The Biobrio ISSN : 2393-9508 e-ISSN: 2582-4902
An International Quarterly Journal of Life Sciences
Website: www.thebiobrio.in SJIF 2022:7.34
9 (1&2): 767-771, 2022

Physico-chemical characteristics of fish tanks of application of raw and fermented poultry manure

***Shanti Kumari & Arvind Kumar**
Department of Zoology, B. N. M. V. College, B N M University, Madhepura, Bihar, India

Received : 8th January, 2022 ; Accepted : 9th February, 2022

ABSTRACT

The present study evaluated the physico-chemical characteristics of the waters in two fish tanks in laboratory condition of BNM University, Madhepura. The experiment was carried out from May 2019-April 2020. The water quality parameters studied for the current study were water temperature, pH, acidity, total alkalinity, dissolved oxygen, and total hardness. The aim of the study was to see the effect of raw poultry manure and fermented poultry manure in fish tank. It was found that there is no much difference in the physic chemical parameters of the two tanks.

Key Words - Fish tanks, Physico-chemical characteristics of the water, Poultry manure, Fermented Poultry manure

***Corresponding author :** prf.arunkumar@gmail.com

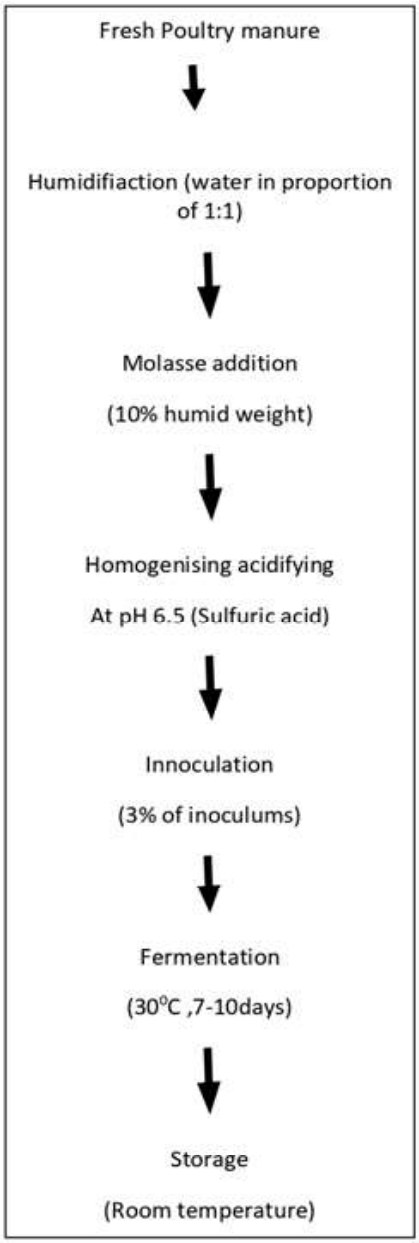
INTRODUCTION

Water is very precious for every living organism on this earth. The available fresh water to man is hardly 0.3 to 0.5% of the total water available on the earth and therefore its judicious use is imperative. In today's scenario, unplanned urbanization, rapid industrialization and indiscriminate use of artificial chemicals cause of heavy and varied pollution in aquatic environments leading to deterioration of water quality and depletion of aquatic fauna including fish. Without the knowledge of water chemistry, it is difficult to understand the biological phenomenon fully, because the chemistry of water reveals much about metabolism of the ecosystem and explains the general hydro-biological interrelationship. Physico-Chemical characteristics are highly important with regard to the occurrence and abundance of species. Discharge of urban, industrial and agricultural wastes have increased the quantum of various chemicals that enter the receiving water, which considerably alter their physico-chemical characteristics. Nutrients like phosphorous and nitrogen from the domestic wastes and fertilizers accelerate the process of eutrophication. Natural factors like dust, storm, runoff and weathering of minerals are slow processes in causing eutrophication. Lentic water bodies have tremendous importance, as they are recharging reservoirs for drinking water, domestic use and as infrastructure for pisciculture. Eutrophication has become a widely recognized problem of water quality deterioration. Temperature, turbidity, dissolved oxygen, pH, chloride, and total alkalinity are significant parameters used to study the water quality (APHA 2005). The present study aims at making an assessment of the water quality with reference to physico- chemical characteristics of the fish ponds using the raw and fermented poultry manure.

MATERIALS AND METHODS

Poultry manure (PM) was obtained from the chicken farm. Fermented PM (FPM) was prepared by adopting the following flow chart.

Fig. 1. Flow chart showing the production of fermented Poultry manure



The experiment was conducted in 600 lits capacity plastic tanks. The fish tanks were divided into 3 groups, The fish tanks were supplied with chlorine free tap water with continuous aeration, using an electric aquarium air pump. Two sets of manure were used, the first set received Poultry manure @10 tons/ha/month with supplementary feed, the second set received Fermented Poultry Manure with supplementary feed and the control tank received commercial fish feed only. Two replicates for each treatment were made, with water changes on a daily basis. Water sampling was done once every two weeks, with a total number of 4 water samples which was done at a fixed time. (APHA,2005).

RESULTS AND DISCUSSION

Table 1: Physico-chemical parameters of water in raw Poultry manure treated tank T1 (2019)

Parameters	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	Mean	SD
Water Temp (°C)	29.7	29.4	29.2	28.6	26.1	25.5	23.3	16.2	15.2	16.4	27.3	29.8	24.62	5.55
pH	6.8	7.2	6.8	6.2	7.2	7.4	7.2	6.7	6.5	6.8	7.1	7.3	6.43	0.13
Dissolved oxygen (	6.8	7.2	7.3	7.1	7.3	7.5	7.9	8.7	9.6	8.6	7.8	7.1	7.43	0.57
Conductivity (µS/cm)	0.294	0.409	0.493	0.496	0.386	0.41	0.387	0.205	0.413	0.386	0.214	0.278	0.38	0.11
Total Alkalinity (mg/l)	97	89	96	91	76	75	82	73	75	64	66	96	82.66	12.83
Total Hardness (mg/l)	108	103	105	108	114	106	99	72	69	89	92	98	106.91	24.19
Turbidity (NTU)	21.21	23.09	25.34	22.23	24.27	16.84	19.12	20.11	14.21	25.67	26.98	27.23	16.17	1.94
Total Dissolved Solids	139	166	159	166	178	188	175	198	185	178	73	178	126.25	6.24

Table 3: Physico-chemical parameters of water in fermented Poultry Manure T2 tank (2019)

Parameters	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Mean	SD
Water Temperature (^{0}C)	29.6	29.7	29.2	28.3	26.5	25.6	23.3	15.9	15.4	16.6	27.2	29.7	24.65	5.53
pH	6.8	7.1	6.9	7.1	7.2	7.7	7.2	7.1	6.6	6.7	7.3	7.5	6.4	-0.38
Dissolved oxygen (mg/l)	7.4	7.1	7.4	7.6	7.9	8.2	8.7	9.7	9.9	9.5	8.4	7.7	7.99	0.66
Conductivity (in µS/cm)	0.336	0.481	0.574	0.526	0.485	0.487	0.483	0.434	0.481	0.484	0.276	0.294	0.48	0.13
Total alkalinity (in mg/l)	116	111	115	113	107	101	105	104	99	88	89	115	106.08	10.66
Total hardness (in mg/l)	126	120	122	134	141	134	105	96	95	112	114	124	120.41	16.92
Turbidity(in NTU)	37.93	43.98	47.91	36.12	33.88	24.96	23.82	24.78	22.98	35.81	36.46	48.98	23.75	-1.85
Total dissolved solids (mg/l)	161	182	176	206	241	274	221	248	209	198	186	199	170.41	-5.26

Table 5: Physico-chemical characteristics of water in the T0 (control) tank (2019)

Parameters	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Mean	SD
Water temperature (^{0}C)	29.2	29.6	29.4	28.4	25.9	25.4	23.6	16.4	15.6	16.6	26.8	29.6	24.3	5.06
pH	6.6	7.4	6.6	6.1	7.2	7.4	7.4	6.6	6.5	6.8	7.2	7.6	5.95	-0.52
Dissolved oxygen (mg/l)	6.4	6.8	7.4	7.5	7.6	7.9	8.3	9.5	9.7	9.2	8.4	7.6	6.79	-0.12
Conductivity (µS/cm)	0.296	0.424	0.496	0.511	0.389	0.417	0.389	0.196	0.432	0.396	0.232	0.274	0.39	0.12
Total alkalinity (mg/l)	96	82	86	84	82	86	74	65	79	78	80	96	82.33	8.57
Total hardness (mg/l)	106	104	106	107	116	104	93	74	66	86	88	92	109.16	28.81
Turbidity (NTU)	21.02	23.25	25.71	23.12	21.42	15.25	16.71	16.12	13.98	24.98	24.88	28.21	14.03	-2.53
Total dissolved solids (mg/l)	128	168	154	164	176	162	168	194	188	176	171	174	122.58	-29.23

Temperature is a physical factor that alters water characteristics and is considered an essential factor in controlling the fluctuation of plankton and the functioning of the aquatic ecosystem. The water temperature is a fundamental parameter of a marine ecosystem and its effects on the metabolic activities of organisms present in that environment. The temperature ranged between 23.4-31.6°C, which falls within the aquaculture practices. In the present study, the water temperature fluctuated according to the atmospheric temperature variations. However, the temperature varied in a narrow range with no pronounced effects on the phytoplankton, zooplankton or fish diversity.

Interestingly the magnitudes of variation in atmospheric and water temperatures were less during summer. Surface temperature is closely reflected in ambient air temperature. This is particularly true for shallow lakes and ponds like in the present study. However, it may be probably due to smaller bodies of water. It is now a well-known fact that smaller more petite the body of water, more quickly it reacts to the changes in the atmospheric temperature.

The maximum water temperature recorded in T0, T1, and T2 were 29.6^{0}C during May-June in both years of observation may due to the experiment being conducted in plastic and placed in nearby. There was not much variation in the minimum temperature and the temperature range found within the permissible content of fish culture.

pH:

The limnological value of pH is a limiting factor and works as an index of general environmental conditions. The pH value of the tank showed a slight acidic trend. The average pH value in T1 was 6.43±0.13 in 2019. In T2, it was 6.40±0.38 in 2019, and in T0, it was 5.950±0.52 in 2019. The maximum pH value was 6.1-7.2. It is evident from the data that the pH declines during the rainy and increases during summer. Sharma *et al.* (1984) state that in India, many small confined water pockets are particularly alkaline Seasonal fluctuations is small indicating good buffering capacity. It has been suggested that the high pH is typically associated with high photosynthetic activity in water (*Goel et al*., 1986). High value also promotes algae growth and results in the heavy bloom of phytoplankton. Fertilization is widely used worldwide to improve soil fertility. Excessive fertilizer application aggravates soil organic matter and fertility decline and accelerates soil acidification. Soil properties affect the community structure of soil microbes. Fertilization influences soil microbial diversity through direct effects on the soil nutrient content. Soil microbial communities are sensitive to fertilization, and their responses to manure and mineral fertilizers in soils have been well studied over the past several years. The long-term application of nitrogen fertilizer or nitrogen fertilizer in combination with other mineral fertilizers affects the nitrogen cycle and related bacterial populations. Repeated overuse of chemical fertilizer can have a negative effect on soil quality and soil microbial community structure. In addition, the long-term application of chemical fertilizers can significantly reduce soil pH which is closely associated with decreased bacterial diversity and significant changes in bacterial community composition; livestock manures can prevent soil acidification and its effects on soil bacteria (Wu *et al*., 2020).

Dissolved Oxygen:

Dissolved oxygen level in the water directly affects the growth, metabolism, and survival of all the living forms in an aquatic ecosystem. The variations in a narrow range show pronounced effects on fish by impairing their physiology. The dissolved oxygen is one of the most critical parameters, and it acts as a primary limiting factor for controlling fish growth and survival. Earlier reports have endorsed that the dissolved oxygen should be above 5.0 mg/L for average or good aquacultural production (Banerjea, 1967). Oxygen content is essential for the immediate needs of many organisms and affects the solubility of many nutrients and, therefore, the periodicity of the aquatic ecosystem (Das *et al.,*1978). The oxygen contents in tropical water would be low considering their high temperature. The value of dissolved oxygen was in T0, 6.79±0.12 mg.l in 2019, whereas in T1, it was T0, 7.43±0.57

mg/l. The value increased from July to January and then decreased from February to June. The results of the present study are similar to those reported by others.

Total Alkalinity:

Alkalinity in most natural water is the function of bicarbonate and carbonates. Their salts get hydrolyzed in solution and produce hydroxyl ions. It is also used to measure productivity (Jhingran, 1982). Natural water bodies in the tropics usually show a wide range of fluctuations in their total alkalinity value depending on geography and season. In the present study the total alkalinity was in T2, 106±10.66 in 2019, where as in T1, it was 82.66±12.83 in 2019. In T0, it was 82.33±8.57 in 2019.

Increases in total Alkalinity during the rainy season were due to the input of water and dissolution of calcium carbonate ions in the water column (Patil *et al.,*1982). The degradation of plants and other organisms and organic waste might also be one of the reasons for the increase in carbonate and bicarbonate, thereby the Alkalinity (Naganandini, *et al*., 1998) in the natural water bodies. In the present investigation, the high alkalinity value in Fermented poultry manure compared to raw poultry manure and control tank may be due to the easy availability of the nutrients in fermented poultry manure. According to Jhingran (1982), total Alkalinity in Indian waters ranged between 40 to >1000 mg/l of $CaCO_3$. Pandey *et al*., (2000) suggested that alkaline pH is favourable for good plankton growth.

Electrical conductivity:

The electrical conductivity of the water depends on the nature and concentration of salts in high ionic concentration, pollution status, trophic levels, some domestic effluents and other organic matter in water. The average value of electrical conductivity in the present study was in T0, 0.39±0.12µs/cm in 2019, where as in in T1, it was 0.38±0.11 in 2019. In T2, value was 0.48±0.13 in 2019. The electrical conductivity values show marked seasonal variation being maximum during rainy and minimum during the winter season in the earthen pond. Various workers observed similar results (Patil *et al*., 1985).

REFERENCES

APHA (2005). Standard Methods for the Examination of water and wastewater. *American Public Health Association*, Washington D. C.: 1000p.

Banerjee, S.M. (1967). Water Quality and Soil Conditions of Ponds in Some States of India in Relation to Fish Production. *Indian J. Fish* 14: 115-144.

D.K.; Patil, S.G. and Singh, D.F. (1982). Limnological studies on a tropical freshwater fishtank of Jabalpur, India. 1. The abiotic factors. Geobios New Reports 1(2): 98-102.

Das, S.M. and Pathani, S.S. (1978). Some physicochemical and biological indicators of pollution in lake Nainital, Kumaun (U.P.). *Indian J. Ecol.* 5 (1): 7-16.

Datta Munshi, J.S. (1995). Fundamentals of Fresh Water Biology. Narendra Publishing House, New Delhi: p. 222.

Gupta, S. and Shukla, D.N. (2006). Physicochemcal analysis of sewage water and its effect on seed germination and seedling growth of *Sesamum indicum*. *Journal Nat. Res. Development.* 1: 15-19. Harshey,

Naganandini, M.N. and Hosmani, S.P. (1998). Ecology of certain inland waters of Mysore district, occurrence of *Cyanophycean bloom* at Hosakere lake. *Pollut. Res.* 17(2):123-125.

Pandey, J.; Pandey, U. and Tyagi, H.R. (2000). Nutrient status and Cyanobacterial diversity of a tropical freshwater lake. *J. Environ. Boil.* 21(2): 133-138.

Patil, S.G.; Harshey, D.K. and Singh, D.F. (1985). Limnological studies on a tropical freshwater fish tank of Jabalpur, M.P. *Geobios New Reports* 4: 143-148.