# Development of Floating Oxygen-Filling Device in Ponds for Selling Giant Freshwater Prawn (*Macrobrachium rosenbergii de Man).*

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## Abstract

The efficiency of the gas delivery pipes was assessed by analyzing the relationship between the amount of oxygen gas and the time received at different lengths of 5, 10, and 15 centimeters. The $R^2$ correlation coefficient was used as a measure of this relationship. The analysis revealed a positive correlation between the amount of oxygen gas and the time received from gas delivery pipes of varying lengths. Furthermore, the amount of oxygen gas had the highest $R^2$ value of 0.966 with a gas delivery pipe length of 10 centimeters.
As a result, a 10-centimeter gas delivery pipe was selected as the optimal floating oxygen-filling device for selling Giant Freshwater Prawns in the pond. In addition, an automatic notification system was developed and combination with a water quality control device in the pond. When testing the prawn in the farmer's pond and the experimental pond with the automatic notification system installed, the experimental pond has DO value was found to be 8.45 ± 0.27 milligrams per liter, and the difference in surface water temperature and underwater temperature was not significant. The water transparency was measured at 0.58 ± 0.00 meters, and only 453.04 grams of prawn death were recorded. In contrast, the pond owned by the farmer had different water quality measurements with a DO value of 8.63 ± 0.33 milligrams per liter, Additionally, a difference of 2.00 ± 0.00 degrees Celsius was seen between the surface water temperature and underwater temperature, accompanied by a diminished water transparency of 0.36 ± 0.00 meters, indicating an increase in water turbidity. Not only that, the death of prawns in this pond was higher at 684.13 grams compared to the experimental pond. Furthermore, it was noted that notifications were dispatched through LINE, and the functioning of the floating oxygen-filling device was monitored up to twelve times per hour.

**Key Word:** Giant Freshwater Prawn (Macrobrachium rosenbergii de Man), Prawn sales pond, and Floating Oxygen-Filling Device

## Introduction

The production of Giant Freshwater Prawns in Thailand has been experiencing growth in recent years. The total production of these prawns from aquaculture amounts to approximately 16,693 tons, which is certified under the Good Aquaculture Practice (GAP) standard. This accounts for 22.3% of all farms. Specifically, in the Northeast region, two provinces, Kalasin and Udon Thani, have implemented the GAP standard. Among these provinces, Kalasin stands out with a significant number of Giant Freshwater Prawn farms, providing a substantial source of income for its farmers (Office of Fisheries, Kalasin Province, 2022). The cultivation of these prawns heavily relies on favorable water and weather conditions. It is crucial to maintain a consistent balance in these aspects to ensure optimal conditions for the growth of the prawns. Any decrease in temperature can have a severe impact on the well-being of the prawns (Boonrat Pratumchat 2018). Once caught for sale, the prawns are then transferred to a pond, where they are kept until they are ready for retail. The group of merchants will face a predicament concerning prawn death caused by inadequate water quality for their survival. This will result in financial losses for some merchants who need to invest in improving the water quality by consistently utilizing the oxygen machine. Furthermore, this will escalate the selling costs due to energy expenses. Moreover, excessive oxygen in the water can lead to turbidity, posing additional challenges for prawns and ponds. In light of this, the project team is cognizant of this issue and proposes the employment of scientific, technological, and automated knowledge to develop a system capable of warning farmers and regulating water quality to prevent both problems and economic losses. Consequently, the project team is enthusiastic about creating a floating oxygen-filling device for the sale of Giant Freshwater Prawns in ponds.

## Research Questions

- Can a floating oxygen-filling device solve the problem of prawn death in ponds awaiting sale? If so, how?

## Research Hypothesis

● The floating oxygen-filling device can solve the problem of prawn death in ponds awaiting sale.

## Research Objectives

● To develop the floating oxygen-filling device and solve the issue of prawn death in ponds awaiting sale.

## Expected Benefits

1. Obtain a device to control the water quality in prawn ponds awaiting sale.
2. Obtain an automatic system to notify and improve water quality in prawn ponds.

## Materials and Methodology

### Materials

1. PVC pipe (size 2/3)
2. Clear Plastic Hose
3. small coupler pipe
4. Air pump
5. Hose clamps
6. Bubble diffuser

**Part 1: Designing a floating oxygen-filling device in ponds for Selling Giant Freshwater Prawns (Macrobrachium rosenbergii de Man).**

Step 1. Cut a PVC pipe to a length of 40 cm. Attach the hose clamps at 10 cm intervals. Then attach the small coupler pipe to the pipe as shown in Figure 1.

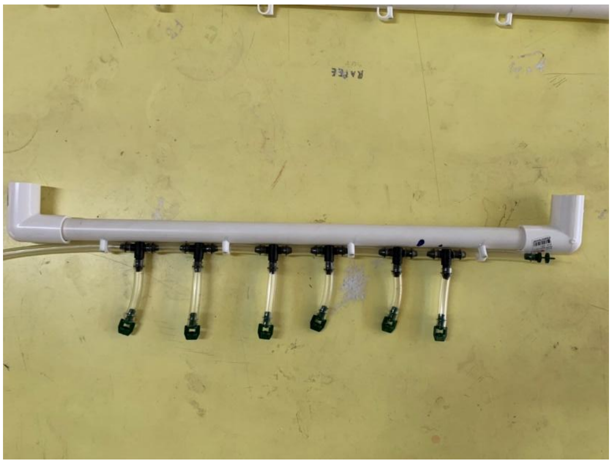


Figure 1: Components of the floating oxygen-filling device.

Step 2. Cut clear hoses to lengths of 5, 10, and 15 cm, respectively. Install them on the device as shown in the image of Figure 2.

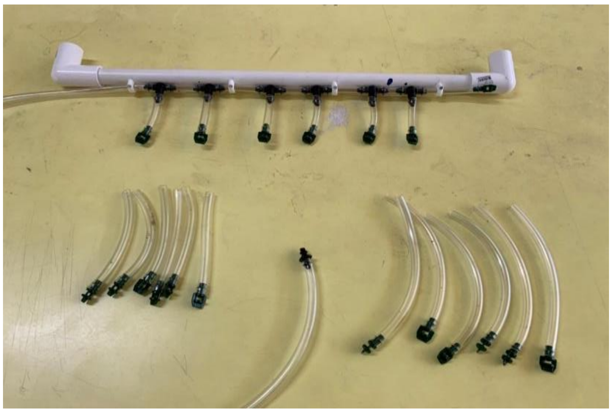


Figure 2: Installation of clear hose fitting for filling oxygen gas.

Step 3. Measure the oxygen content in the water before experimenting.

Step 4. Install the device in a test tank with water at a certain height above the ground 10 cm. Turn on the air pump and continuously measure the dissolved oxygen (DO) levels in the water every 1 minute until they stabilize.

Step 5. Using the sandstone head connect it to the air pump and turn it on. Follow steps 3-4 and compare the efficiency.

Figure 3: Testing different bubble diffuser heads for filling oxygen gas.

**Part 2: Development of an automatic system for notification and quality control of prawn ponds.**

**Materials and tools**

1. Temperature sensors (4)
2. DO sensor (1)
3.Jumper wires (male-to-male and female-to-female) (1 set)
4.220v power cord (1)
5. Channel relay (1)
6. Jet aerator (1)
7. Water circulator (1)
8. Breadboard (1)

**Automatic system operation**

1. If the DO value is below 7 milligrams per liter
    1.1 The relay will command the aerator to turn on.
    1.2 A notification will be sent via LINE that the aerator is running.
    1.3 The DO and Temp values will be displayed on a website.
    1.4 The status of the pond will be displayed.

2. If the DO value is 7 milligrams per liter or higher
    2.1 The DO and Temp values will be displayed on a website.
    2.2 The status of the pond will be displayed.

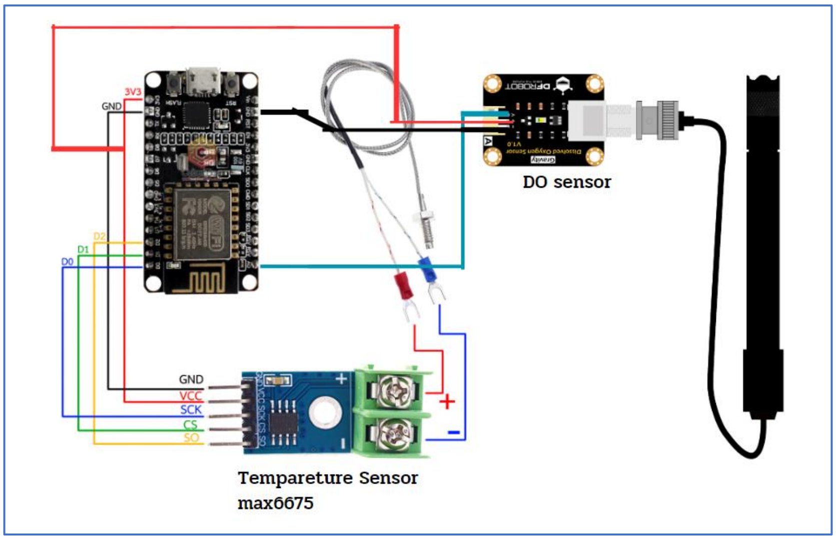



Figure 5: Diagram showing connections in the system.

### Testing Procedure

An automatic notification system has been developed to work in combination with water quality control equipment in ponds for the sale of Giant Freshwater Prawn. To test the quality of the automation system and notification system. The test has been designed as follows:

1. Install the automatic water quality control system and notification system in the prawn pond for Giant Freshwater Prawns.

2. Fill the pond with 0.8 cubic meters of water. Check the dissolved oxygen (DO), temperature, and transparency of the water at the surface and bottom of the pond.

3. Release prawns into the pond at a density of 7.5 kilograms per square meter.

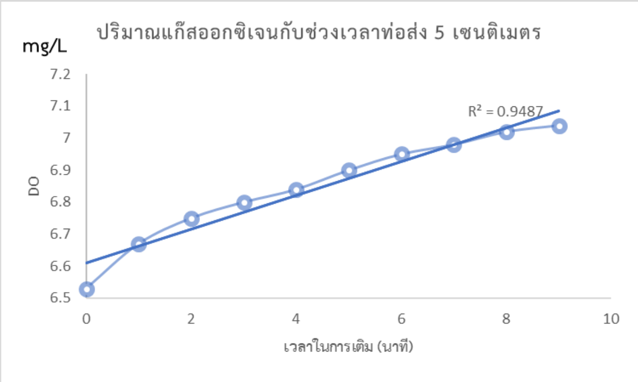
4. Leave it undisturbed and check the screen every hour. Record the number of notifications received through the Line Application.

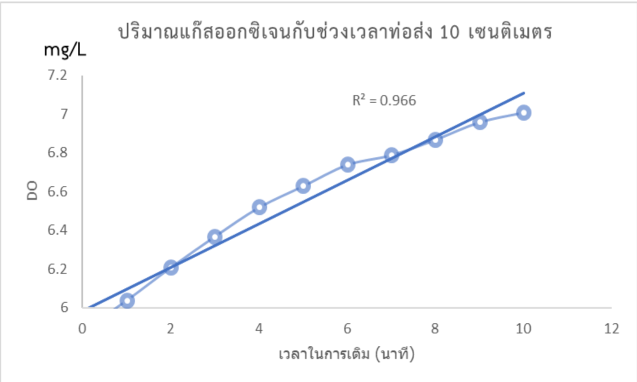
5. After 5 hours, check the number of dead prawns to analyze and compare the data with the pond used by farmers for selling.

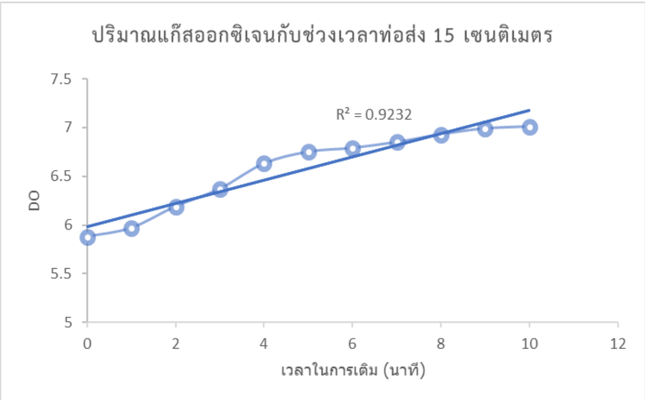
## Research Results

The research aimed to develop a floating oxygen-filling device for stocking and selling Giant Freshwater Prawns in ponds. The experimental results are as follows:

**Part 1: Designing a floating oxygen-filling device for Stocking and Selling Giant Freshwater Prawn.**




Based on data analysis, it has been found that the efficiency of oxygen replenishment varies with the length of the gas delivery pipe at 5, 10, and 15 centimeters. By analyzing the $R^2$ correlation coefficient, it was found that the amount of oxygen gas and the time received from the gas delivery pipes of different lengths were positively correlated and the amount of oxygen gas and the time of the 10 cm delivery pipe had the highest $R^2$

value, which was $R^2 = 0.966$. Therefore, a 10 cm long gas delivery pipe was selected to be used as a floating oxygen-filling device in a pond for the sale of Macrobrachium rosenbergii de Man, commonly known as Giant Freshwater Prawn.

**Part 2: Development of an automatic notification system for water quality monitoring and alerting in ponds.**

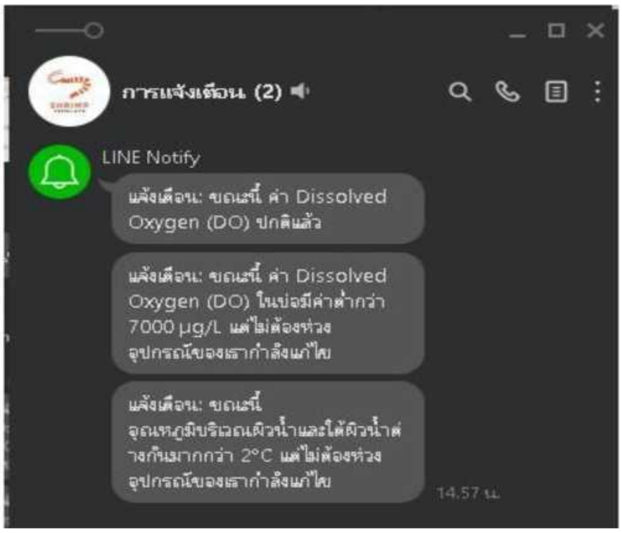



Figure 11: Example of a notification screen on the Line application.

**Test results**

**Table 4: Comparison of the performance of oxygen equipment.**

| The Pond | Dissolved Oxygen (DO) (mg/L) | Temperature (°C) | Transparency (m) | Number of dead prawns (grams) |
|---|---|---|---|---|
| Pond using equipment | 8.45 ± 0.27 | 0.00 ± 0.00 | 0.58±0.00 | 453.04 |
| Ponds that farmers sell | 8.63 ± 0.33 | 2.00 ± 0.00 | 0.36±0.00 | 684.13 |

*Number of alerts sent via the Line application: 12 times per hour

According to the data provided in the table, it was observed that the prawn pond equipped with an automatic alert system, together with water quality control equipment, had a dissolved oxygen (DO) value of 8.45 ± 0.27 milligrams per liter. The temperature difference between the surface of the water and the bottom of the water was not considered significant. The water transparency was 0.58 ± 0.00 meters, and there were only 453.04 grams of dead prawns found. On the other hand, the farmer's pond, which had different water quality, had a dissolved oxygen (DO) value of 8.63 ± 0.33 milligrams per liter. The temperature difference between the surface and the bottom of the water was 2.00 ± 0.00 degrees Celsius, which was higher compared to the equipped pond. Furthermore, the water transparency measure was 0.36 ± 0.00 meters, indicating more turbidity in the water. It was also observed that there were 684.13 grams of dead prawn, which was higher than in the equipped pond. Additionally, it was observed that the machine sent notifications via LINE and was capable of delivering oxygen beneath the water 12 times per hour.

**Conclusion**

The experiment aimed to investigate the amount of oxygen gas and the time from the 5, 10, and 15 cm gas delivery pipes had different oxygen-filling efficiency. By analyzing the $R^2$ correlation coefficient, it was found that the amount of oxygen gas and the time received from the gas delivery pipes of different lengths were positively correlated. The amount of oxygen gas and the time of the 10 cm delivery pipe had the highest $R^2$ value, which was $R^2$ = 0.966. Therefore, a 10 cm long gas delivery pipe was selected to be used as a floating oxygen-filling device in the pond for the sale of Giant Freshwater Prawn. In addition, an automatic notification system was developed in combination with water quality control equipment in the pond for the sale of Giant Freshwater Prawn. When releasing prawns in a pond that farmers sell and a Pond using equipment, it was found that a Pond using equipment achieved a dissolved oxygen (DO) level of 8.45 ± 0.27 milligrams per liter, with no significant difference in temperature at the water surface and the bottom. The water transparency was measured at 0.58 ± 0.00 meters. However, it was observed that the dead prawn rate was 453.04 grams. On the other hand, A pond that farmers sell achieved a dissolved oxygen (DO) level of 8.63 ± 0.33 milligrams per liter, with a temperature difference between the water surface and the bottom of 2.00 ± 0.00 degrees Celsius, which is higher than a pond using equipment. The water transparency was measured at 0.36 ± 0.00 meters, indicating higher turbidity in the water. Additionally, a higher dead prawn rate of 684.13 grams was observed compared to pond-using equipment. Furthermore, it was found that there were 12 notifications sent through the Line messaging app, along with observing the operation of the floating oxygen-filling device.

**Results**

The development of a floating oxygen-filling device for ponds of Giant Freshwater Prawns has demonstrated the effectiveness of integrating such devices with a notification system via the Line Application. This user-friendly system can promptly inform farmers through their mobile devices whenever there is an event requiring attention. The Experiments have shown that this system can effectively reduce the death rate of prawns and decrease electricity consumption by activating the oxygenation device only when necessary. The experiment has confirmed that oxygenation below the water surface, in combination with an automatic system, can address the issue of prawn death. Furthermore, the implementation of an automatic notification system and water quality control equipment in the pond for the sale of Giant Freshwater Prawn also contributes to the maintenance of good water quality. This includes DO level, water temperature, and water transparency. According to the Department of Alternative Energy Development and Energy Conservation (2015), water that is over-oxygenated can lead to turbidity, which becomes a problem for the prawn and the pond itself.

**References**

Mueang-Umphan, K. (2000). **Principles of Aquatic Animal Farming**. Department of Fisheries Technology, Faculty of Agricultural Production, Maejo University.

Prathumchart, B. (2018). **Effects of Temperature and Stocking Density During Transportation of Postlarvae of White Shrimp (Litopenaeus vannamei), Black Tiger Shrimp (Penaeus monodon), and Giant Freshwater Prawn (Macrobrachium rosenbergii) on Survival and Changes in Some Water Quality Parameters during Transportation.** Department of Aquatic Science, Faculty of Science, Burapha University, Mueang District, Chonburi Province.

Prommanon, P. (n.d.). **An Experiment on Breeding Giant River Prawn in a Recirculating Water System.** Proceedings of the Agricultural and Biological Sciences Conference. Songkhla Marine Fisheries Patrol Center, Songkhla Province.

Kalasin Provincial Fisheries Office. (2018). **Giant Freshwater Prawn Farmers Group in Kalasin Province.** Kalasin Province.