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# Investigation of Chemical Parameters and Major Anions of Two Selected Aquaculture Ponds at Santosh Region, Tangail, Bangladesh

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**Abstract**
The study was conducted to analyze the chemical parameters and major anionic contents of water from Taltola and Mullahbari Pond at Santosh, Tangail during the months from January to March 2014. Chemical parameters such as pH, EC, DO, TDS, BOD and Alkalinity of all water samples were ranged from 7.56 to 7.78, 239.7 to 342 µS/cm, 4.3 to 5.7 mg/L, 123.7 to 175 mg/L, 2.1 to 2.63 mg/L and 87 to 154 ppm, respectively. On the other hand, the anions such as $F^-$, $Cl^-$, $NO_2^-$, $NO_3^-$, $SO_4^{--}$ were ranged from 0.221 to 3.8, 16 to 24, 2.5 to 3.8, 0.96 to 1.67 and 1.99 to 17.93 mg/L, respectively. In case of $Br^-$ the anionic value of water sample was not detectable.

**Key words:** Anions, Ion chromatograph, Chemical parameters

## Introduction

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities (Buchholz, 1998). Water quality is defined in terms of the chemical, physical and biological contents of water. The water quality of rivers and lakes changes with the seasons and geographic areas, even when there is no pollution present. Important physical and chemical parameters influencing the aquatic environment are temperature, rainfall, pH, salinity, dissolved oxygen and carbon dioxide. Others are total suspended and dissolved solids, total alkalinity and acidity and heavy metal contaminants. These parameters are the limiting factors for the survival of aquatic organisms (flora and fauna). Poor water qualities may be caused by low water flow, municipal effluents and industrial discharges (Chitmanat *et al.*, 2010).

Water is essential to all forms of life and makes up 50-97% of the weight of all plants and animals and about 70% of human body. Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its importance, water is the most poorly managed resource in the world (Fakayode, 2005). The aquatic environment with its water quality is considered the main factor controlling the state of health and disease in both cultured and wild fishes. Pollution of the aquatic environment by inorganic and organic chemicals is a major factors posing serious threat to the survival of aquatic organisms including fish (GAFRD, 2006). There are many ponds in Santosh region in Tangail and they are mostly important for aquaculture. Local people are dependent on these ponds for their livelihoods but they are not aware of pollution of the pond water in this area. So, it is needed to know the water quality status of these ponds. Keeping these points in thinking this study was conducted to determine the status of chemical parameters and major anions in water of two selected ponds in this area to investigate the status of aquatic environment of the ponds, develop public awareness and help in formulating guidelines regarding this problem.

## Materials and Methods

The study was conducted in two selected aquaculture ponds namely Taltola and Mullahbari Pond which are situated at Santosh region in Tangail district. The study was carried out from January to March 2014. The water samples were collected from three points of each of the two ponds. Plastic bottles were used for sample collection and before sample collection all the plastic bottles were properly cleaned by distilled water. Bottles were immersed below the water surface, filled brought out of the water and properly closed. Then they were labeled (date, time etc.) properly and preserved in a refrigerator.

The pH, dissolved oxygen (DO), electrical conductivity (EC), total dissolved solids (TDS) values of water samples were measured by a Sension 156$^{TM}$ Multi-parameter (APHA, 1998). Biological Oxygen Demand (BOD) was measured by following 5 days incubation method. Distilled water was taken in volumetric flasks. Then aerated air was passed in the flask by an air compressor. The aerated water was transferred into volumetric flask and the beaker was filled with distilled water up to the mark. Then the dissolved oxygen (DO) content of collected water sample was measured by using DO meter. Then the bottle was kept in an incubator for 5 days. After incubation, the dissolved oxygen was measured again by using DO meter. The difference of two DO values was calculated for

each sample and it was the BOD value (APHA, 1998). Alkalinity of the water samples were measured as $CaCO_3$ and done by titration. Mixed indicator (Bromocressol green + Methyl orange) was used here. The color of the solution changes from green to orange at the end point (APHA, 1998).

For measuring the anions ($F^-$, $Cl^-$, $NO_2^-$, $Br^-$, $NO_3^-$, $SO_4^{--}$), at first the samples were filtered with Qualitative filter paper (No. 1, Circles 90 mm Dia) and then kept in a 25 ml volumetric flask for each sample. Then the filtered samples were taken in vials by using syringe with micro-pipette filter. Every time the volumetric flasks, syringes and vials were washed with DI (De-ionized) water. Then the anions were determined using Ion-Chromatograph (Model: Shimadzu, CTO-20 AC SP) (APHA, 1998).

## Results and Discussion

***Physicochemical properties***

***pH***

The average pH values of Taltola pond were 7.65 in January, 7.78 in February and 7.7 in March (Table 1). The pH of Mullahbari pond was 7.61 in January, 7.56 in February and 7.75 in March (Table 1). According to De (2005), the usual pH range for freshwater aquatic system is 6.5 to 8.5 with most waterways around 7. Ganeshalingam *et al.* (2012) found pH ranged from 6.53 to 7.76 in pond water. The average values of pH of all the samples were suitable for aquaculture.

***Dissolved oxygen (DO)***

The average DO values of Taltola pond were 4.3 mg/L in January, 4.6 mg/L in February and 5.13 mg/L in March (Table 1). The DO of Mullahbari pond was 5.7 mg/L in January, 5.5 mg/L in February and 4.7 mg/L in March (Table 1).The optimum DO in natural water is 4 to 6 mg/L (De, 2005). According to Ganeshalingam *et al.* (2012), found DO of pond water ranged from 6.06 to 10.99 mg/L. The DO of all collected water samples were varied between 4.3 to 5.7 mg/L which was suitable for aquaculture.

***Biological oxygen demand (BOD)***

The average values of BOD of Taltola pond in January, February and March were 2.1, 2.2 and 2.4 mg/L, respectively (Table 1). The values of BOD of Mullahbari pond were 2.3, 2.2 and 2.63 mg/L in January, February and March, respectively (Table 1). Chowdhury (2007) recommended that optimum BOD level for aquaculture should be less than 6 mg/L. On the basis of measured BOD all water samples collected from Taltola and Mullahbari pond were within the acceptable range. So, from the observation of both of the pond it is seen that the BOD level was suitable for fish production.

**Table 1.** Physicochemical parameters of water

| Parameters | Taltola Pond | | | Mullahbari Pond | | |
|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Jan | Feb | Mar |
| pH | 7.65 | 7.78 | 7.7 | 7.61 | 7.56 | 7.75 |
| Dissolved oxygen (mg/L) | 4.3 | 4.6 | 5.13 | 5.7 | 5.5 | 4.7 |
| Biological oxygen demand (mg/L) | 2.1 | 2.2 | 2.4 | 2.3 | 2.2 | 2.63 |
| Total dissolved solids (mg/L) | 159 | 170 | 175 | 123.7 | 126.7 | 147 |
| Electrical conductivity (µS/cm) | 329.3 | 336 | 342 | 260 | 239.7 | 273.3 |
| Alkalinity (ppm) | 137 | 154 | 141 | 146 | 87 | 91 |

***Total dissolved solids (TDS)***

The average TDS values of Taltola pond was 159, 170 and 175 mg/L in January, February and March, respectively (Table 1). The TDS of Mullahbari pond was 123.7, 126.7, 147 mg/L in January, February and March, respectively (Table 1). According to DoE (2005), the standard value of TDS for freshwater is 500 mg/L. Measured TDS values of all samples collected from the study area was within the acceptable range.

***Electrical conductivity (EC)***

The average EC values of Taltola pond were 329.3, 336 and 342µS/cm in January, February and March, respectively. And the average EC values of Mullahbari pond were 260, 239.7 and 273.3 µS/cm in January, February and March, respectively (Table 1). The standard level of EC for fishing is 1000 µS/cm (ADB, 1994), All collected samples were within the acceptable range. So, these ponds were suitable for aquaculture.

***Alkalinity***

The average values of alkalinity of Taltola pond was 137, 154 and 141 ppm in January, February and March, respectively (Table 1). Alkalinity of Mullahbari pond was 146, 87 and 91 ppm in January, February and March, respectively (Table 1). The suitable value of alkalinity for aquaculture ranged from 50 to 300 ppm (James, 2000). So, from the observation of both of the pond it is seen that the alkalinity level was suitable for fish production. According to Ganeshalingam *et al.,* (2012), alkalinity of pond water ranged from 75.624 to 308.798 ppm.

***Anions***

***Fluoride ($F^-$)***

The average $F^-$ values of Taltola pond were 0.317, 0.308 and 0.38 mg/L in January, February and March, respectively (Table 2). The $F^-$ values of Mullahbari pond were 0.221, 0.276 and 0.375 mg/L in January, February and March, respectively (Table 2). The permissible limit of $F^-$ for surface water is 1.7 mg/L (EPA, 2001) and all the experimented values are lower than this limit. There is no specific source of $F^-$ in the experimented ponds and they are suitable for aquaculture.

***Chloride ($Cl^-$)***

The average $Cl^-$ values of Taltola pond were 21, 22 and 24 mg/L in January, February, and March, respectively (Table 2). $Cl^-$ values of Mullahbari pond were 16, 18 and 20 mg/L in January, February and March, respectively (Table 2). The permissible limit of $Cl^-$ for surface water is 250 mg/L (EPA, 2001) and all the experimented values are lower than this limit. So, the ponds are not harmful for aquaculture.

**Table 2.** Anionic constituents of water

| Parameters | Taltola Pond | | | Mullahbari Pond | | |
|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Jan | Feb | Mar |
| Fluoride (mg/L) | 0.317 | 0.308 | 0.38 | 0.221 | 0.276 | 0.375 |
| Chloride (mg/L) | 21 | 22 | 24 | 16 | 18 | 20 |
| Nitrite (ppm) | 3.5 | 2.5 | 3.8 | 3.2 | 2.5 | 2.8 |
| Nitrate (mg/L) | 1.34 | 1.67 | 1.5 | 1.16 | 0.96 | 1.14 |
| Sulfate (mg/L) | 1.99 | 2.27 | 2.64 | 9.27 | 11.73 | 17.93 |
| Bromide (mg/L) | ND | | | ND | | |

ND- Not detectable

***Nitrite ($NO_2^-$)***

The average $NO_2^-$ values of Taltola pond were 3.5, 2.5 and 3.8 mg/L in January, February and March, respectively (Table 2). The average $NO_2^-$ values of Mullahbari pond were 3.2, 2.5 and 2.8 mg/L in January, February and March, respectively (Table 2). The permissible limit of $NO_2^-$ for fishing water is 0.01 mg/L (EPA, 2001) and all the experimented values are higher than this limit. So, there is source of $NO_2^-$ in these ponds and are much harmful for aquaculture.

***Nitrate ($NO_3^-$)***

The average $NO_3^-$ values of Taltola pond were 1.34, 1.67 and 1.5 mg/L in January, February and March, respectively (Table 2). The average $NO_3^-$ values of Mullahbari pond were 1.16, 0.96 and 1.14 mg/L in January, February and March, respectively (Table 2). The permissible limit of $NO_3^-$ for surface water is 50 mg/L (EPA, 2001) and all the experimented values are lower than this limit. So, the ponds are not harmful for aquaculture.

***Sulfate ($SO_4^{-2}$)***

The average $SO_4^{--}$ contents of water samples of Taltola pond were 1.99, 2.27 and 2.64 mg/L in January, February and March, respectively (Table 2). Similarly the average $SO_4^{--}$ content of water samples of Mullahbari pond were 9.27, 11.73 and 17.93 mg/L in January, February and March, respectively (Table 2). The permissible limit of $SO_4^{--}$ for surface water is 200 mg/L (EPA, 2001) and all the experimented values are lower than this limit. So, the ponds are not harmful for aquaculture.

***Bromide ($Br^-$)***

$Br^-$ is the anion of the element bromine, which is a member of the common halogen element series that includes fluorine, chlorine, bromine and iodine. The anion value of Bromide of water sample was not detectable.

## Conclusions

The present research work was conducted to evaluate the chemical parameters and ionic constituents in water samples collected from two ponds at Santosh region in Tangail district. The collected water samples were analyzed for chemical parameters *viz*., pH, EC, TDS, DO, BOD, alkalinity and anions ($Cl^-$, $NO_2^-$, $SO_4^{--}$, $Br^-$, $F^-$ and $NO_3^-$). The present study shows that all of the samples (water) were within permissible limit regarding chemical parameters and anions except $NO_2^-$. The values of $NO_2^-$ were much higher than the permissible limit for fishing water and it should be minimized immediately. So, the $NO_2^-$ values are not suitable for aquaculture.

## References

ADB. (Asian Development Bank). 1994. Training Manual for Environmental Monitoring. Engineering Science Incorporation, USA. 2-16p.

APHA. 1998. Standard Methods for the Examination of Water and Waste water. 22th ed. Published by APHA, American Water Works Association, and Water Environment Federation.

Buchholz, R.A. 1998. Principles of environmental management. The Greening of Business, 2nd. Prentice-Hall, London, UK.

Chowdhury, J.A. 2007. Essays on Environment. Botomul Publication. Dhaka. Bangladesh. 33-35p.

Chitmanat, C. and Traichaiyaporn, S. 2010. Spatial and temporal variations of physical-chemical water quality and some heavy metals in water, sediments and fish of the Mae Kuang River, Northern Thailand. *International Journal of Agriculture and Biology*, 12 (6): 816-820p.

De, A.K. 2005. Environmental Chemistry. Fifth Edition, New Age International Publishers, New Delhi, India. 189- 242p.

DoE. (Department of Environment). 2005. Government of the people's Republic of Bangladesh, Ministry of Environment and Forest, Department of Environment.

EPA. (Environmental Protection Agency), U.S. 2001. Drinking Water Criteria Document for Silver (Final Draft). Environmental Criteria and Assessment Office, Cincinnati, OH.

Fakayode, S.O. 2005. Impact of industrial effluents on water quality of the receiving Alaro River in Ibadan, Nigeria. 1-13p.

GAFRD. 2006. General Authority for Fishery Resources Development. Year-Book of fishery statistics in Egypt, 1990-2005 Cairo.

Ganeshalingam, S., Jeyadevan, J.P. and Navaratnarajah, K. 2012. Physicochemical Analysis of Pond Water Samples from Selected Areas in Valukkai Aru Drainage Channel, Jaffna, Sri Lanka. 2 (1&2): 12-23p.

James, M.E. 2000. Water Quality and Recalculating Aquaculture Systems. Aquaculture Systems Technologies, LLC. New Orleans, LA. 16-28p.