Impact of Durga Idol Immersion on Haorah River

A Trend Analysis

DATA COLLECTED, COMPILED AND PROCESSED BY

TSPCB-ENVIS HUB

INTRODUCTION

The well known fact is that the existence of life on the earth is mainly due to presence of water. It provides sustenance to plants, animals, aquatic organisms and support human needs likes agriculture and industries. From ancient times, rivers are used as fresh water resources for human beings. The quality of usable water is degrading due to the overexploitation caused by increase of population and its anthropogenic activities. Water bodies get polluted regularly by the dumping of domestic, hospital and industrial wastes. On the other hand, our religious rituals are also responsible for water quality deterioration as most of the rituals are performed near the bank of river and water bodies. Majority of our population believes in idolatry and idol immersion has become a cause of water pollution during festive seasons. Water pollution caused by idol immersion has social, religious, scientific and environmental dimensions. Idols are made of clay, clothes, straw, bamboo, plaster of paris, nails and are decorated by natural and synthetic paints and colors. The constituting materials of idols degrade the quality of water on immersion.

Tripura, one of the north-eastern states of India, situated in the eastern part of India and surrounded by Bangladesh on the West, South and North side. It is well gifted with surface water resources and all major rivers of Tripura bring about from hill ranges and occurrences like typical lattice and dendrite pattern. During rainy season the river water being in flurry while in summer month they remain almost in dry condition. Out of ten major rivers in the state, River Haora is the lifeline of Agartala city, capital of Tripura state because it fulfils the major demand of drinking water. But nowadays numbers of inhabitants on the banks of the river are increasing very rapidly which deteriorates the quality of river water and put it into a distressing condition.

The people of Tripura are always exited about festivals and various festivals are observed throughout the year. Among them Durga Puja is the greatest one which is celebrated every year in the month of October. After this festival, lot of Durga idols are immersed into the Haora River at selected immersion site during a predetermined time.The extent of idol immersion increases with increasing population which is alarming situation. In the present study, one sampling station Dashamighat was selected for determination of physiochemical parameters and metals concentration of the water samples. The analysis was carried out for DO, BOD under physiochemical parameters and metals such as magnesium, calcium, cadmium, chromium, lead, and arsenic.

OBJECTIVE

Tripura is a rich cultural state in which diverse cultural and religious festivals are organized. Idol is an image of a god which is used as an object of worship. After worship, these idols are immersed into water bodies. Idols are constructed by plaster of Paris, clay, cloths, small iron rods, bamboo and decorated with different paints such as varnish, water colors etc. which can lead to significant alteration in the water quality after immersion. Paints which are used to colour these idols contains various heavy metals such as Mercury, Cadmium, Arsenic, Zinc, Chromium and Lead. Particularly, red, blue, orange and green colours contain mercury, zinc oxide, chromium and lead, which are potent carcinogens. Two heavy metals such as Lead and Chromium also add in the water bodies through Sindoor (a traditional red colored cosmetic powder, usually worn by married women and often used in the festivals). The floating materials released through idol in the river and lake after decomposition result in eutrophication, increase in acidity and heavy metal concentration. Heavy metal pollution caused by idol immersion can damage the ecosystem as it kills fishes, damages plants, blocks the natural flow of the water, causing stagnation. Hence, investigations were carried out by Tripura State Pollution Control Board to find out the effects of immersion of idols on water quality by collecting and analyzing the water samples from the immersion sites of the rivers. The samplings were done before the immersion, on the day of immersion and after the event and several parameters like dissolved oxygen, BOD, Calcium, Magnesium, Chromium, Lead, Cadmium, Arsenic etc. are estimated. The entire sampling site has divided into three part, Upstream (Station 1), Immersion point (Station 2) and Downstream (Station 3) for clear identification of changes of parameters and also identify their trend of behaviour. Such type of trend analysis will be helpful for getting a clear concept of temporal and spatial change of parameters and also help to make a prediction of future water pollution.

Fig: Show Immersion of Durga Idol in Haorah river after Durga Puja Festival

COMPOSITION AND INGREDIENTS OF PAINTS

Paint is any liquid, liquefiable, or mastic composition that, after application to a substrate in a thin layer, converts to a solid film. It is most commonly used to protect colour or provide texture to objects. After detailing work over the prepared idol is sent for painting process. In its most basic form, paint consists of colour (the pigment) and the glue in which the pigment is suspended (the binder). Many paints also contain ingredients that add texture and bulk (fillers), a thinner (the solvent) and other additives, such as biocides and drying catalysts.

Pigments: Safer alternatives to the toxic compounds and heavy metals used to colour conventional paint include natural pigments derived from plants, insects, iron oxides and minerals. These are usually in powder form.

Binders: Binders keep paint glued to a surface. The acrylic and vinyl binders in commercial paints are derived from the by-products of refining crude oil. The binders in natural paints rely instead on materials such as starch (from flour), casein (the protein in milk) and linseed oil (from pressed flax seeds).

Fillers: Fillers create texture and add bulk to paint. Common fillers include whiting (powdered chalk), talcum, limestone, silica and marble. Clay is a popular filler to pair with flour, because it reinforces the binding ability of starch, and it's abundant and potentially free if clay soil is used.

Solvents: Solvents, or thinners, help achieve a workable consistency. The solvents in commercial paints are usually made from organic materials, but they will evaporate or "outgas," causing that new paint smell. The outgassing of these volatile organic compounds (VOCs) can cause headaches, nausea, dizziness, blurred vision and fatigue, especially in areas that are not well ventilated. The hazards are significantly worse for people who paint regularly. Natural solvents such as citrus thinners and natural turpentine are preferable, but they can still emit low levels of VOCs.

Additives: Commercial paint manufacturers frequently include several additives in their products, but they aren't required to list them on the can. Additives include plasticizers, foaming and antifoaming agents, driers, biocides that inhibit the growth of mould, and ingredients that improve water resistance or opacity.

Fig. : Half made idol before festival.

Fig.: A painter is painting an Idol.

ADVERSE EFFECTS OF HEAVY METALS USED IN PAINTS

When Idol immersed in water bodies then lots of paints which are used making of idol, those paints are also add into water bodies. These paints do not dissolve easily in the water bodies. Also these paints are contains of various heavy metals such as Mercury, Lead, Arsenic, Cadmium, Chromium and Zinc etc. Through food chain these heavy metals get into human bodies. These heavy metals have lots of adverse effect on human bodies. Here are some effects of some heavy metals are mentioned below.

Mercury (Hg): Mercury pollution can be a serious health threat, especially for children and pregnant women. Humans risk ingesting dangerous levels of mercury when they eat contaminated fish. Since mercury is odourless, invisible and accumulates in the meat of the fish, it is not easy to detect and can't be avoided by trimming off the skin or other parts. Even in low

doses, mercury may affect a child's development, delaying walking and talking, shortening attention span and causing learning disabilities. Less frequent, high dose prenatal and infant exposures to mercury can cause mental retardation, cerebral palsy, deafness and blindness. In adults, mercury poisoning can adversely affect fertility and blood pressure regulation and can cause memory loss, tremors, vision loss and numbness of the fingers and toes. A growing body of evidence suggests that exposure to mercury may also lead to heart disease.

Cadmium (Cd): A by-product of zinc production is Cadmium. Cadmium is primarily toxic to the kidney; especially to the proximal tubular cells are the main sites of accumulation. Cadmium can also cause bone demineralization, either through direct bone damage or indirectly as a result of renal dysfunction. Cadmium is primarily toxic to the kidney, especially to the proximal tubular cells, the main site of accumulation. Drinking water with very high cadmium levels severely irritates the stomach, leading to vomiting and diarrhoea, and sometimes death. Eating lower levels of cadmium over a long period of time can lead to a build-up of cadmium in the kidneys. If the levels reach a high enough level, the cadmium in the kidney will cause kidney damage, and also causes bones to become fragile and break easily.

Arsenic (As): Arsenic is one of the most toxic elements. Exposure to inorganic arsenic can cause various health effects, such as irritation of the stomach and intestines, decreased production of red and white blood cells, skin changes and lung irritation. It is suggested that the uptake of significant amounts of inorganic arsenic can intensify the chances of cancer development, especially the chances of development of skin cancer, lung cancer, liver cancer and lymphatic cancer. A very high exposure to inorganic arsenic can cause infertility and miscarriages with women, and it can cause skin disturbances, declined resistance to infections, heart disruptions and brain damage with both men and women. Inorganic arsenic can damage DNA. Ingestion of large amounts can lead to gastrointestinal symptoms such as severe vomiting, damage to the nervous system, and eventually death.

Zinc (Zn): Excess amounts of zinc lead can lead to heavy metal poisoning. The National Institutes of Health cites that gastrointestinal complaints are usually the most common side effects of zinc toxicity. Upset stomach, vomiting and diarrhoea are most common. These effects, especially nausea and vomiting, can start as soon as a half hour after ingesting large quantities of zinc. High doses of zinc have also been associated with decreased urine output, which is the number one reason for hospitalization associated with zinc toxicity. Aside from vomiting and nausea, this can lead to doziness, a metallic taste in the mouth, low blood pressure, convulsions, shortness of breath and even shock. Emergency treatment for heavy metal zinc poisoning involves fluids like water or milk to flush out the body, medications that counteract the effects of zinc and sometimes removal of the stomach contents.

Lead (Pb): Lead is a toxic substance that poses a variety of dangers for humans. Lead damages the central and peripheral nervous system, the kidneys and the body's ability to regulate vitamin D. Lead negatively affects the formation of red blood cells. Very high levels of lead can cause seizures, coma and death. At lower levels of exposure, a child can suffer from developmental delay, lower IQ, hyperactivity, learning disabilities, behavioural problems, impaired hearing and stunted growth. Lead can cause several unwanted effects, such as- Disruption of the biosynthesis of haemoglobin and anaemia, arising blood pressure, Kidney damage, Miscarriages and subtle abortions, Disruption of nervous systems, Brain damage, Declined fertility of men through sperm damage, Diminished learning abilities of children, Behavioural disruptions of children, such as aggression, impulsive behaviour and hyperactivity. Lead can enter a foetus through the placenta of the mother. Because of this it can cause serious damage to the nervous system.

STANDARD LIMIT FOR SURFACE WATER QUALITY

Central Pollution Control Board has specified standard limit for different water quality parameters for Surface water according to their class. They are presented below as tabulated form. Here,

Class A-Drinking water without conventional treatment but after disinfection
Class B-Water for outdoor bathing
Class C-Drinking water with conventional treatment followed by disinfection
Class D-Water for fish culture and wild life propagation
Class E-Water for irrigation, industrial cooling and controlled waste disposal

Table: **CPCB Standard for Surface Water Quality (as per IS:2296)**

Parameter	Unit	Class A	Class B	Class C	Class D	Class E
DO	mg/l	6	5	4	4	-
BOD	mg/l	2	3	3	-	-
Calcium	mg/l	80.1	-	-	-	-
Magnesium	mg/l	24.28	-	-	-	-
Chromium	mg/l	0.05	0.05	0.05	-	-
Cadmium	mg/l	0.01	-	0.01	-	-
Lead	mg/l	0.1	-	0.1	-	-
Arsenic	mg/l	0.05	0.2	0.2	-	-

MONITORING STATIONS

The study area of Dashamighat Idol immersion site in Haora River, Agartala, Tripura is geographically located at Latitude: 23º 49´ 742´´ N and Longitude: 91º 15´ 838´´ E where lots of Durga idols were immersed during the Puja festival. Figure 1 showing the location taken up for idol immersion study in the Haora River.

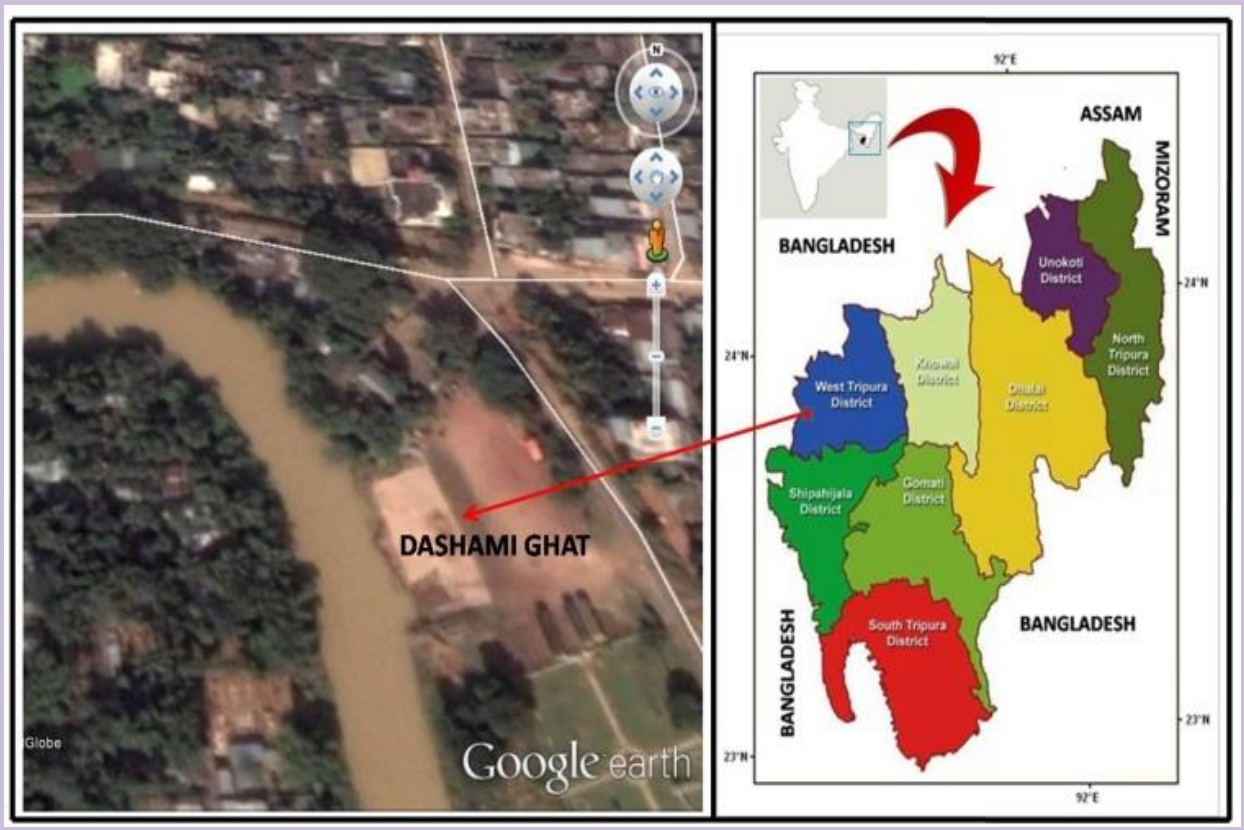

Fig. 1: Map showing the Monitoring Station in Haorah River

TREND ANALYSIS OF WATER QUALITY PARAMETERS

Fig.1 to Fig.9 shows the yearly variation of water quality parameters in Haorah river during Durga Idol immersion. In all of these figures changes of all important parameters has been shown station wise. In some of the stations some metal concentration was below detectable limit. Hence, at these particular points values were not shown in the graph. However, remaining all the perimeters were clearly depicted in the above figures. The entire trend analysis procedure is divided into three parts, namely Before Durga Idol immersion, During Durga Idol Immersion and After durga Idol Immersion. They are stated below.

❖ ***BEFORE DURGA IDOL IMMERSION***

Fig. 1 shows the changes of water quality parameters at Station 1 (upstream). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. Besides, Chromium and lead also increases in the year 2017 than previous year.

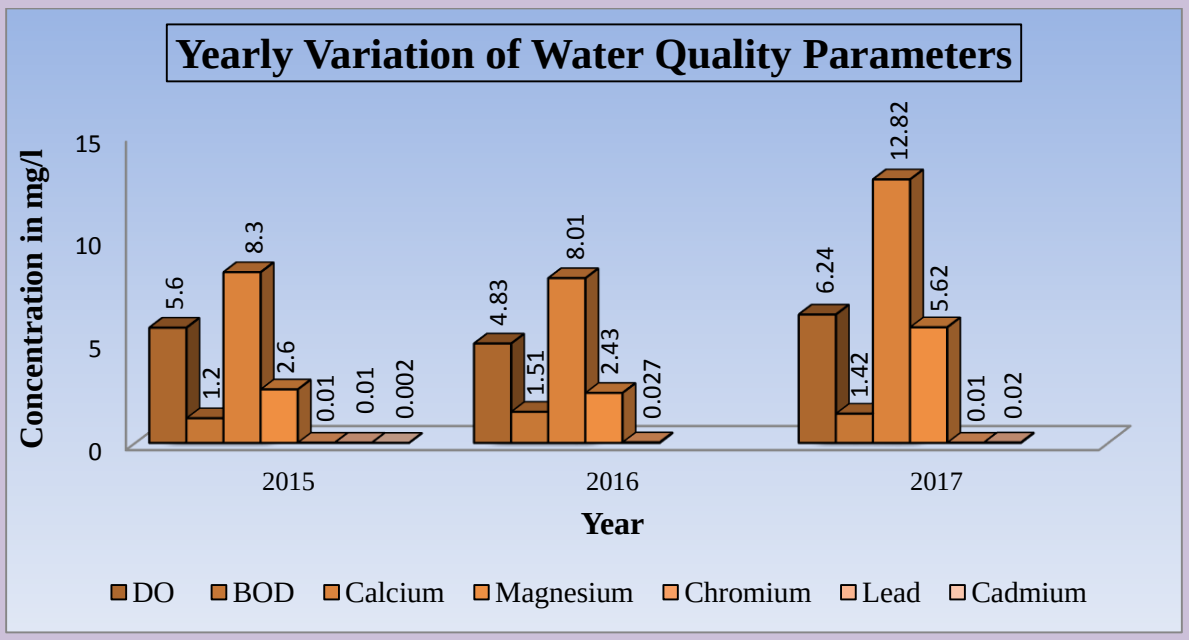

Fig. 1: Year wise comparison of water quality parameters at Station 1 **(before Idol Immersion).**

Fig. 2 shows the changes of water quality parameters at Station 2 (Immersion Point). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. On the other side, the value of Chromium, lead and Cadmium decreases in the year 2017.

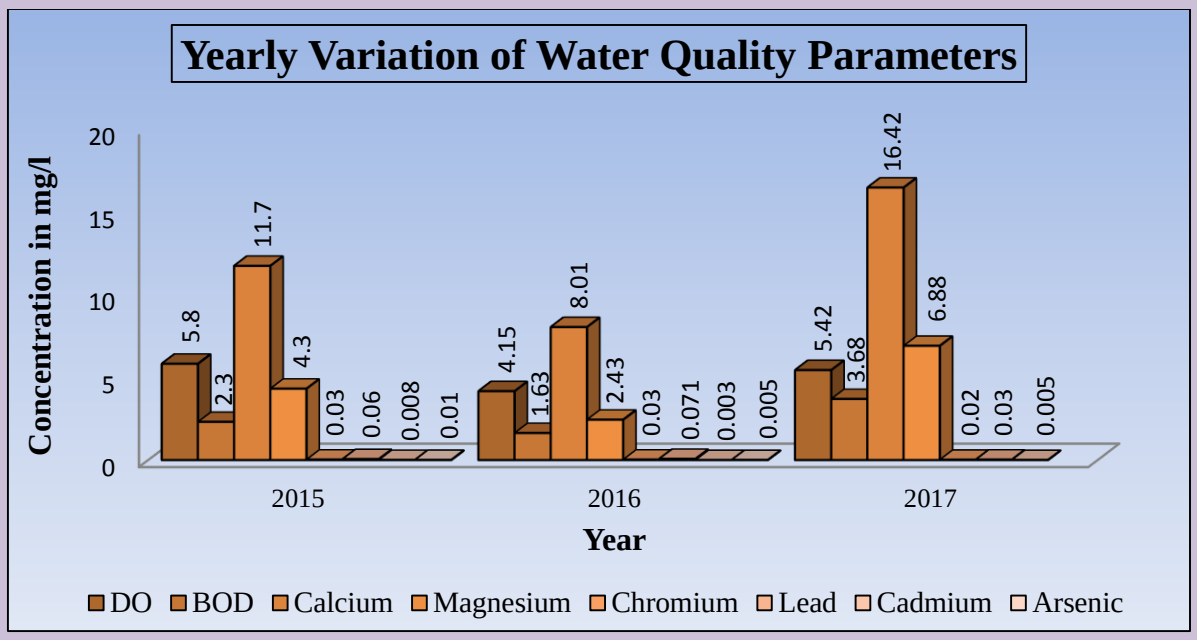

Fig. 2: Year wise comparison of water quality parameters at Station 2 **(before Idol Immersion).**

Fig. 3 shows the changes of water quality parameters at Station 3 (Downstream). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. On the other side, the value of Chromium increases in the year 2016 and lead decreases in the year 2017.

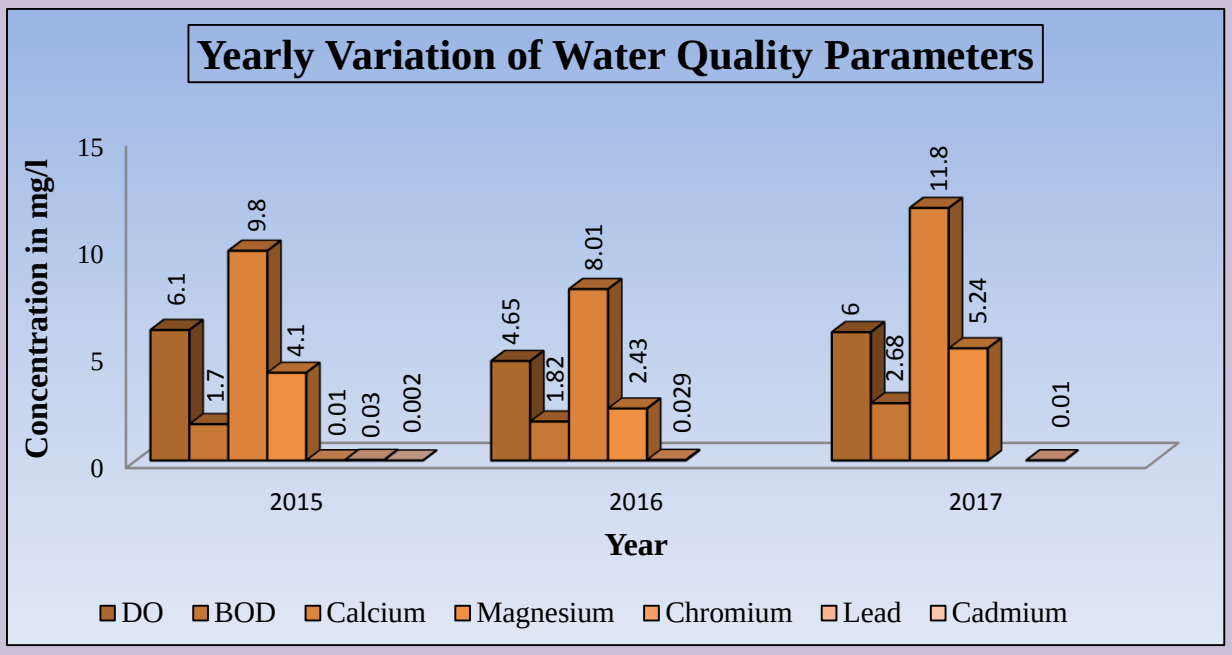

Fig. 3: Year wise comparison of water quality parameters at Station 3 **(before Idol Immersion).**

❖ ***DURING DURGA IDOL IMMERSION***

Fig. 4 shows the changes of water quality parameters at Station 1 (Upstream). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. Besides, Chromium and lead decreases in the year 2017 than previous year.

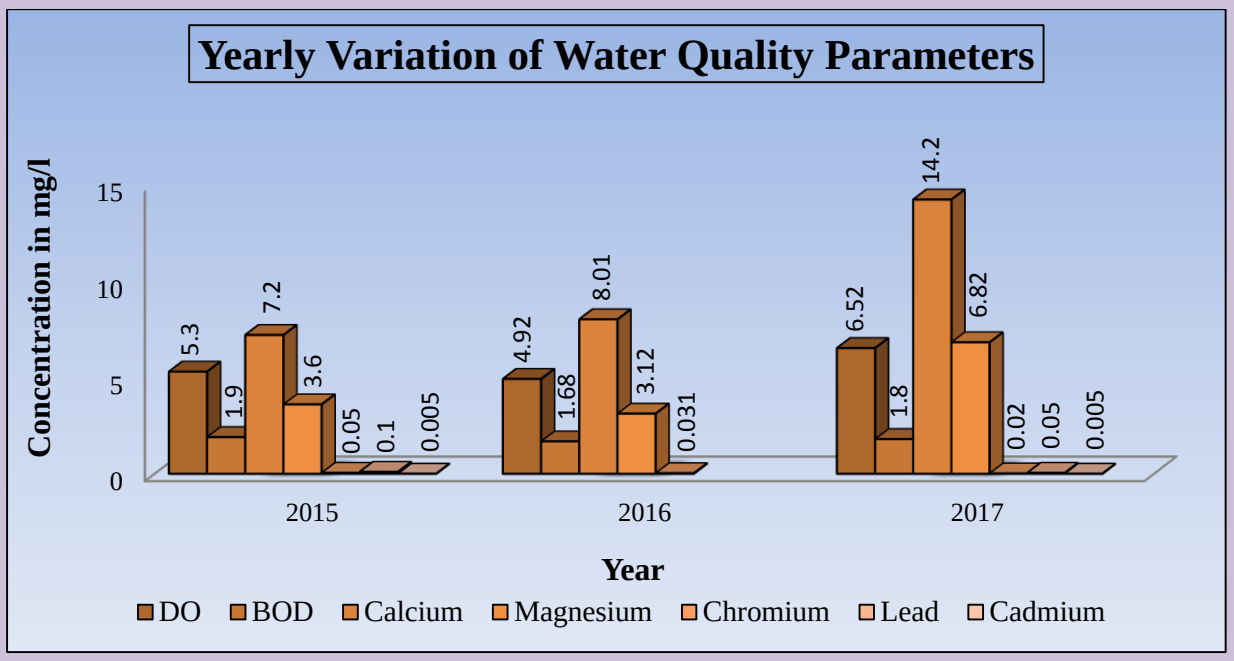

Fig. 4: Year wise comparison of water quality parameters at Station 1 **(during Idol Immersion).**

Fig. 5 shows the changes of water quality parameters at Station 2 (Immersion Point). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. Besides, Chromium and lead decreases in the year 2017 than previous year.

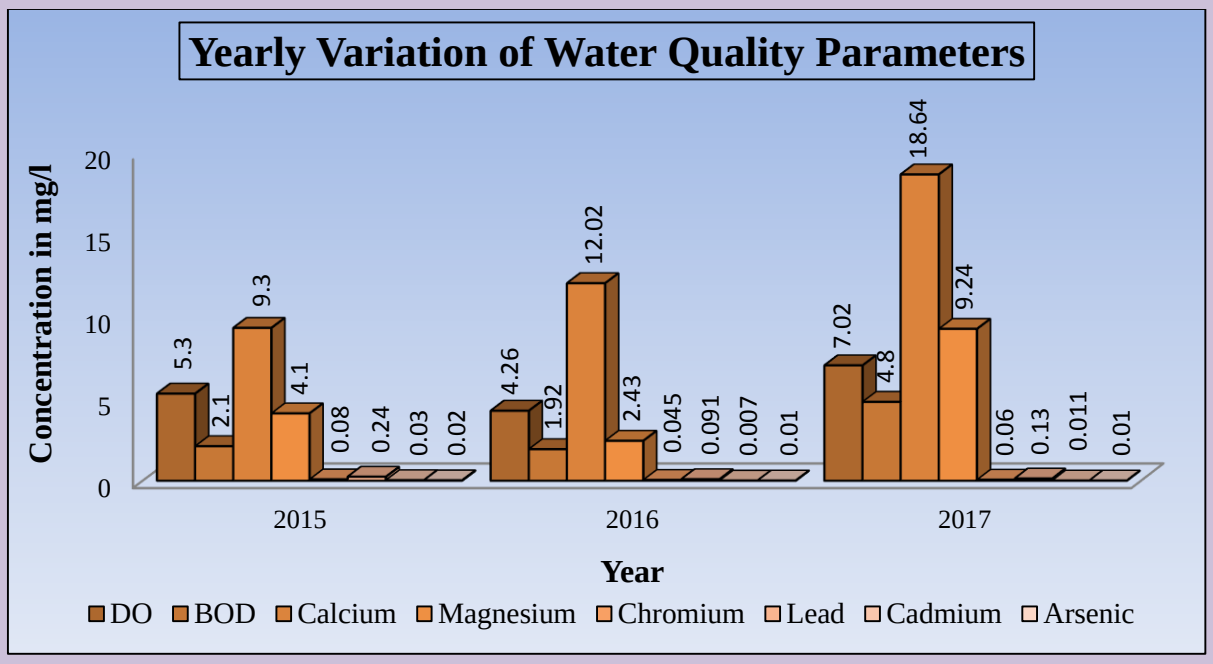

Fig. 5: Year wise comparison of water quality parameters at Station 2 **(during Idol Immersion).**

Fig. 6 shows the changes of water quality parameters at Station 3 (Downstream). Here the values of DO, BOD, Calcium, Magnesium decreases in the year 2016 than 2015 but increases in the year 2017. Besides, Chromium and lead decreases in the year 2017 than previous year.

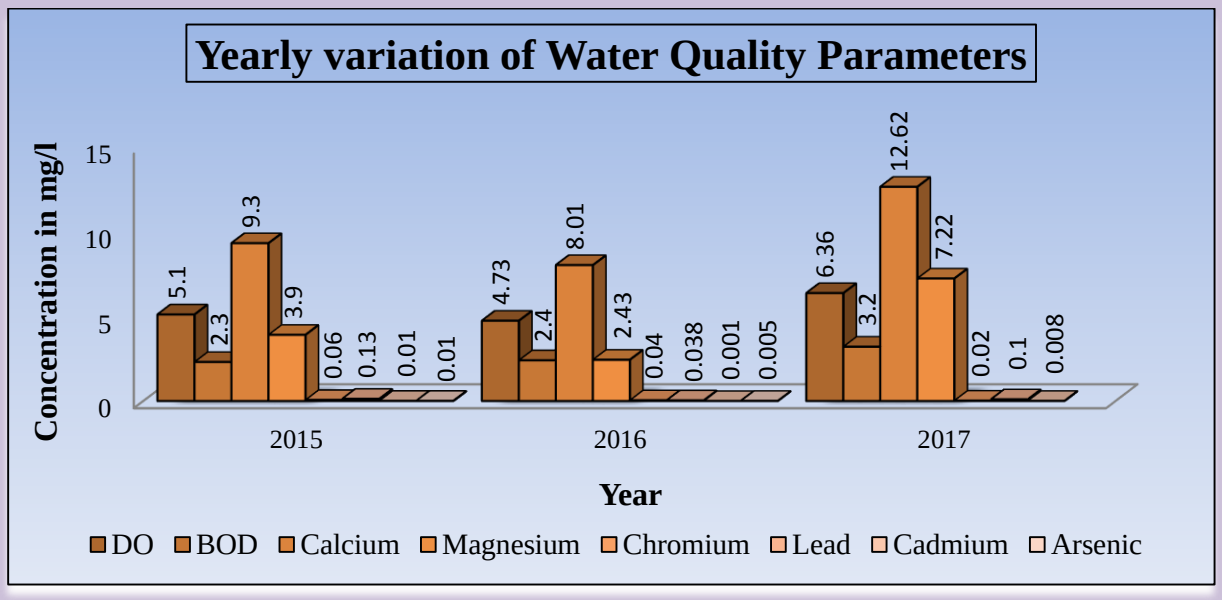

Fig. 6: Year wise comparison of water quality parameters at Station 3 **(during Idol Immersion).**

❖ ***AFTER DURGA IDOL IMMERSION***

Fig. 7 shows the changes of water quality parameters at Station 1 (Upstream). Here the value of DO decreases in the year 2016 but increases in the year 2017. But BOD gradually decreases in the year 2016 and 2017 than previous year and Calcium, Magnesium gradually increases in the year 2016 and 2017 than previous year Besides, Chromium increases in the year 2016 but decreases in the year 2017.

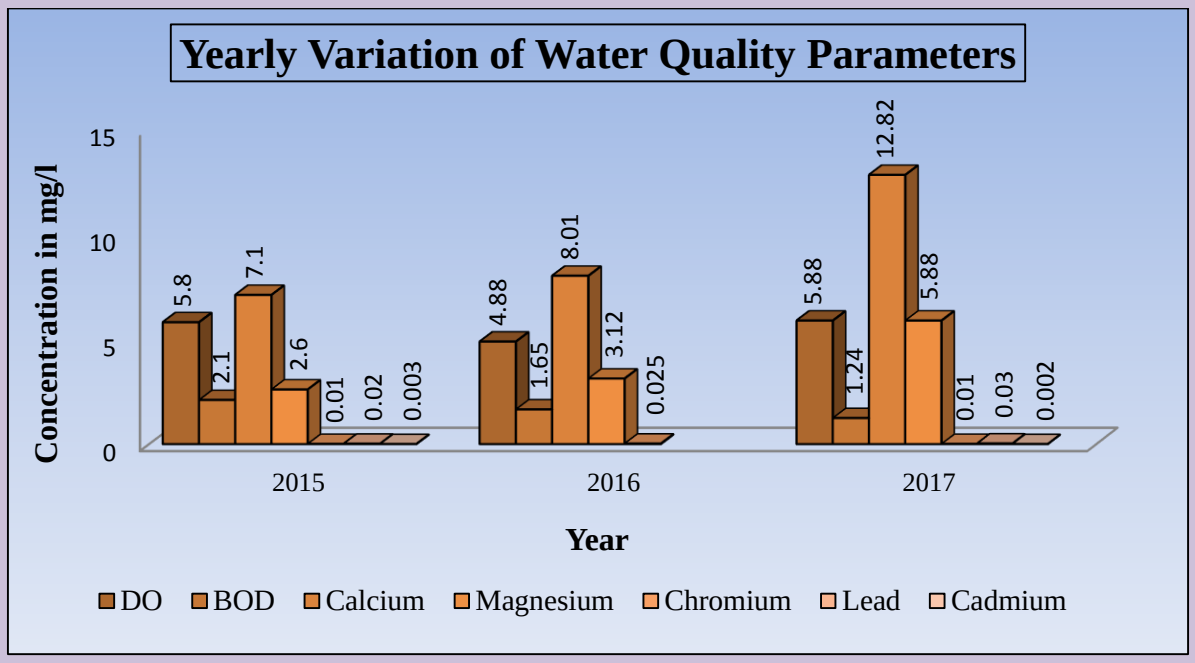

Fig. 7: Year wise comparison of water quality parameters at Station 1 **(after Idol Immersion).**

Fig. 8 shows the changes of water quality parameters at Station 2 (Immersion Point). Here the value of DO, BOD, Calcium decreases in the year 2016 but increases in the year 2017. But Magnesium gradually increases in the year 2016 and 2017 than previous year. On the other side, Lead and Cadmium slightly increase in the year 2017.

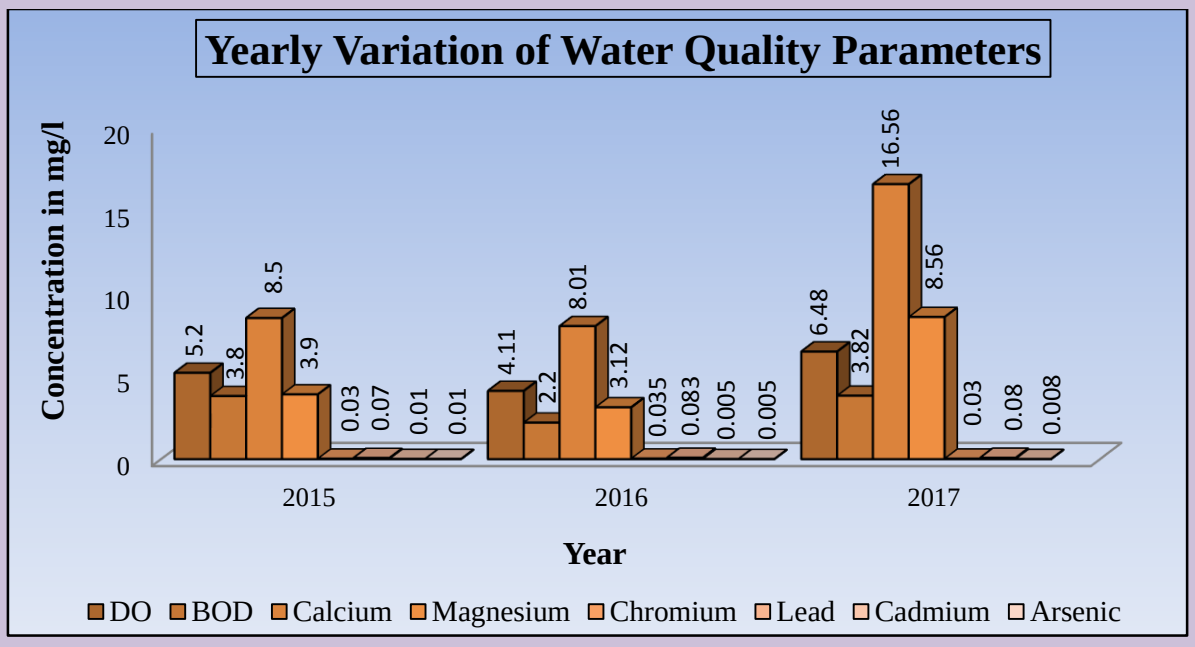

Fig. 8: Year wise comparison of water quality parameters at Station 2 **(after Idol Immersion).**

Fig. 9 shows the changes of water quality parameters at Station 3 (Immersion Point). Here the value of DO, BOD, Calcium, Magnesium decreases in the year 2016 but increases in the year 2017. But Chromium decreases and Lead increases in the year 2017 than previous year.

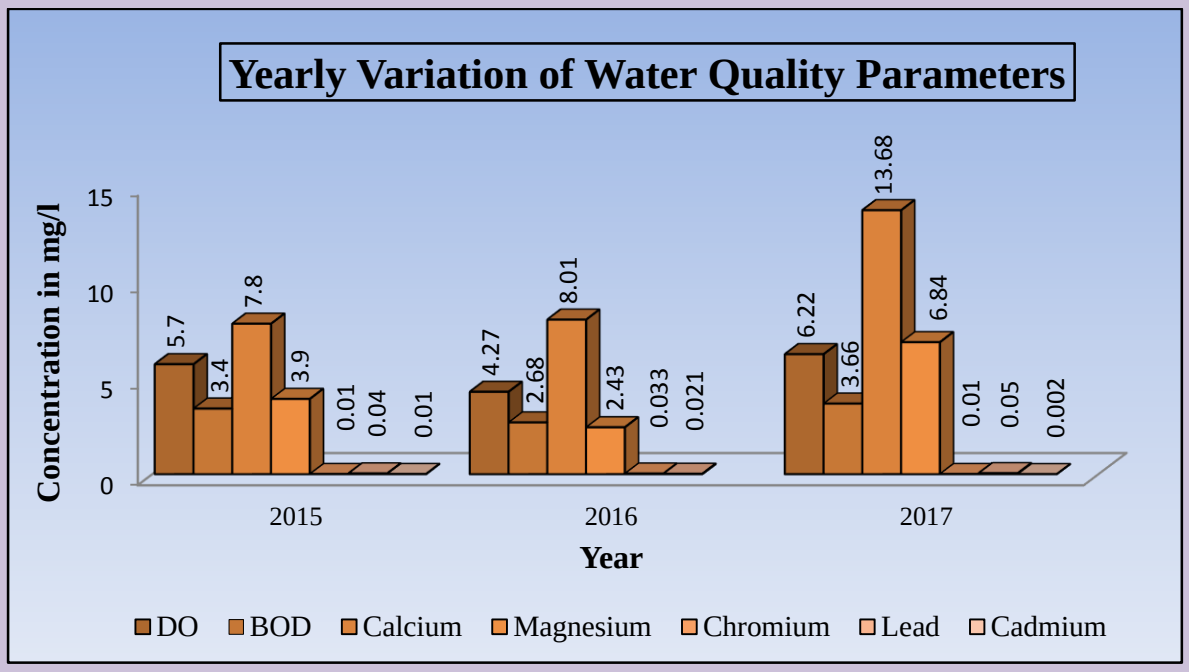

Fig. 9: Year wise comparison of water quality parameters at Station 3 **(after Idol Immersion).**

SUMMARY

The report clearly depicts that the concentration of DO, BOD, Calcium, Magnesium follows decreasing nature from the year 2015 to 2016 but they follows increasing nature from the year 2016 to 2017 which indicates a large presence of pollutant before, during and after Idol immersion in Haorah river. On the other side the concentration of various metals like Chromium, Lead, Cadmium, Arsenic were more or less equal at all the years. However, the metallic concentration was very low before Idol immersion at all the three stations and in some place the level were below detectable limit (BDL) but after Idol immersion concentration was extended which indicates that the immersed Idols were enriched with artificial colour, dye etc. which may destroy the ecological balance of Haorah river. Whatever the fact is, the results obtained from reveals that all the physiochemical parameters were found within the permissible limit with a few exceptions. The concentrations of metals were found within the permissible limits except in some stations (considering only Class-A category). The trend of increasing some parameters indicates that idol immersion activity affects the water quality to the extent with respect to self-purification and drinking water purpose without conventional treatment and disinfection.

Health effect due to exposure in Metal Concentration

Name of Metal	**Health Effect**	
	Acute	**Chronic**
Arsenic	Nausea, vomiting, "rice-water" diarrhea, encephalopathy, MODS, LoQTS, painful neuropathy	Diabetes, hypopigmentation/ hyperkeratosis, cancer: lung, bladder, skin, encephalopathy
Cadmium	Pneumonitis (oxide fumes)	Proteinuria, lung cancer, osteomalacia
Chromium	GI hemorrhage, hemolysis, acute renal failure (Cr6+ingestion)	Pulmonary fibrosis, lung cancer (inhalation)
Copper	Blue vomitus, GI irritation/ hemorrhage, hemolysis, MODS (ingested); MFF (inhaled)	vineyard sprayer's lung (inhaled); Wilson disease (hepatic and basal ganglia degeneration)
Iron	Vomiting, GI hemorrhage, cardiac depression, metabolic acidosis	Hepatic cirrhosis

Lead	Nausea, vomiting, encephalopathy (headache, seizures, ataxia, obtundation)	Encephalopathy, anemia, abdominal pain, nephropathy, foot-drop/ wrist-drop
Manganese	MFF (inhaled)	Parkinson-like syndrome, respiratory, neuropsychiatric
Mercury	Elemental (inhaled): fever, vomiting, diarrhea, ALI; Inorganic salts (ingestion): caustic gastroenteritis	Nausea, metallic taste, gingivo-stomatitis, tremor, neurasthenia, nephrotic syndrome; hypersensitivity (Pink disease)
Nickel	Dermatitis; nickel carbonyl: myocarditis, ALI, encephalopathy	Occupational (inhaled): pulmonary fibrosis, reduced sperm count, nasopharyngeal tumors
Selenium	Caustic burns, pneumonitis, hypotension	Brittle hair and nails, red skin, paresthesia, hemiplegia
Silver	Very high doses: hemorrhage, bone marrow suppression, pulmonary edema, hepatorenal necrosis	Argyria: blue-grey discoloration of skin, nails, mucosae
Thallium	Early: Vomiting, diarrhea, painful neuropathy, coma, autonomic instability, MODS	Late findings: Alopecia, Mees lines, residual neurologic symptoms
Zinc	MFF (oxide fumes); vomiting, diarrhea, abdominal pain (ingestion)	Copper deficiency: anemia, neurologic degeneration, osteoporosis

CPCB guideline for idol immersion

• **I**dols should be made from natural materials as described in the holy scripts. Use of traditional clay for idol making rather than baked clay, plaster of paris, etc. may be encouraged, allowed and promoted.

• **P**ainting of Idols should be discouraged. In case idols are to be painted, water soluble and nontoxic natural dyes should be used. Use of toxic and non-biodegradable chemical dyes for painting idols should be strictly prohibited.

• **W**orship material like flowers, vastras (clothes), decorating material (made of paper and plastic) etc. should be removed before immersion of idols. Biodegradable materials should be collected separately for recycling or composting. Non biodegradable materials should be collected separately for disposal in sanitary landfills. Clothes may be sent to local orphan house(s).

• **P**ublic should be educated on ill effects of immersion in the holy water bodies through mass awareness programme.

• **T**he "Idol Immersion Points" shall be cordoned and barricaded. Synthetic liner may be placed in the bottom, well in advance. The said liner shall be removed on completion of immersion ceremony so that remains of idols would be brought to the bank. Bamboo and wooden logs, if any would be reused. Clay, etc may be taken to sanitary land fill for disposal.