



## Study on the Quality of Water and Soil from Fish Pond in Around Bhimavaram West Godavari District, A.P., INDIA

Devi Priyamvada<sup>1</sup>, Sirisha D.<sup>1</sup>, and Gandhi N.<sup>2</sup>

<sup>1</sup>St.ann's college for women mehdipatnam, Hyderabad, INDIA

<sup>2</sup>Center for Environment and Climate Change (CECC), School of Environmental Science, Jawaharlal Nehru Institute of Advanced Studies (JNIAS), Hyderabad A.P. INDIA

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### Abstract

*The physico and chemical characteristics of water and soil in Aquaculture pond are investigated in Khariff (June and July) season before seedling with a view to optimize the fish productivity and to incorporate the scientific way of fish rearing in Palakoderu village, West Godavari District in Andhra Pradesh. The soil and water samples are collected in Khariff season before and after seedling. The samples are collected from six places and the soils and water are separately mixed to get a composite sample and it is collected in polyethylene bags and shifted to the laboratory. The analysis is carried out. The soil samples are analyzed in with respect to color, plasticity, nitrogen, phosphorous, potassium, sodium, organic carbon, heavy metals and electrical conductivity. Similarly water samples are analyzed with respect to color, turbidity, total solids, salinity, nitrates, calcium, Ammoniac. Nitrogen, phosphorous, chlorides, sulphates, free CO<sub>2</sub> and heavy metals.*

**Keywords:** Aquaculture pond, seedling, optimize fish productivity.

### Introduction

Andhra Pradesh is the fifth biggest state of India. Andhra Pradesh is considered to be important states in the consumption and production of fishes. Due to the high cost involved in cultivation and agriculture practices and due to commercialism, consumption strategies the farmers of Andhra Pradesh are shifting to the new type of practices to solve the problem of food production i.e the aqua culture ponds. The Godavari River is Perennial River and second largest river in India. It flows in southern India and it is considered to be one of the sacred rivers. The Godavari River and its tributes flow through the states of Maharashtra, Karnataka, Madhya Pradesh, Orissa and Andhra Pradesh. Two districts in Andhra Pradesh are named after Godavari as East and West Godavari districts.

West Godavari district is a part of Godavari delta. It lies between 16.15 to 17.30 northern latitude and 80.55 eastern latitudes. It is bounded by Khammam district on the north, Bay of Bengal on south east by river Godavari and Krishna districts on the west. It is geographically situated between mighty rivers of Godavari and Krishna having the total area of 1,700 sq.kms. The districts can be divided into three parts i. Delta, ii. Upland area, iii. Agency. The normal rain fall is 1076.20mm. The district has population of 3,80,35,17.

The productivity of a pond or lake depends upon the quality of water and soil. The principal physical conditions such as

depth, shore conditions, pressure and movement of water, temperature, turbidity and light are important for aqua culture. Similarly the chemical conditions such as oxygen, carbon dioxide, pH, Total hardness of water, nitrates phosphates, conductivity, chlorides heavy metals are important. Similarly the productivity of pond depends upon a large number of animal and plant communities living in various zones of the ponds. The aquatic plants and plankton are used as food by several species of herbivorous fishes. For the good development of fisheries, the right type of plankton is essential. The quality of water in turn depends on the source and kind of soil it traveled over<sup>1-5</sup>. Physical and chemical analysis of water and soil in culture practices throw light on the development of plankton (producers and primary consumers) directly and growth of fish and fishery indirectly. The present study deals with the analysis of water and soil samples in aqua culture ponds (before and after seedlings) in West Godavari region.

### Material and Methods

**Study Area:** Two ponds in the Bhimavaram region of west Godavari district were selected. The water and soil samples were analyzed for pH, Conductivity, nitrates, phosphates, chlorides and heavy metals will be studied by using standard procedures. Comparisons were made with standards of water and soil quality for the pond aquaculture by determining the water quality before and after seedling<sup>5-12</sup>.

## WEST GODAVARI MAP (Mandal Wise Map)



### Results and Discussion

**pH of water samples:** pH of the fish pond is influenced by many factors, including pH of source water, acidity of bottom soils, prawn culture inputs and biological activity pH of water samples is influenced by variations in CO<sub>2</sub> concentrations. The pH of pond water is slightly basic in nature and the pH of the water samples falls in the desired range of 6.5–9.5. The growth of fish will be good in the range of 7-8. it is a tolerable range for most fish.

**Electrical conductivity:** Electrical conductivity is a measure of how well a solution conducts electricity and it is correlated with salt content. Electric conductivity of the pond is within the desired range but the electrical conductivity from pre harvesting to post harvesting stage has decreased.

**Turbidity of water samples:** Turbidity of water determines the amount of dissolved suspended dirt in the water. Turbidity is caused when the light is blocked by large amounts of silt, micro organisms, plant fibers, sawdust, wood shavings, chemicals and coal dust. Turbidity of collected water samples are decreased as the samples are taken in rainy season (pre seedling) to summer season (post seedling stage) due to increase in temp. The turbidity values of the present tank indicate that the pond is clear.

**Total solids:** Total solids in water are due to inorganic substances organic matter, suspended solids, silt, clay and

plankton etc. total solids are in desirable range and they have decreased from post to pre seedling stage.

**Salinity of water:** Salinity of water is essential for the fish health and it enhances the natural slime coating it fights off fungus and disease. It also kills most parasitic infestations. Salinity of pond water is very low and it has still decreased. In rainy season salinity largely decreases the salinity of water should be increased by adding freshwater before harvesting only. The antibiotics and chemicals should not be used during harvesting time.

**Nitrates of water samples:** Nitrates is formed through nitrification process is oxidation of NO<sub>2</sub> by the action of aerobic bacteria. Nitrate is not taken by aquatic plants but it is denitrified in an aerobic sediments and microtones. It is generally stable over a large range of environmental conditions and highly stable in water. It is less toxic the Nitrates in the present study is high and it is observed in the pre seedling and post seedling stage. These values should be lowered otherwise they will effect the cultural species.

**Calcium content in water samples:** calcium is the most abundant substance of the natural water. It is associated with different cations like carbonates, bicarbonates and fluorides. It is in the desirable range for the fresh pond water fish.

**Ammonium-Nitrogen (NH<sub>4</sub>-N):** The Ammonium – Nitrogen in the fish ponds from the decomposition of organic wastes

resulting in the breakdown of decaying organic matter such as algae, Plants animals and uneaten foods. In the present study Ammonical nitrogen in the pre seedling stage very high compared to the post seedling stage.

**Phosphates:** The element phosphorous is necessary for plant and animals growth. All the fertilizers contain phosphates. They stimulate the growth of plankton and water plant that provide food for fish. The phosphates are slightly higher than desired range and there is much difference in phosphate levels from pre seedling to post seedling stage. These values are lower than those of David, Pahawa and Mehrotra who reported 1.00 mg/L

**Chlorides in a Water Sample:** A chloride is a common compound of most waters and is beneficial to fish in monitoring their osmotic balance. Chlorides in the present study have decreased from post to pre seedling stage. It is higher than maximum permissible limit for fresh water fish pond.

**Sulphates:** Sulphates are common compound found in water samples. It is a result of dissolution of minerals from soils and rocks. The sulphates are in a tolerable range and there is no much change from post to pre-seedling stage. The amounts of sulphates are lower than those of Mishra (1991) who reported 42.46 – 57.36 mg/Li

**CO<sub>2</sub>:** CO<sub>2</sub> is a odorless, colorless gas produced during the respiration cycle of animals, plants and bacteria. Green plants absorber CO<sub>2</sub> is determined during the day time and it will not affect the fish as it is present in low concentration. As the sample is collected during day time the low level of CO<sub>2</sub> in water can be attributed to high rates of photo synthesis by autotroph. As the CO<sub>2</sub> is low it may cause stress to fish by interfering with respiration or by forming calcareous deposits CO<sub>2</sub> presence is low and it is decreased from pre seedling to post seedling stage.

**Heavy metals in water samples:** Heavy metals in the water samples are determined by atomic absorption spectrophotometer (ASS). The traces of Pb, Ni, Hg, Pd are observed. As the pond is away from the industrial area, traffic zones smelting engraving operations and mines. The fishes are not affected by heavy metals.

**Analysis of soil samples: Colour:** Colour is one of the characteristic carbon content, climate soil drainage and soil mineralogy. The present soil in the study is black in Colour. The black Colour of soil indicates high aeration, high available nitrogen and high fertility.

**Plasticity of the soil:** The present soil of the fish pond is black cotton soil exhibiting the behavior of clay soils. These soils have extremely large surface area. They have fine pores, poor drainage and poor aeration. They have a highest water holding capacity. It is a store house for aeration and nutrients. Hence it is suitable for aquaculture.

**Soil organic carbon content:** The present soil sample are black in Colour and they are high argillaceous with a high proportion of calcium, Magnesium, Carbonates and iron but low in phosphorous, nitrogen and organic matter. Ponds with greatest production of fish and intensively managed ponds will have organic carbon content and has decreased and it is high. It will effect the production of water bodies and nitrogen fixation is affected.

**PH of the soil samples:** PH of the present soil decreased from preseedling to basic nature of soils. It is ideal for fish production. These soils are associated for high rates of soil respiration.

**Electrical conductivity of soil:** Electrical conductivity is a measure of how well a solution can conduct electricity and it is correlated with the salt content. Electrical conductivity of the soil sample is in the desired range. But it decreased from pre seedling to post seedling stage.

**Nitrogen in soil samples:** Nitrogen in soils is present mostly in organic forms which are broken down into simpler inorganic compounds through bacterial action. Due to unlimited supply of this element from the atmosphere through fixation by azotobacter, blue green algae and atmospheric electric discharge, the deficiency of this element is less acute compared to phosphorus deficiency, usually encountered in most soils Nitrogen in the present soil samples is high and sufficient for good productivity of fishes. There is no much difference between the pre seedlings to post seedling stage.

**Phosphorus:** Phosphorus has been called “the key to life” because it is directly involved in most life processes. It is second only to nitrogen in frequency of use as a fertilizer element. The availability of phosphorus is important to aquatic productivity owing to the fact that PO<sub>4</sub> ions in soil form insoluble compounds with iron and aluminum under acidic conditions and with calcium under alkaline conditions, rendering the phosphorus ion unavailable to water body.

**Potassium and Sodium content in soil sample:** Generally relatively small amount of potassium are need in fish ponds. Optimum concentrations of this element are unknown. However it is readily available absorbed by plant tissues and it is particularly effective in stimulating the growth of aquatic flora. Potassium content in the soil samples decreased from pre seedling stage to post seedling stage and it is present in the adequate quantity which is ideal for the plant growth. The decrease in potassium content indicates that potassium is used up in the growth of the carp and young fish consumed potassium more readily which has been observed in our studies. The study shows that potassium is a significant productivity limiting nutrient in fish pond.

**Heavy Metals in the soil sample:** The heavy metal toxicity is not observed in the present study. The traces of Pb, Ni, Cd, Hg

an Pd are observed in the study. The fish pond is away from the industries, traffic areas and mines. The fishes are not affected by the fish pond.

the present study has helped to formers and researchers for their future studies to improve the growth and productivity of fishes.

**Table-1**  
**Analysis of water samples before and after seedlings**

S. No	Characteristic property	Before seedling	After seedling
1	pH	7.24	7.12
2	Electrical conductivity	792 m.mohs	556 m.mohs
3	Turbidity	14.8 NTU	8.60 NTU
4	Total solids	609 mg/l	488 mg/l
5	Salinity	76.2 mg/l	56.1 mg/l
6	Nitrates	8.61 mg/l	4.96 mg/l
7	Calcium	59.2 mg/l	39.2 mg/l
8	Ammonium (NH <sub>4</sub> )	2.61 mg/l	0.70 mg/l
9	Phosphate (PO <sub>4</sub> )	0.26 mg/l	0.20 mg/l
10	Chlorides	85.2 mg/l	78.1 mg/l
11	Sulphates	18.24 mg/l	18.4 mg/l
12	CO <sub>2</sub>	0.28 mg/l	0.24 mg/l
	<b>Heavy Metals</b>		
13	Pb (ppm)	0.002	0.0016
14	Cd (ppm)	0.0014	0.0012
15	Hg(ppm)	<0.001	<0.001
16	Ni (ppm)	<0.01	<0.01
17	Pb (ppm)	<0.001	<0.001

**Table-2**  
**Analysis of soil samples before and after seedling**

Characteristic property	Before	After
pH	7.9	7.87
Electrical conductivity	882	146
N %	5.42	5.26
P %	4.96	3.94
K %	2.18	1.42
Na %	2.54	2.04
Organic carbon %	5.82	4.24
Heavy Metals		
Pb (ppm)	0.016	0.06
Cd (ppm)	0.028	0.10
Hg (ppm)	< 0.001	< 0.001
Ni (ppm)	< 0.01	< 0.01
Pd (ppm)	< 0.04	< 0.015

## Conclusion

It is necessary for the environmental and aqua culture researcher to control the ill effects caused by imbalance in the quality of water and soil of fish ponds for survival of aquatic animals. So

## References

- Ademoroti CMA. Standard methods for water and effluents analysis. *Foludex Press, Ibadan*. 28-76 (1996)
- American Public Health Association (APHA), Standard methods for examination of water and wastewater, 18<sup>th</sup> Edition (1992)
- Biggs J., Williams P., Whitfield M., Nicolet P. and Weatherby A., 15 years of pond assessment in Britain: results and lessons learned from the work of pond conservation. *Aquatic conservation; Marine Freshwater Ecosyst.* **15**, 693-714 (2005)
- Boyd C.E., Water Quality Mangement for pond for fish culture. *Elsevier scientific publishing company, Amsterdam* (1982)
- Boyd C.E., Water Quality Mangement and aeration in shrip forming (1989)
- B.R. Kiran, Physico-Chemical Characteristics of fish ponds of Bhadra Project at Karnataka, *Rasayan. J. Chem.*, **3(4)**, 671- 676 (2010)
- Das K.K., Biswas A.K. and Gangulu A.K., Recycle and re-use of industrial effluent for aquaculture-a case study, *Procession of National seminar on Utilisation of Resources, India.*, 73-78 (1990)
- David A., Studies on Fish and Fisheries of Godavri and Krishna River systems, *Proc. Natl. Acad. Sci. India*, **1(33)**, 163-286 (1963)
- Desia V.D., Physical chemical and biological test for Kankari lake, *Proc. Natl. Acad. Sci. India*, **22**, 131 (1982)
- Dhawan A. and Karu S. Pig dung as pond manure: Effect on water quality pond productivity and growth of carps in poly culture system. *The International Centre for Living Aquatic Resources Management (ICLARM) quarterly, Manila*, **25(1)**, 1-14 (2002)
- Eze. V.C. and Ogbaran I.O., Microbiological and Physico-chemical characteristics of fish pond water in ughelli, Delta state, Nigeria, *Inter. J. current research.*, **(8)**, 082- 087 (2010)
- Hrudayanthnanth Thatio et al. Water Quality Assesment of Aquaculture Ponds Located in Bhitarkanika Mangrove Ecosystem, Orissa, *India Tur.J. Fish. Aquat. Sci.*, **8**, 71-77 (2008)
- I-wudeidin Characteristics of pond water and bottom soil in channel cat fish pond in west central Alabama (2006)
- J.E. Ehiagbonare and Y.O. Ogumrinde, Physico – chemical analysis of fish pond water Okada ang its Environs, Nigeria, *African. J. Biotechnol.* **9(36)**, 5922-5928 (2005)

15. Mahazan A., Studies on seasonal variation of abiotic factors of fresh water pond at Barwan: (M.P), *Thesis of Ph.D Vikram University M.P.* (1995)
16. Mishra S., Aquaculture and Environment, *Yojana*, **4(9)**, 31-35 (1998)
17. Mohamed H. Ardo, Physico-chemical characteristics of afazabad ponds-Egypt, *Egypt, J. Aquatic research*, 1687-4285 (2000)
18. R.K. Trivedy and P.K. Goel, Chemical and biological methods for water pollution studies, Environmental Publ. Karad, India, 1 (1984)
19. Standard Methods, Standard Methods for the Examination of Water and Waste Waters (21st edn.), American Water Works Association (AWWA), Water Pollution Control Federation (WPCF) and American Public Health Association (APHA) Washington DC, USA (2002)
20. Parikh Ankita N. and Mankodi P.C., Limnology of Sama Pond, Vadodara City, Gujarat Research Journal of Recent Sciences, **1(1)**, 16-21 (2012)
21. Ganai H.A., Parveen S. and Khan A., Study of some physico-chemical parameters in medical pond, Aligarh, The Ekol, **10(1-2)** (2010)