The Impact of Component Modification of “Double Bottom Filter” Recirculation System to Concentration of Ammonia in Water and Survival Rate at Rearing Media of Blue Devil Fish (*Chrysiptera cyanea*)

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Abstract

Jacqueline M.F. Sahetapy, Daniel G. Louhenapessy, and Elna C. Riry. 2016. The Impact of Component Modification of “Double Bottom Filter” Recirculation System to Concentration of Ammonia in Water and Survival Rate at Rearing Media of Blue Devil Fish (*Chrysiptera cyanea*). *Aquacultura Indonesiana*. 17 (1): 26-29. Blue devil (*Chrysiptera cyanea*), blue damselfish, is a variety of marine ornamental fish. In rearing ornamental fish, water quality management is required to maintain the optimal condition of water quality. Filtration and recirculation are proven as preminent ways to manage the optimal condition of water quality in aquarium as the vessel for rearing ornamental fish. Simple recirculation system double bottom filter was applied in this research with treatments of components modification of the system. The objective of the research was to identify the concentration of ammonia in rearing media of blue devil (*C. cyanea*) using recirculation system double bottom filter with several modification components. The treatments are *i.e.* (1) no recirculation/aeration only (treatment A), (2) system with components of sand and dacron (treatment B), (3) sand and sponge (treatment C). The result showed that the ammonia concentration in system A (control) was 0.890 mg/L, system B (sand and dacron) was 0.129 mg/L, and system C (sand and sponge) was 0.7 mg/L. The highest value of survival rate was in system B (components sand and dacron) which valued 90%. As the conclusion, component sand and dacron in recirculation system double bottom filter provided better performance in reducing ammonia in rearing media of blue devil (*C. cyanea*) which also confirmed with the survival rate value.

Keywords : Ammonia; Blue devil fish; Component modification; Double bottom filter

Introduction

Blue devil (*C. cyanea*), blue damselfish, is a variety of marine ornamental fish. The color of the fish is attractive and resistant to environmental change therefore it is usually used as a starter fish of marine culture in seawater aquarium (Rajasekar *et al.*, 2009). The attractive body shape and color of blue devil influences people for culturing them hence the fish categorized as high economic value commodity. For this reason, the exploitation of blue devil is becoming greater and extinct its population. To conquer this problem, the fish is needed to be cultured. To accomplish the success in rearing and culturing blue devil, the stability of optimal condition of water quality in rearing this fish has to be kept. Some factors influenced the stability of rearing media are *i.e.* quality of water source and maintain the quality of rearing media (water). The water used in rearing blue devil is required to fulfill good quality of physics, chemical, and biological parameters (Widowati *et al.*, 2005).

Recirculation system is a system that using water continuously by circulate the water to cleanse it in a filter afterward run it back to rearing media (Fauziah *et al.*, 2013). Recirculation system maximizes water re-use by employing comprehensive water treatment system. Water

treatment processes typically are solid removal, infiltration, gas balancing, oxygenation and disinfection (Oparaku and Nnaji, 2013). The components of recirculation system are physics/mechanical filter, biological filter, and chemical filter. Simple recirculation system double bottom filter, known as undergravel filter, is common recirculation system in ornamental fish lover. This filter is a form of corrugated plastic filter that causes a space between filter and bottom of aquarium for cleaned water, and by using the materials such as gravel or coarse sand, this filter capable to bind toxic material/element that endanger the fish. Recirculation is purposed to increase dissolved oxygen, reducing ammonia content and organic sewage produced by the fish, and skimp water. The objective of this research was to identify the concentration of ammonia in rearing media of blue devil (*Chrysiptera cyanea*) using recirculation system double bottom filter with several modification components.

Methods

Fish Stocking

The fish were hatching product from Balai Perikanan Budidaya Laut Ambon. The

sizes were ranged 3.5-3.7 cm of length and 0.24 g weight. The fish were acclimatized for 7 days in prepared aquarium. The water quality parameters were measured twice a day of experiment. The parameters were *i.e.* physical parameters (temperature, pH, salinity, and DO) and chemical parameter (ammonia and nitrate) were measured every week. The fishes were stocked at densities of 5 per aquarium. Feedings using ornamental fish pellet were conducted three times a day (08:00, 12:00, and 17:00) to satiation. This research used 3 treatments and 3 replications per treatments. The treatment A (without sand, dacron and sponge), B (sand and dacron) and C (sand and sponge).

Sampling and Observation

Ammonia concentrations were observed once a week during the rearing period. The fish were fasted a day before data collected due to reduce stress condition of fish during the scaling.

Data Analysis

The data were analyzed using Microsoft Excel 2010 and descriptively presented in tables and graphics.

Results and Discussion

Ammonia concentration

Ammonia concentrations during the rearing of blue devil were shown in Figure 1. Figure 1 explained that the concentrations of ammonia were increasing each week. Treatment A (control) and C (sand and sponge) were significantly in increasing compared to Treatment B (sand and dacron). Average concentrations of ammonia at first week were found 0.044 mg/L then rose to 0.176 mg/L for treatment A, 0.056 mg/L for treatment B, and 0.10 mg/L for treatment C at second week of rearing. At third week concentrations became 0.454 mg/L for treatment A, 0.09 mg/L for treatment B and 0.30 mg/L for treatment C. At fourth week concentration became 0.891 mg/L for treatment A, 0.129 for treatment and 0.70 mg/L for treatment C. The result showed that the highest concentration of ammonia was at treatment A and the lowest was at treatment B.

Component modification from recirculation system double bottom filter using sand and dacron provided better result to reduce concentration of ammonia compared to component

of sand and sponge or without component modification (only aeration). It could be assumed that dacron which composed of synthetic fiber has smaller pores than sponge's. Dacron commonly utilized as filter media of aquarium, rarely utilized as filter component in recirculation system double bottom filter. The capacity of double bottom filter was improved related to the smaller the filter component size. The smaller the size of filter component, the larger the surface directly contacted to water that subsequently offered better filtration process. It was proved that recirculation system double bottom filter was effective in reducing nitrogen waste such as ammonia.

Ammonia is one of the important sources of nitrogen for the living system (Li *et al.*, 2015). The major source of ammonia in seawater aquarium derived from excretion products of fish and other heterotrophic organism (organism that lived by consume organics material) (Emerson *et al.*, 1975). Fish release ammonia through gills and the amount is lesser than the urine. It is the reason the aquariums are requiring a mechanism to restrain ammonia excreted up to more toxic level. Heterotrophic bacteria are also being main source of ammonia in aquarium (Choo and Caipang, 2015). For example, feeds consumed by fish which broken down by bacteria activity will produce ammonia that is being released into the water.

Survival Rate

The survival rate of blue devil during the rearing process showed different values of each treatment. The highest result was at treatment B (sand and dacron) then followed by treatment C (sand and sponge) and treatment A (control) which valued 100%, 70%, and 50%, respectively. The survival rate is affected by internal and external factor. Internal factors are such as disease, feed and age while external factors are such as stocking density, disease and water quality (Effendi, 1997). Figure 2 depicted the survival rate of blue devil (*C. cyanea*). The survival rate in this research not affected by disease, feed, age and stocking density but affected by the recirculation system especially treatment C (combination between sand and sponge). The highest survival rate were in treatment C (combination between sand and Dacron) because Dacron filter are constructed of a polyester that performs chemical, biological and mechanical filtration. The surface area provided allows the colonization of large numbers of nitrifying bacteria.

Figure 1. Ammonia Concentrations during the Rearing of Blue Devil (*C.cyanea*)

Figure 2. The Survival Rate of Blue Devil (*C. cyanea*)

Water Quality Parameters

During the rearing process, the parameters of water quality showed that the values were in optimal range for life of blue devil. The temperature was ranged from 26.33 to 27.77°C, the salinity varied between 33.04-34.50 ppt, the pH was ranged between 8.32-8.38 and the DO was varied from 4.88 to 5.09 mg/L. Water quality management could be conducted by controlling each parameters (pH, temperature, and salinity). Blue devil properly lives in water with pH value ranged between 8.1-8.4 and temperature ranged between 25-28°C (Bapary *et al.*, 2011). Table 1 showed the value of each parameter of water quality measured during observation.

Table 1. Value of Water Quality Parameter in Blue Devil Rearing

Time (Week)	Parameter of Water Quality			
	Temperature (°C)	Salinity (ppt)	pH	DO (mg/L)
1	27.37	33.04	8.32	4.88
2	27.77	33.57	8.38	4.95
3	26.33	33.60	8.34	4.89
4	26.50	34.31	8.36	5.09
5	27.37	34.50	8.35	4.97

Conclusion

Based on the result, it could be concluded that modification of component recirculation system double bottom filter using

composition of sand and Dacron provided better result in reducing ammonia and increasing survival rate compared to composition of sand and sponge.

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