# Physico-chemical studies on surface water quality due to idol immersion activities in Bhilai-Durg region

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**Abstract:-** This paper intends to present the environmental impact of idol immersion on water quality of surface water bodies during festivals season in and around Durg-Bhilai area. For this purpose, six ponds and River Shivnath was selected for sampling purpose as these are some of the important idol immersion locations of this area. Water samples were collected before and after immersion from these locatons. The Idols are made up of degradable and non degradable components and paints containing heavy metals due to that immersion activity deteriorates water quality. The physico-chemical parameters including pH, Temperature, Dissolved Oxygen, Conductivity, Total Hardness, Total Solids, Biological Oxygen Demand, Chemical Oxygen Demand, Oil and grease and heavy metals like Lead , Cadmium, Chromium(hexavalent) , Phosphates, Sulphates, Iron were analysed to study the environmental impact of idol immersion on ShivnathRiver and other ponds and these parameter shows the significant variation due to immersion idols. A comparative study of both type of surface water i.e. river as well as pond water was carried out by taking certain important parameters like pH, Total dissolved solids, Total Solids, Oil & grease, Dissolved oxygen, BOD, COD, chloride and the same were compared with drinking water standard IS:10500:2005. In this present study it was found that the maximum parameters were not at the level of pollution.

On the basis of this study it is concluded that pollution load increases more in the ponds with respect to the Shivnath River due to these religious activities and stagnant and closed waters system are more adversely affected. The work highlights the condition of these surface water bodies after idol immersion with respect to the parameters mentioned above. The study found significant changes in the water quality parameters due to immersion activities. These religious activities can not stop but we can reduce pollution and save the river to create awareness among the people and society.

***Keywords: Pond, water quality, Idol, immersion, surface water, physic-chemical, heavy metal***

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## 1. Introduction

Since ancient times, the tradition of idol immersion has been part of the religious festivals in India. Two major festivals in India that involve idol immersion are ‘Ganesh Chaturthi’, dedicated to Lord Ganesha and ‘Durga Puja’ dedicated to Goddess Durga. Other festivals like

Vishwakarma Puja and other local festivals also involve the tradition of idol immersion. Thousands of Ganesh and Durga idols of various sizes reaching heights up to 20 to 40 feet are immersed every year in different water bodies. Beautifully carved and decorated idols are drowned into water bodies like rivers, ponds and lakes with prayers for success, happiness and peace. For many years, only natural materials like clay, natural colouring material from leaves, flowers, was being used in making and decorating these idols which were bio-degradable. However since last 20-30 years these idols are being made from non-biodegradable materials such as plastic, cement and plaster of Paris and are painted with toxic dyes that contain harmful and toxic chemicals. When they come in contact with water, it becomes poison. However, amidst the celebrations, people tend to forget the ill effects of this practice. The most serious impact of idol immersion is on the environment. It disturbs the ecological balance by polluting water and adversely affecting the flora and fauna.

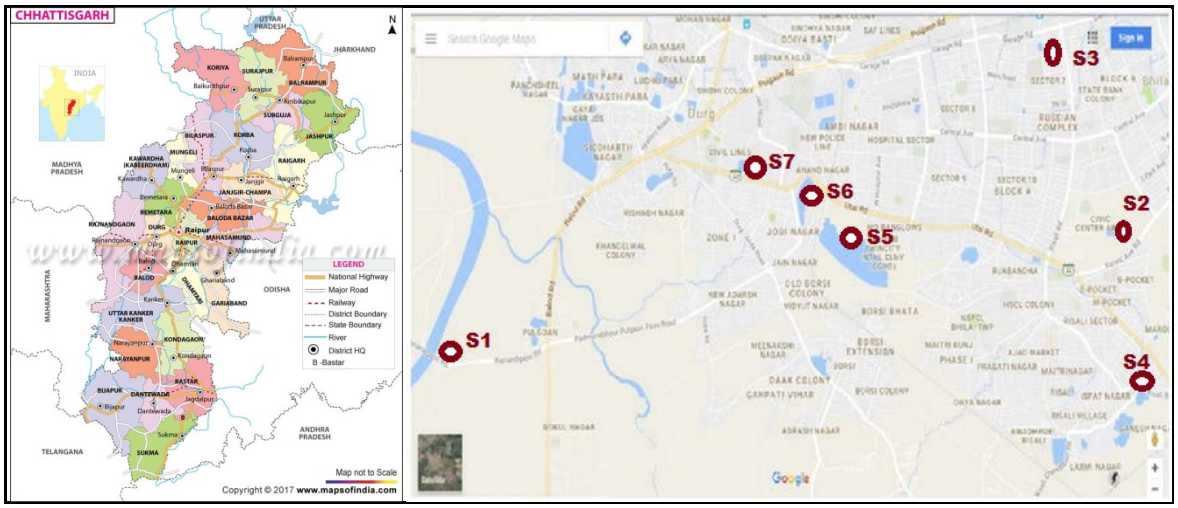
When the idols are immersed, their colors, chemicals and other components that are used for idol preparation get dissolved and lead to significant changes in the water quality (Dhote et al, 2001). Reddy et al (2001) observed that Ganesh idol increases pollution in Hussainsagar Lake, Hyderabad. Malik et al (2010) reported deterioration in water quality of rivers due to idol immersion in south Gujarat. The input of biodegradable and non biodegradable substances deteriorates the river water quality and enhances silt loaded in the river. The floating materials released through idol in the river and lake after decomposition result in eutrophication of the river, lake etc. (Leland et al, 1981). The idol immersion is a religious activity which is responsible for adding pollution load in the water bodies.

Bhilai being an industrial township, people from different part of the country have been living here and earning their livelihood. In and around Bhilai & Durg people from different states of live here in harmony for more than sixty years. Here festivals of all regions and religions are celebrated with great pomp and show. The festival season is mostly starts in the month of august with Onam, Janamasthami, then GaneshaChaturathi, Vishwaharma Puja and Durga puja in the months of September and October. Then Diwali and Chhattparva in the month of November. Every year hundreds of idols of Lord Ganesha, Goddess Durga, Lord Vishwakarma, are immersed in ponds and rivers in and around this twin cities. Similarly during the Mohram festival, tazias are also being immersed every year. The time span of any festival may vary from one and half day to ten days. However in present day scenario ever growing use of metals, ornaments, oily substances, and synthetic colours, chemical are used to make polish and decorate these idols for worship followed by large number of idols, immersion of these large idols in our surrounding aquatic environment severally affects the water body on its natural characteristics. So astudy was undertaken to determine the quality of surface water of Shivnath river &six ponds in and around Durg and Bhilai region by analyzing various Physico chemical parameters

## STUDY AREA

The basic objective of the study is the water quality assessment to evaluate the qualitative nature and quantitative extent of pollution in water body pre-immersion and post-immersion of idols in festivals season (September- October) during the study year and their comparison of the analytical results. The scope covers the surface water of River Shivnath and six ponds located in and around Bhilai Township. Bhilai is located at Latitude of 21° 12′ 36″ N, and Longitude of 81° 22′ 48″ E. It is situated in the southern part of the rich Chhattisgarh plain (Fig-1.1)..

**Fig. 1 Map of Bhilai, Durg and sampling location**




**List of Sampling Locations**

S1 - River Shivnath near Gurdwara at Pulgoan Bridge.

S2 – Jayanti Pond near Jayanti Stadium Civic Center,

S3 - Sector-7 Talabnear Kalyan College,

S4 - KalyanSagarTalabin Risali sector,

S5 -TalpuriTalab behind MD banglow

S6 – ThagdaBandh in Padmanapur in Durg,

S7 - SteetalaTalab in Durg

The locations was selected as sampling points station considering the large number of idol of Lord Ganesh, Goddesses Durga , Lord Viswakarma idol etc. are immersed in these water bodies..

## SAMPLING PROCEDURE

Water samples were collected in the forenoon hours during pre immersion, and post immersion in the periods of idol immersions for all these locations. They were normally collected in non-reacting bottles of 1 litre capacity. Immediately after sampling, preservatives were added to them and the bottles were recapped. These sealed bottles were put in a thermocol box and carried it to the laboratory where the samples were put inside a deep fridge till laboratory analysis was carrying out. Sodium thiosulphate preservatives were used for sampling in tablet forms.

## SAMPLE ANALYSIS

The various physical (pH, Conductivity, TS, TDS) and chemical parameters (DO, BOD, COD, Chloride, Total Hardness, Oil & Grease) of collected samples were analyzed by following standard methods. Study of the Physical parameter (pH, Conductivity, TDS, TS) of collected water samples were determined using physical equipments like pH meter, conductivity meter, Filtration apparatus, water analyzer kit.

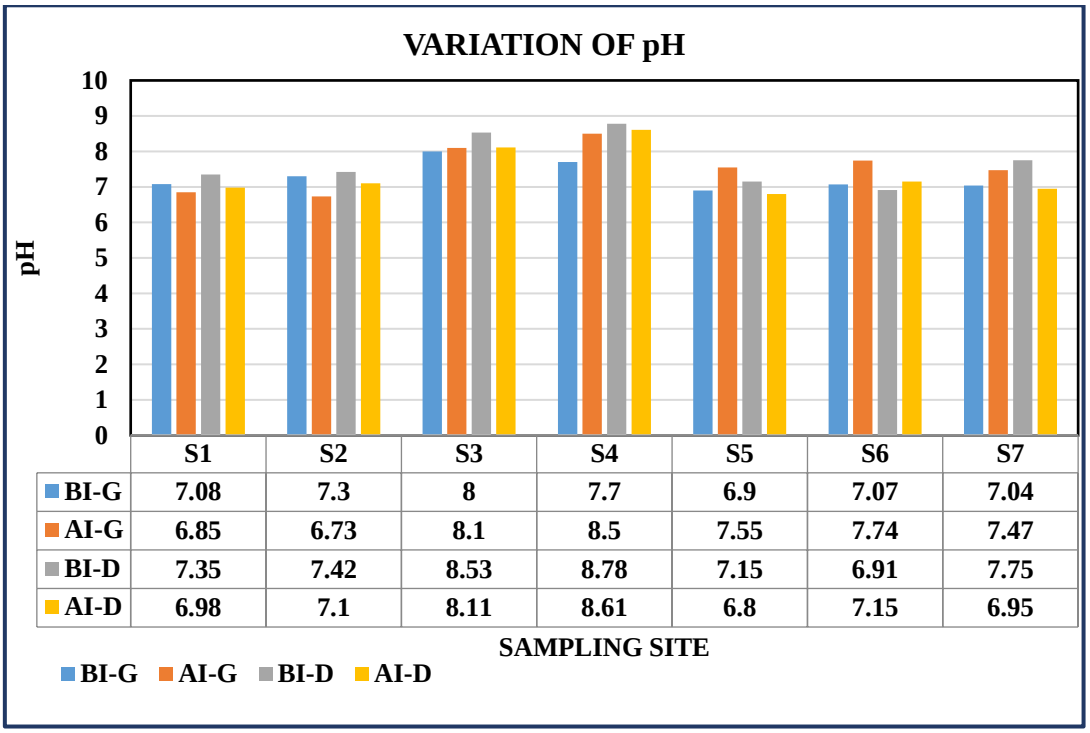
Analysis of Chemical parameter (D O, BOD, COD, Chloride, Hardness, Oil & Grease) of collected water samples were determined by different water analysing equipments and their relevant chemicals like DO meter, Oxy-Top & BOD incubator for BOD, COD Digestor and HACH CODReagents Vials for COD, gravimetric method with water bath ,filter paper and n-hexane for oil & grease analysis, Hardness by Titrimetric method, Chloride by Argentometric method.

The parameters were determined using standard procedure in accordance with the standard methods APHA (2005). These instruments were used in the limit of precise accuracy and chemicals used were of analytical grade.

## RESULTS AND DISCUSSION

The environmental impact of idol immersion activity on water quality of the six ponds / talabs and River Shivnath was assessed and significant changes in physico-chemical properties of water were observed. The results of this research work have been shown in Table 1 and Figures. 2 to 9. These data revealed that water of these locations has deteriorated due to the immersion of idols.

**pH:** It is an important factor that determines the suitability of water for various purposes, including toxicity to plants and animals. The pH of water is major factor because many chemical reactions and microbial activities are governed by it. The pH range varied from 6.73 to 8.78 for all seven sites. pH was found to be within the acceptable limits for inland surface except for site S4 which is slightly higher than the prescribed limit of 8.5. The comparison indicate decreasing trend after immersion both during Ganesh puja and Durga puja.

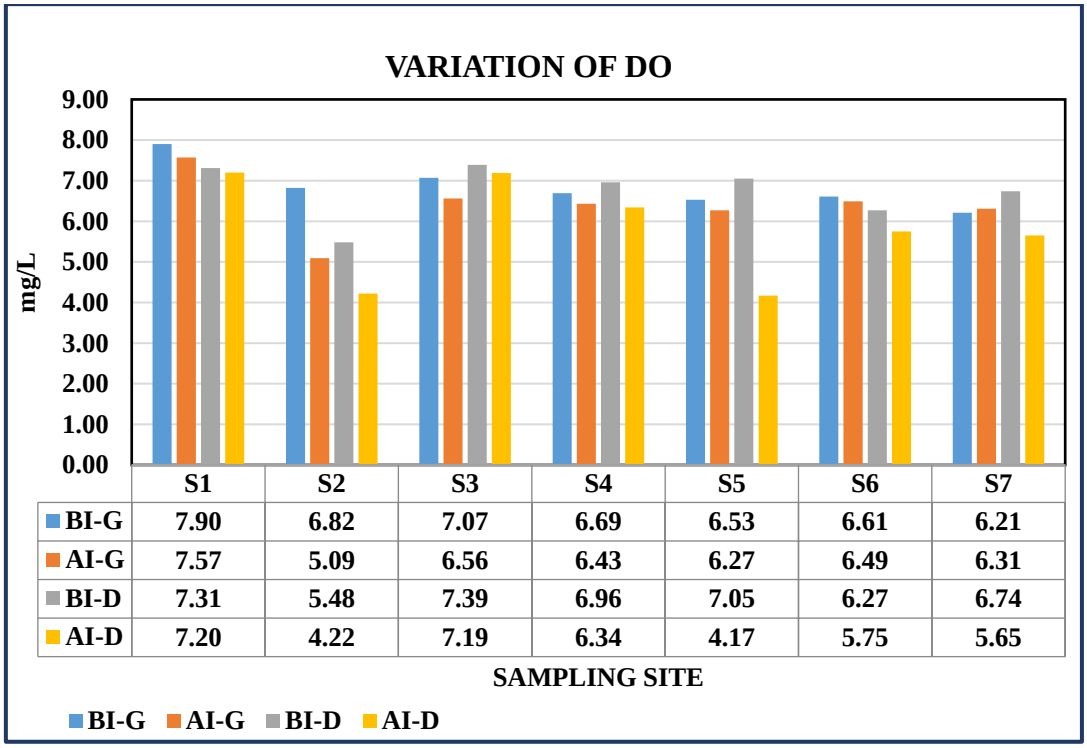



| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 7.08 | 7.3 | 8 | 7.7 | 6.9 | 7.07 | 7.04 |
| AI-G | 6.85 | 6.73 | 8.1 | 8.5 | 7.55 | 7.74 | 7.47 |
| BI-D | 7.35 | 7.42 | 8.53 | 8.78 | 7.15 | 6.91 | 7.75 |
| AI-D | 6.98 | 7.1 | 8.11 | 8.61 | 6.8 | 7.15 | 6.95 |

**Fig. 2 : Variation of pH at the Sampling sites**

**Dissolved Oxygen (DO):** The amount of dissolved oxygen present is most important. As DO drops below 4 to 5 mg/l, the forms of life that can survive begin to reduce. The DO range varied

from 4.17 (in Talpuri talab after Durga puja) to 7.90 (in River Shivnath before Ganesh puja, may be due to rainy season) for all seven sites. D.O. of pond water before immersion of idol was higher and it decreased sharply after immersion. Occurrence of low DO value has been attributed to the process of decomposition of organic matter involving the utilization of oxygen. Variation in Dissolved Oxygen (DO) in collected water samples is shown in Fig-3.




| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 7.90 | 6.82 | 7.07 | 6.69 | 6.53 | 6.61 | 6.21 |
| AI-G | 7.57 | 5.09 | 6.56 | 6.43 | 6.27 | 6.49 | 6.31 |
| BI-D | 7.31 | 5.48 | 7.39 | 6.96 | 7.05 | 6.27 | 6.74 |
| AI-D | 7.20 | 4.22 | 7.19 | 6.34 | 4.17 | 5.75 | 5.65 |

**Fig. 3 : Variation of Dissolved Oxygen concentration at the Sampling sites**

**Biological Oxygen Demand (BOD):** The amount of oxygen consumed during microbial utilization of organics is called the Biochemical oxygen Demand (BOD). BOD indicates the prances of microbial activities and dead organic matter on which microbes can feed. The higher values of BOD have direct correlation with the increase of nutrient level in the water body due to the immersion activity. The higher values of BOD means present of more biodegradable organic material. BOD was noticed comparatively higher in post immersion period at all the sites both during Ganesh puja and Durga puja. BOD values are lowest in River Shivnath before Ganesh Puja (4 mg/l) and highest value of 27 mg/l after Durga Puja at Kalyan Sagar Talab. Variation in Biological Oxygen Demand (BOD) in collected water samples is shown in Fig-4

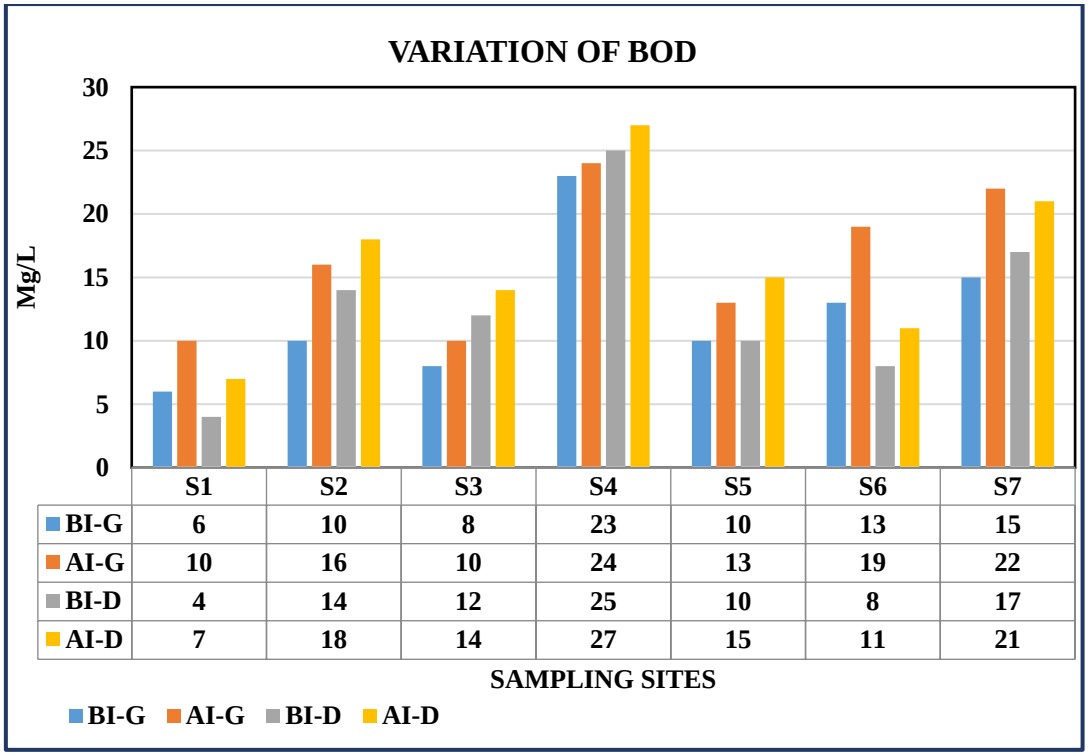



**Fig. 4 : Variation of Biological Oxygen Demand at the Sampling sites**

**Chemical Oxygen Demand (COD) : COD** is the main parameter to access waste water quality, as far as drinking water quality is concern no limits of COD is given, but the COD data interprets the status of chemical load of the water bodies. From the results of COD all water bodies showed increase in COD after idol immersion. Variation in Chemical Oxygen Demand (COD) in collected water samples is shown in Fig-5.

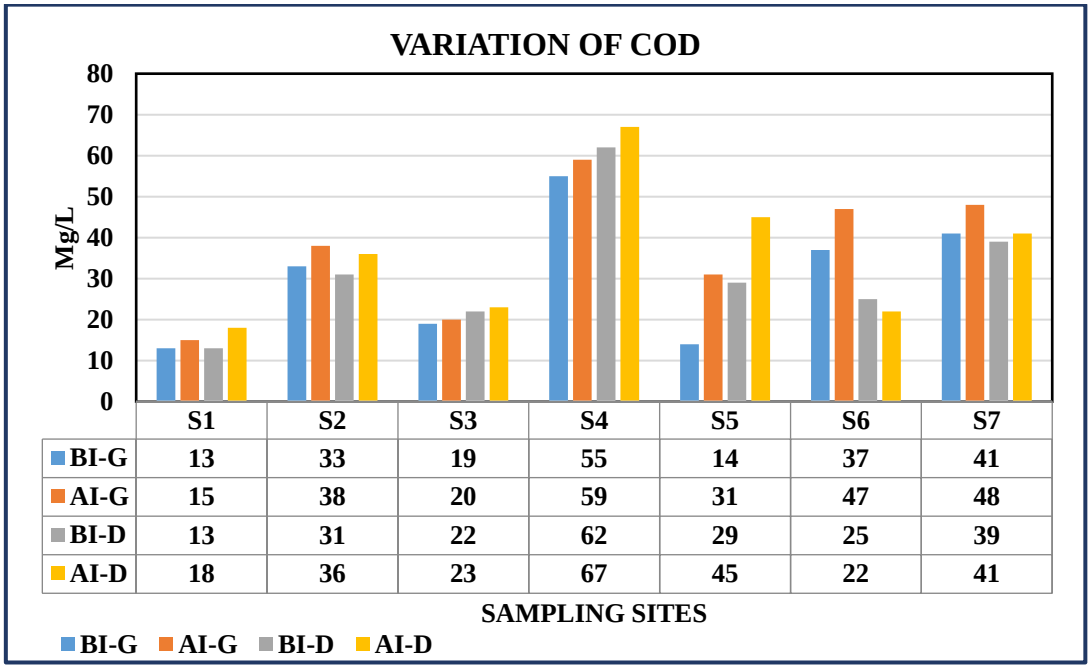
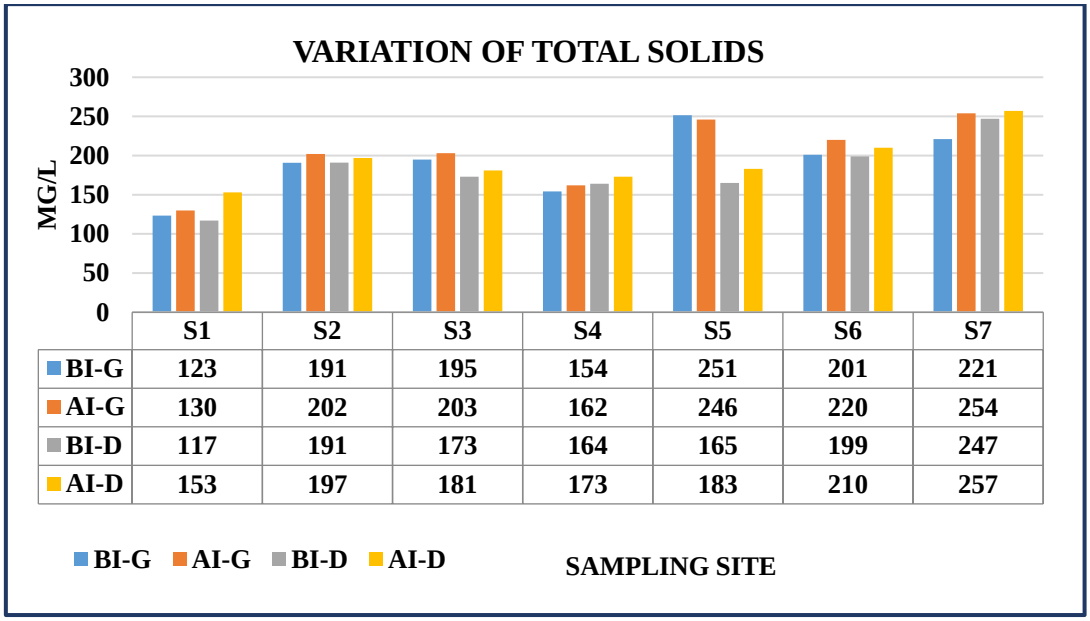



**Fig. 5 : Variation of Chemical Oxygen Demand at the Sampling sites**

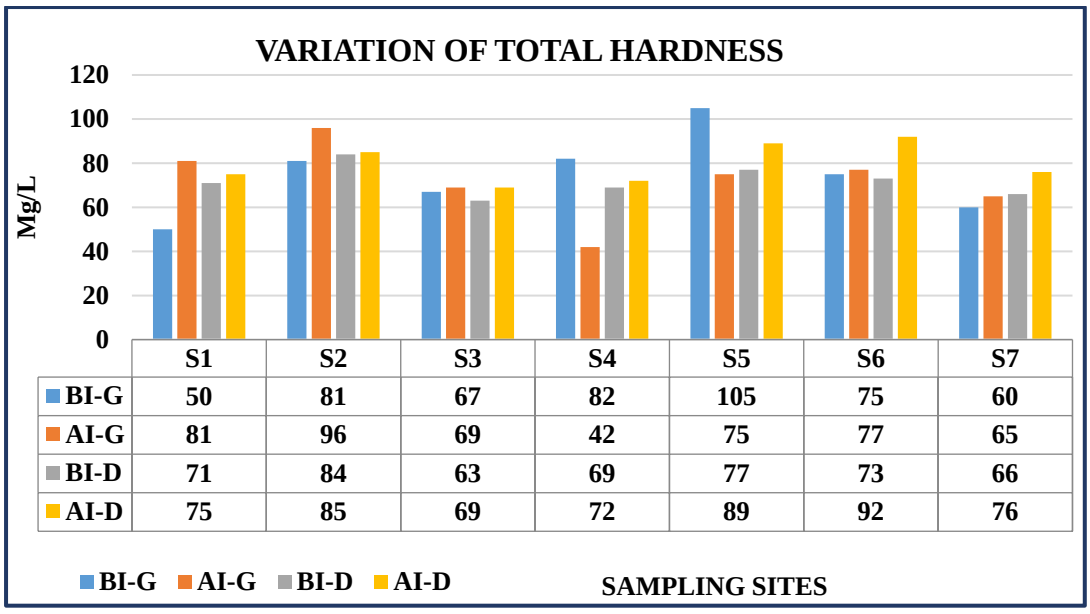
**Total Solids (TS):** The composition of solids present in the natural body of water mainly depends upon the nature of the bed rocks and soil developed from it. Solids are enhancing due to decomposition of organic matter present in the water body. On an average, TS increased post immersion at all the sites both during Ganesh puja and Durga puja. Variation in Total Solid (TS) in collected water samples is shown in Fig-6.




| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 123 | 191 | 195 | 154 | 251 | 201 | 221 |
| AI-G | 130 | 202 | 203 | 162 | 246 | 220 | 254 |
| BI-D | 117 | 191 | 173 | 164 | 165 | 199 | 247 |
| AI-D | 153 | 197 | 181 | 173 | 183 | 210 | 257 |

**Fig. 6 : Variation of Total Solids concentration at the Sampling sites**

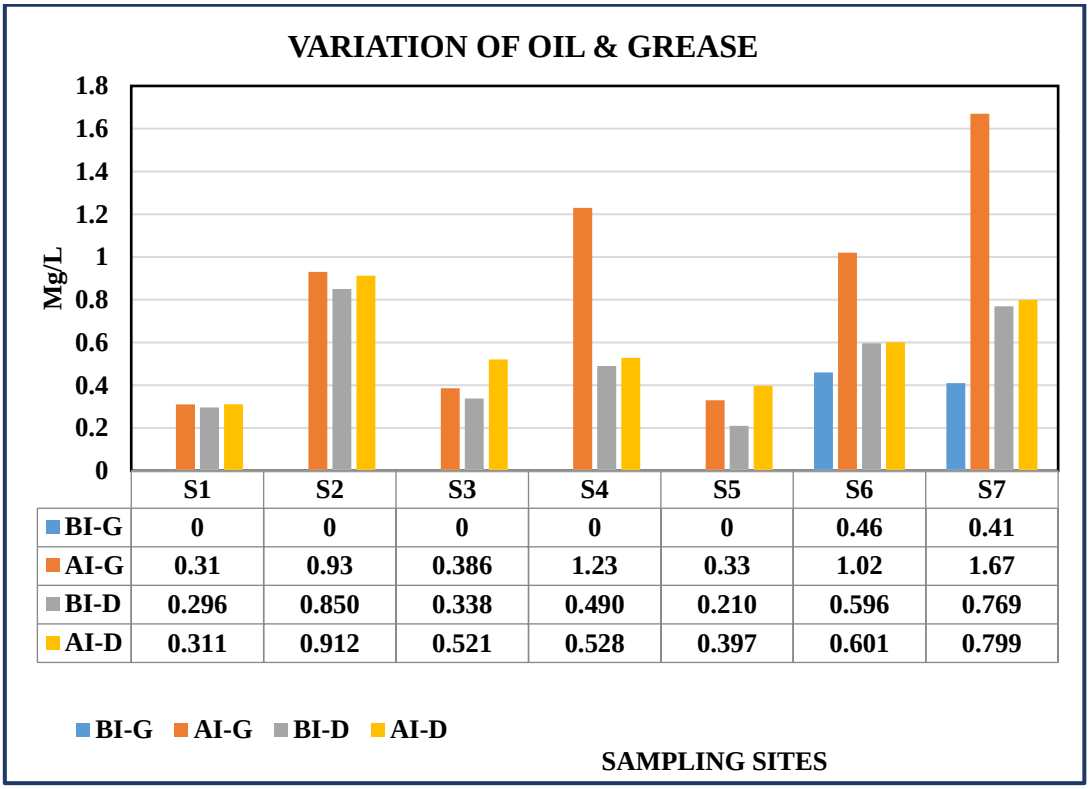
**Total Hardness (TH):** The hardness of water is not a pollution parameter but indicates water quality. The total hardness of water depends upon the origin of the water or the treatment of which the water has been subjected too. In the present study, the hardness was higher than of the permissible limit and increases after idol immersion. Hardness in ponds/ talabs was higher than in river. Total Hardness varied from 42mg/l to 105 mg/l. Variation in Hardness in collected water samples is shown in Fig-7.




| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 50 | 81 | 67 | 82 | 105 | 75 | 60 |
| AI-G | 81 | 96 | 69 | 42 | 75 | 77 | 65 |
| BI-D | 71 | 84 | 63 | 69 | 77 | 73 | 66 |
| AI-D | 75 | 85 | 69 | 72 | 89 | 92 | 76 |

**Fig. 7 : Variation of Total Hardness concentration at the Sampling sites**

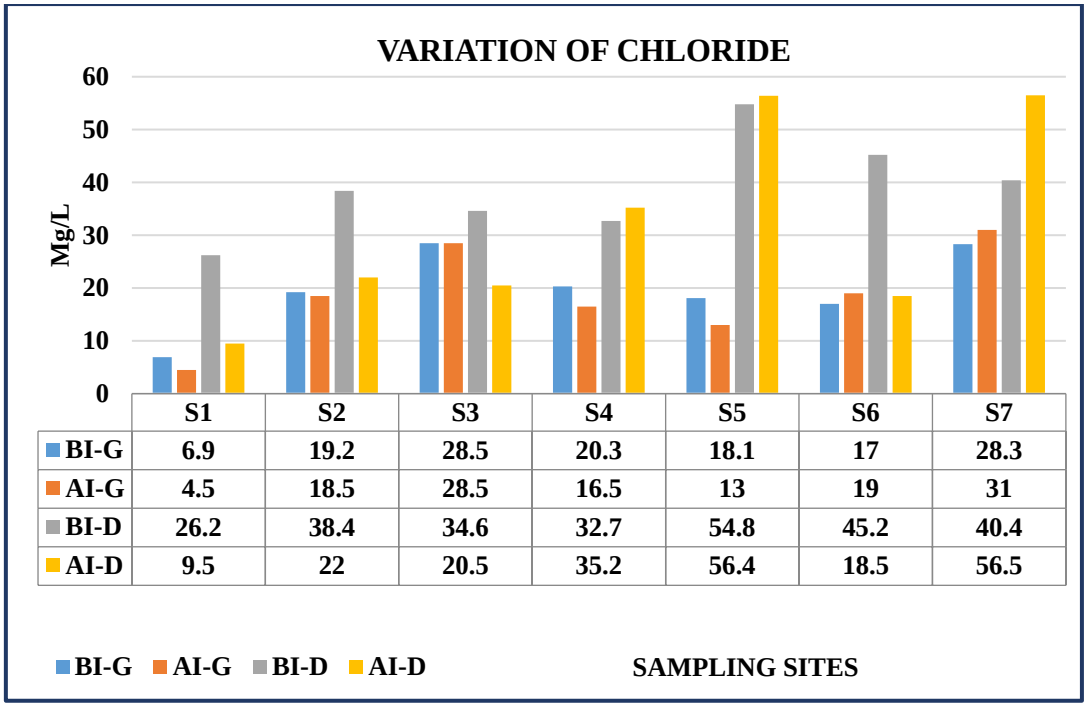
**Oil & Grease (O&G):** As far as drinking water quality is concern no limits of oil & grease is given, but this may cause unpleasant odour and taste to water. Oil & grease are not quickly broken down by bacteria and they increase BOD. They may float to the surface and harden, causing aesthetically unpleasing conditions. In the present study, the concentration of oil & grease increases after idol immersion but hardness is within the permissible limit. Not much difference is seen in the concentration of oil & grease in river. However in ponds/ talabs, the concentration has increased sharply post immersion. This increase may be due to oil paint for decoration of the idol and devotee offer oil to the idols of lord Ganesha and Goddess Durga during the worship. Variation in oil & grease in collected water samples is shown in Fig-8.




| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 0 | 0 | 0 | 0 | 0 | 0.46 | 0.41 |
| AI-G | 0.31 | 0.93 | 0.386 | 1.23 | 0.33 | 1.02 | 1.67 |
| BI-D | 0.296 | 0.850 | 0.338 | 0.490 | 0.210 | 0.596 | 0.769 |
| AI-D | 0.311 | 0.912 | 0.521 | 0.528 | 0.397 | 0.601 | 0.799 |

**Fig. 8 : Variation of Oil & Grease concentration at the Sampling sites**

**Chlorides (Cl):** Chlorides occur naturally in all types of waters. High concentration of chlorides is considered to be the indicators of pollution due to organic wastes of animal or industrial origin. The levels of chlorides in the present investigation chloride values are in higher concentration in samples analyzed after immersion of Goddess Durga idols at sampling sites S4, S5 and S7. It ranges between the 4.5mg/ L to 56.4 mg/L. However no samples crossed the permissible limits of 250mg/L Chloride increases with the increasing degree of eutrophication. Variation in Chloride concentration in collected water samples is shown in Fig-9.




| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|---|---|
| BI-G | 6.9 | 19.2 | 28.5 | 20.3 | 18.1 | 17 | 28.3 |
| AI-G | 4.5 | 18.5 | 28.5 | 16.5 | 13 | 19 | 31 |
| BI-D | 26.2 | 38.4 | 34.6 | 32.7 | 54.8 | 45.2 | 40.4 |
| AI-D | 9.5 | 22 | 20.5 | 35.2 | 56.4 | 18.5 | 56.5 |

**Fig. 9 : Variation of Chloride concentration at the Sampling sites**

## CONCLUSION

The study assessed the evolution of water quality in surface water of River Shivnath and six ponds of Bhilai -Durg area. A comparative study of both type of ground water i.e. river as well as pond water was carried out by taking certain important parameters like pH, total dissolved solid, total solids, oil & grease, dissolved oxygen, BOD, COD and chloride. In this present investigation it was found that the maximum parameters were not at the level of pollution. So both type of surface water satisfy the requirement for the use in various purposes. But the study of pond water indicated that the community ponds are highly polluted and unsafe for human use.

## RECOMMENDATIONS

1. The idols should be made of traditional clay instead of POP/baked clay.
2. The paints of idols should be water soluble and biodegradable.
3. The offerings like flowers, leaves, etc. should be collected separately so that it can be used for composting.
4. Awareness activities should be carried out to educate people in this regard.
5. The pond water should be disposed properly.

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