

# STUDY ON PHYSICO-CHEMICAL PARAMETERS ASSESSMENT IN *L. VANNAMEI* PONDS OF SELECTED VILLAGES OF WEST GODAVARI DISTRICT, ANDHRA PRADESH

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## Abstract

The study was conducted to determine the physico chemical parameters of selected eight village's viz., Undi, Visakoderu, Nelamuru, Jonnalapalem, Navudur, Konthewada, Palakoderu and Dongapindi pond waters of West Godavari District which is located at 16°55'2.7" North Latitude and 81°20'23.79" East Longitude, Andhra Pradesh. The present study shown the total mean values of pH (8.1), Salinity (5.94 ppt), Electrical Conductivity (175  $\mu$ hos/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.

## Introduction

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,

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). 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).

Water quality in an aquatic ecosystem is determined by many physical, chemical and biological factors (Sargaonkar and Deshpande, 2003). The term water quality was developed to give an indication of how suitable the water is for human consumption (Vaux, 2001) and is widely used in multiple scientific publications related to the necessities of sustainable management (Parparov et al., 2006). Physico-chemical properties of the water gets varied season wise and in addition, anthropogenic activities such as agriculture, urbanization, domestic sewage, etc in the catchment area result in the deterioration of water quality (Verma et al., 2012). Temperature, turbidity, nutrients, hardness, alkalinity and dissolved oxygen are some of the important factors that play a vital role for the growth of living organisms in the water body. Chemical factors like dissolved gases, bicarbonates, nitrogen, phosphorus, silicon, calcium, magnesium etc. largely govern its productivity (Nath et al., 1994). Chemicals are a major source of water contamination that introduced during water movement through geological materials (Kataria et al., 2011). Fertilizers and pesticides are major contributors to water pollution. Weathering of rocks, leaching of soils and mining processing, etc., these are contaminate natural water (Manjare et al., 2010). This study aims to determine the magnitude of the physico-chemical parameters for the sustainability of pond shrimp culture in the area of West Godavari District. This study is expected to give the information to pond shrimp farmers to increase their production.

## Material and methods

### *Study area*

This investigation was carried out to assess the status of the pond water in West Godavari District. West Godavari District is situated between 16°55'2.7" North Latitude and 81°20'23.79" East Longitude. These ponds water is used for agriculture, fisheries and partially domestic activities. The present study was conducted to analyze physico-chemical properties of water in the selected eight ponds viz., Undi, Visakoderu, Nelamuru, Jonnalapalem, Navudur, Konthewada, Palakoderu and Dongapindi during the year of 2017-2018 of West Godavari District, Andhra Pradesh.

### *Sample collection*

Water Samples from the selected eight ponds viz., Undi, Visakoderu, Nelamuru, Jonnalapalem, Navudur, Konthewada, Palakoderu and Dongapindi of West Godavari District were collected in the bottles. All the precautions were taken during the sampling. The collected water samples were analyzed for different physico-chemical 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 discussion

The physico-chemical parameters such as pH, Salinity, EC (Electrical Conductivity), TDS (Total Dissolved Solids), Total Alkalinity, Carbonates, Bicarbonates, Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrite, Ammonia and Dissolved Oxygen of water were analysed for the water samples collected from the eight ponds viz., Undi, Visakoderu, Nelamuru, Jonnalapalem, Navudur,

Konthewada, Palakoderu and Dongapindi of West Godavari District. These parameters were taken from the eight selected ponds which have shown in table 1 and figure 1, 2 and 3 respectively.

#### *pH (Potentia Hydrogenii)*

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 Visakoderu village pond water 7.6 to a maximum Konthewada village 8.5 (table 1; figure 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.

#### *Salinity*

Salinity is the saltiness or dissolved salt content of a body of water. The salinity of eight village's pond water values observed in between 4 and 10 ppt in the area of Navudur and Visakoderu mandalam (table 1; figure 2) found the variation of salinity in pond waters. The present study shown 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  $\mu\text{mhos/cm}$ ) village whereas minimum was in pond water of Undi (143.9  $\mu\text{mhos/cm}$ ) village which has shown in table 1 and figure 2. Kataria et al. (2011), and Shrivastava and Kanungo (2013) also reported a range of EC in between 296 to 723  $\mu\text{mhos/cm}$  and 115.11 to 212.13  $\mu\text{mhos/cm}$  respectively.

#### *TDS (Total Dissolved Solids)*

The amount of total dissolved solids (TDS) in water indicates salinity of water and the higher values of total dissolved solids in natural waters are generally due to increased anthropogenic activity, stagnation and concentration of water. The current study represented the maximum (264.9 mg/l) values of TDS were found in the village of Nelamuru whereas the minimum (194.2 mg/l) values of TDS were found in the Jonnalapalem village (table 1; figure 2). Chavan et al. (1999) reported the TDS values in the range of 5 to 290 mg/l and Pawar et al. (2009) recorded TDS values between 186 to 284 mg/l.

#### *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 Navudur village and these results were represented in table 1 and figure 3 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.

#### *Total Hardness*

Hardness is caused due to the presence of metallic carbonates of  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Fe}^{+3}$  etc. The hardness of water is referred to by three types of measurements: grains per gallon, milligrams per liter (mg/L), or parts per million (ppm). The highest (1830 ppm) values of hardness were recorded in the Visakoderu village and the lowest (940 ppm) values of hardness were observed in the Konthewada village (table 1; figure 3) and the current study shown the similar values with Sathe et al. (2001) which has reported hardness to vary from 134 to 1800 mg/l of hardness.

### *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 1; figure 3). 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).

### *Ammonia*

Ammonia in water exists in two forms, as ammonium ions ( $\text{NH}_4^+$ ), which are nontoxic, and as the un-ionized toxic ammonia ( $\text{NH}_3$ ). The desirable range of ammonia for shrimp farming is less than 0.1 ppm. It was reported that the half of shrimp production was reduced due to the presence of ammonia at 0.45 ppm (Mazid, 2009). In this experiment, average ammonia content was 0.44 the maximum (1.35) values were observed in the Navudur village and minimum (0.01) values were observed in the Undi and Konthewada village (table 1; figure 3) respectively.

### *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 1; Figure 1), 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.

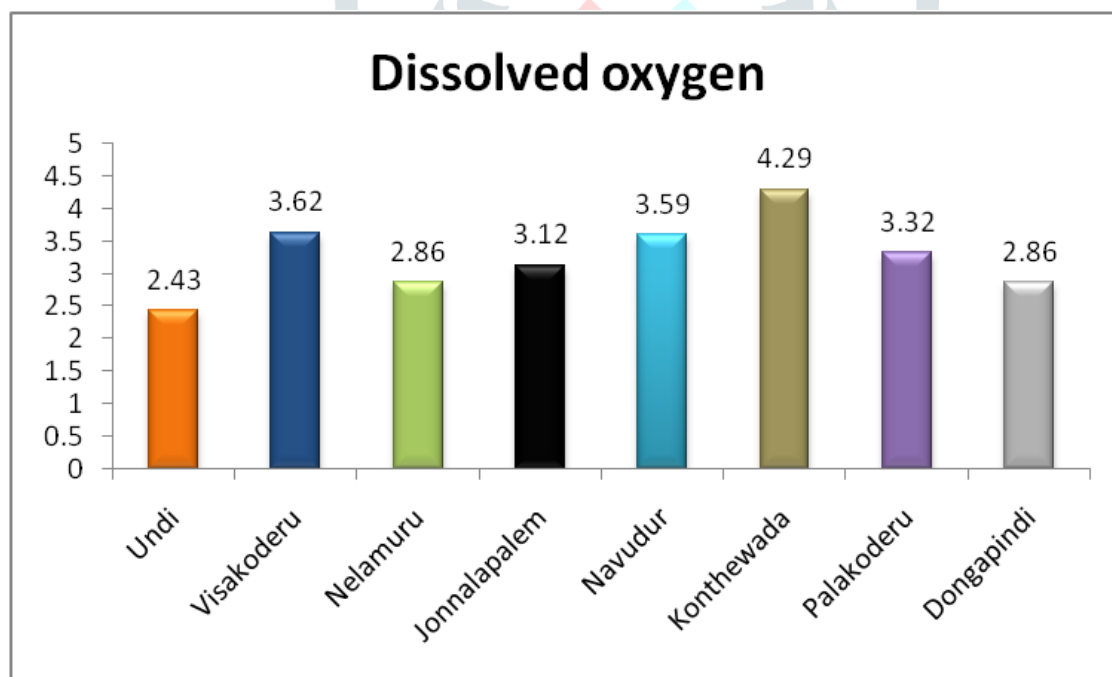
## Conclusion

This study is essentially for the lack of adequate knowledge of farmers about shrimp and prawn farming particularly about water quality parameters. The current study has provided the information about the status of water quality parameters of West Godavari District, Andhra Pradesh.

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Figure 1. DO (Dissolved Oxygen) determination of various pond in West Godavari District, Andhra Pradesh





	Undi	Visakoderu	Nelamuru	Jonnalapalem	Navudur	Konthewada	Palakoderu	Dongapindi
pH	8.4	7.6	8	8.1	7.9	8.5	8	8.3
salinity	5	10	5.5	6.5	4	6	5	5.5
EC	143.9	197.8	198.4	169.8	186.4	156.7	164.9	182.7
TDS	206.8	225.8	264.9	194.2	212.6	198.3	196.1	236.9
Total alkalinity	120	130	150	180	90	120	210	190
carbonates	30	30	40	50	0	10	60	30
bicarbonates	90	100	110	130	90	110	150	160
Total hardness	1420	1830	1560	1280	1360	940	1285	1740
calcium hardness	170	220	187	153	163	113	154	209
Magnesium hardness	241	311	265	217	231	160	218	296
nitrite	0.07	0.1	0.05	0.06	0.86	0.07	0.65	0.05
ammonia	0.01	0.1	0.06	0.13	1.35	0.01	1.23	0.68
dissolved oxygen	2.43	3.62	2.86	3.12	3.59	4.29	3.32	2.86



Figure 2. pH, Salinity, EC & TDS determination in different ponds of West Godavari District, Andhra Pradesh

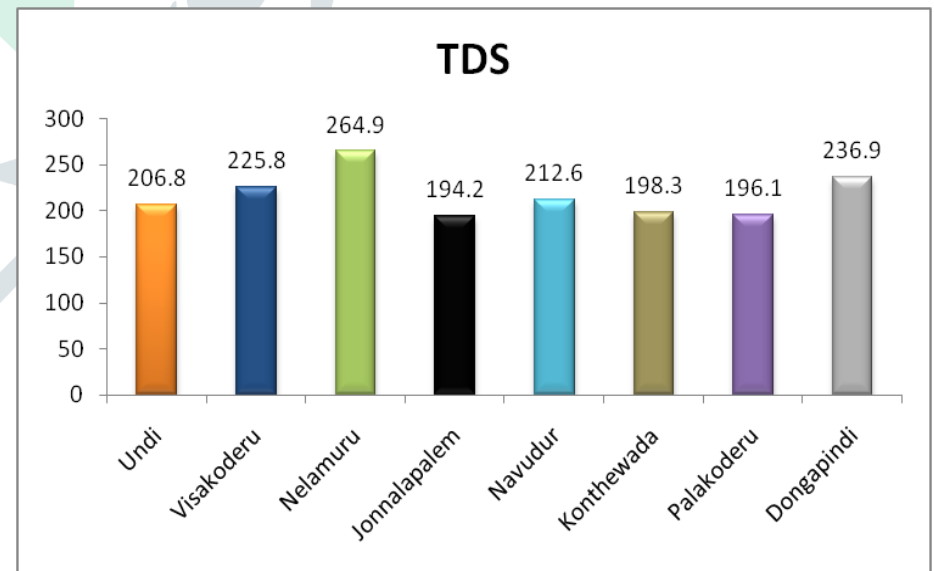
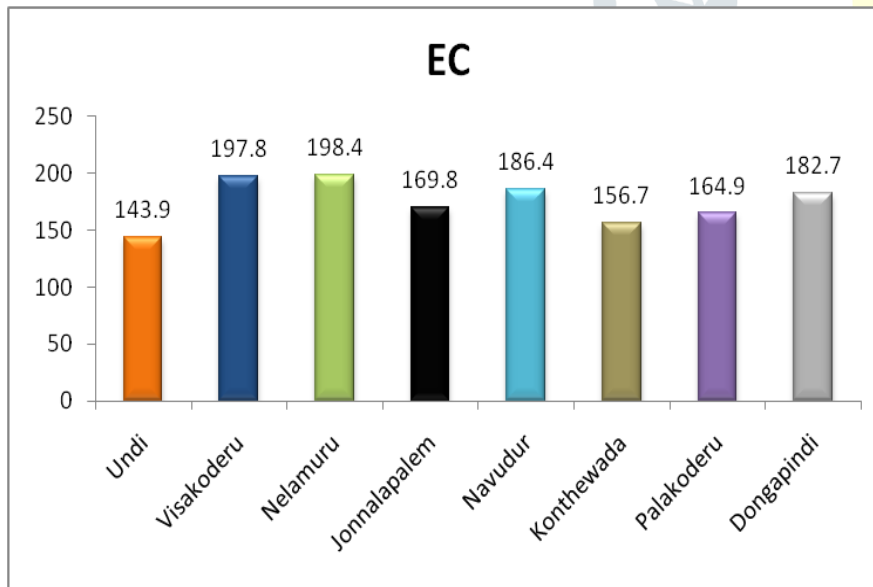
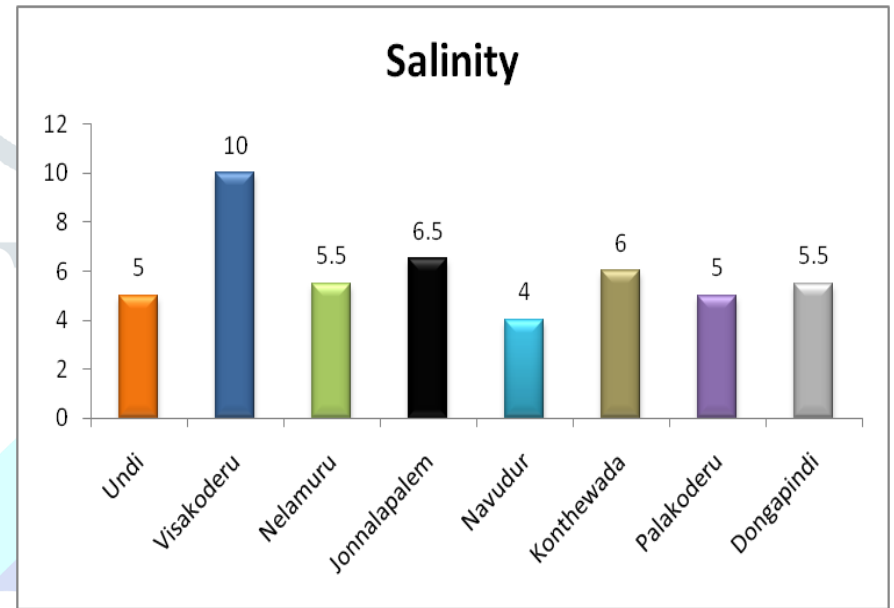
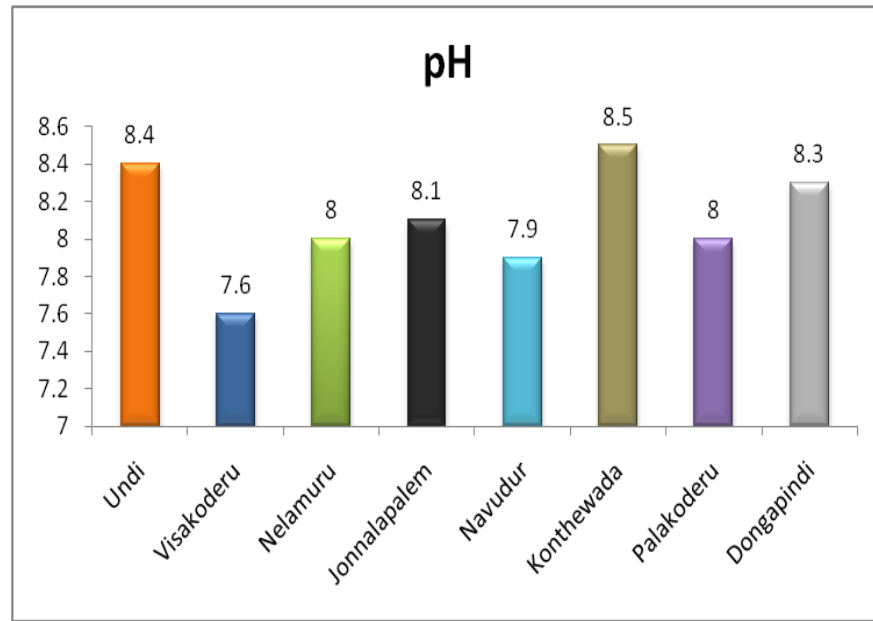
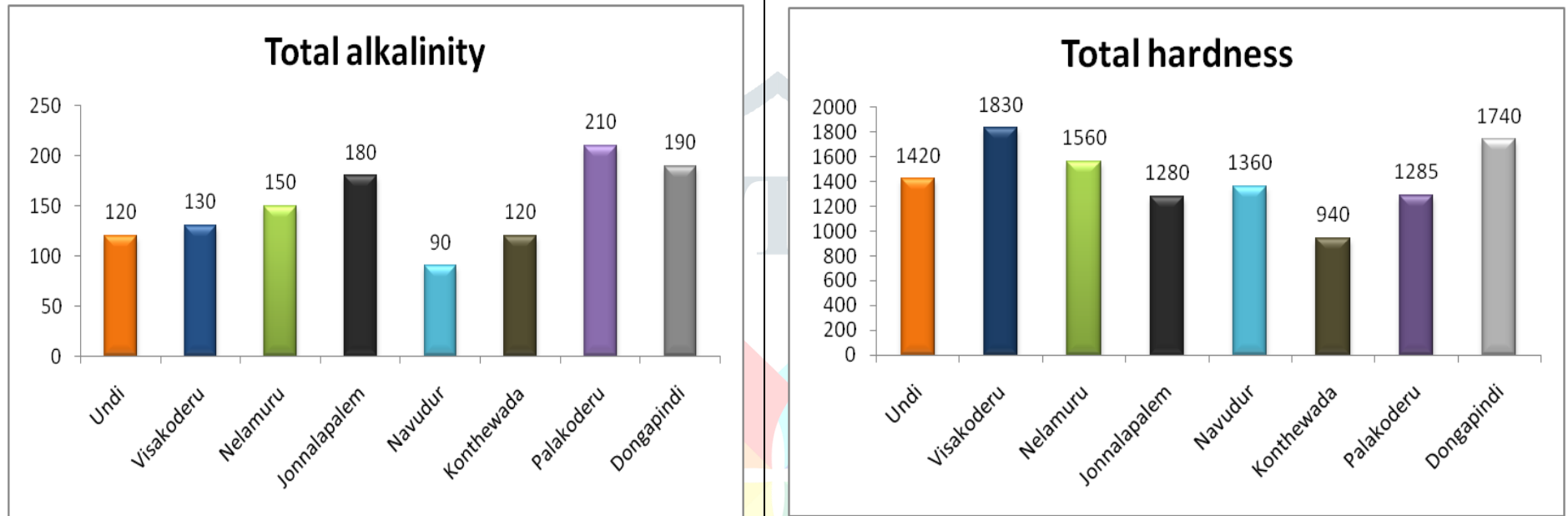
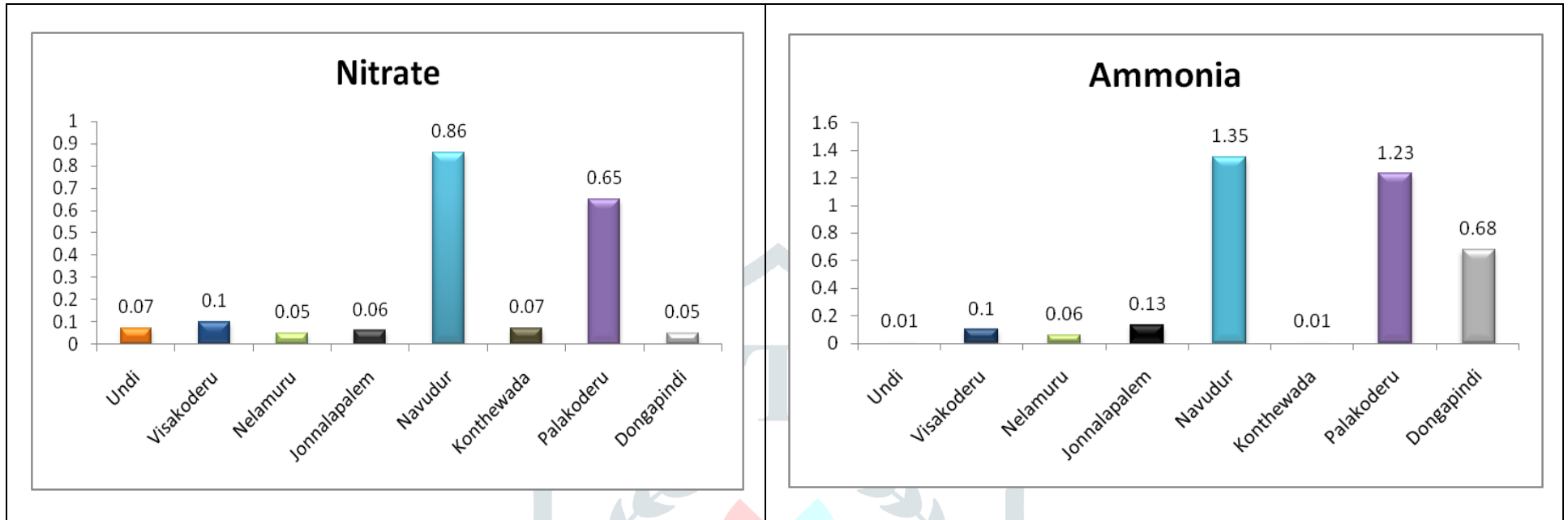


Figure 3. Total alkalinity, Total Hardness, Nitrate & Ammonia determination in different ponds of West Godavari District, Andhra Pradesh





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