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STUDIES ON PHYSICO-CHEMICO PARAMETERS ANALYSIS IN WHITE LEG SHRIMP *L. VANNAMEI* DIFFERENT CULTURE PONDS IN THONDI, RAMANATHAPURAM DIST, TAMILNADU

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ABSTRACT

The study was conducted to determine the physico-chemico parameters of selected 4 different ponds. R.R Aqua Farm Namputhalai, Thondi, Ramanathapuram Dist which is located at 9.7438° North Latitude and79.0185° East Longitude, Tamilnadu. The present study shown the total mean values of pH (8.1), Salinity (5.94 ppt), Electrical Conductivity (175 µmhos/cm), Total Dissolved Solids (216.95 mg/l), Total Alkalinity (149 ppm), Carbonates (31 ppm), Bicarbonates (118 ppm), Total Hardness (1427 ppm), Calcium Hardness (171 ppm), Magnesium Hardness (242 ppm), Nitrite (0.23 ppm), Ammonia (0.44 ppm) and Dissolved Oxygen (3.26 mg/l). Different co-relationships found between the water quality parameters in all the farming systems. The results have shown that all the tested parameters were maintained under optimal conditions which are suitable for *L. vannamei* farming.

KEYWORDS: Physico-chemical, water quality, pond water, White leg shrimp.

INTRODUCTION

Water is the second most important need for life to exist after air. As a result, water quality has been described extensively in the scientific literature. The most popular definition of water quality is "it is the physical, chemical, and biological characteristics of water. Aquaculture is one among the fastest growing food sectors in the world. Amongst the various branches of aquaculture, shrimp culture has expanded rapidly across the world because of faster growth rate of shrimps, short culture period, high export value and demand in the market. Water is the main source of energy and governs the evolution on the earth. 71% of earth surface is covered by water (CIA, 2008), 96.5% of the world's water is sea water which is salty that is not to be directly useful for irrigation.

Water quality is a measure of the condition of water relative to the requirements of one or more biotic species and/or to any human need or purpose, drinking, domestic and industrial purposes, 1.7% in groundwater, 1.7% in glaciers and the ice caps. According to an estimate about 70% of all the available water in our country is polluted due to the discharge of effluents from the industries, domestic waste, land and agricultural drainage (Shrivastava and Kanungo, 2013). Brackish water aquaculture is one of the fastest-growing food sectors in the world. Amongst the various branches of aquaculture, shrimp culture has expanded rapidly across the world because of the faster growth rate of shrimps, minimum culture period, more export value and demand in the market. In developing countries of east and Southeast Asia, shrimp aquaculture has become an important industry and contributes to the majority of the export both in terms of quantity and value. Currently, more than 70% of global shrimp production is coming from Asian countries and most of the produced shrimp are exporting to earn foreign exchange and economic development of the countries. India is one of the leading producers of farmed shrimp in the world. Although shrimp cultivation has an important contribution for the export earnings but still there's a space for improvement in total production through lateral growth and Better management Practices (BMPs). In this regard, the state of tamilnadu has the high productive shrimp producing brackish water aquaculture area in India, and it can be for its suitability for the wide expansion or development of the shrimp aquaculture. Majority of water available on the earth is saline in the nature only 3% of exists as fresh water. Fresh water has become a scare commodity due to over exploitation and pollution (Ghosh and Basu 1968: Gupta and Shukla 2006). The successful productivity of fish using ponds depends on the physical–chemical and biological characteristics of water used for fish cropping and the nutrition management of the aquaculture species. Aquaculture is the cultivation of the natural produce of water (fish, shellfish, algae and other aquatic organisms). Also known as aqua-farming, the term is distinguished from fishing by the idea of active human effort in

maintaining or increasing the number of organisms involved, as opposed to simply taking them from the wild (Kinsey, 2006). The subsets of aquaculture include mariculture (aquaculture in the ocean), algaculture (the production of kelp, seaweed and other algae), fish farming (the raising of catfish, tilapia and milkfish in freshwater and brackish ponds or salmon in marine ponds) and the growing of cultured pearls. Although the management of fish can be improved using increased protein component of fish diets by sources of protein derived from non-aquatic sources such as soybean meal (Webster et al., 1999; Duarte et al., 2007; Nelson, 2006), the poor conditions in the water such as the potential damage to ocean and coastal resources through habitat destruction, waste disposal, exotic species and pathogen invasions can affect fish productivity (Naylor et al., 2000). This present study aims to determine the magnitude of the physico-chemicao parameters analysis for the sustainability of pond shrimp culture in the area of Ramanathapuram District. This study is expected to give the information to pond shrimp farmers to increase their production. Water quality plays an important role in increasing the productivity of the pond. It provides nutritionally a balanced and healthy environment to cultured animals (Boyd CE. 1992). Sediment and water quality has a significant role in increasing the total production of the pond. However, in India, much fewer efforts have been made to assess the role of these parameters in the productivity of shrimp farms, and it necessitates attention for further research. Water quality management is important in aquaculture quality of the pond water is one of the main factors for the success of ~ 395 ~ International Journal of Fisheries and Aquatic Studies the shrimp aquaculture as shown in the (Table.1). Physical and chemical factors like temperature, salinity, total suspended solids (TSS), dissolved gases and nutrients influence the water quality directly or indirectly, which ultimately govern the healthy survival of organisms in the aquatic ecosystem and also salinity plays an important role in the physiological functions of culture organisms.

Table 1: optimum water quality parameters for white leg shrimp *l. vannamei* culture.

S.NO	Parameters	Measuring unit	Range
1	Salinity	PPt	20-35
2	pH		7.5-9
3	Alkalinity	Ppm	>120
4	Total hardness	Ppm	>1000
5	Calcium	Ppm	>150
6	Magnesium	Ppm	>450
7	Ammonia	Ppm	<1.0
8	Nitrite	Ppm	<0.5
9	DO	Ppm	>4
10	Hydrogen sulfide	Ppm	<0.01
11	Temperature	Celsius (°C)	30-40

MATERIALS AND METHODS

The study was conducted using four ponds (P1, P2, P3, and P4 located at R.R Aqua Farm Namputhalai, Thondi, Ramanathapuram Dist Ponds P1, and P4 were at a distance of 30 m Apart while ponds P2 and P3 were 10 m apart. The sizes of the ponds were 10 m long and 10 m wide with a depth of 1.4 m for Ponds P1 and P4, 20 m long and 15 m wide with a depth of 1 m for Ponds P2 and P3. Pond 1- 0.5 Hec and stocking density 40, Pond 2 - 0.3 Hec and stocking density 36, Pond 3 - 0.5 Hec and stocking density 30.92, Pond 4 - 0.5 Hec and stocking density 40. All the ponds were made of concrete made from the mixing of cement, sand and rough stones and received direct sunlight. The water fed into the ponds contained residual chlorine, the result of chlorination at the water treatment plant. The ponds did not have draining systems and, therefore, the water loss was through evaporation and underground seepage. All the ponds were open, with no fencing and, therefore, could be accessed by anyone.

Sample collection

Water Samples from the selected four ponds viz., P1, P2, P3, and P4 of R.R Aqua Farm Namputhalai, Thondi, Ramanathapuram District were collected in the bottles. All the precautions were taken during the sampling. The collected water samples were analyzed for different Physico-Chemico parameters such as for pH, Salinity, Electrical Conductivity, Total Dissolved Solids, Total Alkalinity, Carbonates, Bicarbonates, Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrite, Ammonia and Dissolved Oxygen by following the standard protocols (APHA, 2005). All the above analyses were performed in triplicate. The parameters present in the water sample can be calculated by using various methods. The pH of all the water samples was determined using a pH meter (Model no LI 127, Elico) Electrical conductivity was measured using a conductivity meter. The chloride, calcium, magnesium and total hardness were estimated by the standard methods of water.

RESULTS AND DISCUSSIONS

Water quality is one of the important factors in the determination of shrimp farm culture activity success. in shrimp ponds water quality is influenced by both environmental and management practices. The result analysis (Mean±SD) of the water quality parameters

analysis in white leg shrimp *L. vannamei* culture ponds of Namputhalai, Thondi, Ramanathapuram District in Tamilnadu was shown in Table. 2 In Shrimp ponds Water exchange is a management tool for that is intended to reduce organic and solid loadings in shrimp pond; if water exchange is not being practiced or is significantly reduced it could be expected that the concentrations of solids, nutrients, and organic matter would increase in the pond system. There are other environmental characteristics that might influence water quality; these are the nature and condition of the pond bottom, aeration level, Lime applications, feeding rate, and stocking density.

Table 2: Water quality parameters (Mean ±SD) in selected shrimp ponds from P1, P2, P3, and P4 of R.R Aqua Farm Namputhalai, Thondi, Ramanathapuram District.

Descriptive Statistics									
	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
pH_6:00:00 AM	320	1	8	9	2604	8.14	.009	.157	.025
pH_6:00:00 PM	315	1	8	9	2721	8.64	.009	.163	.027
Salinity _6:00:00 AM	320	12	32	44	12472	38.98	.204	3.647	13.303
Temperature _6:00:00 AM	320	6	36	42	12612	39.41	.080	1.436	2.061
Temperature _6:00:00 PM	320	16	19	35	8760	27.37	.083	1.482	2.197
Transparency_6:00:00 AM	320	28	0	28	5780	18.06	.575	10.286	105.808
Transparency_2:00:00 PM	320	32	0	32	6409	20.03	.634	11.333	128.435
Transparency_6:00:00 PM	320	38	0	38	7093	22.17	.703	12.582	158.314
Dissolved Oxygen_6:00:00 AM	320	6	0	6	1012	3.16	.109	1.958	3.833
Dissolved Oxygen_2:00:00 PM	320	7	0	7	1382	4.32	.142	2.535	6.426
Diss_2:00:00 PM	320	6	0	6	939	2.93	.102	1.831	3.354
Diss_1:00:00 AM	320	6	0	6	938	2.93	.100	1.788	3.197
Alkalinity_6:00:00 AM	320	90	75	165	34345	107.33	1.260	22.531	507.651
Alkalinity _6:00:00 PM	320	80	100	180	42070	131.47	1.098	19.641	385.767
Ammonia_6:00:00 AM	320	2	1	3	434	1.36	.020	.362	.131
Ammonia_6:00:00 PM	320	2	2	3	594	1.85	.020	.361	.130
Valid N (listwise)	315								

pH

The hydrogen ion concentration (pH) of pond water is considered as an index of environmental conditionals. It affects the chemical and biochemical reactions and controls the activities and distribution of aquatic fauna and flora (Verma and Shukla, 1969). In the study, the pH of eight pond water samples ranged from a minimum of Pond 1 water 7.6 to a maximum pond 4 is 8.5 (table 2) shown the difference of pH of pond water. According to George (1961) and Ali and Khan (1976) the pH values over 8.0 occur as a result of increased photosynthetic activity.

Temperature

Temperature is an essential parameter to influence the photosynthesis in water, physiological responses of culture organisms and decomposition of organic matter and subsequent biochemical reactions. It is also one of the most important factors controlling the growth of marine shrimp[7] a significant seasonal variation in the water temperature has been noticed among all the culture ponds from February to June due to the onset of summer. The high temperature will cause the high organic load formation and increase the bacterial loads in the culture ponds, during the study temperatures was noticed lowest 24.47±1.86 °C and highest 28.62±2.78 °C in the shrimp ponds due to high temperature (Table:2). Dissolved oxygen DO dissolving rate will increase in the pond water and it causes some physiological stress to the animal in the ponds.

Salinity

Salinity is the saltiness or dissolved salt content of a body of water. The salinity of four pond water values observed in between 4 and 10 ppt in the area of pond 2 and pond 4 found the variation of salinity in pond waters.

The present study showed the similar values to the previous study (Shrivastava and Kanungo, 2013). EC (Electrical Conductivity) Electrical conductivity (EC) is the ability of an aqueous solution to conduct the electric current. Electrical Conductivity is a useful tool to evaluate the purity of water (Acharya et al., 2008). Maximum electrical conductivity was recorded in the pond water of Nelamuru (198.4 µmhos/cm) village whereas minimum was in pond water of pond 1 (143.9 µmhos/cm) pond which has shown in table 2 (Kataria et al. (2011), and Shrivastava and Kanungo (2013) also reported a range of EC in between 296 to723 µmhos/cm and 115.11 to 212.13 µmhos/cm respectively.

Total hardness

Total hardness (Calcium and Magnesium) are essential nutrients for the shrimp. Calcium functions to minimize the rise in PH when photosynthesis rates are high. Hardness in all culture ponds was ranged from 3089.39±466.58 to 5408.82±538.45 observed (Table: 2).

Calcium (Ca)

Calcium is essential for the bones formation, shell formation of the crustaceans in the brackish water aquaculture calcium hardness ranges from lower is 346±112.7 and higher 896.51±131.5 was observed (Table: 2).

Magnesium (Mg)

Magnesium is essential for the development of natural plankton in water also mineral balance in the animal body plays a crucial role for the growth and development of the shrimp ranges from 998±101 to 1032±176 observed (Table: 2).

Total Ammonia

Ammonia is the main end-product of protein catabolism in crustaceans and can account for 40% to 90% of nitrogen excretion (Bower CE .1978). In the present study noticed that ammonia levels 0.8±0.07ppm in lower ranges and 1.1±0.09 ppm higher ~ 398 ~ International Journal of Fisheries and Aquatic Studies observed (Table: 2). Many of the farmers are careful about their culture ponds to maintain good water quality using pond care products weekly to lowering the ammonia levels in the ponds. Ammonia concentrations in water can be observed due to increase ammonia excretion by aquatic organisms diminishes, and levels of ammonia on blood pH and adverse effects on enzyme-catalyzed reactions and membrane stability. Ammonia increases oxygen consumption by tissues, gills, and reduces the ability of blood to transport oxygen. In water, ammonia may be derived from microbial metabolism of the nitrogenous compounds under low oxygen condition. Ammonia exists in water in both ionized (NH4) and unionized (NH3) forms. Unionized ammonia in aquaculture ponds is more harmful form of ammonia due to its ability to diffuse readily across cell membrane the fraction of NH3 depends on pH, temperature, and to a lesser extent on salinity (Parry G. 1960). As pH or temperature raises in the pond water, NH3 increases relative to NH4, and the toxicity of ammonia to animals, increasing pH level in a given ammonia solution could increase the ammonia toxicity to shrimp postlarvae.

Total alkalinity

Total alkalinity refers to the total concentration of carbonates, bicarbonates and other ions in water. Alkalinity, a measure of productivity of water is of primary importance in the ecology of the environment (Banerjea, 1972). In the current study, the maximum (210 ppm) values were observed in the palakoderu village and the minimum (90 ppm) values were observed in the pond 2 and pond3 these results were represented in table 2 respectively. The current study values were found to be well within the standard permissible limit of BIS (1991) and however according to WHO (1993). It is to be 200 mg/l.

Nitrate

Nitrite and nitrate concentration in the shrimp ponds play an significant role in primary production. The most important source of the nitrite and nitrate is biological oxidation of organic nitrogenous substances such as feed; manure/fertilizers/shrimp faces (Gopalkrishnan et al., 1997). The atmospheric nitrogen fixed as ammonia by the nitrates in pond waters. The concentration of nitrate was higher in experimental ponds 0.05-0.86 ppm (table 2). The highest amount of nitrate influences the high vegetation which supported the growth of plankton (Pandit and Solanki, 2004). The lowest amount of nitrate in water influences the utilization by plankton and aquatic plants (Verma et al., 2010).

DO (Dissolved oxygen)

The occurrence of dissolved oxygen is essential to maintain the higher forms of biological life and to keep proper balance of various pollutions thus making the water bodies healthy. The chemical and biochemical process undergoing in water body are largely dependent upon the presence of oxygen. In the current investigation (Table 2), the dissolved oxygen values occurred in between 2.43 mg/l and 4.29 mg/l respectively. Shrivastava and Kanungo (2013). Reported a rage of DO 2.43 - 4.45 mg/l in their study. Thirupathaiah et al. (2012) reported a range of DO in between 5.18- 9.72 mg/l.

CONCLUSION

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REFERENCE

1. Abdul-Farah, M., Ateeq, B., Ali, M.N., Ahmad, W., 2003: Evaluationof genotoxicity of PCP and 2,4-dichlorophenoxyacetic acid bymicronucleus test in

fresh water fish *Channa punctatus* (Bloch). Ecotoxicol. Environ. Saf., 54: 25–29.
2. Ali, Norhidayah, Jusoff, Kamaruzaman, Ali, Syukriah, Mokhtar, Najah and Salamt, Azni Syafena Andin. (20 December 2009). 'The Factors Influencing Students' Performance at Universiti Teknologi MARA Kedah, Malaysia'. Canadian Research & Development Center of Sciences and Cultures: Vol.3 No.4.
3. Bower CE, Bidwell JP. Jonization of ammonia in seawater, effects of temperature, pH and salinity. Journal of Fisheries Research Board Canada, 1978; 35(7): 1012-1016.
4. Boyd CE, AW Fast. Pond monitoring and management. In: Marine Shrimp Culture: Principles and Practices (eds. A.W. Fast and L. James Lester). Elsevier Science Publishers BV, 1992.
5. CIA. 2008. the world factbook" Central Intelligece Agency, Retrived. 20 December 2008.
6. Ghosh, B.B. and Basu, A.K. 1968. Observation on estuarine pollution of the Hooghly by the effluents from a chemical factory complex at Rashasa, west Bengal Env. Health, 10: 29-218.
7. Gopalkrishnan M, Radhakrishnan K, Dhami PS, Kulkarni VT, Joshi MV, Patwardhan AB, Ramanujam A, Mathur JN. Determination of trace impurities in uranium, thorium and plutonium matrices by solvent extraction and inductively coupled plasma atomic emission spectrometry. Talanta, 1997 Feb 1; 44(2): 169-76.
8. Kinsey, D., 2006. Seeding the water as the earth: epicentre and peripheries of a global aquacultural revolution. Environmental History, 11(3): 527–566.
9. Naylor, R.L., Goldburg, R.J., Primavera, J.H., Kautsky, N., Beveridge, M.C.M., Clay, J., Folke, C., Lubchenco, J.,
10. Parry G. Excetion. in T.H. Waterman, editor, the physiology of crustacean, Academic Press, New York, 1960; 1: 341-366.
11. Shrivastava S, Kanungo VK. 2013. Physico-Chemical Analysis of Pond Water of Surguja District, Chhattishgarh, India. International Journal of Herbal Medicine, 1(4): 35-43.
12. Thirupathaiah M, Samatha CH, Sammaiah C. Analysis of water quality using physico-chemical parameters in lower manair reservoir of Karimnagar district, Andhra Pradesh. International Journal of Environmental Sciences, 2012; 3(1): 172-80.
13. Verma A, Shukla UK. Deposition of the upper Rewa sandstone formation of proterozoic Rewa group of the Vindhyan Basin, MP, India: a reappraisal. Journal of the Geological Society of India, 2015 Oct; 86: 421-37.
14. Wyban JA, Ogle J, Pruder GD, Rowland LW, Leung PS. Design, operation, and comparative financial analysis of shrimp farms in Haweii and Taxes. Tech Report 86-6. The Oceanic Institute, Honolulu, Haweii, USA, 1987; 56.
15. Webster, C.D., Tiu, L.G., Margan, A.M., Gannam, A., 1999. Effect of partial and total replacement of fishmeal on growth and body composition of sunshine bass, Morone chrysops Morone saxatilis, fed practical diets. Journal of World Aquaculture Society, 30: 443–453.