FABRICATION OF AQUAPONIC GRAVITY FLOW PLANTATION SYSTEM FOR LETTUCE PLANT

AMIERUL AMIN BIN ABDUL AZIZ

Faculty of Mechanical Engineering

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS ◆

JUDUL: FABRICATION OF AQUAPONIC GRAVITY FLOW PLANTATION SYSTEM FOR LETTUCE PLANT

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Alamat Tetap:

A-21 Perkampungan Pak Ngah Aziz,
R.T.P Bukit Goh,
26050 Kuantan,
Pahang Darul Makmur.

PROF. DATO' DR. ROSLI BIN ABU BAKAR

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FABRICATION OF AQUAPONIC GRAVITY FLOW PLANTATION SYSTEM FOR LETTUCE PLANT

AMIERUL AMIN BIN ABDUL AZIZ

Report submitted in partial fulfillment of the requirements for the award of
Diploma of
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FACULTY OF MECHANICAL ENGINEERING

I certify that the project entitled *"Fabrication of Aquaponic Gravity Flow Plantation System for Lettuce Plant*" is written by *Amierul Amin Bin Abdul Aziz*. I have examined the final copy of this project and in my opinion; it is fully adequate in terms of scope and quality for the award of the degree of Diploma of Engineering. I herewith recommend that it be accepted in partial fulfillment of the requirements for the Diploma of Bachelor of Mechanical Engineering.

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Signature : _____

Name : PROF. DATO' DR. ROSLI BIN ABU BAKAR

Position : LECTURER

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I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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Date :

DEDICATION

I specially dedicate to my beloved parents
(Abdul Aziz Bin Awang Kechik & Hamidah Binti Hasan), my siblings,
My supervisor and those who have guided
And motivated me for this project

ACKNOWLEDGEMENT

I would like to express my highest gratitude to Allah the Almighty for blessing me in finishing this project. Besides, I would like to take this opportunity to express my sincere gratitude and appreciate especially to my supervisor, Prof. Dato' Dr. Rosli Bin Abu Bakar for his constant guidance, consideration and constructive idea in leading me to accomplish this project.

Moreover, I wish to express my sincere appreciation to all staff in Mechanical Engineering Laboratory, whom I owe particular debt of gratitude for their suggestion, endless effort in helping finding solutions and experiences that has supported me and assisted me tremendously in many aspects.

Last but not least, I acknowledge my sincere indebtedness and gratitude to my parents for their help, love and sacrifice throughout my life. These are the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals. Special thanks also should be given to all my friends whose have helped me in the completion my Final Year project. I sincerely appreciate all of your help.

ABSTRACT

This project was carried out to fabrication of aquaponic gravity flow plantation system for lettuce plant. The objectives of this project are to fabricate and reinforced the curved water tank for hydro plantation and to integrate the gravity flow plantation unit for aquaponic system. In this study, it is focus on the history development of aquaponic, why is so significant for future, types, technology, advantages, types of plantation, types of animals and vegetables and the significant of gravity flow design. The design generation and design selection have been shown in this report in order to select the best design concept of the gravity flow plantation system. The solid three dimensional structures modeling of the gravity flow plantation system has been developed by using the solid work software. Material selection and the factor of the selection also have been listed based on the appropriate criteria predetermined. A briefly explanation about the fabrication process for completing this project is also has been stated in this report. An improvement and recommendation of the fabrication of aquaponic gravity flow plantation system for lettuce plants is provided for further implication.

ABSTRAK

Projek ini telah dijalankan untuk menghasilkan sistem aliran graviti perladangan aquaponik untuk tumbuhan salad. Objektif projek ini adalah untuk mereka dan memperkukuhkan tangki air melengkung untuk perladangan hidro dan untuk mengintegrasikan unit perladangan aliran graviti untuk sistem aquaponic. Dalam kajian ini, ia memberi tumpuan kepada pembangunan sejarah aquaponics, mengapa begitu penting untuk masa depan, jenis, teknologi, kelebihan, jenis tanaman, jenis haiwan dan sayur-sayuran dan ketara reka bentuk aliran graviti. Generasi reka bentuk dan pemilihan reka bentuk telah ditunjukkan di dalam laporan ini untuk memilih konsep reka bentuk yang terbaik dalam sistem perladangan aliran graviti. Pepejal tiga dimensi model struktur sistem perladangan aliran graviti telah dibangunkan dengan menggunakan perisian kerja-kerja yang kukuh. Pemilihan bahan dan faktor pemilihan juga telah disenaraikan berdasarkan kriteria yang sesuai yang telah ditetapkan. Satu penerangan ringkas mengenai proses fabrikasi untuk menyiapkan projek ini juga telah dinyatakan dalam laporan ini. Peningkatan dan syor untuk menghasilkan sistem aliran graviti perladangan aquaponik untuk tumbuhan salad disediakan bagi implikasi selanjutnya.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

For this chapter, it is about the discussion on the project background, problem statement, objectives of the project, the project scope and gantt chart.

1.2 PROJECT BACKGROUND

This project is about fabrication of aquaponic gravity flow plantation system for lettuce plant. By using gravity as a transport, water is drained from the fish tank into a gravel bed. Here, beneficial bacteria break down the toxic ammonia in fish waste to nitrite and then to nitrogen, a key nutrient for plant development. On the gravel bed, we also use dry gravel as a secondary means of water filtration.

1.3 PROBLEM STATEMENT

The problem statement in this project is lack of agricultural land**.** Besides, the agriculture products are exposed to chemical pesticides**.** Then, this project also discussed about to reduced number of pumps by letting the water flow upwards and downwards as much as possible. Therefore, this problem will be the factor to improve the fabrication.

1.4 PROJECT OBJECTIVES

The objectives of this project are:

1. Fabricate and reinforced the curved water tank for hydro plantation.
2. To integrate the gravity flow plantation unit for aquaponic system.

1.5 PROJECT SCOPE

The scopes of this project are:

1. Pump the fish water to a greenhouse, which is evenly distributed.
2. Excrement fish made as fertilizer for plants
3. The fish water feeds the plants, such as lettuce and tomato.
4. Then filters through a porous material (dry gravel) and returns to the fish tank by gravity.
5. Both systems are in a controlled environment, meaning light and temperature are controlled.
6. The primary crop is the vegetable and the fish are secondary, meaning commercially.
7. The gravity flow uses this type of aquaponic system because it is easy to build and only needs a small pump and heat to get the system running.

1.6 GANTT CHART

A gantt chart is a table representation of a detail project activity that has been conducted from first week until week of fourteenth.

Table 1.1 shows the details project activities in order to complete this project.

PROJECT ACTIIVITIES		WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
LITERATURE REVIEW	PLANNING														
	ACTUAL														
REVERSE ENGINEERING	PLANNING														
	ACTUAL														
DESIGN & PLANNING	PLANNING														
	ACTUAL														
PREPARE MATERIAL & TOOL	PLANNING														
	ACTUAL														
FABRICATION	PLANNING														
	ACTUAL														
SYSTEM INTEGRATION	PLANNING														
	ACTUAL														
MODIFICATION	PLANNING														
	ACTUAL														
FINAL REPORT	PLANNING														
	ACTUAL														

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will be more focused on the history development of aquaponics, why is so significant for future, types, technology, advantages, types of plantation, types of animals and vegetables and the significant of gravity flow design. In this chapter also will be briefly discussed about to reduced number of pumps by letting the water flow upwards and downwards as much as possible. Then the material used and apparatus used by the gravity flow system also will be discussed. In addition, the advantages and the disadvantages using gravity flow system will be briefly explained in term of its function and the way how to use it.

2.2 FOCUS ON THE ADVANTAGES AND DISADVANTAGES OF AQUAPONIC SYSTEM, COMPARISON PRODUCTION, COMPARISON YIELD CROP, HOW IT'S WORK, TYPES OF ANIMALS AND VEGETABLES.

Figure 2.1 show the previous aquaponic system around the world.

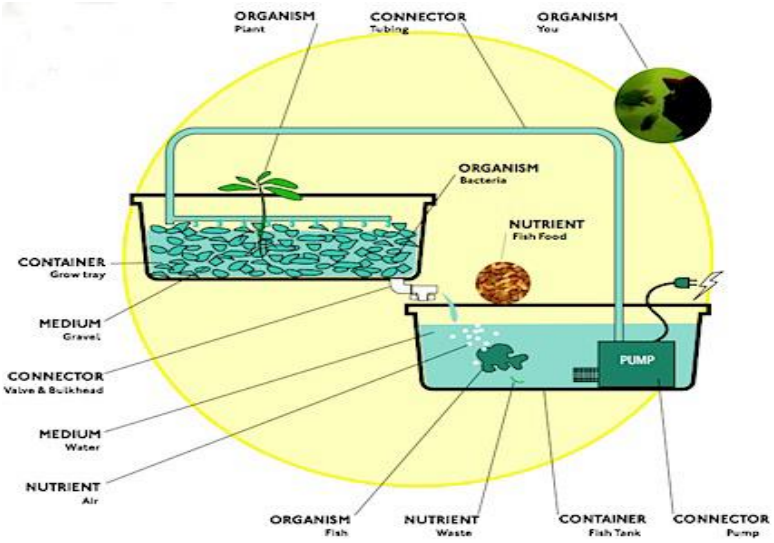


Figure 2.1: Gravity flow system

2.2.1 THE ADVANTAGES AND DISADVANTAGES OF AQUAPONIC SYSTEM

Some of the reasons why aquaponic is being adapted around the world for food production are the following on the no soil is needed for aquaponics, the water stays in the system and can be reused. Thus, lower water costs.

No nutrition pollution is released into the environment because of the controlled system Stable and high yield. Pests and diseases are easier to get rid of than in soil because of the container's mobility. It is easier to harvest. No pesticide damage. Plants grow healthier. It is better for consumption.

Today, aquaponic is an established branch of agronomy. Progress has been rapid, and results obtained in various countries have proved it to be thoroughly practical and to have very definite advantages over conventional methods of horticulture.

There are two chief merits of the soil-less cultivation of plants. First, aquaponic may potentially produce much higher crop yields. Also, aquaponic can be used in places where in-ground agriculture or gardening are not possible.

Table 2.1: Advantages and disadvantages of aquaponic system

ADVANTAGES	**DISADVANTAGES**
Growth faster	Daily attention
Root not difficult to find nutrient	Pests remain a big risk
Produce plant in high quality	Finding a market
Water is used efficiently	

2.2.2 COMPARISON PRODUCTION

Table 2.2 showed the comparison production between aquaponic production with production by soil.

Table 2.2: Comparison production between aquaponic and by soil

AQUAPONIC PRODUCTION	**PRODUCTION BY SOIL**
No soil required	Good top soil required
Plant irrigated automatic	Plant need to be irrigates
Nutrient are available all times	Nutrient must be added to soil
Soil borne disease eliminated	Soil borne disease build up in the soil

2.2.3 COMPARISON YIELD CROP

The figure 2.2 shows the comparison yield crop between the lettuce plant produced using aquaponic system and the lettuce plant produced by normal crop.

LETTUCE PRODUCED USING AQUAPONIC SYSTEM

LETTUCE PRODUCED BY NORMAL CROP

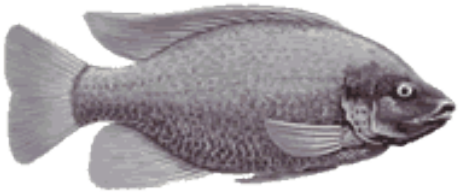
Figure 2.2: Comparison yield crop

2.2.4 HOW IT'S WORK

The water flow in aquaculture, aquaponics system or any aquatic system which requires oxygen for metabolism and catabolism is one of the most important parts of system design, next to water temperature. In this article it want to share about some simple information that will go a long way to working out the water flow needed to keep the oxygen in the water for your fish to grow fast and healthy.

Water flows in the aquatic systems at home or commercial are very important to the the health and growth of your fish and help maintain safe levels of Ammonia, Nitrite and more importantly removing solid wastes and Oxygen. There is never any reason to compromise on the flow rates for you set up. The result of cutting corners with flow rates generally results in poor growth and majority of the time loss of the fish.

2.2.5 TYPES OF ANIMALS AND VEGETABLES



Tilapia

Originally found in Africa, Tilapia has been farmed for more than 2,500 years. Tilapia is a perfect fish for aquaponics because of its rapid growth, large size, and because it tastes great. This hardy fish can adapt to most any condition with the exception of water temperature. Tilapia prefer warm water at least 75 degrees Fahrenheit. It takes about 9 months for our Tilapia to grow to a harvestable size, about 1.5 pounds.

What does Tilapia eat? At Growing Power, we feed our fish duckweed, ground-up salad greens from the greenhouse, worms, and Tilapia love to eat algae from the side of the tank.

2.3 THE SIGNIFICANT OF GRAVITY FLOW DESIGN

The figure 2.3 shows the design of the significant of the gravity flow into the curved tank.

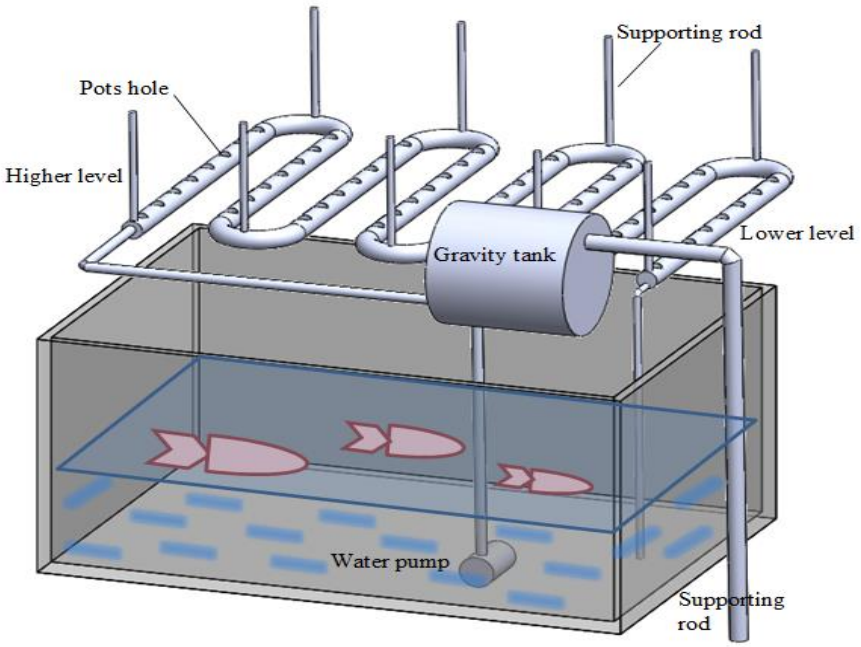


Figure 2.3: Design of the significant of gravity flow

The design is mainly shows the gravity flow system. This design concept has advantages of easy to manage gravity flow when use, stable and requires high point to low point by gravity tank. Aquaponic Solutions has advised many people on their backyard aquaponic systems, and the following are some of the main things we have seen people do wrong or completely avoid. Backyard aquaponic systems should encapsulate several design principles to be efficient and effective:

- One pump only - for energy efficiency
- Gravel bed hydroponic components - easy and efficient plant growth, solids filtration and bio filtration in the one unit
- Constant Flow or Ebb & Flow water delivery to the hydroponic component
- The preparedness to heat the system water in colder months
- The use of the correct gravel type in the hydroponic component
- A requirement to test the water on a regular basis

2.3.1 One Pump

There are many plans for backyard aquaponic systems available on the internet. Some are good, some are not. The first thing to remember about an aquaponic system is that it is being used to grow food in a way that confers several environmental advantages. These include low environmental impact and water use efficiency. Many people are interested in aquaponics because of these principles. Therefore, it is often confounding why people then build systems are that are not energy efficient. Many of the system designs available from web sites at present are designed using two pumps or oversized pumps for the application required, which is completely unnecessary and energy inefficient.

Basically, if you locate the outlet from your hydroponic bed slightly higher than your fish tank, then you always only require one pump. The water is then pumped from the fish tank, up to the gravel bed, and then returns to the fish tank via gravity flow which is free and better for the environment.

2.3.2 Gravel Bed Hydroponic Component

Gravel beds, whilst not practical on a commercial scale, are the easiest and most efficient hydroponic component you can use for a backyard or hobby system. This is due to several reasons: good plant support, good plant growth & yield, better water buffering and the fact that the gravel acts as both the bio-filter and solids filter. For systems not using

gravel beds, more water filtering components are required, therefore raising the cost of the system build.

2.3.3 Constant Flow or Ebb & Flow Water Delivery

Many systems at present advocate flood & drain water delivery to the gravel beds. This is done because of several arguments, these being: it enhances root zone oxygen, it saves energy, its assists to mineralize solid fish waste and dissolved nutrients. These are all valid reasons, however, it doesn't mean that constant flows cannot be used. We tested this in replicated experiments and found that constant flows actually improve water quality in terms of ammonia levels and lead to increased plant growth rates and yields. However, it must be understood that constant flows can lower dissolved oxygen at the root zone and if solids separation isn't used it can lead to bed blockages and the development of anaerobic zones. Because of this, additional aeration in the fish tank is usually required and a simple solids removal device helps because solids in the system will compete for oxygen.

Gravel aquaponic systems, if operated in flood & drain modes, do have a high ability to mineralize, dissolve and treat solid fish wastes. However, if fish to plant ratios are too high, gravel beds can clog and lead to toxic anaerobic conditions which can kill both fish and plants. Therefore, gravel bed systems do need to be sized correctly to reduce the possibility of this occurring.

We have developed a model to size flood & drain, gravel bed aquaponic systems so that hobbyists have access to the science and engineering that enables confident system sizing.

2.3.4 Water Heating

Aquaponic systems work much better if a constant water temperature is used. The chosen water temperature should suit that required for the particular fish species being cultured and so can be cold (below $12^{o}C$), medium (12 - $18^{o}C$) or warm (above $19^{o}C$). The other reason for keeping water temperatures as constant as possible is because of the biofilter (gravel bed) organisms required to process the dissolved fish wastes from

something potentially toxic (example: ammonia) to something non-toxic (example: nitrate). The particular bacterial species that convert ammonia to nitrate are adapted to a temperature at which they operate at maximum efficiency. Different bacterial species will colonize the filter depending on the water temperature, cold bacterial species in cold water, warm bacterial species in warm water, and so on. If the water temperature fluctuates outside of the range of the bacteria that colonize the media in the bed, then the bacteria can loose efficiency and efficacy. For example, if the temperature requirement of the bacteria in the aquaponic system is in the warm range between 20^{o} C and 30^{o} C, and if the water temperatures then drop below 18^{o} C, bio-filter efficiency is lost, the bugs go to sleep, and ammonia spikes can occur. This is why many warm water fish species have a lower feeding rate at lower water temperatures and cold water fish species have a lower feeding rate at higher water temperatures. Therefore, it is always a good idea to try and maintain water temperatures and avoid letting them fluctuate too much. Heating water may be achieved by many methods, like electrical emersion heaters like those used for aquariums. However, my favored method is to use the sun. It is very easy to rig up simple solar water heaters for aquaponic systems. In addition, using insulation to insulate fish tanks, gravel beds and pipe work all help to retain heat. Also remember, it is generally less costly to heat water than to cool it.

2.3.5 Correct Gravel/Media Type

Gravel comes in many shapes and forms, and few people state which gravel is good or bad. For example, I visited a backyard system once where Red Scoria was used. It was very dusty, very red, and was staining the water and pipe work a deep red color. In addition, the Scoria had very sharp edges, which is no good for plant stems and is difficult to work in. The owner could see no problem with this, and was happy to feed the plants and fish to his family. I am not sure of any toxicity associated with the use of Red Scoria, however, some gravels may contain toxic chemicals and compounds, like heavy metals. Therefore, choose gravel carefully and always research any potential toxicity.

The best gravel to use is washed river gravel. Get it at a size of about 10 mm to 20 mm diameter. Gravel that is too small clogs easily and retards water movement; gravel that

is too large is harder to plant into and may not act as an efficient solids trap or filter. People who advocate larger gravel particle sizes often do so because they do not know how to size the media bed for the applied solids load bed sizing is dependent on a knowledge of correct and efficient solids mineralization rates for the available surface area of the bed and so choose larger gravels so they do not clog as quickly with the excess solid waste loads. If gravel/media beds are sized correctly with respect to the fish and feeding rate loads, then gravel beds should last for many years without detrimental clogging. River gravel has nice, well rounded edges that are easy on both hands and plant stems. Clay balls (Lecca) is also often used in aquaponics and is also an excellent medium for media beds.

2.3.6 Water Testing

pH and temperature are the 2 main basic parameters that need to be tested in aquaponic systems.

Fish, plants and bacteria live at an optimal pH value. For the fish, this around a pH of 6.5 to 8.0. For plants, this around a pH of 4.5 to 7.0 and for bacteria it is about a pH of 6.0 to 8.0. Therefore, aquaponic systems are a compromise between the pH requirements of the fish and bacteria, and those of the plants. The best pH to run at is around 6.7 to 6.9. This is okay for the fish as it protects against ammonia toxicity, is okay. for the plants as it allows them to uptake the nutrients they require for growth and is good for the bacteria. pH may be tested with simple pH kits obtainable from aquarium stores for less than $20, or by using electronic pH meters.

Many people do not bother to test for pH in their backyard systems. If pH drops below 6.0, the plants usually don't mind and the fish will adapt somewhat over time. However, the infiltration bacteria do become inactive below a pH of 6.0, so whilst the fish may have adapted they may not be in water of the best quality for their health and well-being. Therefore, I feel it is important to regularly test pH.

Temperature - measuring water temperature regularly allows an understanding of whether the fish are being kept in a temperature range that they are suited to and also

allows and understanding of whether the bacteria have the best chance to operate efficiently. Water temperature may be used as a management tool. For example, when I keep Murray Cod which likes temperatures of 18 to 24^{o}C, I stop feeding them if the water temperature drops below 18^{o}C or rises above 24^{o}C. This is to protect the fish as they may have digestive problems at water temperatures outside of their ideal range, but also, at these water temperatures outside the acceptable range, the ammonia conversion bacteria may loose efficiency and the fish may then be subject to elevated ammonia levels which can become toxic.

2.4 SUMMARY

In this chapter, by using gravity as a transport, water is drained from the fish tank into a gravel bed. Here, beneficial bacteria break down the toxic ammonia in fish waste to Nitrite and then to Nitrogen, a key nutrient for plant development. On the gravel bed, we also use dry gravel as a secondary means of water filtration.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will briefly describe the process to fabrication of aquaponic gravity flow plantation system for lettuce plant. The process is conducted step by step as shown in the flow chart below. The literature review has been carried out to establish the specification of the history development of aquaponics, why is so significant for future, types, technology, advantages, types of plantation, types of animals and vegetables and the significant of gravity flow design. The design concept of the gravity flow system and curved tank is has been implemented by using the Solid Works software. Then, the concept generation and concept selection are performed to select the best design in order to fabricate the best gravity flow system and curved tank. In this section also shows material selection and the process that has been conducted to fabricate the gravity flow system and curved tank.

Then improve the design. Try to come with several concepts. Then compare the criteria from each design which are the best. If the best design chosen still needed to be improved go back to the previous step. If no improvement is needed go to next step. Produce the drawing together with dimension of the product and the type of materials needed. After completing the previous task, start the fabrication process. Gather the parts needed for the project to proceeds the fabrication process. Here come the testing and evaluation process. The test rig will be test to see if it full fills the requirement such as safety, ability and strength.

During the testing, if a problem occurs, the process of fabrication gravity flow system will step back to the previous process. The reason to step back is to fix the error. After all the parts had been joined together and no error, here comes the phase of result and discussion. In this part, how the gravity flow functions will be informs. Beside, how to achieve objective and solve problem statement of the project will be discuss in this phase.

3.2 METHODOLOGY PROCESS FLOW CHART

Figure 3.1 show the process flow chart along doing this project

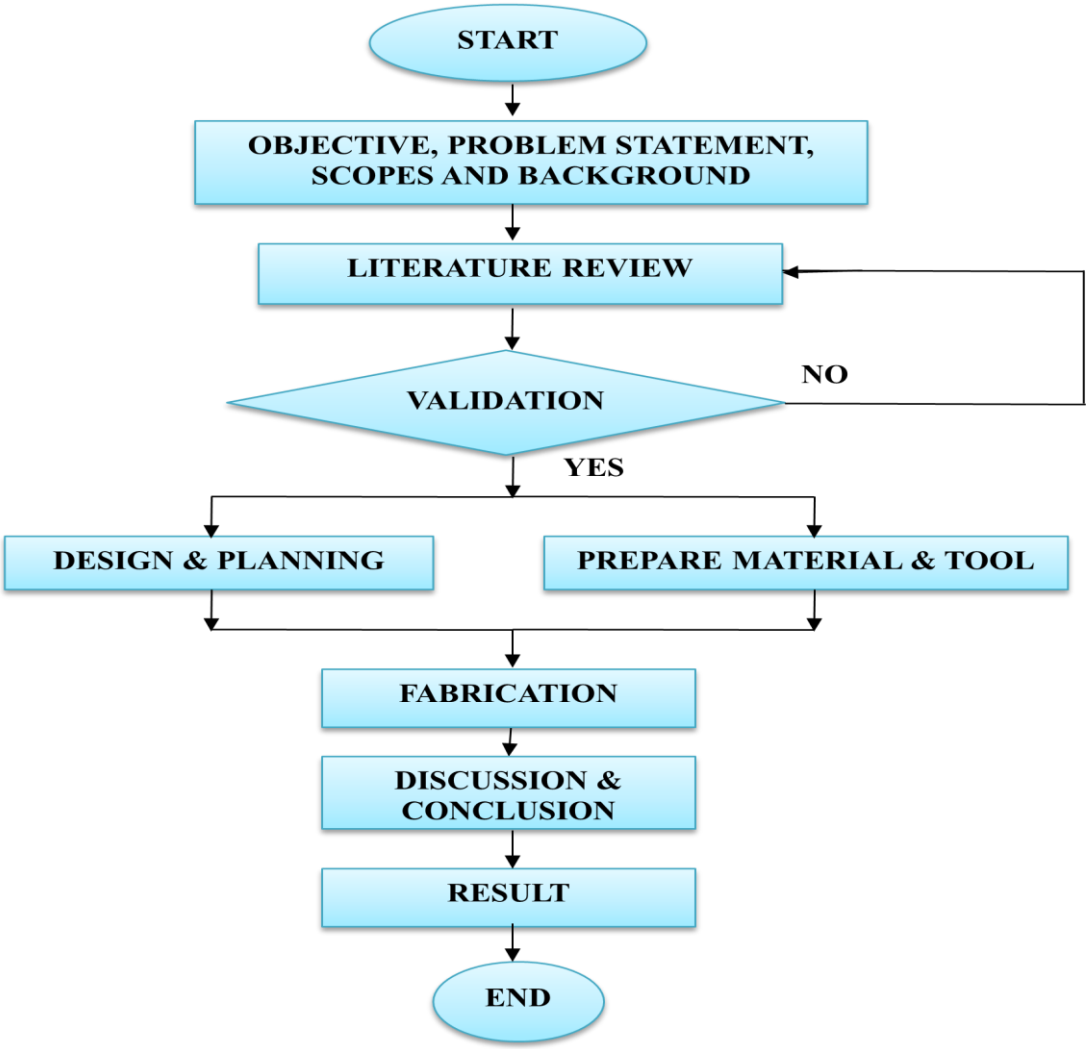


FIGURE 3.1: Flow Chart

This project is basically beginning with the topic selection and discussion regarding the project topic about the project objectives and project scopes with the supervisor. Then, the literature review process has been performed of the establish the specification of the history development of aquaponics, why is so significant for future, types, technology, advantages, types of plantation, types of animals and vegetables and the significant of gravity flow design. Others references materials like reference books, journals and appropriate web sites also have been studied to get further understanding about this project topic.

After that, the designing process has been carried out starting with the design sketching and then improves into proper design drawing by using Solid Works software. The design generation and design selection have been implemented in order to select a best design among the others design. The selection of the design is carried out by using the concept scoring method based on the some criterions. Next, the necessary materials to fabricate the gravity flow system and curved tank have been selected.

Then, the fabrication process of the selected design is conducted by using appropriate fabrication process. After the fabrication process has been done, the evaluation on the gravity flow system and curved tank are performed how to know whether the gravity flow system and curved tank can operate or not. If the gravity flow system and curved tank are able to operate very well, it is ready to be presented in the final project presentation. Finally the report of this final project needed to be completed and submit before the due date.

3.3 DESIGN AND PLANNING

In this project, the design is beginning with the designing of four sketching of the gravity flow system and curved tank. Then, only three appropriate designs sketching have been choose from the previous four designs sketching. Next, the selected designs sketching have been improved into Three Dimensional (3D) drawing by using the Solid Works software. In this case, the precision of the gravity flow system and curved tank dimension are very important during performing the Solid Works drawing process in order to get the real and better shape of the gravity flow system and curved tank.

3.3.1 FIRST DESIGN

The first design is mainly shows the gravity flow system. This design concept has advantages of easy to manage gravity flow when use, stable and requires high point to low point by gravity tank.

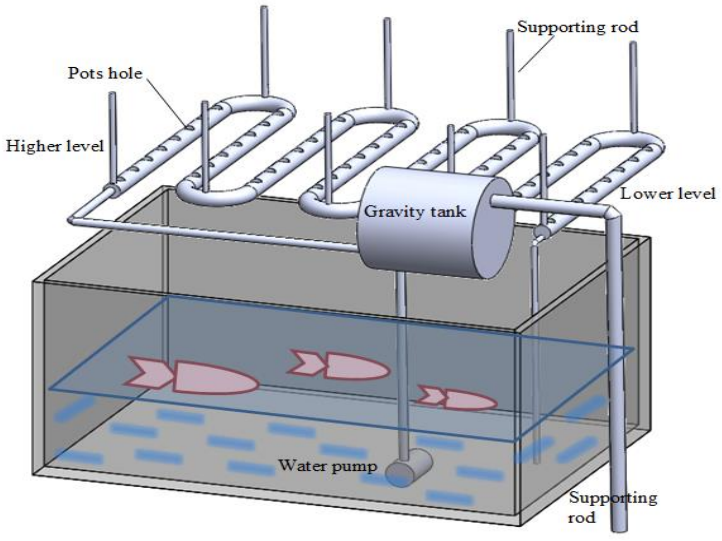


FIGURE 3.2: First design: isometric view

3.3.2 SECOND DESIGN

The second design is mainly shows the curved tank. The curved tank mostly are made on two tanks.

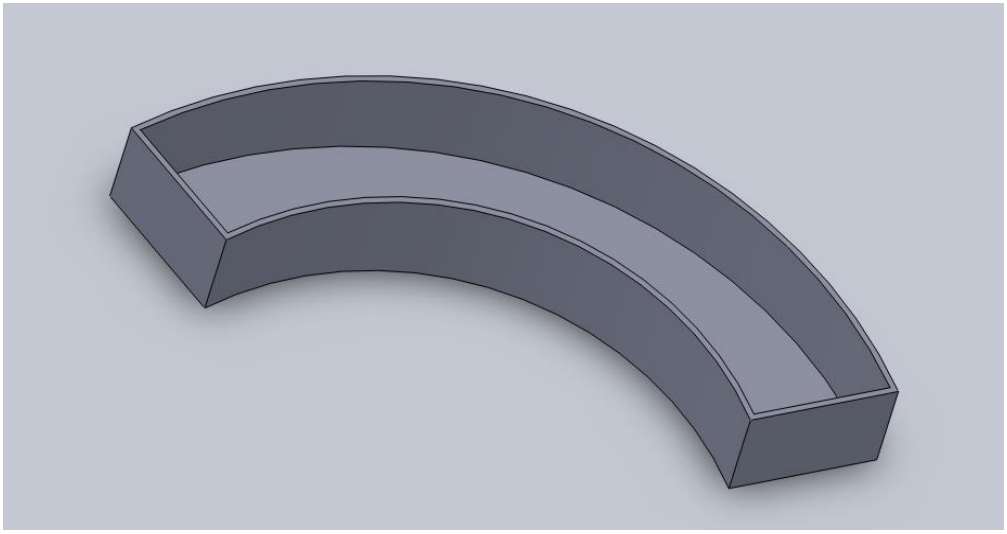


FIGURE 3.3: Second design, isometric view

3.3.3 THIRD DESIGN

The third design is basically shows dome house.

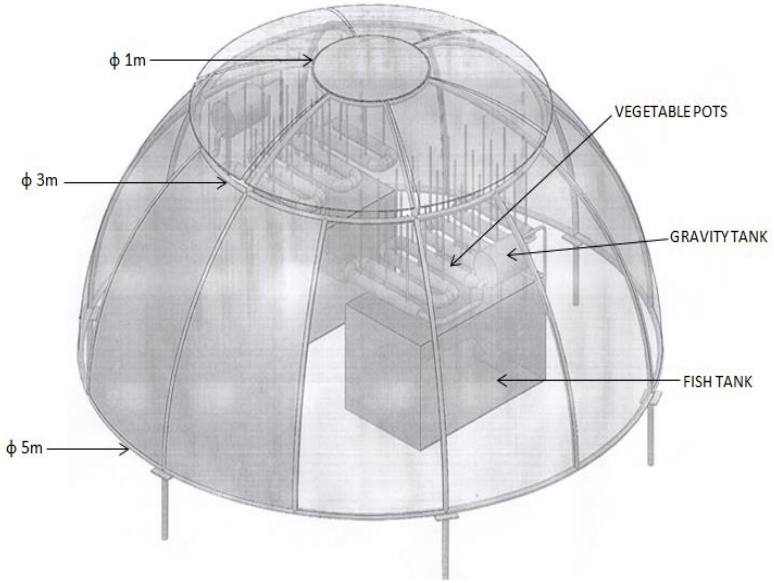


FIGURE 3.4: Third design, isometric view

3.4 FABRICATION PROCESS

3.4.1 STEPS TO FABRICATE THE CURVE TANK

The curved tanks are made on three layer for each. The two tanks were fabricated by using the mold firstly. The mold of curved tank is build from the plywoods.

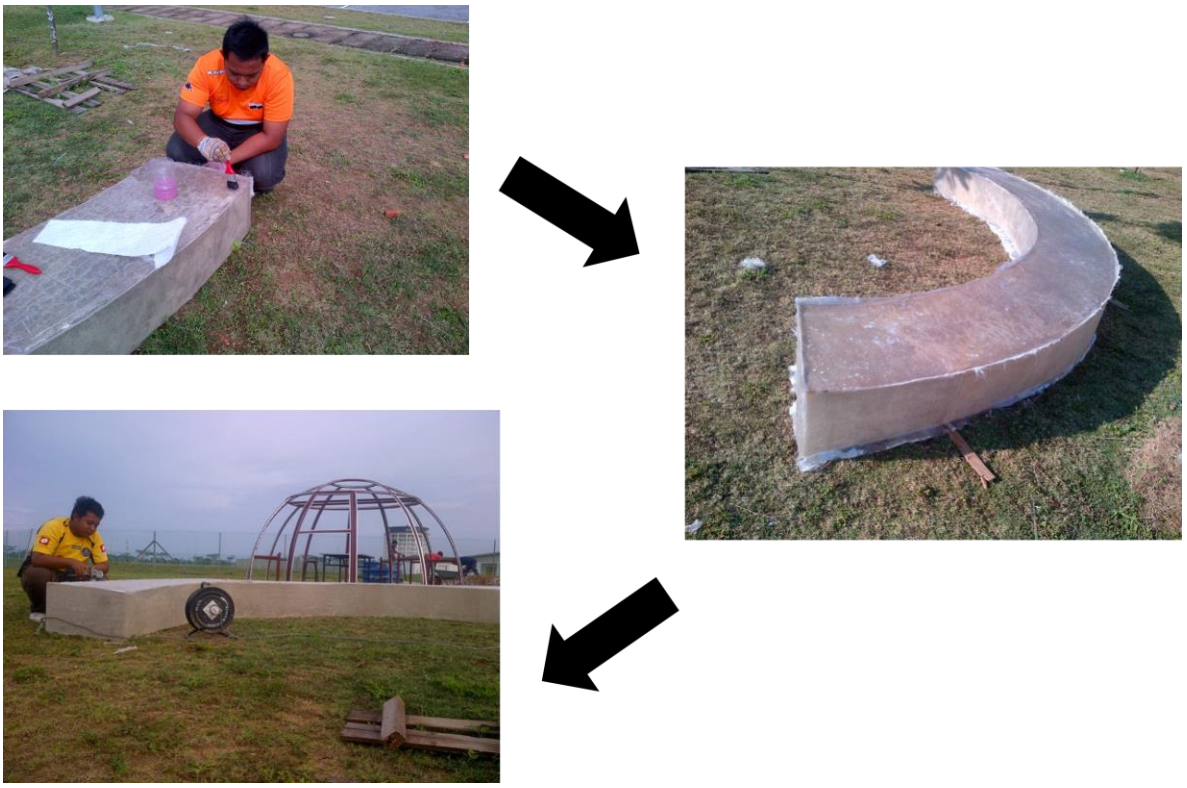


Figure 3.5: Steps to fabricate two curved tanks

3.4.2 STEPS TO MADE THE MOLD FOR THE REINFORCEMENT ON THE CURVED TANK

Before made the reinforcement, there the steps to build it's mold. Firstly, the process is to make curving of 2 X 1 inch of hollow square about two meter lengths.

Figure 3.6: Steps to build the mold for the reinforcement on the curved tank.

3.4.3 STEPS TO ASSEMBLED TOGETHER THE REINFORCEMENT ON THE CURVED TANK

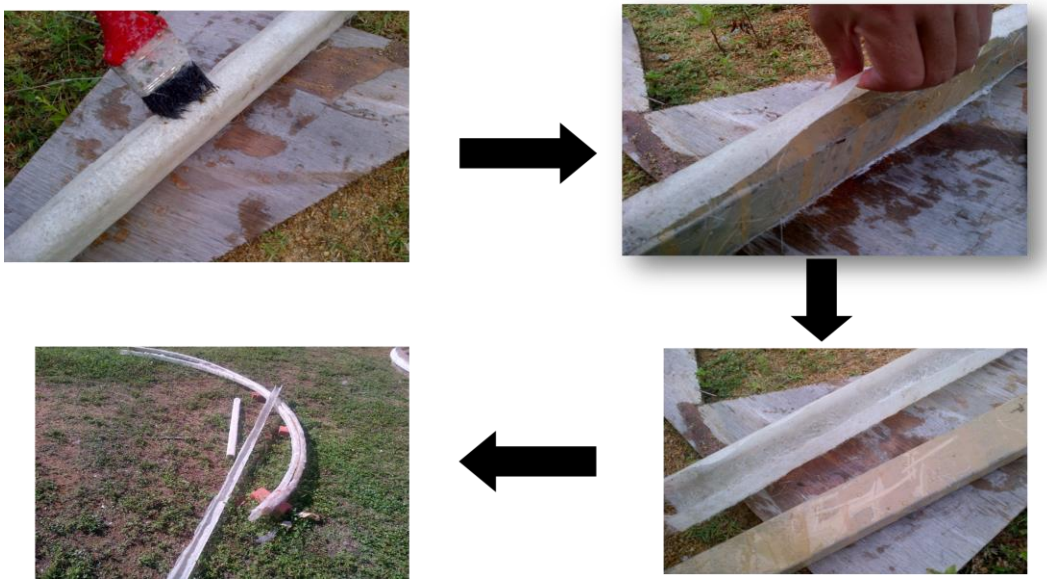


Figure 3.7: Steps to assemble together the reinforcement on the curved tank

3.5 FINISHING

The final fabrication process is the finishing process which is involving of assembly the reinforcement on the curved tank. Before assemble all the parts of reinforcement on the tank, the parts are make it by using the fiber glass. This is because to improve the part appearance and to make the material used long lasting especially for the based of curved tank. After that, the assembly process is performed by assembly all the part as shown in the figures.

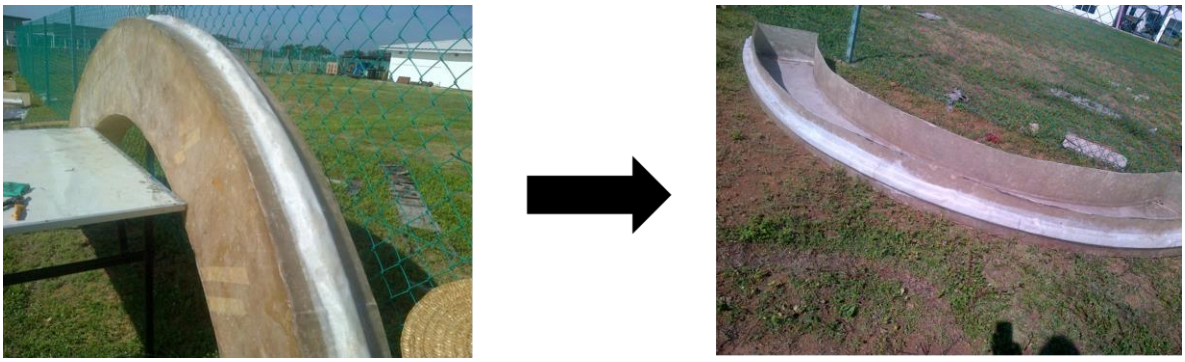


Figure 3.8: The reinforcement assembled together on the curved tank.

3.6 SUMMARY

This chapter present on how the project is being conducted. The curved tanks are usually very hard to build it. So many ways to dissolved the problem and make the perfect curved tank.

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CHAPTER 4

RESULT AND DISCUSSION

4.1 INTRODUCTION

The result and discussion of the project is a project in theory and writing of the functionality and operation of gravity flow system and applications related to the field of the project. In addition, it should describe the product or the results obtained after the execution of a project implemented works well or not.

There are several parts to be fabricating to produce of aquaponic gravity flow plantation system for lettuce plant:

i. Dome house
ii. Curved tank
iii. Reinforcement
iv. Piping system

4.2 FUNCTION OF PARTS

4.2.1 Dome house

Main dome house is the most important part in this project. The purpose of fabricated dome house is mostly important parts because it’s functioning as the house for plants, fish and everything had in this project.

Figure 4.1 show the design of dome house and figure 4.2 shows the fabrication of the dome house.

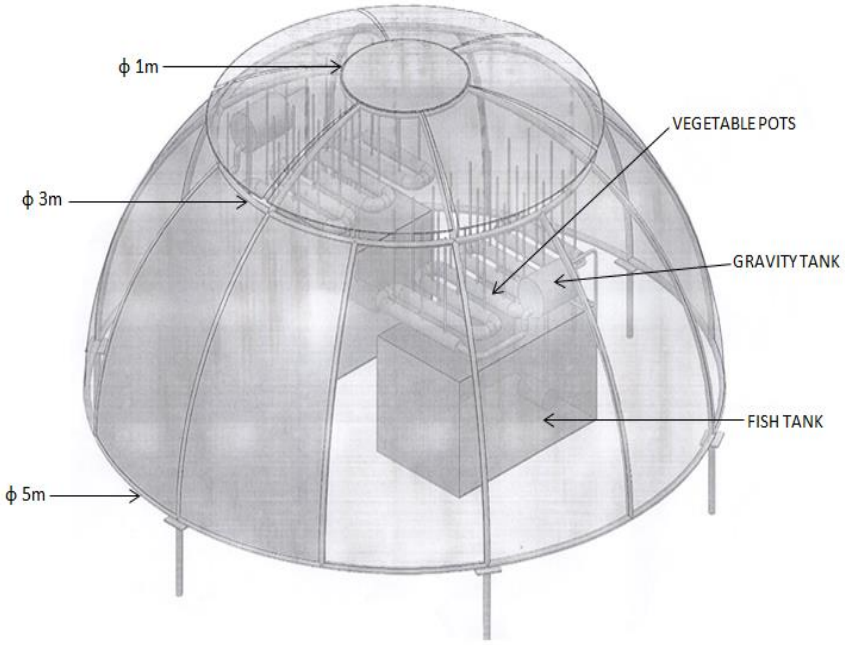

Figure 4.1: The design of dome house

Figure 4.2: The fabrication of the dome house.

4.2.2 Curved tank

The curved tank consists with two tanks. Figure 4.3 shows the design of curved tank and Figure 4.4 shows the fabrication of curved tank.

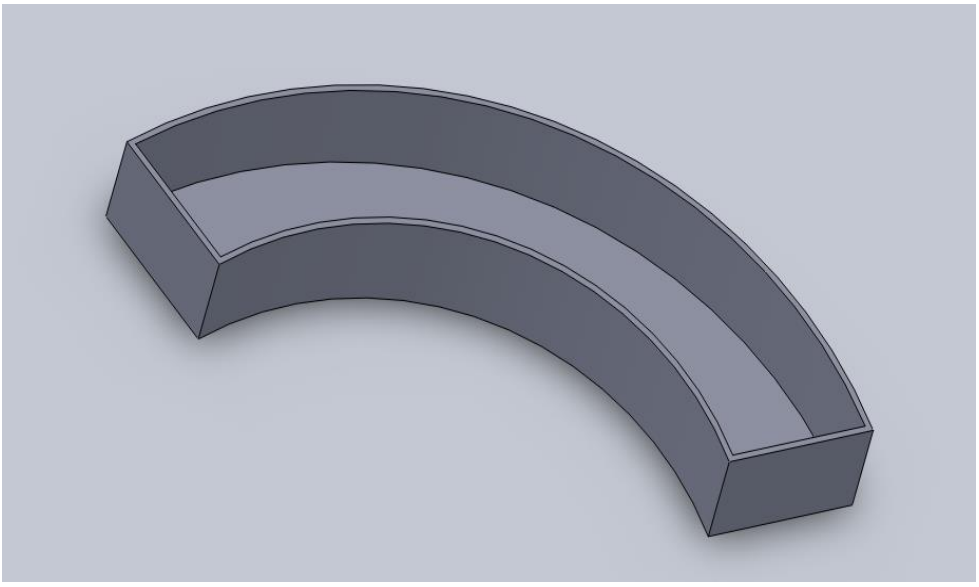

Figure 4.3: The design of curved tank

Figure 4.4: The fabrication of curved tank

4.2.3 Reinforcement

Reinforcement is used to guide the curved tank to become rupture. So, the reinforcement is very important in this project. Figure 4.5 shows the curved tank was assembled with the reinforcement.

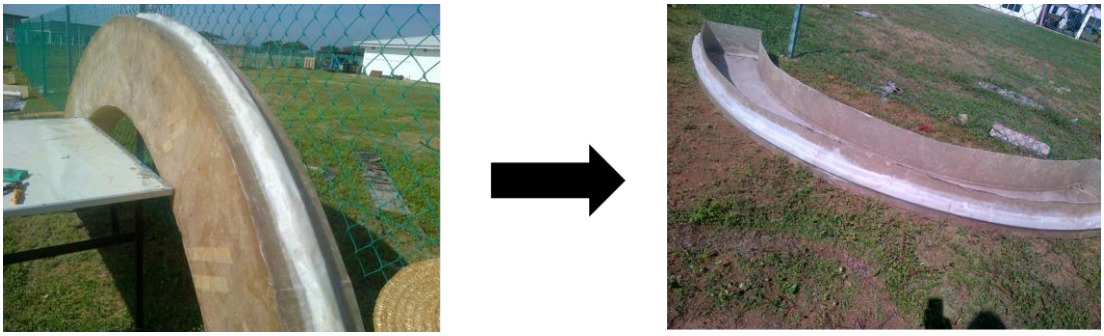

Figure 4.5: The reinforcement on the curved tank

4.2.4 Piping system

Piping system is functioning as how the water can flow by the gravity by the gravity tank. Figure 4.6 show the piping system of gravity flow in this project.

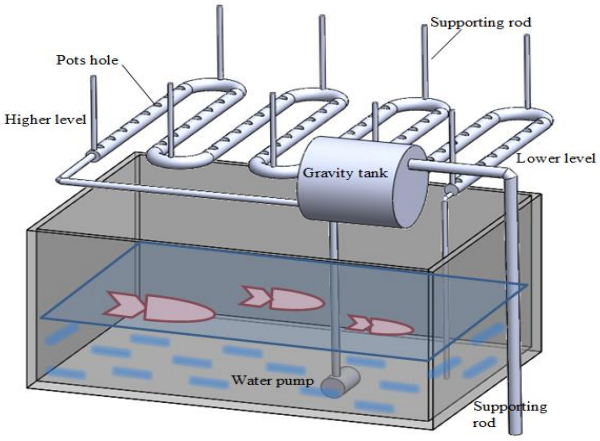

Figure 4.6: The piping system of gravity flow in this project

4.3 ASSEMBLING OF REINFORCEMENT ON THE CURVED TANK

After all sections were completed, each part reinforcements must be assembled together with the curved tank as shown on Figure 4.7 shows that the steps how the reinforcement assembling together with curved tank.

Figure 4.7 (a): The reinforcement is built using fibre glass.

Figure 4.7(b): The reinforcement is divorced from the mold

Figure 4.7(c): The reinforcement is assembled together the curve tank.

4.4 Discussion

After all the completed, the curved tanks are put on the basement in the dome house. The basement of curved tank was created by PSM students. There are many problems during doing the progress works are difficult to make the reinforcement. Its makes so long time to manage it. Besides, the weather condition also some of the problems in this project while late arrive ordered item also some problem in this project.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The five main inputs to the system are water, oxygen, light, feed given to the aquatic animals, and electricity to pump, filter, and oxygenate the water. Spawn or fry may be added to replace grown fish that are taken out from the system to retain a stable system. In terms of outputs, an aquaponic system may continually yield plants such as vegetables grown in hydroponics, and edible aquatic species raised in an aquaculture.

As in all aquaculture based systems, stock feed usually consists of fish meal derived from lower-value species. Ongoing depletion of wild fish stocks makes this practice unsustainable. Organic fish feeds may prove to be a viable alternative that relieves this concern. Other alternatives include growing duckweed with an aquaponics system that feeds the same fish grown on the system, excess worms grown from sericulture composting, using prepared kitchen scraps, as well as growing black soldier fly larvae to feed to the fish using composting grub growers.

5.2 RECOMMENDATIONS

1. When we have the fish tank positioned above the grow beds then we can use gravity to move the water. There are ways of moving the water and solids most efficiently though.
2. If we simply put an outflow on the side of the fish tank the water would indeed flow out of the tank and into the grow beds - the problem, is that the solid waste is heavy and generally sinks to the bottom of the tank - so a hole high up on the side of the tank is not going to move the solid waste to where we need and want it.
3. In this case, we use what is known as an SLO or a Solids Lift Overflow. This draws the water and the solid waste from the bottom of the tank. The beauty of this system is that it is simple to implement using commonly available materials, it is effective, and it requires no power whatsoever.
4. The Solids Lift Overflow is a wide diameter pipe that sits upright, usually in the centre of the tank. It is fitted with a T connector at the top and the piping then goes through the side of the tank and on to the grow bed. We use a T connector instead of a 90 degree elbow so that we don't form a siphon and drain the tank.

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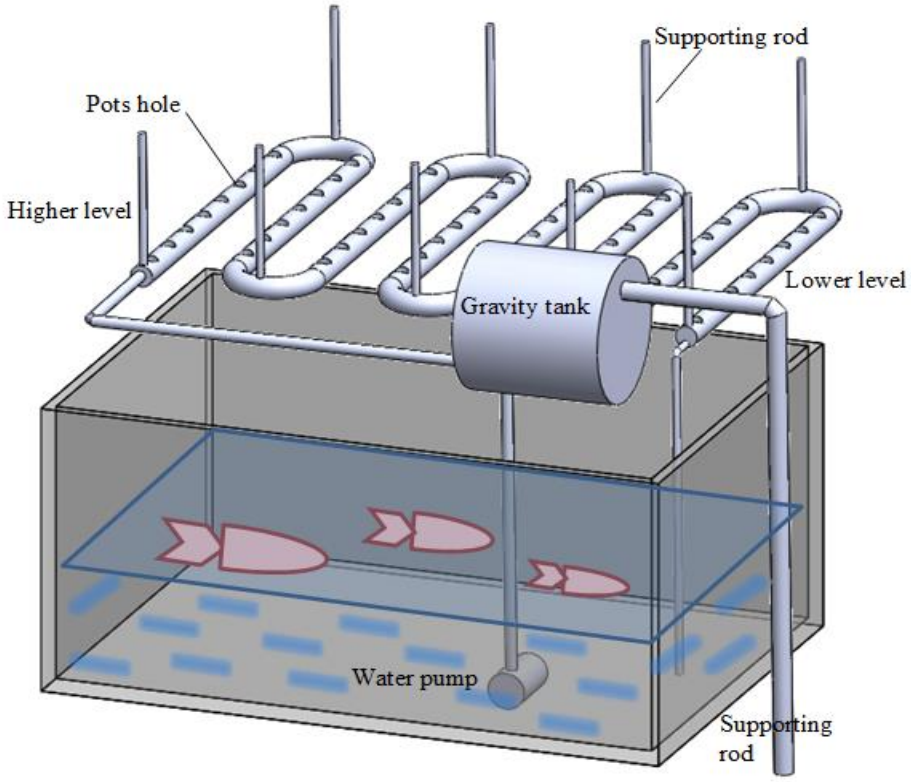
APPENDIX 1

The Gantt chart shows the details project activities in order to complete this project

PROJECT ACTIIVITIES		WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
LITERATURE REVIEW	PLANNING														
	ACTUAL														
REVERSE ENGINEERING	PLANNING														
	ACTUAL														
DESIGN & PLANNING	PLANNING														
	ACTUAL														
PREPARE MATERIAL & TOOL	PLANNING														
	ACTUAL														
FABRICATION	PLANNING														
	ACTUAL														
SYSTEM INTEGRATION	PLANNING														
	ACTUAL														
MODIFICATION	PLANNING														
	ACTUAL														
FINAL REPORT	PLANNING														
	ACTUAL														

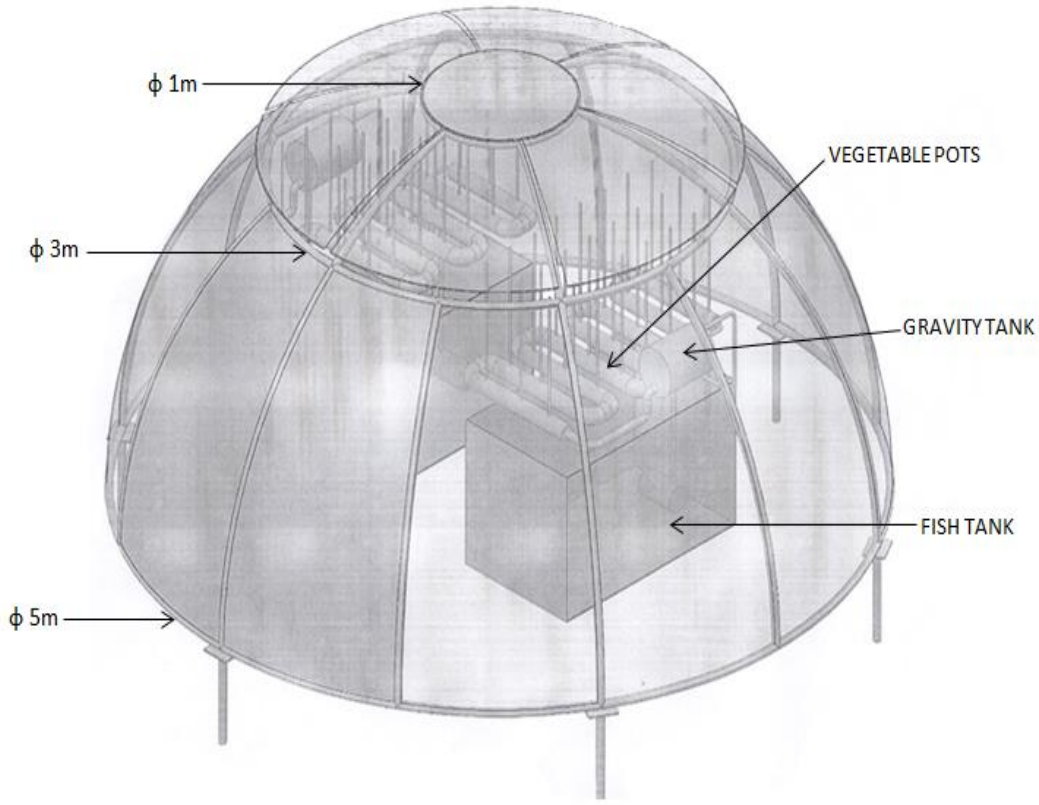
APPENDIX 2

The piping system of gravity flow in this project



APPENDIX 3

The isometric design of dome house.



APPENDIX 4

The design of curved tank