

# Physico Chemical Analysis of a Pond Water at the Bank of which Crackers are Exploded during Chhath puja in Bihar

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## ABSTRACT

To assess the magnitude of degradation of water of a rural pond near a temple, where fire crackers are every year exploded at the occasion of Dipawali and Chhath Puja in Bihar, the physico-chemical analysis was done before and after the festival. Water sample of the pond was collected and experiments like determination of total dissolved substances, the electrical conductivity, total alkalinity, presence of chlorides, sulphide, elements like magnesium, iron, phosphorous, sodium, potassium, calcium, nitrate etc. were analyzed per the standard methods mentioned in the book. For calculation of dissolved oxygen, water sample was fixed at the point of collection of water. Similarly, free carbon dioxide was also determined of pH was observed at the site of the pond. Findings of the present work clearly revealed that there were discrepancies in the data for all parameters selected for study. For study, before and next day of the festival where countless fire crackers were exploded at the bank. This indicated that the residues of the fire crackers formed after explosion. Finally cause down in the pond water along with the dew drops as this festival is celebrated in winter where dew formation takes place.

Keywords : Rural Pond, Fire Cracker, Dipawali and Chhath, Physico-chemical Parameters, Dew Drops, Discrepancy.

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## I. INTRODUCTION

In the present day the scenario of celebrations of Dipawali and Chhath festival has been completely changed. This festival of light was earlier celebrated by lightening of earthen Deepak with mustard oil. The aim was to destroy the population of insects and

mosquitoes population, produced during rainy seasons as the insects shall be attacked by the light and shall be burnt on the flame of te Deepak. Further, most of them may stick to the oil of Deepak placed in open air. However, people do say this is an old fashion and in place of Deepak, they used varieties of bulbs to decorate their house and few deepaks are burnt near

the Puja/worship places only. Similarly, due to change in the economic status, people belonging to all categories explode variety of fire crackers for fun. These fire crackers in addition to gun powder contains nitrate, carbonate sulphate, chloride of different elements for varieties of colour, sparks, sounds and smokes. These smokes or the residues are no doubt going to air but finally the return to the earth surface which also include the water body like pond at the bank of such activities are done.

Access to clean and safe water for human consumption was declared a human right by the United Nation General Assembly in July 2016 (UN 2016). Given that climate change and anthropogenic activities are leading to major alterations in the hydrological cycle, water quality, degradation has become a critical worldwide issue for the sustainable development of human beings. Water resources are under severe threats from pollution generated by human intervention and in appropriate utilization (Jin et al; 2020a, 2020b).

This rural pond is surrounded by agricultural land and residential areas. During rainy seasons the run off rain water deposits different, agricultural residues, the local people also dump different waste in this pond. In addition to the above, the explosion of varieties of fire crackers also add varieties of residues in this pond water which being used by the local people for bathing, cleaning and for drinking water for their animals particularly cattle.

From the survey of literature, it was gathered that impact of products of fire crackers have been studied by different workers of the air quality, but its impact on nearby water bodies has not been explored. Physico-chemical analysis of different water bodies such as river, lake, wet land and ponds have been done by different workers all over the world. Some of them may be mentioned here such as, Ali et al; (2000); Kaur et al; (2005); Kadam et al; (2007); Acharya et al;

(2008); Araoye et al; (2009); Chandra et al; (2010); Carpenter et al; (2011); Madhudhula et al; (2012); Devi et al; (2013); Chaudhary et al; (2014); Barman et al; (2015); Balai et al; (2016); Balakrishnan et al; (2017); Bhattacharya (2018).

Keeping all these ideas in mind the present work was done to study the selected physico-chemical parameters of a rural pond on the bank of which thousands of people including children to adult celebrate diwali festival by cracking the varieties of fire cracker starting from 6:00PM to 12:00 PM at night. The data generated here may indicate the impacts on water quality of the above human activities.

## II. METHODS AND MATERIAL

The pond is situated near Thawe temple of Gopalganj District. Gopalganj District is located on the West-North corner of Bihar State. Geographically it is located between 83.540 – 85.560 latitude and 26.120 - 26.390 North longitude. It is bounded on East by Champaran and river Gandak, on the South by Siwan district and on North West Deoria District of Uttar Pradesh. Different small rivers cross the district so its land is much fertile. River Gandak deposit top quality of soil brought from the Nepal, play an important role in the economy of the district.

### Collection of sample water:

Sample water was collected for laboratory analysis before and after the festival. Sample water was collected in well cleaned plastic jars and bottles having proper mouth cover. For the analysis of dissolved oxygen, sample water was collected with precautions so that there should not be air space or air bubble. Again by adding chemicals the oxygen was fixed in the reagent bottle just after collection at the collection point. This was also done for the study of free carbon dioxide present in the water sample. pH

of the pond water was measured with the help of digital pH meter. Alkalinity, total hardness, calcium, magnesium, chloride all was determined in the laboratory by titration with the use of different indicators and titrants. For determination of dissolved oxygen, free carbon dioxide similar methods were adapted.

Electrical conductivity was measured with the help of conductivity meter. For nitrogen Kjeldahl method was used. Available phosphorous was determined with Sodium-bi-carbonate. All the experiments were repeated thrice and means of the data were used for analysis, discussion and conclusion. Data have been tabulated in table-1.

Table-1

Showing data taken before and after the festival at Gopalganj Pond water

S.N.	Parameters	Pre-Festival	Post Festival
01	Ph	7.8	7.3
02	TDS	238	325
03	Electrical Conductivity	172.64	188.56
04	Total Alkalinity	160.0	142.0
05	Chloride	426.0	478.0
06	Sulphide	24.0	36.0
07	Nitrate	0.64	1.25
08	Phosphorous	0.38	0.54
09	Magnesium	16.60	19.24
10	Sodium	12.0	17.0
11	Potassium	2.8	3.6
12	Calcium	52.64	61.15
13	Iron	0.19	0.65

### III. RESULTS AND DISCUSSION

Physico-chemical parameters are considered as one of the essential features to influence the pond water qualities. In the present study different physico-

chemical parameters revealed variation in its amount before and after the festival, during which difference fire crackers were exploded. It may be noted from the table, that just after one day the pH was reduced to 7.3 from 7.8, the total dissolved substances increased from 238 mg/L to 325 mg/l, the electrical conductivity increased from 172.64  $\mu\text{S}/\text{cm}^2$  to 188.56  $\mu\text{S}/\text{cm}^2$ , the alkalinity from 160 to 142, respectively. It may further be noted that amount chloride increased from 426.0 mg/l to 478.0 mg/l, sulphide 24.0 mg/l to 36.0 mg/l, nitrate from 0.64 mg/l to 1.25mg/l phosphorous 0.38 mg/l to 54.0 mg/l respectively.

Selected metals whose compounds are being used in fire crackers were also analyzed. From the table, it may be noted that concentrations of Magnesium increased from 16.60 mg/l to 19.24 mg/l, concentration of sodium from 12.0 mg/l to 17.0 mg/l potassium 2.8 mg/l to 3.6 mg/l, calcium 52.64 mg/l to 61.15 mg/l, iron 0.19 mg/l to 0.65 mg/l respectively.

#### Discussion:

From the survey of literature it was gathered that different workers have analyzed physicochemical parameters of different pond water either in different months or in different seasons. These workers have reported that different parameters varied either month wise or in different seasons. Some of them are being cited here such as Garg *et al*; (2006); Abdullah et a; (2010); Hulyal and Kaliwal (2011); Ahnagar *et al*; (2012); Bhat *et al*; (2012); Nirmala *et al*; (2012); Jena *et al*; (2013); Abir Sahib (2014); Dixit *et al*; (2015); Prab and Pradhan (2015); Sangeet and Pradhan (2015); Das *et al*; (2016); Narasimha and Banerjee (2016); Goswami *et al*; (2017); Durge *et al*; (2018); and Ram Nathan and Amsath (2018); Das and Dey (2020); Das Piyali and Mithra Dey (2020). Because different months and reasons have different environments. So naturally, different parameter must vary in different seasons. Here during festivals like Dipawali and Chhath puja in Bihar all the villagers gather at the bank of the pond and they explode fire cracker from

6:00PM to 12:00 night and again in the morning. The components of fire crackers no doubt are spreaded in the air but them along with dew drops sediments in the water body. These pollutants may be compared with different pollutants of the atmosphere in the different seasons or months of the year. Therefore, present findings are in agreement with the findings of the previous workers.

#### IV. CONCLUSION

Fire crackers contain different chemicals either in elemental form or in their compounds for development of colours and sound these mixture are put into it. One burning the residues finally falls on the water surface or in the agricultural land. They are thus creating problem along with air pollution, they also pollute the water and soil.

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