Imitating the characteristics of Yang Na Seeds to devise oxygen gas impeller in a sewage pond

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Abstract

The researcher measured the physical characteristics of 50 Yang Na seeds. It was found that the straight wing length was 10.68 ±1.26 cm, the wing length was arched 8.48 ±1.11 cm, the wing width was 2.37 ±0.36 cm, the wing angle was 42.94 ±14.78 degree, and the time fall to the ground 1.02 ± 0.25 s, respectively. The physical characteristics of both wings were not significantly different at the .05 level.

From recording the results of the experiment, the Yang Na seed was released 3 meters from the reference position and timed. The data obtained from the experiment were plotted in graphs to analyze the relationship between the physical characteristics of the Yang Na seeds and the time of landing. It was found that the relationship between the wing angles of the Yang Na seeds. The longest floating Yang Na seed in the air at an angle of 46 degrees. The longest wing length of the Yang Na seeds floating in the air is 13 centimeters. The width of the Yang Na seed was not related to the time it fell to the ground. Therefore, the measured mean was the fixed wing length of 8.5 cm and the fixed wing width 2.4 cm, respectively.

The prototype propeller has a wing angle of 46 degrees with four different angles: 44, 46, 48 and 50 degrees. The 48 degree wing angle Yang Na Seed mimics propeller is the best performance of oxygen gas in water with a low DO value. In a period of 15 minutes, it can be filled oxygen gas with 6.25 milligrams per liter. When drilling holes in the wings of the impeller, 2 holes on each side, it was found that the efficiency of oxygen gasification in low DO water was the best. In 10 minutes, it was able to fill 6.5 mg/l. The prototype propeller imitates the Yang Na Seed, able to add oxygen gas to the wastewater from natural water sources well with a filling rate of 0.31 milligrams per liter per minute. Therefore, the propeller can be used to solve the problem of adding oxygen gas to waste water as well.

Introduction

Biomimicry is an imitation of living things in nature to be used to solve human problems. Biomimicry is now applied to unique design, art innovation or to solve life problems. For example, swimwear manufacturers produce swimsuits by pulling from the skin of micro-porous sharks. To reduce friction and force in the water when wearing a swimsuit, thus allowing the wearer to swim more agile and faster (Temsiri Wangthaweesap, n.d.) from observing things trees can spin in the air for a long time. The part of the plant is called the Yang Na Seeds.

The physical characteristics of Yang Na Seeds, there are two curved wings that help to move in the air through the curved wings creating air resistance. The tree gave the Yang Na Seeds gently spinning through the air because of its wings angle. The light weight of the Yang Na Seeds attached to the effect caused the Yang Na Seeds to spin its wings. This spin similar to the propeller of a helicopter (NSTDA 2544), the glide principle of the Yang Na Seeds similar to the wings of a royal plane the upper part of the wing is longer than the lower part. When an airplane moves through the air the air pressure in the cabin will be lower. The gravity will pull the Yang Na Seeds down. The wings are parts of the fruit (seeds) will help support it, causing it to fall slowly. The angle of the wing makes spin movement which is called the angle of attack, causing torque. The Yang Na Seeds rotates around its axis during the fall (Pirunrat Bunyasikhit 2016). For this reason, the organizers hypothesized that the propeller of the Yang Na Seeds can be replaced with an impeller to operate it.

Along with observing the surrounding environment, especially the urban community. The water sources begin to rot, has a foul smell, the physical appearance becomes opaque. This is mainly due to the lack of dissolved oxygen gas. To treat such wastewater requires efficient equipment. Compared to air as fluid as water. The propellers of various Yang Na Seeds can be used as impellers that are originally oxidized in water. In addition, small impellers for efficient applications are not widespread. The organizers are therefore interested in creating an innovation of the original oxygen gas propeller to mimic the movement of the " Yang Na Seeds " that has a rotating motion while falling. Each Seed has a different wing angle resulting in different rotation and when falling to other areas as

well the organizer then applied the information to the impeller design and to determine the efficiency of the impeller in oxygen gas to determine the best conditions of propellers to be used in the next wastewater treatment.

2. Research questions

1. Physical characteristics of Yang Na Seeds Is there a relationship with the falling time of the Yang Na Seeds or not and how?

2. Does the wing angle of the prototype propeller affect the oxygen gas filling to the water or not and how?

3. How does the number of holes in the wings of the prototype propeller affect the oxygen gas filling of the water?

4. Can the prototype propeller imitate the Yang Na Seeds can add oxygen gas to the natural wastewater and how?

3. Research hypothesis

1. The physical characteristics of the Yang Na Seeds are related to the falling time of the Yang Na Seeds.

2. The wing angle of the prototype impeller affects the oxygen gas supply to the water.

3. The number of holes on the wings of the prototype impeller affects the oxygen gas supply to the water.

4. The prototype impeller mimics the Yang Na Seeds, able to add oxygen gas to the natural wastewater well.

4. Project objectives

1. To study the relationship of physical characteristics and movement of Yang Na Seeds.

2. To devise a prototype and find the efficiency of the propeller imitating the Yang Na Seeds in filling oxygen gas for water with low DO

5. Expected benefits

1. Obtain information about the relationship of physical characteristics and movement of Yang Na Seeds for application.

2. Obtained a prototype propeller that mimics a Yang Na Seed that can be filled with oxygen gas in low-oxygen water.

6. Scope Research

The experiments were divided as follows;

Part 1 Studying the physical characteristics of Yang Na Seeds

chapter 1.1 Study the physical characteristics of Yang Na Seeds and measure the size of the paddy Yang Na Seeds.

Chapter 1.2 Making a prototype propeller to imitate a Yang Na Seeds

Part 2 Performance Test of the Prototype Propeller

Chapter 2.1 Study the efficiency of the prototype propeller.

Chapter 2.2 Study of the number of holes on the prototype impeller suitable for oxygenation

Chapter 2.3 Testing the efficiency of the prototype impeller in a wastewater well

Part 3 Related Documents and Research

Yang Na Seeds (Yang) Scientific name Dipterocarpus alatus Roxb. ex G. Don Principles and theories related to the movement of. Yang Na Seeds. Institute for the Promotion of Teaching Science and Technology (NSTDA, 2017) explained Bernoulli's equation in conclusion; the sum of the kinetic energy pressure per unit volume and the gravitational potential energy per unit volume at any position within the pipe through which the fluid flows is constant and aircraft wing design, etc.

Torque is the force that causes the object to rotate. It depends on the magnitude of the force and where the force acts. An object rotates only when the force acting does not pass through the center of mass or does not pass through the pivot point.

Surface tension is the force (F) over the length of the contact surface (L) (effort to adhere to the surface of the liquid), its unit is N/m.

Oxygen on the water surface

The aerator must have two functions: the duty to provide sufficient oxygen to the water in the wastewater treatment system. and the function of stirring water to distribute oxygen to the concentration of dissolved oxygen always throughout the aeration pond area

Dissolved Oxygen : DO

Optimum dissolved oxygen should be between 1 and 2 mg/L. In clean water at 25 °C, the DO value is approximately 5 mg/L.

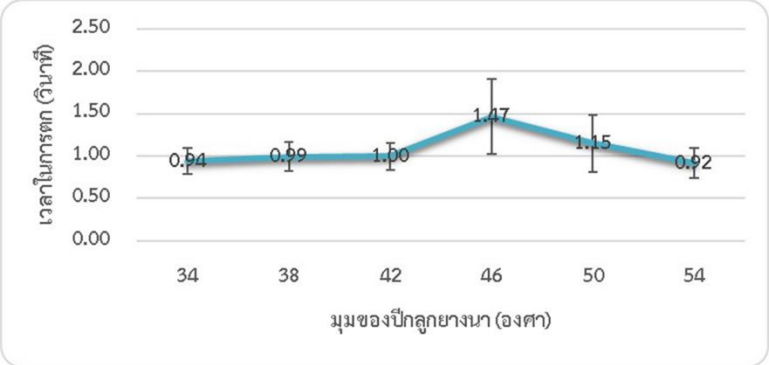
Part 4 Conducting Research

Chapter 1 Study the physical characteristics of Yang Na seeds.

1.1 Study the physical characteristics of Yang Na seeds and measure the size of Yang Na seeds. Various characteristics were measured, including the straight wing length, the wing length was arched, the wing width, the wing angle, the time fall to the ground and the angle of Yang Na seeds with the comparative analysis of data on both wings

1.2 Invent a prototype propeller to imitate a Yang Na seeds from the relationship information brought to the design with Tinkercad 3D program and then taken to 3D printing to test the performance.

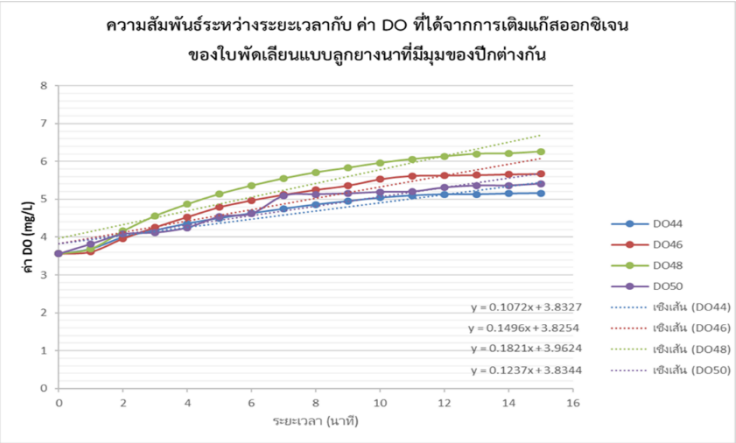
Chapter 2 Performance testing of the prototype propellers.



2.1 Study the efficiency of the prototype propeller.

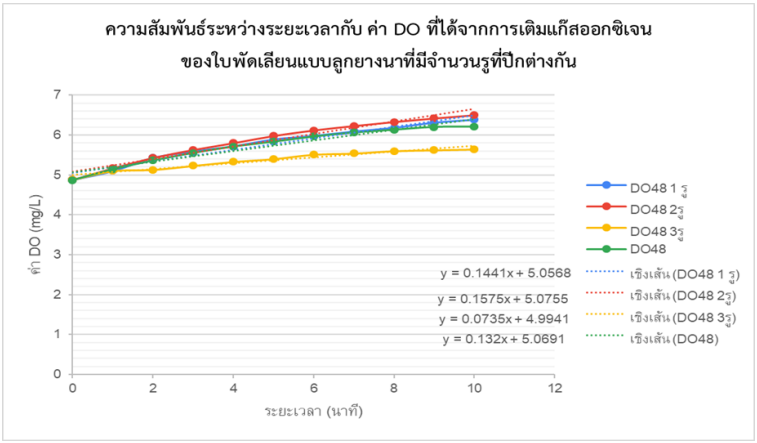
Install the propeller imitating the Yang Na seeds at the wings spread 44,46,48 and 50 degrees with a motor at a speed of 20

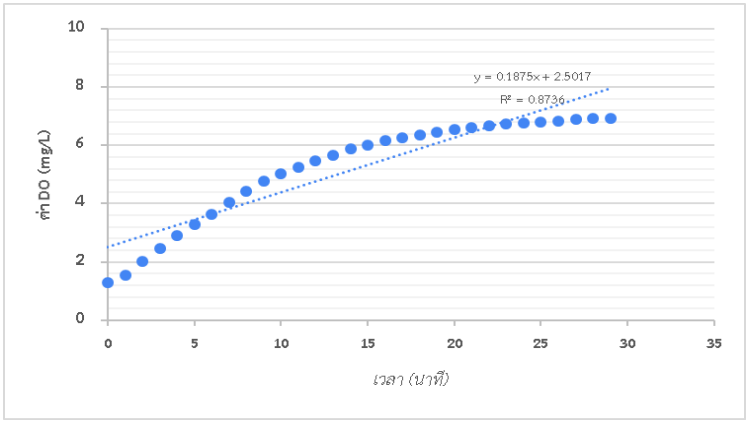
round/second in an experimental plastic box as well as installing a device to measure DO, add water 1,100 cubic centimeters with oxygen gas measurement Turn on the switch to turn the 15 minute timer motor and record the DO value every 1 minute until complete.



2.2 Study of the number of holes in the wings suitable for oxygenation.

Installed the propeller imitating the Yang Na seeds with the highest efficiency from experiment 2.1 drilled at Propellers on each side of 1, 2 and 3 holes with a motor at a speed of 20 round/second a plastic test box as well as installing a DO measuring device.





2.3 Test the efficiency of the prototype propeller in a wastewater well. Bring water from natural wastewater sources with DO 1.31 milligrams per liter, volume 1,100 cubic centimeters. Installed the propeller imitating the Yang Na seeds with the best performance in experiment 2.2 with a motor at a speed of round/second a plastic test box. as well as installing a DO measuring device.

Part 5 Research Results

Chapter 1 Studying the physical characteristics of Yang Na seeds.

The relationship between the followings:

1. thewing angle of the Yang Na seeds,
2. the straight wing length,
3. the wing arched length and
4. the wing width of the Yang Na seeds with the falling time of Yang Na seeds.

In conclusion, the wing angle that can keep the Yang Na Seeds floating in the air for the longest time is 46 degrees. Therefore, the prototype propeller is designed to have a wing angle between 46 degrees with 4 different angles is 44, 46, 48 and 50 degrees.

Chapter 2 Performance testing of the prototype propellers.

The propeller imitating Yang Na seeds the wingspan angle of 48 degrees, has the best efficiency for oxygen gas filling in water with low DO values. In a period of 15 minutes, it can be filled with 6.25 milligrams per liter.

Finding the efficiency of the Propeller imitating Yang Na seeds found that when the time has passed the same Propeller imitating Yang Na seeds, wings spread angle of 48 degrees, piercing 2 holes per wing, able to fill the gas with the highest oxygen in the same time, by filling 6.50 milligrams per liter. When drilling more holes, the efficiency decreases. That is, when 3 holes are drilled on each side of the impeller, the propeller can add less oxygen in the water. Propeller with 2 holes per wing, which can fill 5.60 milligrams per liter. During the first 15 minutes, the Propeller imitating Yang Na seeds quickly injected with oxygen gas with a filling rate of 0.31milligrams per liter per minute After 15 minutes, the oxygen gas filling rate began to decline with a filling rate of 0.06 milligrams per liter per minute Shows the prototype propeller capable of filling oxygen gas until the wastewater is saturated within 15 minutes per 1100 cubic centimeters of water.

Part 6 Summary

When measuring the physical characteristics of 50 Yang Na seeds, the data was obtained straight wing length 10.68 ±1.26 cm, wing length arch 8.48 ±1.11 cm, wing width 2.37 ±0.36 cm. Wing angle 42.94 ± 14.78 degrees and landing time 1.02 ± 0.25 seconds, respectively. When comparing the physical characteristics of both wings are not different. Significantly at the .05 level, when analyzing the relationship between the physical characteristics of the Yang Na seeds and the time of landing, it was found that the relationship between the wing angles of the Yang Na seeds and the longest floating Yang Na seeds in the air was at an angle of 46 degrees. Therefore, the prototype propeller was designed to have 4 different wing angles: 44, 46, 48 and 50 degrees. The propeller mimics the Yang Na seeds, the wingspan angle of 48 degrees, has the best efficiency for oxygen gas filling in water with low DO values. In 15 minutes, 6.25 milligrams per liter can be filled and when drilling holes in the wings of the impeller, 2 holes on each side have the best efficiency for oxygen gas filling in water with low DO values. In 10 minutes, it can be filled with 6.5 milligrams per liter, and the propeller model imitates the Yang Na seeds can fill oxygen gas for wastewater from natural water sources well with a filling rate of 0.31 milligrams per liter per minute. Therefore, the aforementioned propeller can be used to solve the problem of adding oxygen gas to waste water further.

Results Discussion

The imitation of natural characteristics (Bio mimicry) of Yang Na seeds developed into an oxygen-filled propeller. The open and slightly twisted wings of the field rubber cause the wings to collide with air in an area farther from the pivot point, the seed part, resulting in torque, causing the ball to spin while being subjected to force. Earth's gravity causes it to fall to the ground. Which the most suitable wing angle to make an oxygen propeller is 48 degrees, and from the nature of the wings of the Yang Na seeds, it has a curvature like the wings of an airplane, thus causing buoyancy due to the movement of the air on the curved wing speed than the opposite side It is from this factor that the authors have designed an experiment using a 3D printer. Production of propellers imitating the original Yang Na seeds with angles and curved wing characteristics. The experiments were carried out as mentioned

above. Then drilled holes in the propeller wings to verify the assumption that the presence of holes on the impeller wings increases the oxygen content of the water. This is because the water surface tension (γ) is reduced, since the perforation increases the contact length (L) between the water and the impeller, according to the equation $\gamma = \frac{F}{L}$. It was found that the optimum number of holes was 2 holes per wing. The reason why by drilling 3 holes per wing decreases the amount of oxygen added may be due to the increase in the number of holes in the wings. This increases the contact length (L) between the water and the impeller too much causing the propeller to not be able to draw water up to touch the air as it should be too many hole until the propeller passes through the water, unable to bring the water up to touch the oxygenated air, thus adding less oxygen. And the propeller model imitating the Yang Na seeds can add oxygen gas to waste water from natural water sources well with a filling rate of 0.31 milligrams per liter per minute. Therefore, the aforementioned propeller can be used to solve the problem of adding oxygen gas to waste water further.

Part 7 References

Plant House Office - Department of National Parks wild animals and plants search online: [qrcode url="http://www.adeq.or.th/qr/0024" margin="10" size="150" after="ต้นยางนา"].

The Institute for the Promotion of Teaching Science and Technology (IPST): 2560. Bernoulli's theorem

search online: https://www.scimath.org/lesson-physics/item/7268-fluid

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