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Kurniawan W Hidayat
Department of Aquaculture
Bogor Agricultural University,
Bogor, Indonesia.

Eddy Supriyono
Department of Aquaculture
Bogor Agricultural University,
Bogor, Indonesia.

Daniel Djoko Setiyanto
Department of Aquaculture
Bogor Agricultural University,
Bogor, Indonesia.

Ani Widiyati
National Research Institute for
freshwater Aquaculture, Bogor,
Indonesia.

Correspondence
Kurniawan W Hidayat
Department of Aquaculture
Bogor Agricultural University,
Bogor, Indonesia.

Effect of three simple design micro-pore aeration on growth and survival of hybrid catfish *Pangasius* sp

Kurniawan W Hidayat, Eddy Supriyono, Daniel Djoko Setiyanto and Ani Widiyati

Abstract
This present study aimed to evaluate the using of micro-pore diffuser hose to provide proper aeration on hybrid catfish. The diffusers used in this study are two type, stone and micro-pore diffuser hose. The micro-pore hose were made of rubber that compressed and formed like pipe. Micro-pore that used in this experiment made by three shapes, linear (L), circular (Cr), parallel (P), and for control (C) using stone diffuser. Each of them was fitted to the bottom of tank and supplied air by blower with same pressure (90 mbar), all the experiments were carried out in triplicates. Sampling for water quality and growth were collected every 14 days for 60 days fish were reared. The performance of the hybrid catfish was measured by Specific growth rate (SGR), Growth rate (GR), feed intake (FI), survival rate (SR) and Harvest (H). The highest mean SGR was recorded in linear shape (1.58±0.30%), while the lowest recorded in control (1.42±0.24%). Growth rate showed that linear shape gain higher value than other (1.81±0.37 gr/days), while the control showed lowest GR (1.63±0.14 gr/days). The highest feed intake (5772.54±35.27 gr), and the lowest were (2764.30±84.61 gr). Survival rate shows identical result between linear and parallel shape (97.22±4.81%), while the lowest is control (33.33±8.33%), Harvest for linear shape gain highest (6512±59.12 gr) and the control recorded lowest value of harvest (2028±166.83%). Water quality parameter showed that treatment relatively better than control. All the experimented diffuser shows good result for growth hybrid catfish. However, linear shape performed best result among the other.

Keywords: hybrid catfish, micro-pore, dissolved oxygen, growth rate, water quality, diffuser

1. Introduction

Indonesian native catfish *Pangasius djambal* or patin jambal are one of commodity that had great economic value in this country, while other Pangasiidae's family, such as *Pangasianodon hypophthalmus* (Sauvage, 1878), is dominant species culture in south East Asia specially Thailand and Vietnam [1]. This industry moves rapidly due to wide local and export market [2, 7]. The meat of this omnivorous fish has good texture and taste, so the demand for this product is high [1]. The meat of Patin jambal *P. djambal* or *P. nasutus* is white with good texture, but this fish grows relatively slow and less fecund. In other hand, Thai catfish *P. hypophthalmus*, has good fecundity and growth, but relatively has yellow meat [1]. To solve that problem, researchers went through many ways of experiments; one of that ways was to use additional feed to reduce fat that caused the meat yellowish [4]. The other way that still in improvement is crossbreeds the female *P. hypophthalmus* with male *P. djambal*. The result of this crossbreeding called patin pasupati, which inherit good traits from both parents. The meat is white, and this crossbreeding fish grows fast with good fecundity [3]. Although hybrids have positive traits it has negative too, as it's become intolerant in low DO (dissolved oxygen).

Water is life media that is very essential for fish. Water qualities consist of physical, biological and chemical parameters [5]. All factors of water quality affect the growth and development of cultured fish. The success rate of aquaculture production depends on providing good nutrient and convenient environment to support rapid growth and fast turn over period. Water quality affects the general condition of cultured organism as it determines its health and growth conditions.

In Aquaculture, the important parameters in water quality are temperature, suspended solids, ammonia, nitrite, carbon dioxide, and dissolved oxygen [6]. However, DO is the most important and critical parameter, due to its requirement to be continuously monitored in aquaculture

Production systems. Fish is an aerobic organism that needs oxygen to perform metabolism, so the DO supply have to continue all day [5].

Oxygen demand varies with fish species, life stage, size, stock health, water quality, feeding regime, and bacterial respiration rate, among other factors [13]. DO could be generated by diffuser aerator. It's operating by forcing air trough porous media that produces a large number of fine bubbles [8]. Through this technique, water displaces from bottom to surface, and air blow from blower bring oxygen and other gases trough the column of water. This technique makes diffusion of gases to the water. Diffuser aerator agitated the water surface, which broke surface tension and allowed for a proper exchange of gases.

2. Materials and Methods

2.1 Duration and location of the experiment

The experiment was carried for 60 days at the Toxicology and Aquaculture Environment Research Station, Research Institute for Freshwater Aquaculture, Bogor, Indonesia. Fish used in this experiment is hybrids patin. Their initial weights were (78.33±2.34) gr. These 144 fish were distributed into 12 rounds tanks that have 1.6 m in diameters and 0.4 m in height. These tanks were filled with 3.5 m^3 volume of water. The fish were fed with commercial pelleted feed three times daily.

2.2 Experimental design

The experiment was arranged with completely randomize design with three replication. There are three variables and one control. Every diffuser treatment randomly distributed in 12 tanks, and placed in bottom of tank. Every treatment linked and supplied airflow from single blower with same pressure 90 Mbar. The notation for treatment are (C) for Control using two stone diffuser, (L) for linear form of micro-pore, (Cr) for circular form of micro-pore, and (P) for parallel form of micro-pore. All shapes of micro-pore diffuser are given in the following Figure 1.

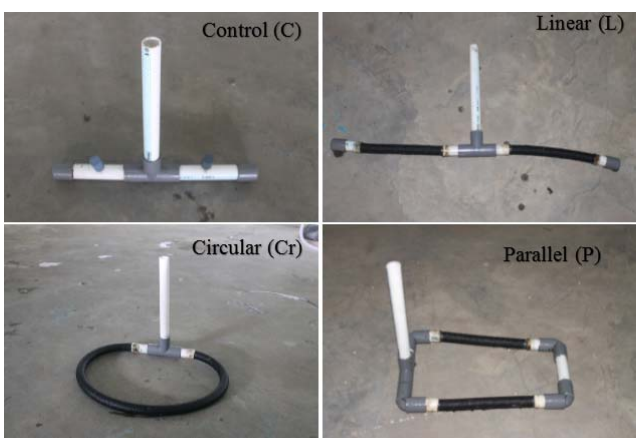

Fig 1: four simple design of diffuser aeration clockwise, control (stone diffuser), linear (micro-pore), parallel (micro-pore), and circular (micro-pore).

2.3 Water and fish sampling

A water sample was collected every 14 days, and then analyzed in laboratory. Water quality parameter is measured by water temperature, hydrogen ion concentration (pH), dissolved Oxygen, free carbon dioxide (CO_2), and Total ammonia-Nitrogen (TAN). Fish were sampled for body weight and length every 14 days. The measurement variables are: SGR (specific growth rate) using equation SGR = $100\{\ln (W_O / W_t)\}/ t$; GR (Growth rate) GR= (Wt –WO) /t; FI (feed intake) daily feed consumption; SR (survival rate) SR= (NT - No)/No × 100 and H (Harvest) is total biomass in the end where P = Wt × NT. The experiment was conducted from 4th week of November 2015 and finish end of February 2016.

2.4 Data analysis

All data were related on growth performances (SGR, GR, FI, SR, and P) and water quality tabulation with Microsoft Excel to analyze mean and standard error (±SE). The differences between treatments were tested using one-way ANOVA and continue with Duncan Test at SPSS version. 22.

3. Results and Discussion

3.1. Growth and survival performance

After 60 days reared, the results showed that highest SGR was recorded in linear shape (1.58±0.30%), while the lowest was recorded in control (1.42±0.24%) (Table 1). Growth rate showed that linear shape gain higher value than other (1.81±0.37 gr/days), while the control showed lowest GR (1.63±0.14 gr/days). The highest feed intake was (5772.54±35.27 gr), and the lowest (2764.30±84.61 gr). The survival rate show the same result between linear shape and parallel shape that is (97.22±4.81%), while the lowest is control (33.33±8.33%). The harvests of linear shape gain the highest (6512±59.12 gr) while the control recorded the lowest value (2028±166.83%).

The linear shape provides relatively best result because of the bubble flows that contain oxygen can support fish growth. This result similar with Tsutsumi *et al*. 2014 [9] that said, usage of micro-bubble enhanced the growth of fish, so it could grew faster than without micro-bubble aeration. The body weight reached 1.83±0.21 kg in wet weight at the end of the experiment (108 days later), which was 0.13 kg heavier than that in the control net pen. The presence of oxigen in the water is very vital because oxygen plays important role in fish metabolism. Beside that, oxygen needed by microorganism for decomposing organic matter [13]. Fish survival was not significantly affected by aeration, but for the control that using coarse stone as diffuser showed significantly different, examination show that fish in control tanks suffer methaemoglobinaemia, the simptoms show brown gill and rigid body, that evidence match with statement Jensen (2003) [14] who said that Nitrite is toxic to fish as it diffuses from the blood plasma into the red blood cells, where it oxidises the Fe^{2+} in haemoglobin (Hb) to the Fe^{3+} oxidation state, converting haemoglobin into methaemoglobin (metHb) high nitrit level in water escalate metHb levels finally become lethal for fish.

Table 1: Specific growth rate (SGR), Growth rate (GR), Feed intake (FI), Survival rate (SR), and Harvest (H) of hybrid patin in different shape and type of diffuser hose aeration.

Variable	Diffuser shape			
	C	L	Cr	P
SGR (%)	1.42±0.24[b]	1.58±0.30[a]	1.45±0.25[b]	1.45±0.17[b]
GR (gr/days)	1.63±0.14[b]	1.81±0.37[a]	1.80±0.44[a]	1.79 ±0.32[a]
FI (gr)	2764.30±84.61[b]	5772.54±35.27[a]	5168.22±4.47[a]	5555.64±13.05[a]
SR (%)	33.33±8.33[b]	97.22±4.81[a]	91.67±8.33[a]	97.22±4.81[a]
H (gr biomass)	2028±166.83[b]	6512±59.12[a]	6160±26.58[a]	6457±19.22[a]

3.2 Water quality during the experiment

The inferior performance of control treatment was caused by high mortality in the beginning week of rearing. The low dissolved of oxygen that showed in Table 2 causes this inferior performance. Free CO_2 in treatment using micro-pore remains relatively higher than the control, but this micro-pore could maintain the presence of dissolved oxygen in the water. The total ammonia nitrogen (TAN) that observed, recorded the lowest in control than in the other treatment. It means water in control tanks were having less pollutant that produce by fish.

Table 2: Water quality parameters measured during experimental period

Variable	Diffuser shape				Ref.
	C	L	Cr	P	
Temp (°C)	25,2-29	25,2-29,5	25,1-29,1	25,2-29,2	[10]
pH	6,8-8,5	6,4-8,6	6,3-8,6	6,8-8,8	[7]
DO (mg/L)	3,7-6,5	5,1-7	5,2-7,5	4,9-7,6	[11]
TAN (mg/L)	0,03-0,06	0,05-0,07	0,05-0,06	0,06-0,08	[12]
Free CO_2 (mg/L)	0,61-12,42	0,42-23,93	0,36-28,72	0,41-14,33	[11]

4. Conclusion

As vital roles for dissolved oxygen and limiting factor for aquaculture production, the presence of aerator devices as DO generator can't be avoid. This research tries to find aeration device and technique for efficient aerator. Efficiency in aquaculture is one of main issue in order to increase profit. In this experiment, some aerator devices tested and evaluated by considering production aspects, such as growth, feed intake, survival rate and harvest. Dissolved oxygen (DO) concentrations were not significantly different in all treatment, mean values for free CO_2, pH, TAN, were not significantly different, fish survival was not affected by aeration with micro-pore hose for all the shape. The result of this research showed that the linear shape are better than other shape.

5. References

1. Anuar H, Mohd AA, Agus PAS. Crossbreeding of *Pangasianodon hypophthalmus* (Sauvage, 1878) and *Pangasius nasutus* (Bleeker, 1863) and their larval development, Journal of Sustainability Science and Management. 2011; 6(1):28-35.
2. Lam TP, Tam MB, Thuy TTN, Geoff JG, Brett AI, Hao VN *et al*. Current status of farming practices of striped catfish, *Pangasianodon hypophthalmus* in the Mekong Delta, Vietnam Aquaculture. 2009; 296:227-236.
3. Maharani Y, Hertria MP. Supply chain analysis for *Pangasius pasupati* aquaculture development at Tulungagung, East Java J Kebijakan Sosek KP. 2013; 3(2):165-178.
4. Laheng S, Setaiwati M, Jusadi D, Suprayudi MA. Applications of the addition of extract and cinnamon leaf flour in the diet on the quality of meat of catfish, Journal Pengolahan Hasil Perikanan Indonesia. 2016; 19(1):36-43.
5. Mallya YJ. The effects of dissolved oxygen on fish growth in aquaculture, United Nations University. Fisheries Training Program, UNU-FTP, 2007, 30.
6. Timmons MB, James ME, Fred WW, Sreven TS, Brian JV. Recirculating Aquaculture Systems NRAC publication, 2001, 01-002.
7. Abdul M, Hameeda K, Sajjad AS, Kalhoro IB. The Effect of Different Stocking Densities on Growth, Production and Survival rate of Pangas (*Pangasius hypophthalmus*) Fish in Cemented Tanks at Fish Hatchery Chilya Thatta, Sindh-Pakistan, International Journal of Interdisciplinary and Multidisciplinary Studies. 2014; 1(10):129-136.
8. Akira E, Sarawut S, Hisatsune N, Ichiro T, Takaaki I, Daigo H *et al*. DO-increasing effects of a microscopic bubble generating system in a fish farm Marine Pollution Bulletin. 2008; 57:78-85.
9. Tsutsumi H, Srithongouthai S, Hama D, Takase I, Nishic T. Application of a microbubble generator to aquaculture. Micro- and Nanobubbles fundamentals and applications. 2014, 230-242.
10. Slembrouck J, Baras ESJ, Hung LT, Legendre M. Survival, growth and food conversion of cultured larvae of *Pangasianodon hypophthalmus*, depending on feeding level, prey density and fish Aquaculture. 2009; 294:52-59.
11. Ahmad T, Sofiarsih L, Kusuma. The growth of patin *Pangasionodon hypophthalamus* in a close system tank, Indonesian aquaculture Journal. 2007; 2(1):67-73.
12. Lefevrea S, Jensen FB, Huong Do TT, Wang T, Phuong NT, Bayley M. Effects of nitrite exposure on functional haemoglobin levels, bimodal respiration, and swimming performance in the facultative air-breathing fish *Pangasianodon hypophthalmus* Aquatic Toxicology. 2011; 104:86-93.
13. Clark ML. Comparison of water quality rainbow trout production and economics in oxygenated and aerated raceways. Thesis Virginia Polytechnic Institute and State University, 2003, 66.
14. Jensen FB. Nitrite disrupts multiple physiological functions in aquatic animals. Comparative and Physiological Biochemistry A. 2003; 135:9-24.