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Optimalization of Water for Nursery and Rearing of Asian Redtail Catfish (*Mystus nemurus* C.V)

Optimalisasi Pemanfaatan Air pada Pendederan Ikan Baung (*Mystus nemurus* C.V)

Mulyadi[*1], Niken Ayu Pamukas[1]
[1]Department of Aquaculture, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
*Correspondent Author: mulyadi@lecturer.unri.ac.id

ABSTRACT

Fish culture activities usually release wastes to environments such as faeces, urine, uneaten food and other by-product metabolism activities. For increased water quality, ideally in aquaculture media, various methods could be used, such as filtering techniques and sinking and dissolving methods. Various filter materials could be used to increase water quality, such as silt, gravel, charcoal, coconut shell, palm fiber, and zeoliteThe study on the effect of recirculation systems using various filter materials and aquaponic systems on water quality has been carried out. Several filter materials were used in four kinds of treatment, namely aquarium using aerators (control), aquarium using silt, gravels and palm fiber (recirculation), aquarium using mustard greens (aquaponic system) and aquarium using spoons (recirculation). The study results showed that different filter materials significantly affected nitrate and nitrite concentration in the catfish culture media. It was invented that the treatment of a recirculation system combined with an aquaponic system could increase water quality parameters such as CO2 (7.99 - 11.98 mg.L-1), NH3 (0.02 - 0.07 mg.L-1), NO2 (2.43 - 0.02 mg.L-1), NO3 (4.32 - 0.04 mg.L-1) respectively. Still, the other water quality parameters were similar. The best results were achieved at the same treatment, namely absolute growth rates (4.01 g), daily growth rates (1.96 %) and survival rates (91.11 %), respectively.

Keywords: Asian Redtail Catfish (*Mystus nemurus* C.V), Filter Materials, Resirculation, Aquaponic

ABSTRAK

Kajian pengaruh sistem resirkulasi menggunakan substrat filter berbeda dan sistem akuaponik terhadap kualitas air telah dilakukan. Penelitian ini menggunakan rancangan acak lengkap 1 faktor dengan 4 taraf perlakuan dan 3 kali ulangan. Sebagai taraf perlakuan adalah empat bahan filter berbeda yaitu, akuarium menggunakan aerator (kontrol), akuarium menggunakan lumpur, kerikil dan ijuk (resirkulasi), akuarium menggunakan sawi (sistem aquaponik) dan akuarium menggunakan spons (resirkulasi). Penelitian menunjukkan bahwa bahan filter yang berbeda berpengaruh nyata terhadap konsentrasi nitrat dan nitrit pada media budidaya ikan baung. Hasil penelitian menunjukkan sistem resirkulasi akuaponik memberikan hasil yang terbaik yang memberikan kisaran CO_2 7,99 - 11,98 mg.L^{-1}, NH_3 0,02 - 0,07 mg.L^{-1}, NO_2 2,43 - 0,02 mg.L^{-1}, NO_3 4,32 – 0,04 mg.L^{-1}, namun suhu dan pH relatif tidak berbeda nyata, laju pertumbuhan absolut sebesar 4,01 gram, laju pertumbuhan harian 1,96 % dan kelulushidupan 91,11 %.

Kata Kunci: Ikan Baung (*Mystus nemurus* C.V), Bahan Filter, Resirkulasi, Akuaponik

INTRODUCTION

Fish culture activities usually release wastes to environment such as feses, urine, uneaten food and other by-product methabolism activities. Aquaculture system with zero water exchange such as stagnant fish pond, waste disposal concentration of ammonia (NH_3), nitrite (NO_2) and CO_2 will increase steadily and they have poisonous substances toward fish culture. Aquaculture waste disposal of fish is a part of fish methabolism activities which is contining mostly ammonia. Fish releases ammonia (N-inorganic) approximately 80 – 90 % through osmoregulation process, while feses and urine are only 10 – 20 % from total nitrogen (Rakocy et al. 1992). Ammonia accumulation in aquaculture media could decrease water quality and it will affect the fish production.

In order to increase water quality ideally in aquaculture media, various methods could be used such as

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filtering technique, sinking and disolving method. Various filter materials could be used to increase water quality such as silt, gravel, charcoal, coconut shell, palm fiber and zeolite. Furthermore, several techniques such aeration, water exchange and filtration could be used to improve water quality so that negative impact of bad water quality on fish culture can be overcome (Mulyadi et al., 2010).

Asian redtail catfish (*Mystus nemurus* C.V) compare with other freshwater fish namely Nile and carp; catfish productivity is lower than those fish. It is caused by high mortality at larvae and juveniles stages. In contrary, market demand needs more the fish as fish consumption. So that, the best new technology to optimize water utilization for nursery and rearing the fish, it should be invented and juveniles in good quality and quantity could be produced every times as seed input in aquaculture activities to produce fish for consumption.

Aquaculture intensive technique should be implemented in catfish culture system in order to speed the fish growth especially through improving water quality management at all phases of fish life cycle such as breeding, larvae rearing, fingerling rearing and growing for fish consumption. Rearing of larvae and fingerling phases is very important to produce seeds in good quality for growing in ponds and cages. If fish seed size in weight up to 100 g/fish, they will grow well rather than the smaller ones.

Innovation technology of resirculation system using various filtering materials could decrease waste disposal and increase productivity. Besides that, other technology using various filter materials are also increasing productivity. Furthermore, other technology could be implemented in fish aquaculture integrating with plants as aquaponic system. Aquaponic as bio-integration related with resirculating aquaculture with plant production or hydroponic (Diver, 2006). Aquaponic technology could produce fish optimally at limited land and water in city areas (Ahmad et al., 2007). Principically, the technology not only used limited water and limited land but also it could more efficient through utilizing of nutrient from methabolic disposal and it is one of fish aquaculture technique as environmental friendly.

Water as fish aquaculture media should be prevented its qualities and quantities. The fish media as closed system where all fish activities as well as waste disposal from methabolism activities are released to the water environment. All wastes in form of organic and inorganic will accumulate in water bodies and they will affect water quality negatively and then it will need more water exchange to maintain good water quality in aquaculture media.

Resirculation system at fish aquaculture activities could give advantages such as maintaining environmental condition to support fish growth. Resirculation system can also control water quality and it has positive correlation with improving water quality. Aquaponic technology as an alternative could be implemented in order to overcome limited water for aquaculture activities. Besides that, aquaponic technology has other advantages such as vegetables production for fish farmer. So that, resirculation system as well as aquaponic at nursery and rearing of Asian redtail catfish as one solution to raise effectiveness of water utilization and finally to increase fish production.

MATERIALS AND METHOD

Research location and time

The research was conducted in the Laboratory of Aquaculture Technology, Fisheries and Marine Sciences Faculty, Universitas Riau.

Experimental design

Design of the research planning was experimental model using Complete Random Design as long as 12 weeks with treatments as follows :

P_0 = 50 catfish juveniles per each aquarium using aerators (control).

P_1 = 50 catfish juveniles per each aquarium using silt, gravels and palm fiber (resirculation).

P_2 = 50 catfish juveniles per each aquarium and 50 mustard greens (aquaponic system)

P_3 = 50 catfish juveniles per each aquarium using spons (resirculation).

Resirculation system using silt, gravels and palm fiber (P_1) and using mustard greens (*Brassica juncea)* as biofilters (aquaponic) (P_2) and thickness of each filter materials was 3 cm

Materials and tools

Water recirculation systems and aquaponic containers were placed in the Laboratory of Aquaculture

Technology, Fisheries and Marine Sciences. The equipment as an aquarium was used for fish rearing with the size of (60 x 40 x 40) cm^3, filled with a water volume of 48 l, and completed with a water pump of 20 watts to flow water toward rearing containers. Filter aquarium (silt, gravels and palm fiber) and mustard green media made of the plastic channel with the size of (300 x 15 x 10) cm^3. Furthermore, water in filter containers and mustard green media will flow through small pipes (PVC) with diameters of 2.5 cm toward growing containers (aquarium). The comparison between filtering media with fish rearing containers was 1 : 2. More detail can be seen in Figure 1.

Figure 1. Construction of resirculation system and aquaponic

The test fish used was Asian redtail catfish which came from the hatchery of the fish spawning and breeding laboratory majoring in aquaculture, faculty of fisheries and marine, Universitas Riau, measuring 4.75±0.25 cm, while mustard greens used in this research was already have 3 leaves as filtering plants. Fish meal used in the research was fish floating pellet made of FF-999 factory (with composition of 38 % protein, 4 % fat, 6 % fiber and water content of 12 %.

Data Collection

Several data were collected over a long research period, such as former weight and final research weight, total fish meal for fish, total die fish, TAN concentration, Nitrite (NO_2^-), Nitrate (NO_3^-), Ammonia (NH_3), dissolved oxygen (DO), temperature, Carbon dioxide (CO_2) and pH. All the data were used to calculate daily growth rates, biomass, feed efficiency, survival rates, feed conversion ratio (FCR) and fluctuation of TAN, NH_3, NO_2^-, and NO_3^-. Several parameters have been examine as follows:

Daily growth rates. According to Metaxa et al. (2006) daily growth rates could be measured using formula as follows:

$$\alpha = \left(t\sqrt{\frac{\overline{Wt}}{\overline{Wo}}} - 1 \right) \text{x } 100\% \quad (1)$$

Description:

α = daily growth rates (%)

$\overline{Wt}$ = average fish weight at the end of the research (g)

$\overline{Wo}$ = fish weight at early research (g)

t = length of research period (day)

Absolute growth rates. Absolute growth rates could be measured using formula of Effendie (1986) as follows :

$$Wm = Wt - Wo \quad (2)$$

Description:
Wm = absolute growth rates (g)
Wt = average growth weight at the end of the research period (g)
Wo = average of fish weight at the beginning of the research (g)

Survival rates. According to Zonneveld et al. (1991) survival rates of could be calculated using the formula as follows:

$$SR = \frac{Nt}{No} x\ 100\% \qquad (3)$$

Description :
SR = survival rates of fish (%)
Nt = total of life fish at the end of research period (fish)
No = total of life fish at the beginning research period (fish)

Total ammonia nitogen (TAN), Nitrite (NO_2^-) and Nitrate (NO_3^-). Values of TAN nitrite and nitrate were obtained by measuring using a spectrophotometer. Comparison of absorbance values from samples and standard multiplied with using liquid concentration. TAN concentration, nitrite and nitrate were obtained by using a formula according to APHA (1989) :

$$TAN\ (mg/l) = (Cst\ x\ As)/Ast \qquad (4)$$

Description:
Cst = concentration of liquid standard
Ast = absorban values of standard liquid
As = absorban values of sample liquid.

Research procedure

Closed resirculation system using various filter materials and aquaponic system separated with culture fish media to isolate organic disposal wastes as long as fish culture period. Containers for fish culture media made of aquarium with size of (60 x 40 x 40) cm^3 with capacity of 48 litres of water and completed with water pump with power of 20 watts. Filtering materials (gravel, silt and palm fiber) and mustard greens which were completed with carcoal and sterofoam for growing media of mustard greens made of plastic channels. Furthermore, water in filtering aquarium as well as mustard greens media will flow again through PVC pipes (diameter of 2.5 cm) to the fish growing containers. Research was conducted for 7 days without containing fish in aquarium to establish all system run well. Fish meal was given as many as 10% from fish body weight (only once for 7 days).

Main research activity

Main research activity was conducted after beginning research activity was completely finish. Main research was conducted after all culture media were fully functioning. Biological parameters were measured as long as research period namely absolute growth rates, daily growth rates, survival rates, physical and chemical parameters such as TAN fluctuation, NH_3, NO_2^-, NO_3^-, dissolved oxygen (DO), temperature, carbondioxide (CO_2) and pH.

Data analysis

All data were analized using variance analysis such as daily growth rates, biomass, feed efficiency, survival rates, feed conversion ratio (FCR). If data analysis were different the data would be analized again using Newman Keuls test. Water quality parameters were analized descriptively in form of graphs and figures.

RESULT AND DISCUSSION

Starting research activity

Water quality parameters (temperature, dissolved oxygen, carbondioxide, pH, ammonia, nitrite and nitrate) at the prior research are presented on Table 1. Based on Table 1, it could be concluded that at the formerly research along 7 days, all systems of the research facilities run properly especially water flow from all containers (aquarium) as well as filter materials. Results of water quality monitored at beginning research period showed that almost all treatments have the same results. It was predicted that the fish were not placed in culture media so that organic material from fish meal was only used for bacteria growth.

Table 1. Water quality parameters at the beginning research activity

Parameters	Treatments				
	Unit	P_0	P_1	P_2	P_3
Temperature	^0C	29	29	29	29
pH	-	5	5	5	5
DO	mg/L	3.80	3.90	3.90	3.80
CO_2	mg/L	9.98	9.98	8.89	10.18
NH_3	mg/L	0.02	0.02	0.02	0.02
NO_2	mg/L	0.05	0.04	0.04	0.05
NO_3	mg/L	0.06	0.05	0.04	0.05

Main research activity

Besides water quality parameters were recorded as long as main research period, absolute fish growth rates, absolute length growth rates, daily growth rates and survival rates were also recorded as explained below.

Water quality

Observation results of temperature, pH, dissolved oxygen (DO), carbon dioxide (CO_2), ammonia (NH_3), nitrite (NO_2^-) and nitrate (NO_3) as long as research period could be seen on Table 2. From the Table 2, it seems that as long as research period, water temperature was recorded around 29-31 ^0C and it is appropriate to support fish growth. According to Boyd (1990) suitable difference water temperature for living organisms is not more than 10 ^0C and range temperature for tropic organisms is around 25-32 ^0C.

Table 2. Average of water quality as long as research period

Parameters	Treatment				
	Unit	P_0	P_1	P_2	P_3
Temperature	^0C	29 – 31	29 - 31	29 – 31	2 9 – 31
pH	-	5 – 6	5 - 6	5 – 6	5 – 6
DO	mg/L	3.80 - 4.50	4.10 - 4.80	3.90 - 4.90	4.50 - 4.90
CO_2	mg/L	15.98 - 17.97	9.98 - 11.98	7.99 - 11.98	11.18 - 13.98
NH_3	mg/L	0.02 - 0.09	0.02 - 0.08	0.02 - 0.07	0.02 - 0.09
NO_2	mg/L	5.02 - 0.05	4.40 - 0.04	2.43 - 0.02	4.60 - 0.05
NO_3	mg/L	6.87 - 0.06	5.99 - 0.05	4.32 - 0.04	6.06 - 0.05

pH at all treatments were recorded around 5–6. It means that pH can support Asian redtail catfish growth and survival. According to Daelami (2001), low pH and high pH could affect negatively fish life. Generally, fish could grow well in the waters with neutral water pH. Ideally, the good pH range can support fish growth in aquaculture environment around 5-9 (Syafriadiman et al., 2005).

Dissolved oxygen (DO) recorded at treatment P_3 (4.50-4.90 mg/L) and then P_1 (4.10-4.80 mg/L), P_2 (3.90-4.90 mg/L) and P_0 (3.80-4.50 mg/L) respectively. All dissolved oxygen recorded at all treatments appropriate to support growout Asian redtail catfish. According to Syafriadiman et al. (2005) ideal dissolved oxygen concentration to support fish development should be more than 5 mg/L. In the research, dissolved oxygen was increasing slightly because function of resirculation system. Lesmana (2001) stated that resirculation system has a function to maintain biological parameters, water temperature and oxygen distribution as well as toxic methabolic prevention.

The highest carbondioxide (CO_2) concentration was achieved at treatment P_0 (15.98-17.97 mg/L) and then P_3 (11.18-13.98 mg/L), P_1 (9.98-11.98 mg/L) as well as P_2 (7.99-11.98 mg/L). High CO_2 concentration at treatment P_0 caused by waste disposal from methabolic waste disposal, so that un-eaten food and methabolic wastes as material suspension were not filtering. CO_2 content at all treatments was still in the save range concentration for fish development. Kasry (2002) stated that CO_2 concentration in the water body produced from decomposing of organic materials. The highest Concentration of ammonia at all treatments are almost same (0.02 - 0.09 mg/L). Ammonia concentrations since early research at all treatments were increasing until day-15 and then decreasing until final research period (day-45) (see Figure 2). Increasing ammonia concentration was invented at treatment P_0 and P_3 as many as 0.09 mg/L and then follow by P_1 as many as 0.08 mg/L and the lowest at P_2 as many as 0.07 mg/L. The highest ammonia concentration at P_0 and P_3 caused by filter functioning effectively.

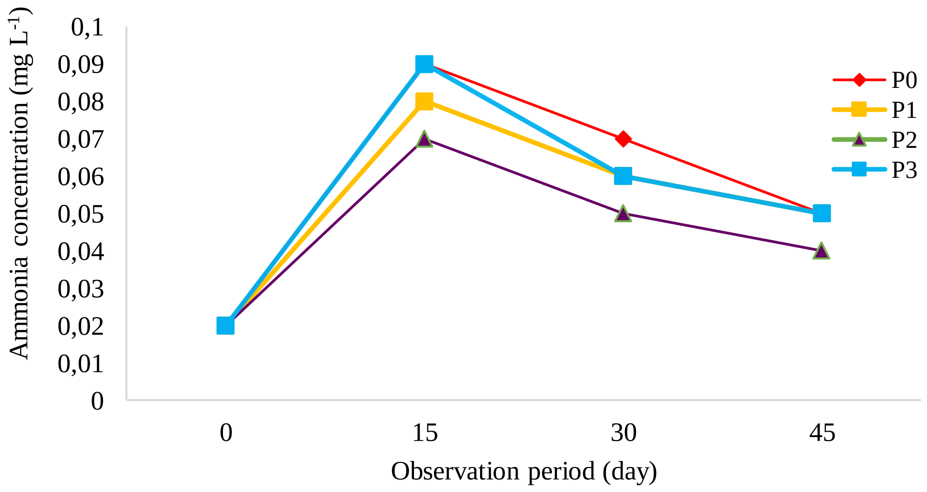

Figure 2. Fluctuation of ammonia as long as research period

Ammonia concentration at the end of the research period was achieved at treatment P_0, P_1 and P_3 same with (0.05 mg/L), while the lowest concentration was invented at treatment P_2 (0.04 mg/L). Low ammonia concentration at treatment P_2 because mustard green roots could absorb ammonia better than the other filter materials. According to Putra and Pamukas (2011) mustard greens can decrease NH_3 concentration, because nitrogen concentration in water could utilize for growth especially nitrite and ammonium. Ammonia concentration at all treatments was still in the save range concentration for organism life. Boyd (1990) said that ammonia concentration was safe for aquatic organism less than 1 mg/L.

Results of Variance Analysis (ANOVA) $P(0.000)<0.05$ showed that different filter materials were affecting ammonia concentration in the catfish culture media. Furthermore, SNK test showed that treatment P_2 with P_3 and P_0 differ significantly, between P_1 with P_0 differ.

Nitrite concentrations (NO_2) were increasing at day 15, where the highest nitrite concentration was P_0 (5.02 mg/L) and then P_3 (4.60 mg/L), P_1 (4.40 mg/L) and P_2 (2.43 mg/L). Furthermore, nitrite concentration decreasing at day 45, where nitrite concentrations at the end of research period were different. The highest nitrite concentration was achieved by the treatment P_0 (0.06 mg/L), P_3 (0.06 mg/L), P_1 (0.05 mg/L) and P_2 (0.02 mg/L). CO_2 concentration should not more than 12 mg/L and the lowest CO_2 concentration 2 mg/L.

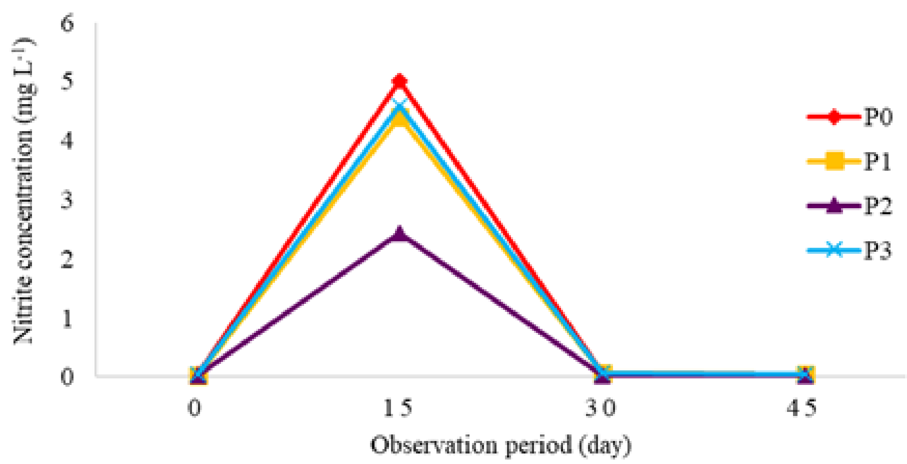

Figure 3. Fluctuation of nitrite concentration as long as research period

Nitrite concentration as long as research period was achieved by treatment P0 around (5.02-0.05mg/L) and then P3 (4.60-0.05 mg/L), P1 (4.40 - 0.04 mg/L) and P2 (2.43–0.04 mg/L). Range of nitrite concentration at all treatments could tolerate fish growth. Siikavuopio and Saether (2006) stated that nitrite concentration at level 16 mg/L as lethal dose concentration, 1-5 mg/L is dangerous for fish and the save concentration should less than 1 mg/L. While Syafriadiman et al. (2005) stated that nitrite concentration up to 2 mg/L for long time will be a toxic for fish.

Putra (2010) said that nitrite concentration without filter materials at nile culture more than (0.286 - 2.47 mg/L) compare with other filter of mustard greens (0.286-1.386 mg/L). Results of Variance Analysis (ANOVA) P(0.000)< 0.05 showed that different filter materials were significantly affecting nitrite concentration in the catfish culture media. Furthermore, SNK test showed that treatment P2 differ significantly with P1, P3, and P2 differ significantly with P0, while P1 and P3 differ with P0. Nitrate concentrations (NO3-) were increasing and decreasing as long as research period. The highest nitrate concentration was achieved at the second measurement (day-15) at treatment P0 (6.87 mg/L) and then P3 (6.06 mg/L), P1 (5.99 mg/L and P2 (4.32 mg/L). Furthermore, nitrate concentration decreasing at day 45 (Figure 4).

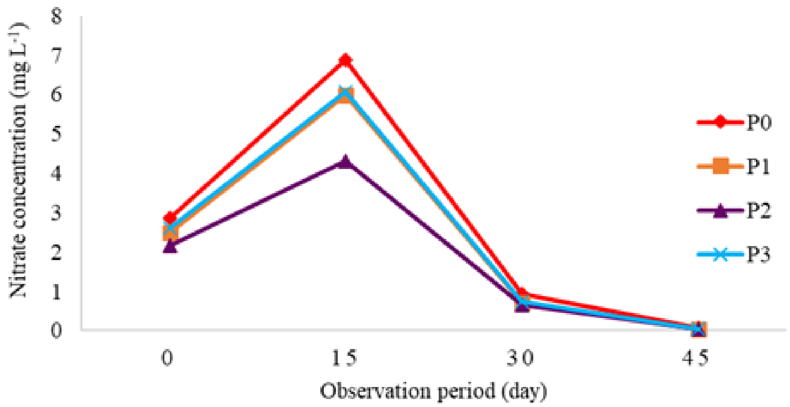

Figure 4. Fluctuation of nitrate concentration as long as research period

Nitrate as nitrogen form has function as main nutrient for algae growth. Nitrate come originally from ammonium (NH_4) enter to culture media through domestic wastes and its concentration decreasing to the outlet caused by microorganism activities in the water such as Nitrozomonas. Microbacteria oxidized ammonium become nitrate. Oxidation processing will decrease oxygen concentration especially at raining season.

The highest nitrate concentration was achieved at treatment P_0 (6.87 - 0.06 mg/L) and then P_3 (6.06 - 0.05 mg/L), P_1 (5.99 – 0.05 mg/L) as well as P_2 (4.32 - 0.04 mg/L). The highest nitrate concentration at treatment P_0 (0.06 mg/L), P_3 (0.05 mg/L) and P_2 (0.04 mg/L). Low nitrate concentration at P_2 caused by mustard greens using nitrates for the growth. According to Putra and Pamukas (2011), mustard greens could utilized nitrate (NO_3) and ammonium (NH_4) for their growth. At the early mustard greens growth, they utilized nitrates more so that nitrate concentration decreasing.

Results of Variance Analysis (ANOVA) P(0.000)<0.05 showed that different filter materials were significantly affecting nitrate concentration in the catfish culture media. Furthermore, SNK test showed that treatment P_2 differ significantly with P_1, P_3, and P_2 differ with P_0, while P_1 and P_3 differ significantly toward P_0.

Average growth rates of Asian redtail catfish juveniles

Result from measuring of average growth rates at all treatments as long as research period could be seen in Table 3.

Table 3. Average growth rates of Asian redtail catfish juvenile (*Mystus nemurus* C.V) as long as research period

Treatments	Observation day-(g)			
	0	15	30	45
P_0	2.83	3.53	3.91	5.95
P_1	2.73	3.87	4.84	6.49
P_2	2.83	4.52	5.66	6.85
P_3	2.77	3.87	4.69	6.37

Average growth rates of fish as long as research period was increasing of each treatment. The highest catfish growth rates was achieved at treatment P2 (6.85 g) and then follow by treatment P1 (6.49 g), P3 (6.37 g) and P0 (5.95 g) respectively. It could be concluded that at treatment P2, the fish in the treatment could utilize fish meal better than the others. beside that the fish appetite in the treatment was higher than the other fish treatments. Furthermore, water quality in this treatment was better than the other treatments. Wilburn and Owen (1964) stated that fish growth is affected by water quality, fish meal quality and quantity and fish age.

Absolute growth rates of Asian redtail catfish juveniles

Absolute growth rates of catfish as long as research period could be seen on Table 4.

Table 4. Absolute growth rates of Asian redtail catfish *(Mystus nemurus* C.V*)* as long as resrach period

Repetition	Treatment (gram)			
	P_0	P_1	P_2	P_3
1	2.96	3.54	3.96	3.64
2	3.12	3.48	4.02	3.66
3	3.26	4.26	4.06	3.5
Total	9.34	11.28	12.04	10.8
Average (Std.dev)	3.11 ± 0.15^a	3.76 ± 0.43^b	4.01 ± 0.05^b	3.60 ± 0.08^b

Average absolute growth rates of fish as long as research period was increasing of each treatment. The highest catfish growth rates was achieved at treatment P2 (4.01 g) and then follow by treatment P1 (3.76 g), P3 (3.60 g) and P0 (3.11 g) respectively. It could be concluded that at treatment P2, the fish could utilize fish meal better than the others. besides that the fish appetite in the treatment was higher than the other fish treatments.

Fish growth means fish body alteration in weight and length along with difference times. In order to reach better growth, the fish should obtain fish meal in good nutrious content as long as culture period. Fish growth affected by internal and external factors such as genetic, sex, age, water quality, food as well stocking density (Effendi, 2003).

Results of Variance Analysis (ANOVA) P(0.009)<0.05 showed that different filter materials gave different effect on absolute growth rates of catfish. Furthermore, SNK test showed that treatment P0 differ significantly with P1, P2, and P3, while among other treatments were not different. It could be concluded that different filter materials were not affect significantly absolute growth rates of catfish.

Daily growth rates of Asian redtail catfish juveniles.

Daily growth rates were different at each treatment as shown on Table 5.

Table 5. Daily growth rates of Asian redtail catfish (*Mystus nemurus C.V*) as long research period

Repetition	Treatment (%)			
	P_0	P_1	P_2	P_3
1	1.60	1.77	1.87	1.95
2	1.58	1.80	1.98	1.81
3	1.76	2.21	2.04	1.80
Total	1.65	1.92	1.96	1.85
Average (Std.dev)	1.65± 0.98	1.92± 0.24	1.96±0.86	1.85±0.83

Average daily growth rates of Asian redtail catfish was achieved by P2 (1.96 %), P1 (1.92 %), P3 (1.85%) and P0 (1.65%). Result of variance analysis (ANOVA) P (0.106) > 0.05 showed that different filter materials did not gave different effect toward daily growth rates of Asian redtail catfish.

Survival rates of Asian redtail catfish

Survival rates of Asian redtail catfish as long research period were around 66.67- 93.33 % (Table 6). The highest survival rates of catfish was achieved by treatment P2 91.11%, while the lowest survival rates was achieved by treatment P0 (73.33 %) (Table 6). Asian redtail catfish mortality as long as research period caused by canibalism characteristic of the fish. At treatment P0 and P3, mortality predicted by bad water quality especially high ammonia concentration at day-15 of 0.09 mg/L.

Survival rates are comparison between life fish at the research period with total fish number at the formerly research period. In aquaculture activities, fish mortality as an indicator of successful fish culture (Tang, 2000). Result of variance analysis (ANOVA) P(0.184)>0.05 showed that different filter materials were not gave different effect toward survival rates of Asian redtail catfish

Table 6. Survival rates of Asian redtail catfish (*Mystus nemurus* C.V) as long as research period

Repetition	Treatment (%)			
	P_0	P_1	P_2	P_3
1	66.67	80	93.33	66.67
2	73.33	66.67	86.67	86.67
3	80	93.33	93.33	80
Total	73.33	80	91.11	78
Average (Std.dev)	73.33± 0.06	80± 0.13	91.11±0.03	78±0.10

CONCLUSION

Rearing of Asian redtail catfish juveniles at resirculation system using various filter materials gave positively effect toward decreasing ammonia, nitrite and nitrate concentration at fish culture media. The best result was achieved at treatment P_2 (aquaponic system with mustard greens) with concentration of NH_3 (0.02 - 0.07 mg/L), NO_2 (2.43 - 0.02 mg/L), NO_3 (4.32 - 0.04 mg/L). But those treatments did not have effect toward absolute length growth rates, daily growth rates, as well as survival rates respectively. At treatment P_2, absolute growth rates, daily growth rates and survival rates were about 4.01 g, 1.96 % and 91.11 % respectively.

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