertain water pollution potential of idols made up of PoP and others.” in compliance to the order passed on 9th May, 2013 by Hon’ble National Green Tribunal (NGT) in matter of Application No. 65/2012 (T_{HC})

2. Background:

Hon’ble National Green Tribunal (NGT) in the matter of application No.65/2012 (T_{HC}) S. K. Waghvankar and others V/s State of Gujarat filed by a group of Idol manufactures and artisans, under section 14 and 16 of the National Green Tribunal Act,2010 issued following directions to the Pollution Control Boards vide its order dated 09th May,2013.

GPCB and all the other Pollution Control Boards which are covered by the Water Act to undertake scientific study of the impact of PoP made idols on immersion thereof, in relation to water quality of rivers, ponds, sea or other sources and examine whether it is an environment pollutant.

The order further directs PCBs to examine whether the immersion of PoP made idols, in fact, cause nuisance, though the PoP by itself may not be a water pollutant, after conducting such scientific study by appointing an Expert Committee. The Pollution Control Board or the Central Government or the State Government may issue appropriate directions in accordance with the powers available under section 33–A of the Water Act or any other provisions under the Water Act or any other Act, in order to control water pollution or to avoid the nuisance caused on account of immersion of the PoP made idols.

Since the Ganesh festival and other festivals are in the offing, it is desirable that the Gujarat PCB as well as the other PCBs should complete the exercise mentioned above within a period of three (3) Months and thereafter the SPCB or Government may issue the necessary directions, if so deemed proper, under provisions of the Water Act or any other Act, as may be permissible and deemed proper.



Accordingly, MPC Board, Mumbai vide **Office Order No. E-66 /2013, dtd 15th July, 2013** constituted a committee under the Chairmanship of Dr. A. R. Supate, Principal Scientific Officer, MPC Board, Mumbai consisting of:

- Dr. Rakesh Kumar, Scientist-G & Head, Mumbai Zonal Lab. NEERI, Mumbai.
- Mr. R.G. Pethe, Ex. Water Pollution Abatement Engineer, MPC Board, Mumbai.
- Mr. Bharat Nimbarte, Joint Director (WPC) MPC Board, Mumbai.
- Mr. Sanjay Bhuskute, Public Relation Officer, MPC Board, Mumbai.

The Chairman of the committee co-opted Shri D T Devale, Sr. Law Officer, MPCB and Ms. Pradnya Thakur, Director, Shaswat Eco-solution Foundation, Pune in the committee.

During the first meeting Chairman of the committee vide Ref. No.MPCB/PSO/Lab./B-3474, dtd.05/08/2013 constituted a study group of scientific staff of the MPC Board as under:

- Mr. S. V. Bhosale, Scientific Officer, Regional Laboratory MPCB, Thane.
- Mr. B. S. Gadhari, Jr. Scientific Officer, Central Laboratory. MPCB, Navi Mumbai.
- Ms. Ragini Butale, Jr. Scientific Officer, PSO Division, MPC Board, Mumbai.
- Mrs. Swapna Satam, Jr. Scientific Assistant, Central Lab., MPCB, Navi Mumbai

As per decision of committee necessary guidelines were issued to the study group constituted for the study. Accordingly the study commenced on 02/08/2013 at Central Laboratory, MPC Board, Mahape, Navi Mumbai.

3. Methodology:

In Maharashtra approx. 68.01 lacks of Ganesh Idols are manufactured, out of which 2.34 Lack idols are of large size and worshiped in Public *Ganesh Mandals* and 65.67 Lakh idols are worshiped at individual houses. Majority house hold Idols are small in size (10 to 13 inches height). Public Ganesh Mandal Idols are immersed in preferably flowing water or Large lakes or sea / creeks on 10th Day (*Anant Chaturdashi*) whereas house hold idols are immersed on 2nd Day, 3rd Day, 5th Day, 7th Day and on 10th day.

To understand the effect of idols made up of various materials the idols available in market with reputed manufacturers are selected for study purpose. Ganesh Idols commonly worshiped in households during Ganesh Festival in Maharashtra are selected according to its weight, height and color combination.

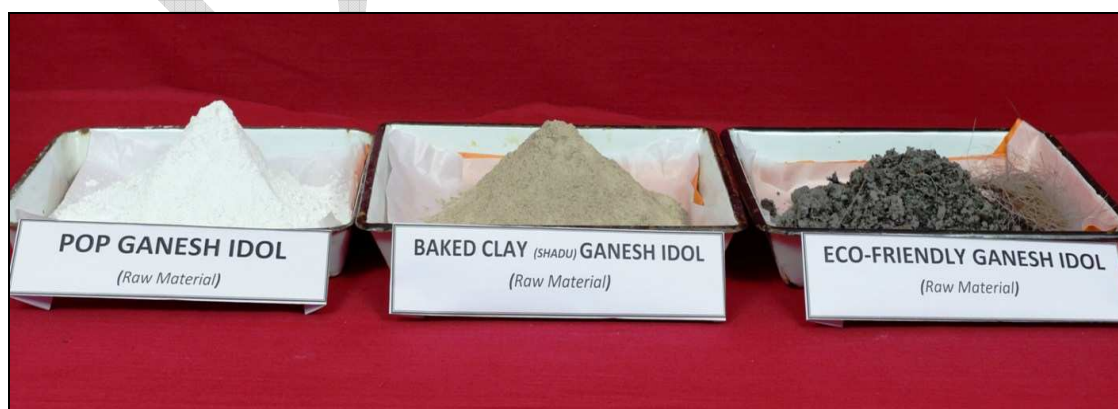
Table 1: Physical Features of Idols used for study (in duplicate):

Idol Features	PoP		Shadu		Eco	
Height- (inches)	10.5	10.5	12.8	12.1	12.7	13.0
Weight (Kg.)	1.80	1.80	4.81	4.81	4.60	4.65
Base	Blue Green	Blue Green	Blue Green	Blue Green	Grey	Light Green
Ornaments	Golden	Golden	Golden	Golden	Golden	Golden
Pitamber	Orange	Orange	Red	Red	Yellow	Yellow
Shela	Pink.	Light Red	Yellow	Yellow	Purple	Green
Colors	Chemical	Chemical	Natural	Natural	Natural	Natural

Table 2: Material used for experimental set up

Sl. No.	Material	Quantity
1	Semi-Transparent Plastic Container (70 liters) (620X450X360 mm)	7 Nos
2	PoP Idols with Chemical colors	3 Nos. (1 Idol for Reference)
3	Shadu Idols with Natural colors	3 Nos. (1 Idol for Reference)
4	“Eco-friendly” idols with Natural colors	3 Nos. (1 Idol for Reference)
5	PoP as Raw material (used in PoP idols)	Approx. 500gms
6	Shadu as Raw material (used in shadu idols)	Approx. 500gms
7	Paper Pulp, Shadu & Coir (used in “Eco Ganesh” idols)	Approx. 500gms

Fig. 1: Raw material used for making Ganesh Idols



In all 7 Nos. of Containers are taken for study. One Plastic container filled with tap water is kept as a control. In other containers Lord Ganesh Idols (PoP, Shadu and Eco-friendly) are separately kept in duplicate. Fix volume of 65 liters tap water is added to each container to ensure complete immersion of idols. Water is collected at '0' hrs (Control), and after defined intervals from each container for water quality analysis. Also, physical observations are recorded for each container and are supported with Photographs and video till disintegration of "Shadu" & "Eco" idols.



Fig.2 : Ganesh idol made up of Plaster of Paris



Fig.3: Ganesh idol made up of "Shadu"



Fig.4 : Eco-Ganesh idol made up of Shadu and paper pulp.

4. Observations:

a. Plaster of Paris Idols (PoP):

Plaster of Paris is extracted from Gypsum rock and is comprises of Calcium and Sulphate. When gypsum is heated at about 150 degree Celsius it losses water and produces powder PoP.i.e. Calcium sulphate dehydrate is fired at relatively low temperature and then reduced to powdered form is PoP. When PoP is mixed with water, it sets within few minutes due to expansion and its surface become smooth. Due to this property, it is used in molds. PoP is not easily soluble in water but gradually goes in water bed over a long time period. Large amount of PoP when comes directly in contact with skin, causes serious burns because of heat produced.

Material used for making PoP idols contain the PoP (Gypsum) 80% and above and paper (cellulose) up to 10% and other material within 1-2% like starch, Boric Acid, Potassium sulfate, Vermiculite, Glass fiber, Paraffin wax and Crystalline Silica. Colors used are mostly chemical and contains metals such as Copper, Chromium, Cadmium, Nickel, Lead, Mercury etc.

POP makes water alkaline if deposited excessively. Calcium and magnesium concentration in water increases significantly leading to increase in the hardness of water.

PoP Idol P1 & P-2:

Sl. No.	Hrs/Days	Physical Observations
1	1 hr	No change/ disintegration is noticed.
2	4 hrs	No change/ disintegration is noticed.
3	12 hrs	No change/ disintegration is noticed.
4	24 hrs	Slight hair cracks to Color at base observed
5	2 nd Day	Hair crack observed is slightly widened
7	5 th Day	White Color of rear side of idol is disintegrated
8	8 th Day	Body color started disintegrating
9	10 th Day	No change
10	15 th Day	No change.

b. “Shadu” Idol S-1 & S-2:

Traditionally, Ganesh Idols are made up of clay from bank of river. Natural clay was widely used for preparation of Idol but making idol from clay is a very skillful job. These clay idols are fragile, and hence limit transportation over longer distance. Due to this property, it is used in molds. Clay is from natural source and is easily soluble in water.

Material used for making clay idols contain the clay popularly called “Shadu” now a day’s mostly sourced from Gujrath. Other material like starch etc. and colors used are mostly natural / eco friendly, except for the Golden color. Due to disintegration of Hindu undivided families and urbanization demand of house hold idols is increased. This has increased demand of ‘Shadu Clay’, which is not easily available resulting into increased cost of Ganesh Idols made from Shadu Clay. Since, these idols get rapidly dissolved in water turbidity of water tends to increase immediately.

Sl. No.	Minutes/Hrs	Observations
1	5 min.	Bubbling started. Dissolving of idol began. Colors (except Golden) started dissolving.
2	10 min	Back hand of right side, & left hand, collapsed. Bubbles started coming from Right hand of idol.
3	15 min	Trunk collapsed. Head and trunk is collapsed
4	30 min	Observed bubbles from all sides. Total idol is disintegrated in to small parts.

c. “Eco” Idol (E1 & E2)

“Eco-Ganesh” idols are made up of Shadu Clay and Paper pulp, Natural gum, eco friendly colors and natural coir from palm / coconut tree. These idols have advantage of light weight, close to traditional belief and having lesser metal contents. The idols have benefit of easy disintegration in water

Sl. No.	Hrs/Days	Observations
1	15 min.	Bubbling started. Dissolving of idol began. Colors (except Golden) started dissolving.
2	1 Hrs.	Colors start disintegrating. Minor cracks are observed Bubbles started coming from Idol
3	2 Hrs.	The crack widens, Bubbling rate increased,
4	3 Hrs.	The idols disintegrated into parts.

IMMERSION OF POP GANESH IDOL



PHOTGRAPH OF IMMERSION OF POP GANESH IDOL



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PHOTGRAPH OF IMMERSION OF ECO-FRIENDLY GANESH IDOL



IMMERSION OF SHADU GANESH IDOL



Uniform sample is drawn from at following frequency from Control and PoP idol container for testing water quality at following frequency:

- | | |
|--------------------------------------|--------------------------------------|
| I) Set -1: 24 Hrs after immersion. | II) Set -2: 48 Hrs after immersion. |
| III) Set -3: 5 days after immersion. | IV) Set -4: 8 days after immersion |
| II) Set -5: 10 days after immersion. | Vi) Set -6: 15 days after immersion. |

The new of plastic cans of 2 lit. Capacity is used for collecting the samples from each setup. The analysis is carried out at Central Laboratory, MPC Board, Navi Mumbai using standard methods for desired parameters.

**WATER QUALITY
(CONTROL SAMPLES)**

Sl. No.	Parameters.	Blank '0' hrs	2 nd Day	3 rd Day	5 th Day	7 th Day	10 th Day	15 th Day
1	pH	8.1	8.1	8.1	7.9	7.9	8.1	8.0
2	Turbidity (NTU)	2.3	2.3	1.8	1.84	1.89	2.18	2.22
3	Conductivity (µs/cm)	131	133	136	139	147	148	150
4	Total Alkalinity	54	54	46	46	48	52	48
5	Total Hardness	56	56	54	54	54	58	58
6	Ca Hardness	36	36	34	34	34	38	38
7	Mg Hardness	20	20	20	20	20	20	20
8	TDS	86	88	95	144	150	158	162
9	Total Solids	95	104	110	167	175	185	189
10	Sulphate	3.9	3.9	3.24	3.92	3.34	2.72	2.84
11	Chlorides	17	17	17	15	15	15	15
12	Dissolved Oxygen	7.4	7.3	7.2	7.0	7.0	7.0	7.4
13	B.O.D.	0.5	0.7	0.7	0.9	0.9	0.8	0.7
14	C.O.D.	12.0	12.0	8.0	8.0	8.0	4.0	12.0

**WATER QUALITY
(POP GANESH IDOLS)**

Sl. No.	Parameters.	Blank '0' hrs	2 nd Day	3 rd Day	5 th Day	7 th Day	10 th Day	15 th Day
1	pH	8.1	8	7.85	7.7	7.7	7.8	7.8
2	Turbidity (NTU)	2.3	2.35	2.3	3.56	3.85	4.965	8.325
3	Conductivity (µs/cm)	131	353	568	1036	1558	1594	1751
4	Total Alkalinity	54	54	44	52.	54.	56	57
5	Total Hardness	56	182	315	710	915	1325	1500
6	Ca Hardness	36	165	284	635	870	1290	1430
7	Mg Hardness	20	17	31	75	45	35	70
8	TDS	86	303	522	1153	1736	1787	2012
9	Total Solids	95	344	576	1286	1778	1934	2422
10	Sulphate	4.0	87	180	371	602	758	818
11	Chlorides	17	17	17	17	18	18	18
12	Dissolved Oxygen	7.4	7.6	7.7	5.7	5.7	5.8	6.2
13	B.O.D.	0.5	1.1	1.05	1.3	1.7	1.8	1.2
14	C.O.D.	12.0	14.0	12.0	12.0	24.0	18.0	20.0

Note: Water quality of the Shadu and Eco-Ganesh idol immersion were not tested as it was not in the scope of the study.

5. Conclusion:

- A Study of time taken to disintegrate the different idols has confirmed that, PoP idols take very long time to disintegrate; in this case it has not dissolved even after 15th Day after immersion. Whereas, the Shadu idol is disintegrated within about 30 minutes and Eco-idol has disintegrated steadily within about 3.00 hrs after immersion.
- B Comparison of water quality after immersion of PoP idols on various days after immersion till 15th day has revealed steady increase of Conductivity from 131 to 1751 μ S/cm, Total Hardness from 56 to 1500mg/l, Calcium hardness from 36 to 1430mg/l, Magnesium hardness from 20 to 70mg/l, Sulphate from 4.0 to 818 mg/l, Total solids from 95 to 2422mg/l and COD from 12 to 24mg/l. Dissolved oxygen has shown trend of depletion over the period i.e. from 7.4 to 5.7mg/l on 5th Day.

6. Recommendations :

- ✓ The present study confirms that idols made of PoP are not easily soluble in water. Even after 15th day of immersion the PoP idols do not disintegrate/deform. Further, gradual disintegration of chemical constituents of PoP idols has shown steady increase in hardness and COD and reduction of dissolved oxygen in water. The large scale immersion of PoP idols may lead to gradual and persistent change of water quality, particularly in water bodies such as wells, ponds etc, having limited dilution factor, therefore, may have marked adverse impact on aquatic life as well as natural quality of receiving body of water. However, the lab scale study does not aim to study impact on life and health of aquatic flora and Fauna.
- ✓ The idols made of PoP are light in weight; do not disintegrate for longer period. In contrast, idols made of "Shadu" and "Eco-idols" made of mixture of "Shadu, Paper pulp disintegrate easily in water within few hours. Immersion of idols made of PoP leads to mutilated idols resurging on surface of the water or the bank of water body, particularly along the sea coast, causing serious jolt to the religious sentiments of people. Whereas , the later one (Shadu and Eco idols) avoids mutilated idols resurging on surface of the water or the bank of water body, particularly along the sea coast I waters after the high tide is over. The sight of such mutilated idols causing serious jolt to the religious sentiments of people can thus be avoided.
- ✓ PoP is not toxic. Immersion of PoP idols having used chemical colours, in large number, in river/sea or ponds, etc., cause gradual changes/ nuisance in characteristics of a water body, which is covered by definition of "pollution" within the meaning of section 2(e) of the Water Act.
- ✓ It is recommended to avoid use of PoP in manufacture of idols to be immersed in natural water bodies and instead promote use of idol manufacturing using material and manufacturing process which will have advantages of PoP idols such as use of moulds, quick drying, light weight and ease of handling during transportation. Thus, promoting idols manufactured using reusable, recycled material as used in

the Eco- Ganesh, and use of natural, water soluble and /or certified eco colors free from toxic heavy metals be considered as one of the priority options.

- ✓ It is recommended to undertake long term study of impact of idol immersion process in aquatic environment (lake, river, sea, creek and well) to assess impact of immersion of idols made of different material, on water quality, aquatic life, productivity etc. It is advised that, till the acceptance of public at large is confirmed for eco friendly idols both in terms of availability, ease of manufacturing and handling / transportation & cost , manufacture of PoP idols for house hold use be restricted to its size not more than 11 ± 2 inches and encourage immersion in artificial lakes/tanks/ponds.

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Receiving Water quality standards for best designated uses as prescribed by MPCB

Water Quality Standards for Best Designated Usages				
Category of Fresh Water	A - I	A-II	A-III	A-IV
Best Usage	Unfiltered Public water supply after approved disinfection	Public water supply with approved treatment equal to coagulation, sedimentation & disinfection.	Not fit for human consumption, Fish & Wildlife Propagation.	Fit for Agriculture, Industrial cooling & process water.
Chemical Qualities : Maximum allowable concentration				
Toxic Substances				
Arsenic (As)	0.3 mg/l	0.3 mg/l	1.0 mg/l	0.1 mg/l
Cadmium (Cd)	0.01 mg/l	0.01 mg/l	-	-
Chromium (Cr ⁺⁶)	0.05 mg/l	0.05 mg/l	0.05 mg/l	0.2 mg/l
Cyanide (CN)	0.05 mg/l	0.1 mg/l	0.05 mg/l	0.2 mg/l
Lead (Pb)	0.1 mg/l	0.1 mg/l	-	0.1 mg/l
Boron (B)	-	-	-	2.0 mg/l
Mercury (Hg)	0.001 mg/l	0.001 mg/l	0.001 mg/l	-
Gross alpha activity	3 PCI/l	10-9 uc/ml	3 PCI/l	3 PCI/l
Gross Beta activity	30 PCI/l	10-8 uc/m	30 PCI/l	30 PCI/l
Substances affecting health				
Fluoride (F)	1.5 mg/l	1.5 mg/l	-	1.0 mg/l
Nitrates (NO ₃)	45 mg/l	45 mg/l	-	-
Substances affecting the potability of water				
pH	6.5 to 8.5	6.0 to 8.5	6.5 to 9.0	6.5 to 9.0
T.D.S.	-	T.D.S.	T.D.S.	-
Total Solids	1500 mg/l.	1500 mg/l.	-	-
Total Suspended Solids	25 mg/l	-	-	-
Total Hardness (Caco ₃)	50 mg/l	-	-	-
Total Residual Chlorine	-	-	-	-
Electrical conduct at 25. C	-	-	1000 x 10 ⁻⁶ mhos	3000 x 10 ⁻⁶ mhos
Free Carbon Di Oxide	-	-	12 mg/l	-
Free Ammonical Nitrogen	-	-	1.2 mg/l	-
Oil & Grease	-	-	0.1 mg/l	-
Pesticides	-	-	0.02 mg/l	-
Biotic Index	-	-	6.0 mg/l	-

Water Quality Standards for Best Designated Usages

Category of Fresh Water	A - I	A-II	A-III	A-IV
Best Usage	Unfiltered Public water supply after approved disinfection	Public water supply with approved treatment equal to coagulation, sedimentation & disinfection.	Not fit for human consumption, Fish & Wildlife Propagation.	Fit for Agriculture, Industrial cooling & process water.
Total Ammonical Nitrogen	1.5 mg/l	1.5 mg/l	-	50 mg/l
Chlorides (Cl)	600 mg/l	600 mg/l	-	600 mg/l
Sulphates	400 mg/l	400 mg/l	-	1000 mg/l
Copper (Cu)	1.5 mg/l	1.5 mg/l	-	-
Manganese (Mn)	0.5 mg/l	3.0 mg/l	-	-
Iron (Fe)	1.0 mg/l	5.0 mg/l	-	-
Sodium	-	-	-	-
Zinc (Zn)	15.0 mg/l	1.5 mg/l	5.0 mg/l	5.0 mg/l
Phenolic Compounds	0.002 mg/l	0.002 mg/l	0.05 mg/l	-
Alkyl Benzene sulphates	1.0 mg/l	1.0 mg/l	-	-
Mineral Oil	0.3 mg/l	0.3 mg/l	-	-
Ammonia	1.5 mg/l	1.5 mg/l	-	-
B.O.D. (5 days 20 . C)	2.0 mg/l(Monthly average of at least 10 samples)	5.0 mg/l(Monthly average of at least 10 samples)	10 mg/l	30 mg/l
C.O.D.	-	-	-	150 mg/l
D.O.	Not less than 5 mg/l(Monthly average of 100 samples)	4.0 mg/l	Not less than 3 mg/l	Not less than 2 mg/l
Bacteriological Standards :	Coliform Bact. 250	Not greater than 5000		
(MPN/100)				