THE INCREASING OF OXYGEN LEVEL USING AERATORS IN A FISHPOND AT YAUMIDDIN ORPHANAGE, KARANG JOANG, NORTH BALIKPAPAN

Riza Hadi Saputra[1)], Muhammad Agung Nursyeha[2)], Muhammad Ridho Dewanto[3)], Adella Aprina[4)]
[1,2,3,4]Institut Teknologi Kalimantan
Email: riza.saputra@lecturer.itk.ac.id[1]

ABSTRACT

Fishing area is one of the favorite tourist attractions for Balikpapan's and surrounding area residents. One of the fishing areas that has just opened is fishing area at the Yaumiddin Orphanage. However, there is a problem about the quality of fish meat due to low oxygen levels in the pond. The solution of this problem is by installing an uniring aerator. However, there were some obstacles when installed the aerator one of them is because the aerator is light and floats, so it needs an additional stone as the ballast. The obtained value for oxygen levels at the pond with temperature 300^0C before the aerator installed is 24.3 mg/L. After the aerator installed, the oxygen level increased to 27.1 mg/L. It proves that the aerators can increase the oxygen levels and it can also improve the quality of fish which is in breeding process.

Keyword: Balikpapan, fishing, aerator, oxygen

INTRODUCTION

Balikpapan City is one of the developing cities in East Kalimantan (Hakim et al., 2020). This city is also one of the nearest cities from the area in east Kalimantan that will be used as the IKN (Ibu Kota Negara) which is the center of government in Indonesia (Herlambang & Said, 2020). As a result, Balikpapan City will most likely become one of the supporting cities for IKN besides Penajam Paser Utara District. Balikpapan already has several tourist attractions (Janah, 2019). However, the tourist attractions have not satisfied the residents of Balikpapan because they are still in the development stage. Therefore, the development of tourist attractions or recreational areas should be done so that the tourism can be attractive, especially for the residents of Balikpapan City. The development also includes the opening of new tourism area or recreational places, one of which are fishing areas because fishing is one of the recreations that was favored by residents inside and outside of Balikpapan City.

One of the fishing areas that has just opened is in the Yaumiddin Orphanage at KM 25 Karang Joang area, North Balikpapan. The owner of the fishing area is the owner of the orphanage itself and all the income from fishing activities and

other businesses are used for the construction of the orphanage (Pratama et al., 2022). The funds used for daily needs and other activities related to the Orphanage. The natural and beautiful environment makes the atmosphere around the fishing area or orphanage more comfortable. There are 3 fishponds for fishing which are 2 large fishponds with a size of about 8 x 12 meters and 1 small fishpond with a size of about 4 x 12 meters which contain with freshwater fish species such as carp fish, tilapia fish, and pomfret fish.

However, there is a problem about the lack of water circulation in all the ponds which is needed to improve the quality of the fish (Endrawati et al., 2021). This condition is also reinforced by the absence of oxygen bubbles in all ponds even though the fishes have resistant to it. To improve the quality of the fish meat, which is the healthy fish has delicious meat to eat, an additional treatment is needed. (Riadhi NRP et al., 2017). One of the methods is by making water circulation in the ponds so the fish get enough oxygen and as the result the fish become fresher and the visitors who come will be satisfied so that they can recommend the fishing spot to relatives, friends, and others.

METHODS

Seen in Figure 1, the block diagram is started from a literature study. The researcher looked for journals or community service report related to aerators or fishponds that could help community service in terms of system comparison and tools installation. After reading the literatures, the next step was preparing the equipment that would be installed in the fishponds based on the previous design which the tools were supporting tools in order to make the system could work properly. For the tool's installation, would be assisted by partners and students as well as the last stage was analysis and conclusions.

Figure 1. Block Diagram

One of the solutions for improving the quality of the fish in the ponds was by providing additional oxygen to the ponds. There are several methods related to water circulation or water flow. However, these methods could not be done due to the limitations of the environmental conditions. So, the solution that would be offered was using an aerator. Aerator is a machine that produces oxygen air bubbles whose purpose is to move the water in the ponds so that the water will be rich with dissolved oxygen which is needed by all freshwater and seawater fish. The working principle of this tool is making oxygen bubbles on the surface of the water as much as possible by making contact with the air. The goal is supplying oxygen in the water as well as the gases and substances that usually cause smelly water can be removed from the ponds. When oxygen increases in the pond, the fish meat will be delicious to eat as time goes by the installation of the aerator. The minimum result from the installation of this aerator is reduce the stench. Seen in Figure 2 for the installation of the aerator.

The method that used in the installation of the aerator was the direct method and the innovation of this activity was by installing the aerator in the fishpond with a position that did not disturb the growing of the fish. There were many methods other than the aerator installation method, one of which was the method with water flow or circulation from the fishpond. However, if the water was returned to the ponds, the radius of the oxygen bubbles that was produced is narrow that was why the aerator was used because the aerator had a wider radius of oxygen bubbles.

Figure 2. Fish Breeding Pond at Yaumiddin Orphanage

RESULT AND DISCUSSION

The technical progress of community service activities for installing the aerator to increase oxygen levels have been through several stages such as the survey stage, the installation or tools installation stage, and the validation or declaration stage (Wijaya et al., 2021). Before starting the survey stage, there was a discussion about the equipment that would be used. The tools that have been decided are immediately purchased so that technical community service activities could be carried out. After the tools were purchased, then the survey stage was started which its function was to find out the technical problems before installing the tools. The following of Figure 3 and Figure 4 were the survey stages that have been carried out.

Before determining which fishpond that would be installed by the aerator, the identification should be done first to choose the right ponds to install the tools (Junius & Adriani, 2021). For the information, there were 3 ponds with different function. The First Pond (left) was a pond for fishing with an estimated pond area of 375 m2. The Second Pond (middle)was a special pond for fish nursery with an estimated pond area of 150 m2. The third pond (right)was a fishing pond with an estimated pool area of 400 m2. After the discussion, it was finally decided to install an aerator in second Pond which functioned as a fish nursery (Baldwin et al., 2022). The higher oxygen levels was important for newly grown fish before being transferred to the fishing pond so that the fish in first and third ponds will have better quality of meat. After determining second pond as the area where the aerator would be installed, then the identification about technical matters that need to be prepared for the installation of the aerator in second pond was carried out (Hendarti & P. Kasih, 2021). The result was the electricity source that used for the oxygen pump was not available yet, so the nearest power source was sought from the second pond. It was found that there is a water pump shown in Figure 2 that flows to the fish nursery.

Figure 3. Position of Wooden Pole as Pump Power Source (left side)
Figure 4. Fish Breeding Pond and Water Pump Position (right side)

The pump was connected directly to the blue house which could be seen in Figure 3 with a cable was running up between the house and the pool. However, on the wooden pole as seen in Figure 3, there was no connecting terminal, which means that the electricity source from the house was directly used to turn on the pump only. Therefore, the teams asked permission to the pond owner or the head of the orphanage to make branches with the source on the wooden pole to power the oxygen pump for the aerator (Fitriana et al., 2021).

Figure 5. Aerator Team and Electricity Team at work (left side)
Figure 6. Terminal Electricity Manufacturing for Oxygen Pump (right side)

Start from made one branches using a triangular box. The process of making the terminal could be seen in Figure 6. Before started this activity, the power source

that connected to the water pump has been turned off. The cable connected to the branch is a single type NYY cable with a diameter of 1.5 mm2 which was sufficient to turn on one oxygen pump. Furthermore, from working on the oxygen pump, there was a slight problem which the oxygen hose that used was not large enough for the pipe hole in the aerator so that a little burning was needed to expand the oxygen hose so it could enter the aerator pipe as shown in Figure 7. To keep the terminal and the oxygen pump did not shake and safed from rain and heat, they were bolted on wooden posts as shown in Figure 8. The oxygen pump used was an oxygen pump with two sources or two oxygen pipes with one engine. There were 2 modes of the electrical power used by the oxygen pump that was mode 1 pumps with 2.5 Watts of power and mode 2 pumps with 5 Watts of power. In this activity, a 2-pump mode was used with an oxygen hose attached to the aerator (Abdur Rofik et al., 2020). Aerator is a device that produces air bubbles whose main function is to produce additional oxygen in the aquarium and pond.


Figure 7. The Aerator Team is Attaching the Hose to the Oxygen Pump (left side)
Figure 8. T Boxes and Terminals that have been successfully created (right side)

There are several types of aerators such as, stone type aerators (round or long type), tube type, and circular porous hose type with different functions and working areas. For stone and tube types, they are widely used in home aquariums, while for porous hose type aerators or uniring aerators (black, ring-shaped porous hoses) are widely used in fishponds or fish nurseries. The uniring aerators used were 2 pieces in diameter of 50 cm. There was an obstacle when installing this aerator as

if the hose used was light and floated when the hose was filled with oxygen (Fuadi et al., 2020). The solution was by providing additional ballast using some stones wrapped in plastic and then tied to the uniring aerator which causes the aerator submerged in the water. After submerged, the air bubbles were come out. These bubbles are used to increase oxygen levels in the pond (Boys et al., 2022). This oxygen is needed especially for fish to live and improve the quality of fish meat that will be consumed (Xu et al., 2022).

Figure 9. Oxygen levels before installing the aerator (left)
Figure 10. Oxygen levels after installing the aerator (right)

After all the equipment installed and the aerator run in the pond, the next step was identifying whether there was a change in oxygen levels in the pond (Kusumah et al., 2022). It can be seen in Figure 9, the value of oxygen levels where the water in the pond had not been installed with an aerator at a temperature of 300C is 24.3 mg/L. After the aerator was installed, the oxygen levels increased to 27.1 mg/L with the same water temperature of 300C as shown in Figure 10. This proved that an increase in oxygen levels occurred or was successfully increased in the second pond with hope that this would improve the quality of the fish in the pond starting from the breeding (Burgos et al., 2018). It is said that in general 5 ppm of the oxygen content with water temperatures ranging from 20-30 C is still good for the fish to life, even if there are no toxic compounds in the water or not polluted, an oxygen content of 2 ppm is sufficient to support the life of aquatic organisms (Wathon & Su'udi, 2019). It was determined that the dissolved oxygen threshold value for marine life was > 5 mg/L to show the pond was not polluted and the oxygen levels for a maximum value of heavily polluted was < 2 mg/L (Winarko et al., 2022).

Figure 11. Group Photo with Orphanage Owner (left side)
Figure 12. Written Submission of Aerator System (right side)

The next stage was the stage of ratification or declaration which is carried out on the other day. For this validation stage, we re-checked the aerator system that have installed and until the validation stage it was running well. It could be seen in Figure 11, which was a group photo with the community service team and the owner of the orphanage where the photo was taking in front of (or behind) the pool where the aerator system installed. For Figure 12, the official handover of the aerator system to the orphanage and documented in the handover documents.

CONCLUSION

The installation of the aerator in the fish nursery pond at the Yaumiddin Orphanage went well. Although there were obstacles such as the difficulty obtained the electricity for the oxygen pump and the uniring aerator that was floating, these could be overcome by making electrical branches and installing ballast on the aerator so that it submerged and produced the desired oxygen bubbles. In addition, this activity also showed the increasing of oxygen level to 27.1 mg/L with the same water temperature of 30^0C after the aerator was installed. This proved increasing in oxygen levels occurs or has been successfully increased for the pond with hope that this could improve the quality of fish meat that is in the process of breeding. The plan for the future is to create an independent power plant between first pond and second pond, to replace the electricity source from the oxygen pump that has been installed so there is no need to use conventional electricity. Another important thing is to make a filter system so that the fish can grow properly or normally because so far, the growth of fish has been slow because the pond water is very muddy which results in a lack of light in the pond. In addition, the filter system can be a source of electricity for water pumps and lighting at night for the fisher so that the fishing

activities can run 24 hours a week. Another thing that will be plan is repairing or revitalizing the electricity distribution, such as the messy cables was tidied up by using cable pipes. Other additional things are revitalizing PLTS (Solar Power Plant) of 400Wp as a source of lighting near swimming pools and bathrooms as well as adding hydroponics and automatic fish feeders to increase the economic value of the place.

ACKNOWLEDGEMENTS

This article is a community service report with the title "PENINGKATAN KADAR OKSIGEN MENGGUNAKAN AERATOR PADA KOLAM IKAN DI PANTI ASUHAN YAUMIDDIN, KARANG JOANG, BALIKPAPAN UTARA" supported by the Institute of Research and Community Service, Kalimantan Institute of Technology, funded 2022 with contract number 4701/IT10.II/PPM.04/2022. I would like to express my gratefulness for an owner of Yaumiddin Orphanage, Bapak H. Hairuddin. I also had given gratefully for other stakeholders and teams.

REFERENCE

Abdur Rofik, D., Jojo Sumarjo, H., & Noubnome, V. (2020). PERANCANGAN DAN ANALISIS ALAT MICROBUBBLE GENERATOR (MBG) UNTUK AERASI KOLAM IKAN TIPE NOZZEL VENTURI. *Gorontalo Journal of Infrastructure & Science Engineering*, *3*(2), 24–30. https://doi.org/https://doi.org/10.32662/gojise.v3i2.1206

Baldwin, D., Boys, C., Rohlfs, A., Ellis, L., & Pera, J. (2022). Field trials to determine the efficacy of aerators to mitigate hypoxia in inland waterways. *CSIRO Publishing Marine and Freshwater Research*, *73*(2), 211–222. https://doi.org/https://doi.org/10.1071/MF20365

Boys, C., Baldwin, D., Ellis, I., Pera, J., & Cheshire, K. (2022). Review of options for creating and maintaining oxygen refuges for fish during destratification-driven hypoxia in rivers. *CSIRO Publishing Marine and Freshwater Research*, *73*(2), 200–210. https://doi.org/https://doi.org/10.1071/MF20364

Burgos, M., Romero, J., Pulido, R., Molinos, A. C., Galvez, A., & Lucas, R. (2018). Analysis of potential risks from the bacterial communities associated with air-contact surfaces from tilapia (Oreochromis niloticus) fish farming. *Environmental Research*, *160*, 385–390. https://doi.org/https://doi.org/10.1016/j.envres.2017.10.021

Endrawati, B. F., Rahendaputri, C. S., & Khairunnissa, I. (2021). PEMBERDAYAAN MASYARAKAT PEMANCINGAN RAMA MELALUI PELATIHAN PENGOLAHAN KERUPUK IKAN LELE GUNA MENINGKATKAN PEREKONOMIAN. *SELAPARANG, Jurnal Pengabdian Masyarakat Berkemajuan*, *5*(1), 957–962. http://journal.ummat.ac.id/index.php/jpmb/article/view/6682

Fitriana, N., Dyah Yuniwati, E., Darmawan, A. A., & Firdaus, R. (2021). The use of a micro-hydro power plant for the educational park area around the reservoir. *AMCA*

JOURNAL OF SCIENCE AND TECHNOLOGY, *1*(2), 34–40. https://doi.org/10.51773/ajst.v1i2.100

Fuadi, A., Sami, M., & Usman, U. (2020). Teknologi Tepat Guna Budidaya Ikan Lele Dalam Kolam Terpal Metode Bioflok Dilengakapi Aerasi Nano Buble Oksigen. *Jurnal Vokasi*, *4*(1), 39–45. http://e-jurnal.pnl.ac.id/vokasi/article/view/1819

Hakim, F. A., Banjarnahor, J., Purwanto, R. S., Rahmat, H. K., & Widana, I. D. K. K. (2020). Pengelolaan obyek pariwisata menghadapi potensi bencana di Balikpapan sebagai penyangga ibukota negara baru. *NUSANTARA: Jurnal Ilmu Pengetahuan Sosial*, *7*(3), 607–612. https://doi.org/10.31604/jips.v7i3.2020.607-612

Hendarti, R., & P. Kasih, T. (2021). THE EFFECT OF NEW TECHNOLOGY APPLICATION ON THE COMMUNITY ENTHUSIASM. *International Conference on Community Development (ICCD)*, *3*(1), 413–415. https://doi.org/https://doi.org/10.33068/iccd.Vol3.Iss1.391

Herlambang, A., & Said, N. I. (2020). Potensi Sumberdaya Air Prioritas untuk Sumber Penyediaan Air Baku Penyediaan Air Minum untuk Calon Ibu Kota negara (IKN) di Penajam, Kalimantan Timur. *Jurnal Air Indonesia*, *12*(1), 29–40. http://ejurnal2.bppt.go.id/index.php/JAI/article/view/4368

Janah, U. (2019). Pendataan Tempat-Tempat Pariwisata di Kota Balikpapan Serta Perbatasan Wilayah Kutai Kartanegara di Samboja. *ABDIMAS UNIVERSAL*, *1*(1), 24–30. https://doi.org/https://doi.org/10.36277/abdimasuniversal.v1i1.17

Junius, A., & Adriani, M. (2021). DISEMINASI TEKNOLOGI PEMBUATAN AERATOR TANPA LISTRIK DI KELURAHAN KARANG MEKAR, KECAMATAN BANJARMASIN TIMUR KALIMANTAN. *AQUANA*, *2*(2), 108–112. http://aquana.ulm.ac.id/index.php/aquana/article/download/26/16

Kusumah, B. R., Kosta Jaya, A., Siskandar, R., & Rahim, F. F. (2022). E-ox level: sustainability test of data storage system and performance test on closed system fish pond. *Aquacultura Indonesiana*, *23*(1), 1–8. https://scholar.archive.org/work/do6rtdjgpbdf3kgwjclvg5pg3a/access/wayback/https://aquasiana.org/index.php/ai/article/download/267/242

Pratama, B., Sunardi, H., & Indreani, S. (2022). Strategi Promosi Pariwisata Pada Kawasan Wisata Mangrove Pendopo Teritip, Kelurahan Teritip, Kecamatan Balikpapan Utara. *Jurnal Mitra Mahajana*. http://www.uniflor.ac.id/e-journal/index.php/mahajana/article/view/1303

Riadhi NRP, L., Muhammad Rivai, A., & Fajar Budiman, M. (2017). *CONTROL SYSTEM OF DISSOLVED OXYGEN USING FUZZY LOGIC BASED ON TEENSY BOARD MICROCONTROLLER*. https://repository.its.ac.id/45614/

Wathon, S., & Su'udi, M. (2019). The inovation of eco-friendly aquaculture system in enhancing clarias gariepinus growth performance in Serut village, Panti sub-distrit, Jember regency of East Java. *IOP Conf. Series: Earth and Environmental Science*, *243*, 1–8. https://doi.org/10.1088/1755-1315/243/1/012158

Wijaya, N., Anugrah, R. A., & Kartika, W. (2021). Pemanfaatan Energi Listrik Portabel untuk Penerangan dan Aerator Kolam. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, *6*(4), 321–326. https://doi.org/https://doi.org/10.33084/pengabdianmu.v6i4.1835

Winarko, W., HS, B., Utami, S., & Luthfiyah, S. (2022). Community Empowerment Through Appropriate Technology: Wastewater Treatment Plant (WWTP) Program in Home-Made Batik Industry at Ngawi, Indonesia. *Frontiers in Community Service and Empowerment*, *1*(2), 37–45. https://doi.org/10.35882/ficse.v1i2.2

Xu, Y., Li, L., Lou, S., Tian, J., Sun, S., Li, X., & Li, Y. (2022). Effects of Nano-Aerators on Microbial Communities and Functions in the Water, Sediment, and Shrimp Intestine in Litopenaeus vannamei Aquaculture Ponds. *Microorganisms*, *10*(7), 1–16. https://doi.org/https://doi.org/10.3390/microorganisms10071302