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SHORT COMMUNICATION

SUITABILITY OF VARIOUS *GHER* WATER FOR SHRIMP CULTIVATION IN FAKIRHAT UPAZILA, SOUTHWEST BANGLADESH

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Abstract

The pH, EC, K^+, Ca^{2+}, Mg^{2+}, Na^+, CP, CO_3^{2-} and HCO_3^- were analyzed for water from different *ghers* in Fakirhat, Southwest of Bangladesh to profile out their suitability in shrimp farming. The range of pH was 8.35 to 8.62, EC was 4.75 to 6.80 dSm^{-1}, Na^+ was 15.06 to 19.35 $meqL^{-1}$, K^+ was 0.81 to 0.90 $meqL^{-1}$, Ca^{2+} was 32.71 to 35.37 $meqL^{-1}$, Mg^{2+} was 4.73 to 5.66 $meqL^{-1}$, CP was 142.0 to 188.5 $meqL^{-1}$, $CO_3^{2'}$ was 45 to 75 $meqL^{-1}$ and HCO_3^- was 0.20 to 0.40 meq^{-1} and it was concluded that the concentration of K^+, Ca^{2+}, Mg^{2+} and the pH levels of the investigated *ghers* were suitable for shrimp farming. However, the levels of Na^+, CP, CO_3^{2-} and HCO_3" exceeded the standard levels and restricted shrimp farming. The results were statistically significant except for CP and $HC0_3^-$.

Key words**:** Suitability, Shrimp culture, Water quality, *gher*, Chemical parameters, Standard levels.

Shrimp culture over the coastal areas has been expanded and spreaded during the decades of seventies and eighties as a result of high demand and price in the international market. However, the fast growing shrimp industry has also several impacts over social, economic and environmental impact. The impact of shrimp culture on the environment is not related to the EU ban but to the overall practice of shrimp culture in Bangladesh. Therefore, the sector brings along a number of problems and risks for the environment. Environmental impacts in terms of salinity of the soil, reduction in agricultural production, decreases in case in cattle production and destruction of mangrove forests have been the reasons for concern for the inhabitants of the region as well as for the policy makers. The salinity of south western part of Bangladesh is very high due to excessive shrimp farming *(baghda).* The water from shrimp ghers at four locations of Fakirhat upazila of Bagerhat has been analyzed to assess the water quality and suitability for shrimp cultivation.

Twelve water samples were randomly collected during 01 December, 2010 plastic bottles (500 ml) after rinsing it with water to be sampled 2 to 3 times. Water samples were filtered and analyses were done on arrival at the laboratory.

The pH was estimated by pH meter and Electrical conductivity (EC) was estimated by EC meter. Potassium and Sodium were determined by Flame emission spectrophotometer (Jenway, Model: PFP-7) and Calcium and Magnesium were determined by titrimetric method. Chloride (Cl^-) and carbonate and bicarbonate were determined by titrimetric method (Jackson, 1973). The chemical properties of the samples are presented in Table 1. Table l. Chemical parameters of the water samples collected from different *ghers* of Fakirhat Thana.

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Sample no	Chemical Parameters								
	PH	EC dSm -i	Na^+ meqL -i	K^+ meqL -i	Ca^{2+} $meqL^{-1}$	Mg^{2+} $meqL^{-1}$	Cl^- $meqL^{-1}$	CO_3^{2-} $meqL^{-1}$	HCO3" $meqL^{-1}$
1	8.40	6.45	19.35	0.89	32.71	4.73	177.5	45	0.25
2	8.35	6.65	16.12	0.81	35.37	5.58	159.5	60	0.20
3	8.62	4.75	15.06	0.84	35.25	5.66	142	75	0.30
4	8.57	6.80	18.01	0.90	34.36	5.53	188.5	60	0.40
SL	7.5	5.5	10	0.5	30	2.71	140	30	0.2

SL = Standard Level (Ahmed, 2000).

The pH of the samples ranged from 8.35 to 8.62 (Table 1). The EC ranged from 4.75 dSm^{-1} to 6.8 dSm^{-1}. The potassium ranges from 0.84 to 0.90 meq L^{-1} . The potassium levels varied from shrimp farms to farms (Table 1). Potassium levels of all farms were found to be>0.8$meqL^{-1}$.

The sodium levels of water samples of four shrimp farms ranged from 15.06 to 19.35 $meqL^{-1}$. The standard level of Na^+ for water is 10 $meqL^{-1}$. And the highest mean value of Na^+ found 19.35 $meqL^{-1}$ in first shrimp farms. The Na^+ levels varied from shrimp farms to farms (Table 1). Na^+ levels of all farms were found to be >15$meqL^{-1}$. The Calcium levels of water samples of four shrimp farms ranged from 32.71 to 35.37 $meqL^{-1}$. The value of Calcium for standard water is 30$meqL^{-1}$. And the highest mean value of Ca^{2+} was found 35.37$meqL^{-1}$ in second shrimp farm. The Calcium value varied from shrimp farms to farms (Table 1). Calcium levels of all farms were found to be >30$meqL^{-1}$.

The levels of $Mg^{2+}$of the water samples of four shrimp farms ranged from 4.73 to 5.66 $meqL^{-1}$. The value of Mg^{2+} for standard water is 2.71 $meqL^{-1}$. And the highest mean value of Mg^{2+} was found 5.66 $meqL^{-1}$ in third shrimp farm. The Mg^{2+}value varied from shrimp farms to farms (Table 1). Mg^{2+} levels of all farms were found to be >4 $meqL^{-1}$.

The levels of Cl^- of the water samples of four shrimp farms ranged from 142 to 188.5 $meqL^{-1}$. The value of CP for standard water is 140$meqL^{-1}$. And the highest mean value of Cl^- was found 188.5 $meqL^{-1}$ in fourth shrimp farm. The Cl^- value varied from shrimp farms to farms (Table 1). Cl^- levels of all farms were found to be >140$meqL^{-1}$. In this experiment, the highest mean value of CO_3^{2-} from third farms was 75 $meqL^{-1}$ and the highest mean value of HCC>3 from fourth farms was 0.4 $meqL^{-1}$. The value of CO_3^{2-} and HCCV for shrimp farms and control value of water samples for four different farms are presented in (Table 1).

In Bangladesh standards, the levels of water quality parameters are given in Table 1 and compared the obtained levels of the parameters. These standard levels and obtained levels showed their suitability of water in Fakirhat Thana (Ahmed, 2000).

According to WHO (1993) the standard pH value for saline water is 7.5 and fresh water is 7.0. The collected water samples were saline in nature. So it remains in this standard limit and some exceeds the limit levels. So the collected water samples were suitable for shrimp cultivation and the highest mean value of pH was found 8.62 in third shrimp farm. The pH value varied from shrimp farm to farm (Table 1). pH levels of all farms were found to be >8. Higher pH levels of compared to standard water pH levels were observed due to the high Ca^{2+}, Mg^{2+}, Na^{+}, and HCO_3^- in water which is harmful for shrimp cultivation (Table 1). Ayers and Westcot (1994) mentioned that the normal pH for water is usually from 6.5 to 8.4. Water with a pH between 7 and 8.3 are in a range that will promote microbial activity, but may limit P, Fe, Mn, Cu and Zn availability at toxic level and help to increase availability of these nutrients under alkaline condition. Little variation in pH value can make available form of nutrients to unavailable non soluble form. Phosphorus availability is highly affected by pH along with other nutrient as Ca^{2+}. The increasing rate of pH was statistically significant, so that this increasing rate of pH would have significant impact on water quality for shrimp culture (Table 1). Higher EC levels of compared to standard water levels were observed due to the presence of high amount of Na^{+}, K^{+}, Ca^{2+} and Mg^{2+}. Thus water has slight to moderately restriction on use of shrimp farms based on EC levels. EC is an indirect measurement of water salinity. Sample collected from shrimp farms show high EC value than the standard water quality value, but near to the standard value. So the water has less suitable to use of shrimp cultivation and water samples are saline in nature. The value of EC is statistically insignificant, so that this value of EC would have no significant impact on water quality for shrimp cultivation. Higher potassium levels were found in the collected samples, compared to the standard levels of the water quality were observed due to the presence of some potash bearing minerals like Sylvite (KC1) and Potassium nitrate (KNO_3) (Table 1). The range 0.89 to 0.81 $meqL^{-1}$ and 0.84 to $0.90meqL^{-1}$ indicated optimum and medium potassium respectively (Muslem *et al,* 2005). Excess potassium may cause deficiencies in Magnesium and Calcium. Thus reduced growth or death of growing stages of shrimps. The K^{+} value is higher than the standard value, so for high alkalinity the shrimp culture of the *ghers* may be restricted and hampered. The value of potassium has statistically significant, so concentration of K^{+} has significant impact on water quality for shrimp culture.

Higher Sodium levels were observed, compared to standard value of water quality due to the presence of salts, various wastes materials and fertilizers (Table 1). The recorded quantity of Sodium in all collected water samples is greater than the standard value. So, the concentration of Sodium has significant impact on water quality for shrimp culture. The contribution of Calcium content in water was largely dependent on the solubility of $CaCO_3$, $CaSO_4$ and rarely on $CaCl_2$. The observed levels of Calcium are compared with the standard value of water quality (Table 1). The observed levels of Calcium in all shrimp farms exceed the standard limit value of water quality. So shrimp culture may be limited or hampered for the presence of excess Calcium in water. This releasing Calcium was statistically significant, so that this concentration of Ca would have significant impact on water quality for shrimp culture.

Higher Mg^{2+} levels of the collected water samples of various *ghers*, compared to standard levels of water quality were observed due to the utilization of various kinds of fertilizers (Table 1). Excess Mg^{2+} is harmful for shrimp production so, shrimp farms of Fakirhat Thana may be fall in problem and production of shrimps and may be hampered or restricted. The amount of releasing Magnesium was statistically significant, so the concentration of Mg^{2+} would have significant impact on water quality for shrimp culture in Fakirhat Thana.

In this experiment it is clear that all the analyzed levels of the collected water samples are more than the standard water quality levels. Bad effect of excess amount of chlorine is not reported yet. But Cl^- works on the photosynthesis reactions in plants. So there is a possibility to enhance photosynthesis (Bennett, 1993). So Cl^- can enhance the photosynthesis of algae and other flora which is food source for shrimp and indirectly can enhance the shrimp production of the *ghers*. The levels of Cl^- for determine the water samples of different farms and standard value of water are presented in (Table 1). The amount of realized Chloride is statistically insignificant, so the concentration of Cl would have no significant impact on water quality for shrimp culture.

The value of CO_3 and HCO_3 varied from farms to farms (Table 1). Presence of Carbonate and Bi-carbonate make the water color whitish and thus may have some effects on temperature. Carbonates and Bi-Carbonates both are responsible for buffering system. Beside this the high pH value and high Carbonate and Bi-Carbonate presence diminishes Ca^{2+} availability and uptake by the plant. Thus reduce plant growth and shrimp production. The Carbonate levels of the water samples of *ghers* exceed the standard limit which is not suitable for shrimp cultivation. On the contrary the HCCV levels of the water samples collected from Mulghar and Uttarpara is nearer to the standard value and the levels exceeds the standard level in Fakirhat and Soyedmoholla, so considering bi-carbonate the first and second *ghers* are suitable for shrimp cultivation where as rest of the *ghers* are not suitable for this. The amount of releasing CO_3^{2-} was statistically significant, so that this concentration of CO_3^{2-} has significant impact on water quality for shrimp culture. On the other hand the amount of releasing HCO_3^- statistically insignificant, so that this concentration of HCO_3^- would have no significant impact on water quality for shrimp culture.

Conclusion

The experiment was carried out to test the impact of water of four shrimp ghers of Fakirhat Thana under Bagerhat district to evaluate its suitability for shrimp cultivation. The concentration of K^+, Ca^{2+}, Mg^{2+} and the pH under the investigated area were not problematic to use safely for shrimp farm. On the other hand Na^+, Cl^{-1}, CO_3^{2-} and HCCV have been at moderate toxic level. The maximum concentration of Na^+ (19.57 $meq.L^{-1}$) was found at sample no. 1A in the first farm and HCO_3^- (10 $meq.L^{-1}$) was found at sample no. 3C in third farm. Results were statistically significant except for K^+ and HCO_3^-. Evaluation showed that fourth shrimp farm is most effectively increased the levels and concentrations of different chemical parameters.

It is evident from the above discussion that all water samples under investigation were not found suitable for shrimp farms. More or less all water samples of the study area are suitable only basis of one or two particular criteria but was not able to satisfy all parameters of the water quality. Alkalinity hazard were observed for all samples. Hence they were not suitable for specific purpose because their long term use may affect the soil permeability, destroy soil structure, increase osmotic potential etc. and can affect the cultivation of shrimp. Sustainable technology should be adopted for the treatment of these water samples in the investigated area for the suitability for shrimp cultivation

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