WATER QUALITY ASSESSMENT OF EFFLUENTS FROM SHRIMP PONDS FARMING

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Abstract: Shrimp aquaculture has become lucrative venture in many of countries in Asia. Water from the shrimp farm contained various substances which can contaminate the water that is resulting from overfeeding to the shrimp, antibiotics or other medicine used to protect shrimp, nutrients and suspended solids. Therefore, the objective of this study is to characterize the water quality of effluent and to be compared with the standard. Water sample were collected from at the point where the water was discharged from the ponds. Analysis of parameters include water temperature, pH, dissolved oxygen, turbidity, total dissolved solids, total suspended solids, biological oxygen demand, chemical oxygen demand, and ammonia nitrogen. The result shows all the parameters analyzed were below the standard limit.

Keywords: Shrimp aquaculture, water quality, pond effluent

INTRODUCTION

Aquaculture is the farming of aquatic organisms including shrimp which has been increased worldwide. Aquaculture of shrimp throughout the world has laid a very exponential growth as generate good social and economic that benefits in areas where it is developed [2]. Shrimp aquaculture usually built near to the coastal ecosystem as aquaculture used resources from environment and interact with environment. However, exponential growth in shrimp aquaculture caused many impacts towards environment [4].

Shrimp farming uses various chemicals for the shrimp growth which can make the shrimp production run smoothly. Chemicals used also gives benefits to the shrimp as it can prevent disease to the shrimp and also to promote growth of the shrimp where the chemicals were resulting from feed, antibiotic or medicine for protecting the shrimp. The water quality of the water from the shrimp pond will be decreases as concentration of nutrient and organic matter is high [5].

The uses of chemicals for shrimp growth, overfeeding of pellets to the shrimp cause the water in the shrimp pond to be polluted. The water polluted that is result from the shrimp ponds will be discharge to the coastal ecosystem. Usually, the effluent from the shrimp farm is directly discharge to the aquatic ecosystem without treatment where the effluent is contained high concentration of nutrients and organic matter. Therefore, the effluent that has not been treated can cause many implications towards environment (Nyanti et al., 2011).

Therefore, there is an obvious need to characterize the water quality of the effluents from the shrimp pond and to be compared with the standards in order to prevent adverse effect to the environment.

METHODOLOGY

Samples were taken at the shrimp farm that is located at Pekan, Pahang. The samples of the effluents were collected at four different of shrimp ponds. The sampling point for each pond was at where the water from shrimp pond was discharged. The water samples collected was analysed to determine the level of the parameters involved and compared with the Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979 (Department of Environment, 2000). The water samples were collected using 1L bottle plastic.

In-situ data of temperature, pH, dissolved oxygen (DO) was collected by using kit probe instrument or YSI meter. For turbidity, data was collected by using turbiditimeter. For ex-situ data, the parameters include Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Dissolved Oxygen (TDS) and Ammonia Nitrate was analyzed at the Toxicology laboratory of Universiti Malaysia Pahang. During sampling, American Public Health Association (APHA) and HACH standard procedures were followed for transportation and preservation of water samples. Sampling bottle for BOD will be used separately [1].

Ammonia nitrogen (NH3-N) was determined by using spectrophotometer. COD was analyzed in reactor digestion method. For BOD, the first reading was taken right after collecting the samples. The water samples were preserved in incubator for 5 days at temperature of 20°C. The final reading for BOD was taken after 5 days, and it was calculated with the formula. TSS and TDS were analyzed by using standard glass-fiber filter method where a well-mixed sample is filtered. The filtrate was evaporated to dryness in a weighed dish and will be dried to constant weight at 180°C.

RESULTS AND DISCUSSION

Water quality of the effluent is important to be characterized in order to manage the shrimp farming for a good shrimp production and also preventing the effluents from giving negative impact to the environment.
Temperature
The temperature obtained at the shrimp ponds were 29.5°C, 29.4°C, 29.2°C and 29.3°C for pond 1, pond 2, pond 3 and pond 4 respectively. The temperature at pond 1 was higher because the water sample was collected during afternoon where the water was heated by the sunlight caused the water warm. The average for the temperature which is 29.4°C was below the standard B limit.

pH
The pH value of the water samples at shrimp ponds from in-situ measurements were ranged between 6.9 and 7.4 showing acidity condition and neutral condition which near to alkaline condition. The average of the pH value obtained from the shrimp ponds with 7.2 was within the range of Standard B limit.

Dissolved Oxygen (DO)
The highest value is 7.03 mg/L which is for pond 4 and the lowest DO value is 6.69 mg/L which is at pond 1. For pond 2 and pond 4, both shows the value of 6.81 mg/L and 6.94 mg/L respectively. The water sample from pond 1 was collected at afternoon where the temperature was higher at that time. As the temperature was high, the DO level will be decreased because warm water can hold less oxygen than cold water. However, the DO average still falls within the range of acceptable limit.

Turbidity
The reading for the turbidity shows the highest reading with 18.00 NTU was at pond 1 has the while pond 2 shows the lowest reading for turbidity with 15.00 NTU. Pond 3 and pond 4 shows a reading of 17.70 NTU and 16.80 NTU respectively. Turbidity at pond 1 was high and turbid water was appeared to be cloudy which is resulted from suspended solids or plankton.

Total Dissolved Solids (TDS)
The value for TDS that was obtained from laboratory analysis was 29.09 mg/L, 26.91 mg/L, 28.25 mg/L and 27.76 mg/L at pond 1, pond 2, pond 3 and pond 4 respectively. Water that contains high concentration of TDS is unstable and potentially unhealthy. However, the high concentration of TDS at pond 1 was still falls below the standard B.

Total Suspended Solids (TSS)
Total suspended solids shows that pond 1 has the highest value with 1.611 mg/L while the lowest value is at pond 2 with 0.833 mg/L. Pond 3 and pond 4 shows a value of 1.043 mg/L and 1.501 mg/L respectively. High concentration of suspended solids in the water can reduced the quality for water in the ponds. The concentration of suspended solid is below the limit of standard B which is 100 mg/L.

Biological oxygen demand (BOD)
For Biochemical Oxygen Demand (BOD5) measurement obtained BOD5 value was 24.6 mg/L, 14.4 mg/L, 23.7 mg/L and 18.0 mg/L at pond 1, pond 2, pond 3 and pond 4 respectively. Effluent that contain of high BOD level will caused the bacteria in the river growth rapidly and the oxygen level in the river will be decreased. The average for BOD is below the limit of standard B.

Chemical oxygen demand (COD)
For COD, pond 1 shows the highest value with 44.47 mg/L while pond 2 shows the lowest value with 23.25 mg/L while pond 3 and 4 shows a value of 42.83 mg/L and 27.76 mg/L respectively. All the COD value recorded from the water sample of the effluents from shrimp ponds in still not exceed the standard limit that have been stated in the Standard B of Environmental Quality (Sewage And Industrial Effluents) Regulations.

Ammonia Nitrogen
Ammonia Nitrogen content observed in shrimp farm waters was 0.26, 0.67, 0.39 and 0.52 at pond 1, pond 2, pond 3 and pond 4 respectively. Pond with high concentration of ammonia nitrogen can be toxic to the shrimp but also can serve as nutrient for phytoplankton, algae and plants when in small concentration.

The result for the effluent of shrimp ponds can be seen clearly from bar chart in Fig. 1 that the effluent was below the standard limit of standard B Environmental Quality (Sewage And Industrial Effluent) Regulations, 1979. Therefore, the effluent can be categorized as clean which means will not impact to the environment.

Table 1 Comparison between result and Standard B

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Result</th>
<th>Standard B</th>
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</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>29.4</td>
<td>40</td>
</tr>
<tr>
<td>pH</td>
<td>7.2</td>
<td>5.5-9.0</td>
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<tr>
<td>Dissolved oxygen (mg/L)</td>
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<td>-</td>
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<tr>
<td>Turbidity (NTU)</td>
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<tr>
<td>Ammonia Nitrogen (mg/L)</td>
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<td>Total suspended solids (mg/L)</td>
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<tr>
<td>Total dissolved solids (mg/L)</td>
<td>28.00</td>
<td>-</td>
</tr>
<tr>
<td>Biological oxygen demand (mg/L)</td>
<td>20.18</td>
<td>50</td>
</tr>
<tr>
<td>Chemical oxygen demand (mg/L)</td>
<td>34.58</td>
<td>200</td>
</tr>
</tbody>
</table>

Fig. 1 Comparison between result and standard
CONCLUSION

The study reveals that the effluents from the shrimp farming is falls below the standard limit when compared with the Standard B of Environmental Quality (Sewage and Industrial Effluent) Regulations. The water management for water quality of the shrimp pond was been monitored by the owner systematically. That is the activities to make sure the shrimp can getting enough nutrients and also can prevent the shrimp to be stressed because of the poor water quality. Therefore, continuous monitoring of effluent before been discharged is required to prevent high concentration of chemical

REFERENCE


