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Effect of brewery waste on water quality parameters of *Cyprinus carpio* (Linnaeus, 1758) fingerlings

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Abstract
The present experiment was conducted for 60 days to assess the "effect of Brewery waste on Water Quality Parameters of *Cyprinus carpio* (Linnaeus, 1758) Fingerlings". This experiment was carried out from April to June 2023. The five different inclusion levels of Brewery waste i.e. T_0 (without Brewery waste), T_1 (10%), T_2 (20%), T_3 (30%) and T_4 (40%) were used to fed the fishes. The fishes were fed @ 3% body weight twice in a day. During the whole experimental period, there was no bad impact of brewery waste can be seen on water quality parameters as the values of water quality parameters show only narrow variation in various treatments. The measurements for the study of water quality parameters as Water temperature (25 to 29.7 °C), pH (6.1 to 8.5), Dissolved oxygen (6.0 to 8.5 mg/l), Electrical conductivity (140 to 182 µS/cm), Total alkalinity (110 to 151 mg/l) and Total hardness (400 to 510 mg/l) were monitored at fortnight period of interval. On the basis of these results, it can be concluded that Brewery waste is safe for water quality and favorable for the growth of *Cyprinus carpio* fingerlings.

Keywords: *Cyprinus carpio*, water quality parameters, brewery waste

1. Introduction

Global fisheries and aquaculture production is estimated to have reached about 214 million tonnes in 2020 with a total first sale value estimated at USD 151 billion. The total production consisted of 178 million tonnes of aquatic animal, 36 million tonnes of algae and 157.4 million tonnes human consumption (Per capita consumption 20.2 kg). Total global capture fisheries production was 90.3 million tonnes in 2020 with an estimated value of USD 141 billion. The total production consisted of 78.8 million tonnes of marine capture production and 11.5 million tonnes of inland capture production. In 2020, Global Aquaculture Production was 122.6 million tones, with estimated value of USD 264.8 billion. The total production consisted of 54.4 million tonnes of inland production and 68.1 million tonnes of marine capture production (FAO. SOFIA, 2020) [8].

Brewers spent grains (BSG) is a heterogeneous material consisting of lignocellulosic biomass & is rich in protein 20-30%, fibre 30-70%, lipids, vitamins and minerals. It contain 12-28% of lignin, 12-25% of cellulose and 28% of non-cellulosic polysaccharides mainly arabinoxylans (Mussatto and Roberto, 2006; Lynch, Steffen and Arendt, 2016) [14, 13].

Among the by-product of the brewing industry, BSG is most often sold as animal feed due to its properties & content of essential nitrogen containing nutrient. It is used in a wet or dry final form as feed for livestock, poultry, pigs, goats and fish (Dhiman, Bingham and Radloff, 2003; Mussato, 2006) [6, 14].

Cyprinus carpio is considered the most widely cultured carp species. It is the world's third-largest aquaculture producer, with over 100 countries cultivating it (Bostock *et al*., 2010) [2]. Because of its excellent growth rate, omnivorous habits, breeding in confined water, hardy nature, and ease of adaptation to artificial feed; it is preferred by farmers for cultivation in ponds alongside or in combination with other fishes. According to research, this bottom feeder grows at a much faster rate than *Cirrhinus mrigala*, an Indian major carp with similar feeding habits (Parameswaran *et al*., 1971) [15]. The fish has been classified as eurythermal, which means it can withstand a wide range of temperature fluctuations, making it ideal for culture in Rajasthan's climatic conditions.

2. Materials and Methods

2.1. Experimental Fish and Maintenance

The *Cyprinus carpio* fingerlings were selected for the experimental study. A total quantity

150 fingerlings was procured from the Seed Production and Research Unit, MPUAT, Udaipur. In order to overcome the handling stress, the fishes were given a mild salt and $KMnO_4$ treatment. The fish were acclimatized in a 500 L capacity FRP circular tank with a basal diet for a week. The feeding was stopped 24 hours before the commencement of experiment.

2.2. Experimental set up
The experimental study lasted for two months, from April to June, 2023, at the Department of Aquaculture, MPUAT, Udaipur (Rajasthan). To conduct the experiment, 15 tank (225-litre capacity) were assigned in Five triplicates (4 treated and 1 control) followed a completely randomized design (CRD). All of the tanks washed with clear water, and dried. The tanks were filled with 200 litters of water before the fingerlings were introduced. Following that, *Cyprinus carpio* fingerlings were equally distributed into tanks with a stocking density of 10 fish per tank. The fingerlings were fed twice a day @ 3% of their body weight in the form of pellets.

3. Water quality analysis
To maintain the congenial environment of the experimental tanks for the fish, the water of the experimental units was partially replaced every alternate day using bore well water. Water quality parameters such as Temperature, pH, DO, Electrical conductivity, Total alkalinity and Total hardness were analyzed on every 15 days interval. For analyzing water quality parameters stated above, standard methods of APHA (2005) [1] were followed.

4. Results and Discussion
4.1 Water temperature
In many parts of the world, fish constitutes a substantial source of protein and a source of income. They can perform physical activities including feeding, swimming, breeding, digestion and excretion because water gives them the assistance they need (Bronmark and Hansson, 2005) [5]. Tolerable limits exist for water quality characteristics within which all living things function most effectively. Within certain ranges, a sudden drop or increase has negative impacts on their physiological functions (Davenport, 1993; Kiran, 2010) [22, 11f]. As a result, good water quality is essential for fish survival and development. Because fish are cold-blooded, their body temperature fluctuates in response to their environment, which affects their metabolism and physiology and, in turn, their productivity. Santhosh and Singh (2007) [16] state that a water's optimal temperature for carp culture is between 24 and 30 °C. The observed fortnightly average water temperature values in the current study ranged from 25 °C to 29.7 °C.

4.2 pH
More ideal and favourable for fish life is a pH range between 7 to 8.5. According to Ekubo and Abowei (2011) [7], it is also excellent for biological productivity. Yee *et al*., (2012) [21] showed that the low oxygen level and high BOD level are primarily caused by a reduction in pH value. Excessive feed and fish waste contribute to this in aquatic environments, which causes the breakdown of organic matter and increased oxygen demand. The optimal pH range for fish culture, according to Santhosh and Singh (2007) [16], is between 7.5 and 8.5, and anything above or below that causes stress for the fish. Water with a pH range of 6.1 to 8.5 with a mean between 7.27 and 7.41 is slightly alkaline.

4.3 Dissolved oxygen
According to Boyd (1979) [3], dissolved oxygen is the most important factor in maintaining fish life and survival. When the dissolved oxygen level falls below 5 mg/L, fish experience stress, which slows down their growth and makes them more vulnerable to disease. The concentration of dissolved oxygen was consistently observed in the current investigation above the minimal required level. As a result, the range of the dissolved oxygen level was 6 to 8.5 mg/L.

4.4 Electrical conductivity
According to Balai (2002), electrical conductance has a positive significant relationship with carbonates, bicarbonats, total alkalinity and silicates. According to Stone and Thomforde (2004) [17], water that is good for growing fish has an electrical conductivity range of 100-2,000 µS /cm. The electrical conductivity (EC) range used for the current investigation was 140 to 182 µS/cm, and it was discovered that this range was ideal for fish growth.

4.5 Total alkalinity
The combined alkalinity of carbonates and bicarbonates is known as the total alkalinity. Freshwater systems should have alkalinity levels between 5 and 500 mg/L (Lawson, 1995) [12]. According to Jiwyam and Chareontesprasit (2001) [10], total alkalinity evaluates both the conditions and production of water. In an aquaculture pond, the alkalinity should range from 75 to 200 mg/L, but not lower than 20 mg/L, according to Wurts and Durborow (1992) [20]. According to Santhosh and Singh (2007) [16], 50–300 mg/L of alkalinity is thought to be excellent for fish culture. In the current investigation, water's total alkalinity ranged from 110 to 151 mg/L.

4.6 Total hardness
According to Swann (1997) [18], a hardness value for fish culture should be between 30 and 180 mg/l (20 ppm is the optimal number). The strong buffering capacity of hard water is indicated by its $CaCO_3$ content, which ranges from 150 to 300 ppm for hard water and more than 300 ppm for very hard water. (Boyd, 1990; 1998) [4]. Hujare (2008) [9] determined that the summer season produced a higher increase in hardness than the rainy and winter seasons. The hardness of culture water is a commonly reported important aspect of water quality. Fish may directly absorb the calcium they need from their food or water. In the biological processes of fishbone and scale production, blood coagulation, and other metabolic reactions, hardness (both Ca and Mg) is essential (William and Robert, 1922) [19]. The range of water hardness as total hardness for the experiment is 400 to 510 mg/L. additionally, the range of the mean water hardness readings after various treatments is from 446.8 to458.13 mg/L.

Table 1: Range and mean values of water quality parameters in different treatments during the experimental period.

Parameters	T_0	T_1	T_2	T_3	T_4
Temperature (°C)	25.3- 29.4 (27.46)	25-29.5 (27.43)	25.6-29.7 (27.54)	25.2-29.5 (27.45)	25.1-29.5 (27.42)
pH	6.5-8.1 (7.27)	6.2-8.5 (7.32)	6.2-8.3 (7.41)	6.1-8.5 (7.41)	6.5-8.3 (7.38)
D.O. (mg/)	6.2-8.1 (7.15)	6.2-8.5 (7.15)	6-8.3 (7.22)	6.1-8.2 (7.34)	6.2-8.3 (7.23)
Total alkalinity (mg/l)	123-151 (128.64)	122-139 (129.71)	110-147 (128.17)	120-142 (132.9)	113-145 (126.41)
Total hardness (mg/l)	400-505 (451.44)	430-510 (460.11)	402-506 (446.8)	400-500 (458.13)	404-508 (454.03)
EC (µS/cm)	140-176 (160.3)	151-178 (163.01)	153-179 (165.06)	150-182 (161.46)	155-179 (162.71)

Note: Figures in bracket shows average values

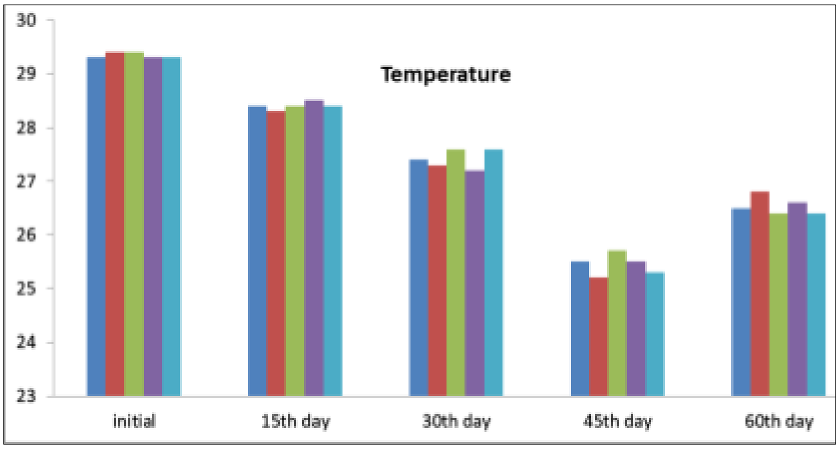

Fig 1: Water temperature during the experimental period in different treatment

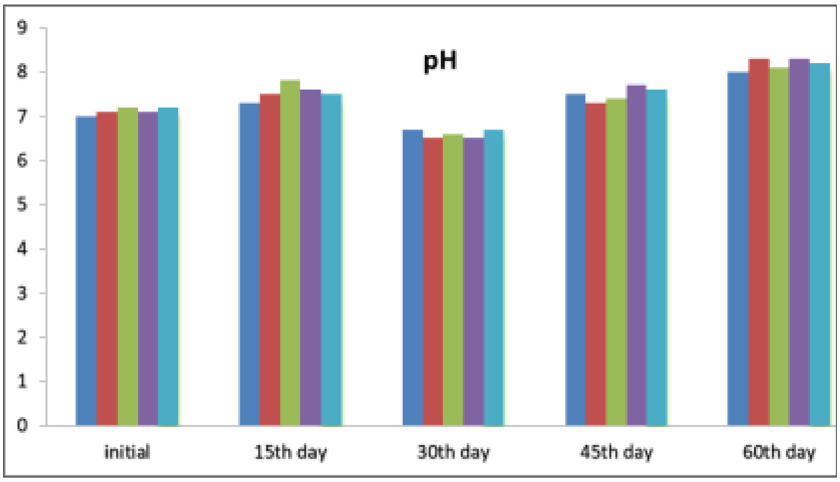

Fig 2: PH of water during the experimental period in different treatment.

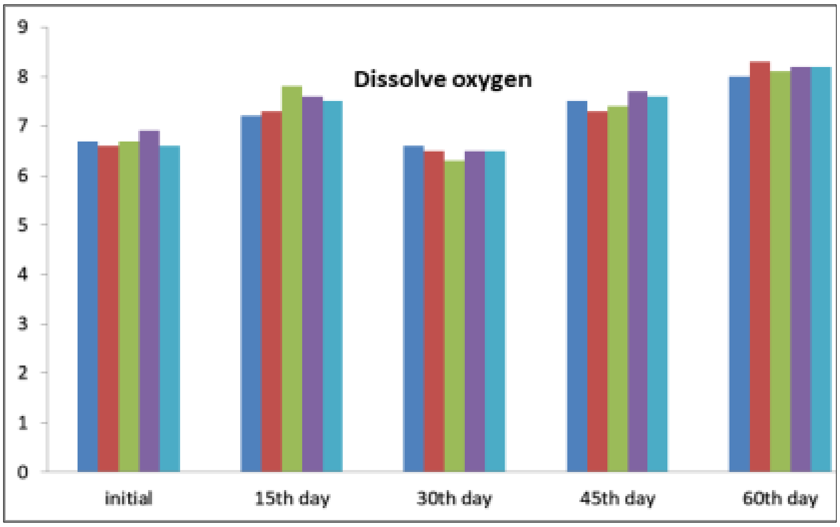

Fig 3: Dissolve oxygen in water during the experimental period in different treatment

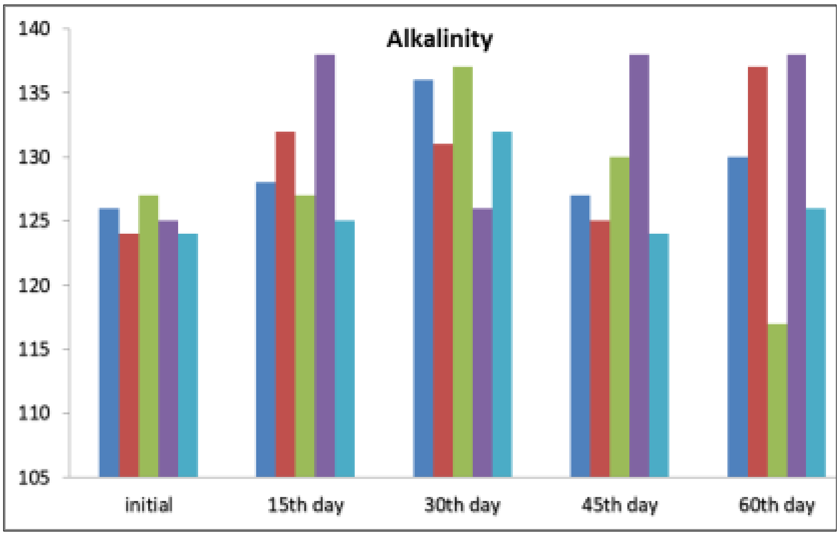

Fig 4: Alkalinity of water during the experimental period in different treatments

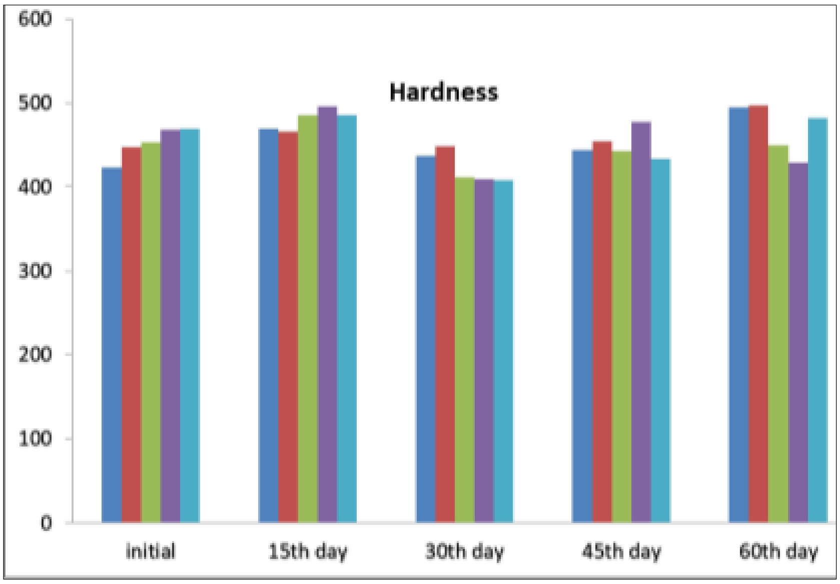

Fig 5: Hardness of water during the experimental period in different treatments

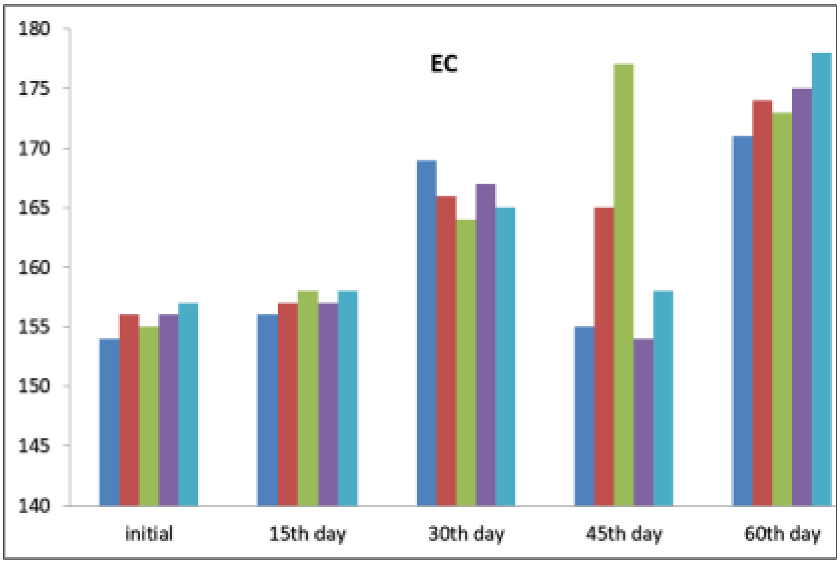

Fig 6: Electrical conductivity of water during the experimental period in different treatment

5. Conclusion

It can be conclude from the present study that water temperature, EC, Total alkalinity, pH, DO, and Total hardness was recorded in optimum range and does not show any adverse effect among all treatments on the growth of fish. So, it can be concluded that brewery waste is safe and favourable for water quality and growth of *Cyprinus carpio* fingerlings.

6. References

1. APHA, American Public Health Association. Standard Methods for the Examination of Water and Waste water, 18th Ed. Washington DC; c2005. p. 1268.
2. Bostock J, McAndrew B, Richards R, Jauncey K, Telfer T, Lorenzen K, *et al*., Aquaculture: global status and trends. Philosophical Transactions of the Royal Society B: Biological Sciences. 2010;365(1554):2897-2912.
3. Boyd CE. Water quality in warmwater fish ponds, Agriculture Experiment Station, Auburn, Alabama; c1979. p. 359.
4. Boyd CE. Water quality for pond aquaculture. Research and Development Series No.43. International center for Aquaculture and Aquatic Environments, Alabama Agricultural Experiment Station, Auburn University, Alabama; c1998.
5. Brönmark C, Hansson LA. The Biology of Lakes and Ponds, – Oxford University Press; c2005.
6. Dhiman TR, Bingham HR, Radloff HD. Production response of lactating cows fed dried versus wet brewers' grain in diets with similar dry matter content. Journal of dairy science. 2003;86(9):2914-2921.
7. Ekubo AT, Abowei JFN. Review of some water quality management principles in culture fisheries. Research Journal of Applied Sciences, Engineering and Technology. 2011;3(12):1342-1357.
8. FAO. State of World Fisheries and Aquaculture, Food and Agriculture Organization, U.N. Rome, Italy; c2020. p. 1-227.
9. Hujare MS. Seasonal variation of physico-chemical parameters in the perennial tank of Talsande, Maharashtra. Ecotoxicology and Environmental monitoring. 2008;18(3):233-242.
10. Jiwyam W, Chareontesprasit N. Cage culture of nile tilapia and itsloadings in a freshwater reservoir in Northeast Thailand; c2001.
11. Kiran BR. Physico-chemical characteristics of fish ponds of Bhadra project at Karnataka. RASĀYAN J Chem. 2010;3(4):671-676.
12. Lawson TB. Flow Estimation and Measurement. In Fundamentals of Aquacultural Engineering (pp. 133-156). Springer, Boston, MA; c1995.
13. Lynch KM, Steffen EJ, Arendt EK. Brewers' spent grain: A review Lynch, K. M., Steffen, E. J. & Arendt, E. K. Brewers' spent grain: A review; c2016. p. 553-568. doi:10.1002/jib.363.
14. Mussatto SI, Dragone G, Roberto IC. Brewers' spent grain: Generation, characteristics and potential applications. Journal of Cereal Science. 2006;43:1-14. doi:10.1016/J.JCS.2005.06.001.
15. Parameswaran S, Radhakrishnan S, Selvaraj C, Bhuyan BR. Fish yield from Assam ponds kept under different experimental conditions. Indian Journal of Fisheries. 1971;18(1 & 2):67-83.
16. Santhosh B, Singh NP. Guidelines for water quality management for fish culture in Tripura, ICAR Research Complex for NEH Region, Tripura Center, Lembucherra-799210, Tripura (west). Publication no. 29, 2007. publication, 2007, (29).
17. Stone NM, Thomforde HK. Understanding your fish pond water analysis report Cooperative Extension Program, University of Arkansas at Pine Bluff, US Department of Agriculture and County Governments Cooperating; c2004. p. 1-4.
18. Swann L. A fish farmer's guide to understanding water quality. Aquaculture Extension, Illinois-Indiana Sea Grant Program; c1997.
19. William AW, Robert MD. Interaction of pH, Carbon dioxide, Alkalinity and Hardness in fish ponds, Southern Regional Aquaculture Center; c1992. p. 464.
20. Wurts WA, Durborow RM. Interactions of pH, carbon dioxide, alkalinity and hardness in fishponds. Southern Regional Aquaculture Center publication no. 464. Liming Fishponds 3. In Auburn University For; c1992.
21. Yee LT, Paka DD, Nyanti L, Ismail N, Emang JJ. Water quality at Batang Ai hydroelectric reservoir (Sarawak, Malaysia) and implications for aquaculture. International Journal of Applied, 2012, 2(6).
22. Davenport TH. Process innovation: reengineering work through information technology. Harvard Business Press; c1993 Feb 24.