FABRICATION OF AQUAPONIC DRY GRAVEL PLANTATION SYSTEM FOR TOMATO PLANT

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FABRICATION OF AQUAPONIC DRY GRAVEL PLANTATION SYSTEM FOR TOMATO PLANT

MOHAMMAD SYAHIR SYAHMI BIN HASSAN

Report submitted in partial fulfillment of the requirements for the award of
Diploma of
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I certify that the project entitled *"Fabrication of Aquaponic Dry Gravel Plantation System for Tomato Plant*" is written by *Mohammad Syahir Syahmi Bin Hassan*. 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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ABSTRACT

This project was carried out to fabrication of aquaponic dry gravel plantation system for tomato plant. The objectives of this project are to fabricate and reinforced the curved water tank for hydro plantation and to integrate the dry gravel plantation unit for aquaponic system. In this study, it is focus 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 dry gravel design. The design generation and design selection have been shown in this report in order to select the best design concept of the dry gravel plantation system. The solid three dimensional structures modeling of the dry gravel 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 dry gravel plantation system for tomato plant is provided for further implication.

ABSTRAK

Projek ini telah dijalankan untuk menghasilkan sistem batu kerikil perladangan aquaponik untuk tumbuhan tomato. Objektif projek ini adalah untuk mereka dan memperkukuhkan tangki air melengkung untuk perladangan hidro dan untuk mengintegrasikan unit perladangan batu kerikil untuk sistem aquaponik. Dalam kajian ini, ia memberi tumpuan kepada pembangunan sejarah aquaponik, mengapa begitu penting untuk masa depan, jenis, teknologi, kelebihan, jenis tanaman, jenis haiwan dan sayur-sayuran dan ketara reka bentuk batu kerikil. Generasi reka bentuk dan pemilihan reka bentuk telah ditunjukkan di dalam laporan ini untuk memilih konsep reka bentuk yang terbaik dalam sistem perladangan batu kerikil. Pepejal tiga dimensi model struktur sistem perladangan batu kerikil 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 batu kerikil perladangan aquaponik untuk tumbuhan tomato disediakan bagi implikasi selanjutnya.

TABLE OF CONTENT

CHAPTER 3 METHODOLOGY

CHAPTER 4 RESULT AND DISSCUSION

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Aquaponics is the combination of aquaculture and hydroponics. In aquaponics, we rear fish and plants together in one integrated, soilless system. The fish waste provides a food source for the plants and the plants provide a natural filter for the water the fish live in. Aquaponics produces safe, fresh, organic fish and vegetables. When aquaponics is combined with a controlled environment greenhouse, quality crops can be grown for few months, everywhere in our country. Aquaponics can be used to sustainably raise fresh fish and vegetables for a family, to feed a village or can give income in a commercial farming field.

Vertical farming is planting vegetable on pipe with water from fish tank. The plants are grown at different level such that the water will flow down from top to bottom and back to the fish tank. We can produce about twice the amount of plants as we can with an ordinary agriculture land system of the same area. The system used fish waste to work as fertilizer for crops.

Aquaponics combines both systems, and in doing so cancels out the negative aspects of each. Instead of adding toxic chemical solutions to grow plants, aquaponics uses highly nutritious fish effluent that contains almost all the required nutrients for optimum growth. Instead of discharging water, aquaponics uses the plants and the media in which they grow to clean and purify the water, after which it is returned to the fish tank. This water can be reused indefinitely and will only need to be replaced when it is lost through transpiration and evaporation.

The dry gravel performs several very important tasks, and if we were to try and describe those functions in a simple way, one suitable description would be, it is a Bio-Filter in which we grow plants. A very happy and combination of duties. It is extremely convenient for our purposes, because as a Bio-Filter it collects and processes the ammonia and solid waste from the fish and returns the water to the fish tank clean, and by the growing of plants in the Bio-Filter (Grow Bed) we use up the nutrients and nitrates produced in the Bio-Filter producing excellent quality fresh veggies for our table.

Aquaponics systems are designed to keep fertilization as natural as possible. To achieve this, fish waste is processed by bacteria. Gravel harbors beneficial bacteria, whose role is to keep fish healthy, and to produce nitrates for optimum plant growth. Gravel should be the appropriate size for the fish that are being housed in the tank. Avoid gravel with sharp edges to reduce injuries to fish. Bacteria helps to complete the nitrogen cycle, which is needed for robust plant growth. Gravel houses two beneficial types of bacteria that work together to produce nitrates for fertilization of plants. Fish waste breaks down into ammonia. The ammonia is consumed by nitrosomonas bacteria, which then converts the ammonia to nitrites. Nitrites are then consumed and converted to nitrates by nitrobacter bacteria.

1.2 PROBLEM STATEMENT

Nowadays, rapid development of country gives an effect to agriculture because land of agriculture was destroyed in order to make new building and residential area. Vertical hydroponics provides an intelligent solution to gardeners that have limited horizontal space and for gardeners that want to maximize their yield. They are mostly suited to that do not grow very tall, and can be used effectively on walls, fences, balconies, and for higher density growth in small yards. The usage of chemical pesticide can be dangerous for the people. It possibly avoided when we practice aquaponic system. The advantages of this method of farming can be further exploited by large scale production of crops. The controlled growing conditions will reduce the use of chemical pesticide.

1.3 OBJECTIVE OF THE STUDY

i. Fabrication of aquaponic dry gravel plantation for tomato plant.

1.4 SCOPE OF STUDY

The scope of study is to fabricate tank by using fiber glass and use dry gravel in plantation system.

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CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, the literature review of previous research that has been conducted in many countries will be review. It will include the basic knowledge about vertical soilless farming, aquaponic and hydroponic. Many researchers have investigated the method how to create system that can be practice for all people and it is possible to achieve it.

2.2 SOILLESS FARMING

For many years, human beings have fed themselves by growing a huge variety of vegetables and grains. In more recent years, technology has helped increase harvests, shorten growing time, and make growing crops indoors feasible. Genetic engineering has brought about strains of plants that are resistant to many diseases. These plants also grow more quickly and spoil also become less. Indoor farming helps to lengthen the growing season and reduce the effect of weather on crops. Now, there is another way of growing the food the world needs. According to Dr. Dickson Despommier, professor of environmental sciences and microbiology at New York's Columbia University, food production increases, the effects of global warming

decrease, the production of clean-burning fuel increases and waste water is made cleaner by creating vertical farms.

(Despommier, 2009) is concerned with the fact that the world's population will increase to nearly 9 billion by 2050. He also is concerned that nearly 80% of the world's suitable farming land is already in use. With current farming methods it would take an area larger than the country of Brazil to create enough food to feed the population of nearly three billion additional people by the year 2050. Realizing that current farming methods will not be adequate in the future, Dr. Despommier has thought about taking current indoor farming methods several steps further. He has explored the concept of vertical farming using multi-storied buildings and tiers of planters to grow a variety of crops. He envisions skyscrapers in the middle of large cities providing fresh vegetable for the entire city. There are many advantages of this idea such as:

First, indoor farming will produce crops that are more productive since plants will not be affected by changes in climate or by rain, hurricanes, floods, monsoons, ice or droughts. In addition, the food grown will be used quickly and consumed by local people, so the damage will be at a minimum. Land in vertical farming also will be used more productively than before it was introduced. Depending on the type of crop grown, an indoor farm can produce as much food as four to six acres of outdoor farming, without the huge losses that outdoor farming can sustain. With vertical farming, crops can be grown more frequent within a year.

Second, vertical farming will make crops grow organically in more simple way and less expensive. Since plants will grow indoors, pesticides will not be needed to protect plants from insects. In addition, fertilizers would not be needed because the indoor methods will provide enough nutrients for plants without having chemicals addition.

Third, this new type of farming will greatly decrease the chances of spreading infectious diseases such as rabies, West Nile virus, malaria and salmonella. Currently, many of these diseases are transferred to food by wild animals and by farm animals that have grazed where the food is being grown. (Despommier, 2009).

Another significant advantage of vertical farming is those current farmlands will maintain to its original purpose. Forests and jungle will begin to be preserved in areas that were used for farming, returning the ecosystems to their natural states. The world's supply of oxygen will increase, helping to protect the ozone layer. Chris Jacobs, working with Dr. Despommier, has created a number of innovative designs. One of the designs is based on the Capitol Records building in Hollywood, California.

Using the same type of round design, Jacob's creation uses space more effectively than square or rectangular buildings. His design covers large area of glass and a rotating solar panel at the top to absorb the sun's energy. Wind power is also used to provide energy for the many functions of the buildings. The concept of vertical farming is beginning to catch on around the world.

Aquaponic is a way of plant agriculture that combines hydroponics and aquaculture. The wastes produced by fish are absorbed by the plants as nutrients and filter the water to prevent water toxification that harms aquatic animal (Kumar,n.d.; Beria, Garber, Neu, Sebes & Sheetz, 2006). This cycle support the existence of both the plants and fish. The idea of aquaponics was taken from the ancient farming techniques of Aztecs and Egypt, wherein the nutrients in nature were recycles (Rogosa, 2010). The reason for the definitions is because aquaponics is a mixture of aquaculture and hydroponics.

It is the same concept as hydroponics. The plants roots are submerged in the water with the fish waste and ammonia that are added is the part of the system that is like aquaculture. The plants absorb and suck up all the ammonia and turn them into nitrites and then into nitrogen, which then helps the plant because the plant needs nitrogen in order to live.

The aquaponic system consists of two main parts the reservoir and the grow bed. The reservoir holds the fish and the grow bed hold the plants. It works by using a pump that takes the water up to the grow bed from the reservoir and waters the plants as well as giving them nutrients from the fish such as ammonia.

Aquaponics is important because it helps during food shortage. It also gives you organic fruits or vegetables. Usually you will not need to put chemicals into your aquaponic system because the plants absorb the ammonia not killing the fish. The only chemicals needed for an aquaponic system is iron which helps give the plants more nutrients and it also does not harm the fish.

2.3 HYDROPONIC

Hydroponics is the science of growing plants in a soil-less medium. The roots feed on a nutrient rich solution that contains all the essential elements necessary for the normal plant growth and development. Plants grown hydroponically are not physiologically different than plants grown in soil. Both inorganic and organic components need to be decomposed into inorganic elements in order to become available for plant uptake (Carpenter, 1994). However the plant processes involved in obtaining minerals from a soil solution compared to a hydroponic solution are different. Mineral nutrients become available for plant uptake when soil colloids release minerals into the soil solution through solubilization of soil minerals and organic matter (Resh, 1995). In hydroponic culture dissolved nutrients are delivered to the plant in a solution rather than a soil solution. Therefore hydroponics allows maintaining the plant in an ideal nutrient condition.

However, the margin of error is great due to the lack of buffering capacity, which can result in plant starvation or nutritional stress. Hydroponics is an efficient and profitable technology for growing plants. Hydroponics is a valuable means of growing plants in regions with little arable land or regions with large, dense populations (Schoenstein, 1996). Hydroponic culture allows for increases in density spacing and yields due to minimal competition among roots. For example, hydroponic organic basil production in California spaced their plants at 12.7 cm centers (Schoenstein, 1996). Herbs have the potential to grow up to 25 percent faster in a hydroponic solution compared to soil (Skagg, 1996). Plants grown hydroponically have a

threefold increase in vitamins and minerals compared to plants grown in soil (Skagg, 1996). By the year 2000, Dutch growers will more than likely be totally free of soil (Carpenter. 1994).

2.4 FISH FARMING

Fish are the power house of an aquaponics system, it provide the nutrients for the plants. There are many different species of fish that can be used in an aquaponic system, depending on local climates and available supplies. There are also a few choices for year round fish that could grow, but it often take a longer time to mature. Live in a cooler climate might be looking at growing trout all year round, or perhaps another locally produced fish species. In warmer areas people generally grow Barramundi, or Jade Perch year round, in most warm areas throughout the world Tilapia is the fish of choice.

There are other fish species which are quite suitable for aquaponics, that might be available. Europe, many different species of carp are grown, within the United States such species as Bluegill are often available, while in Australia we also have a number of other native species like Sleepy cod which would be suitable. Other aquatic animals that can be incorporated into an aquaponic system are fresh water mussles, fresh water prawns, and fresh water crayfish. Mussles are a filter-feeder, and do a great job of helping to clean the water, they will happily grow in flooded grow beds, or can be incorporated into fish tanks. Crustaceans make a nice addition to an aquaponic system and there are a few different species available depending on your location and water temperatures.

2.4.1 Red tilapia

There are about 70 species of tilapias, most of them native to Western rivers of Africa (Anon, 1984). According to Food and Agriculture Organization in 2002 (FAO 2002) from 70, only a few of species are used in commercial and as food such as Nile tilapia (Oreochromis niloticus), Mozambique tilapia (Oreochromis mossambicus) and Blue tilapia (Oreochromis aureus). The term of Red tilapia is widely used since it more familiar at every place we go to find the fresh fish. As we know, Red tilapia is not origin of tilapia species, but it is the name used to describe different type of tilapia that has variant attractive red color. They are result of continuous selected breeding.

Statistic from (FAO 2002) shows that among of that species, the most well-known species is Oreochromis niloticus since it has been reason for the increasing in tilapia production from fresh water aquaculture and accounted for about 83% of total tilapias produced worldwide. (Pullin, 1983) has make comparison between various tilapia species with culture potential and give suggestion to be concentrated on Oreochromis niloticus and Oreochromis aureus.

(Shelton, 2002) has claimed that Oreochromis niloticus is higher production compared to the hybrids species. This species is the most favored by farmers due to its suitability for farming in a wide field of culture environments, higher demand, and give more productivity at low cost. The other species that are gaining recognition because of their adaptability to certain conditions are Oreochromis aureus for colder waters and Oreochromis spilurus for saline waters or water that have amount of dissolved salt.

Red tilapia hybrid was produced for the first time in Taiwan through combination of two species that are Oreochromis mossambicus and Oreochromis niloticus then the third generation of tilapias. It is the combination favored colors with other desirable features of tilapias (Anon, 1994).

This fish has gained increasing preference of commercial farmers in some countries because of their reddish color liked by consumer. In terms of performance, (Alceste, 2000) claimed that Red tilapias are suitable for seawater culture because of

salinity tolerance of the parental species, known to be moderately (Oreochromi niloticus and Oreochromis aureus). Red tilapia hybrids are most commonly used in aquaculture operations because they have potential for culture since it is easy to look after.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The goal of my project was to fabricate aquaponic dry gravel plantation system for tomato 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 FLOWCHART

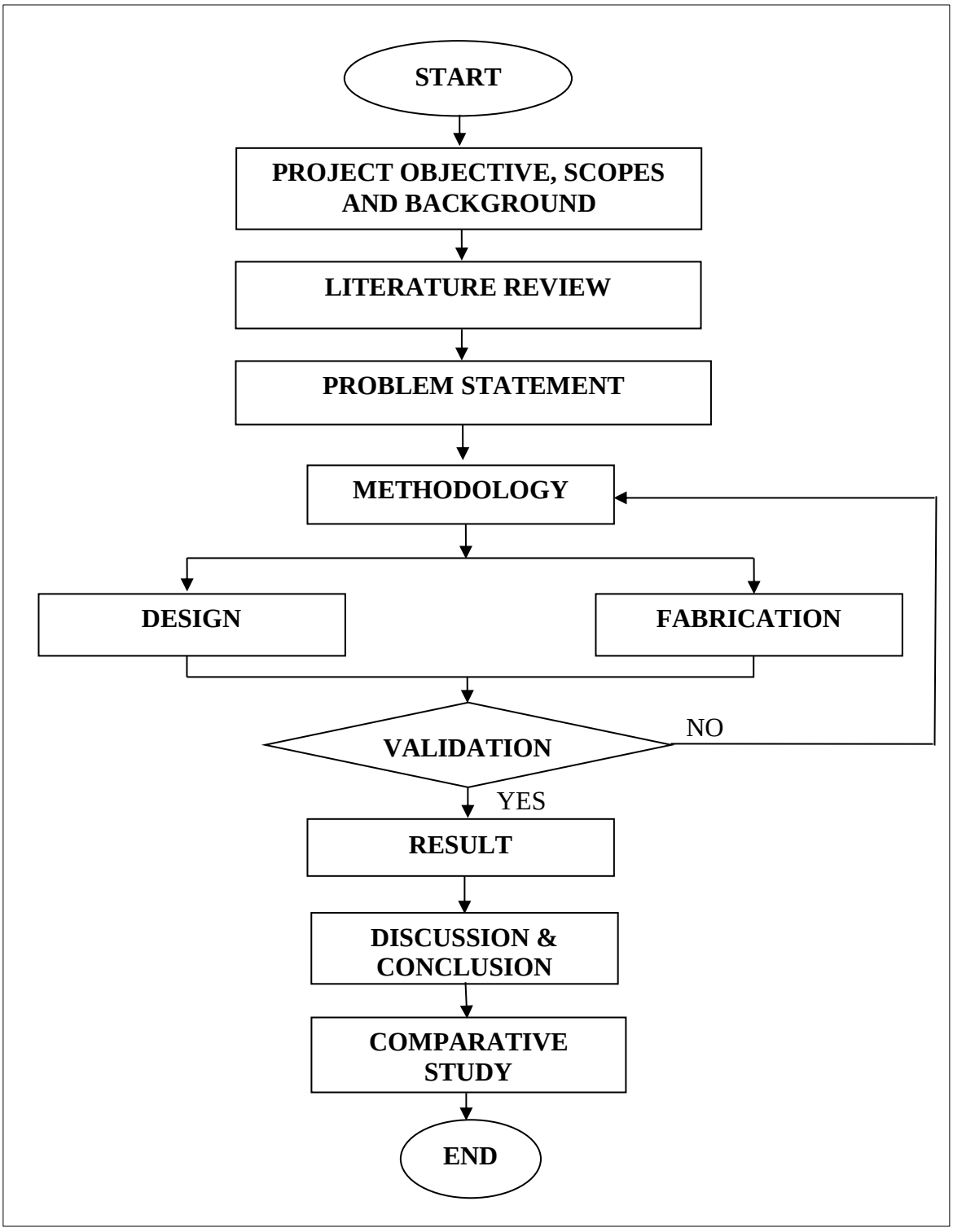

Figure 3.1: Flowchart

3.3 DESIGN

Vertical farming does not have much different in design compared to ordinary gardens. They need vessels to grow plants, most commonly pots that are pipes, a nutrient reservoir, nutrient solution, watering system, fluid lines, and a pump. Because of their increased height compared to ordinary gardens, vertical farming need pumps that can deliver greater pressure, so as to be able to deliver nutrients to the dry gravel tank need sufficient pressure to spray the nutrients onto the plants. Vertical farming can also be grown indoors, where the light needs to be oriented in a way that ensures all plants are illuminated. The flow of the system is from the fish tank, the pump bring the fish waste at bottom of fish tank up through the piping system and the fish waste reach at the dry gravel tank. The nutrient stick between the gravel and plant can got the nutrient. The clean water going down to bottom of the tank and clean water going back to fish tank.

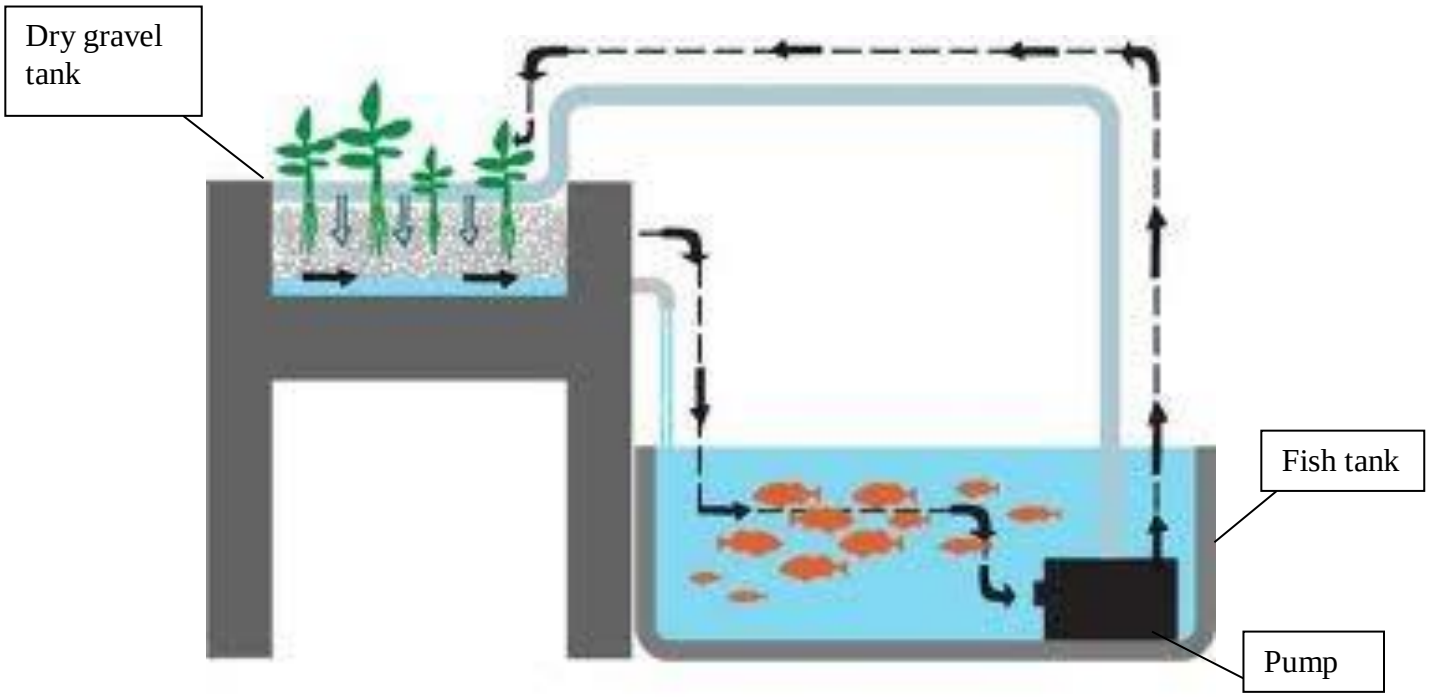

Figure 3.2: Fish tank with other part

3.3.1 Vegetable pots

Water must move around the system for it to be a complete system. This is normally done with a pump of some kind. We must also make sure the water can flow back to the rest of the system and choosing the right size plumbing is important. The vegetable is place in the pots arranged on the pipe that has hole on it. At the end of the pipe is small pipe which is to flow the water back into fish tank.

3.3.2 Pump

Pumped up fish waste that contain nutrient by pump from fish tank. When there are certain amount of water has been pumped into piping system, it will be flow down into vegetable compartment that is located below level from gravity tank. It must have enough space to store water from fish tank and must have enough strength to withstand the water pressure. It has pipe connected to the water pump in order to pump water from fish tank into the tank.

3.3.3 Fish tank

Fish tank is not only to keep fish but also as water storage for the vegetable to get water. It must have space big enough for the system. All the part of aquaponis such as water pump, gravity tank, and vegetable pots will be arranged at upper of this fish tank. Red tilapia will be place in the tank.

3.4 FABRICATION

3.4.1 Aquaponic 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. The tank is about 10 inch depth and the width is 12 inch.

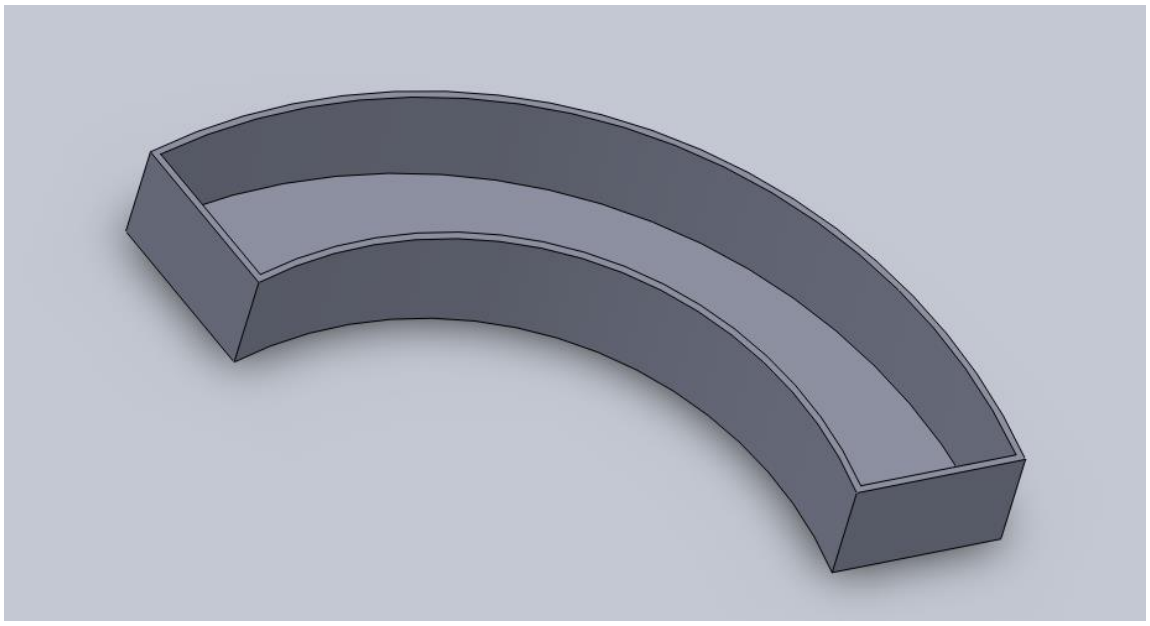

Figure 3.3: Aquaponic curve tank layout

3.4.2 Make Mould For The Reinforcement On Curved Tank

The reinforcement process is to make curving of 2 X 1 inch hollow square. The reinforcement that make for curve tank to make the curve tank more strong. Even the curve tank have doing by three layer it still not strong and at the middle of tank still shaky.

Figure 3.4: Mould reinforcement for curve tank.

3.4.3 Step To Make The Reinforcement On Curve Tank

The reinforcement make by the same process and step to make a curve tank. For the reinforcement mould, put the sellotape to easier pull the reinforcement from the mould. The reinforcement have to put around the curve tank, so the curve tank more stronger and look more solid.

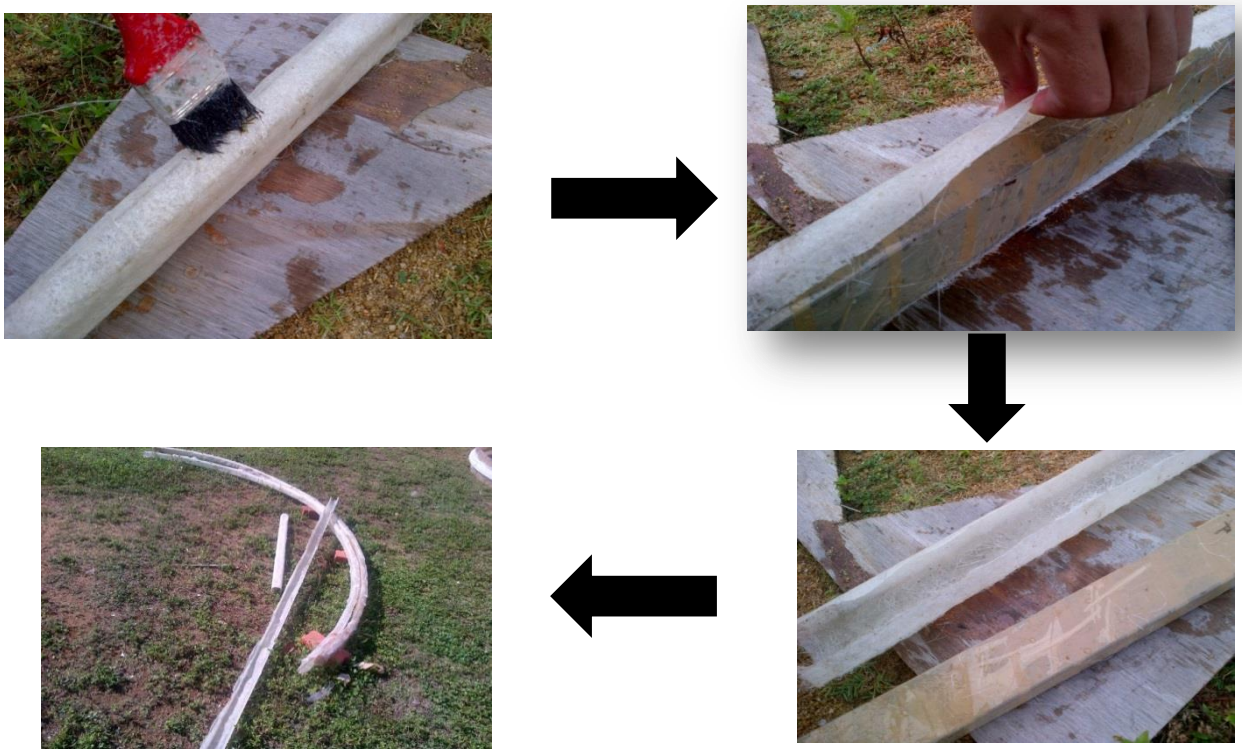

Figure 3.5: Steps to make reinforcement

3.4.4 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 3.6: Curve tank done with reinforcement

3.4.5 Material And Equipment

Material and equipment I use must be suitable for the system in order to make it complete as a circulation system. Correct material selection is important because there are involve can withstand the weight, pressure force, and others. I choose fiber as main part making curve tank, The steel is use as a mould for reinforcement . Equipment we use to fabricate aquaponic curve tank is fiber glass with raisin, cutting machine and welding equipment.

3.4.5.1 Fibre Glass With Raisin

Fiber glass is made up from a small diameter and it combine together. It use for making boat and make a tank. Before that, make sure that have a mould to make a shape of fiber. To stick the fiber, use raisin because it can stick for along time. In raisin, we had to add about 3 drop of hardener so the chemical dry fast. Furthermore, to put raisin into fiber, need some brush to make sure there are no air cavity and all of fiber that want to stick with a fully patched.

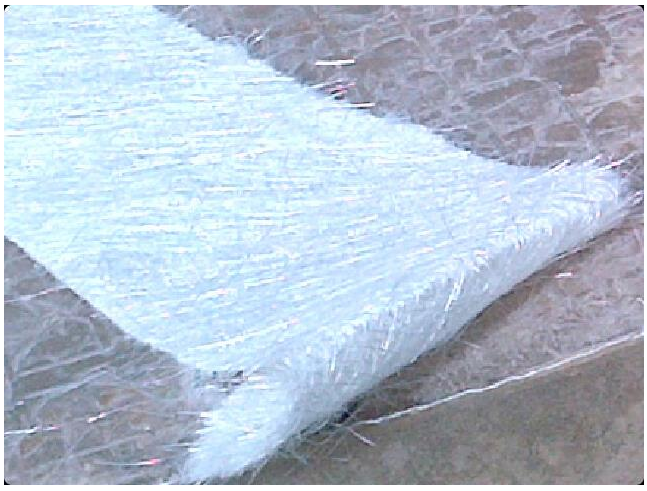

Figure 3.7 (a): Fibre glass

Figure 3.7(b): Raisin with brush

3.4.5.2 Cutting machine

Cutting machine is used to divide the finished mild steel into shorter length. That cut part will be joining to be curve.

Figure 3.8: Cutting machine

3.4.5.3 Welding machine

Welding is one of the joining processes to join parts. Metal-Inert Gas (MIG) welding is one of the arcs welding (AW) which is going to be used in our process to join the 2 X 1 inch hollow square that follow the curve tank.

Figure 3.9: Welding process

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 other part in this project.

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

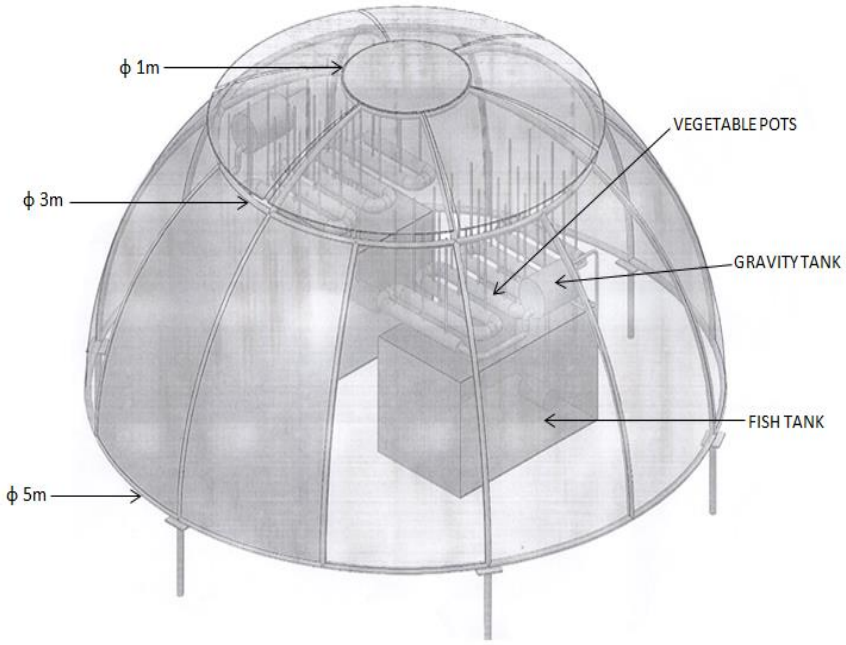

Figure 4.1: The design of dome house

Figure 4.2: The fabrication of 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.

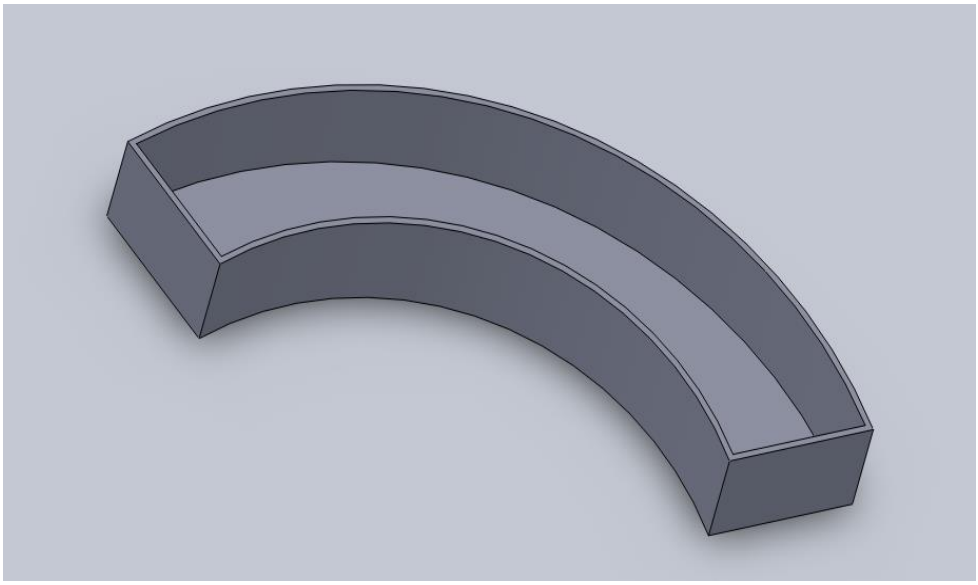

Figure 4.3: The design of curved tank

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.

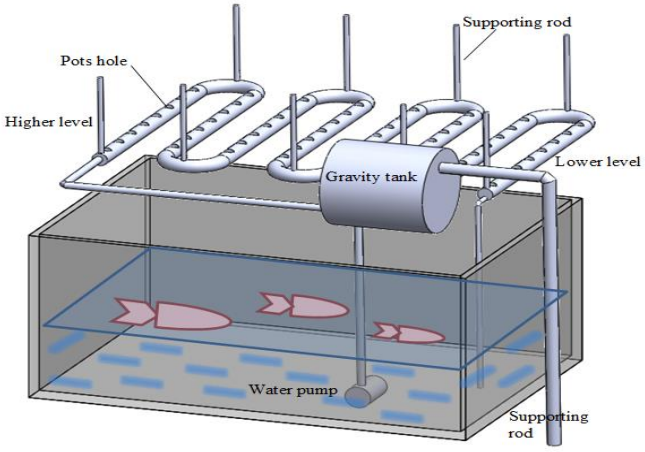

Figure 4.6: The piping system of gravity flow in this project

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 mould

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. It's make 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

CONCLUSION AND RECOMMENCATIONS

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. Typical build ratios are .5 to 1 square foot of grow space for every 3.8 L of aquaculture water in the system 3.8 L of water can support between 0.23 kg and 0.45 kg of fish stock depends on aeration and filtration.

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 growbed. We use a T connector instead of a 90 degree elbow so that we don't form a siphon and drain the tank.

REFERENCES

Alceste-Oliviero, C. 2000.

Regional review of aquaculture status and development trends in the Latin America and Caribbean.

Book of Synopses. NACA and FAO International Conference on Aquaculture in the Third Millenium, 20-25 February 2000, Bangkok, Thailand.

Anon, 1984. Introducing the tilapias.

ICLARM Newsletter. January 1984. 7(1):3.

Anon. 2000. Peru: disease-hit farms turn to tilapia.

INFOFISH International. 3/2000. May/June issue.

Beria, J., Garber, B., Neu, N., Sebes, N., & Sheetz, A. (2006).

The Vertical Farm Project:

Maximally Viable Crop Profile.

Carpenter, Tim. 1994.

Growing media and nutrient delivery systems for greenhouse vegetables and other crops. Greenhouse Systems Automation, Culture, and Environment N.E. Regional Agricultural Engineering Service International Conference, New Brunswick, NJ.

Despommier, D. (2009).

The Rise of Vertical Farming. *Scientific American,* 301, 80- 87.

FAO. 2002.

Fishery Statistics. Aquaculture production. 90(2).

Kumar, A. (n.d). (2006)
Vertical Farming: Future of Food

Pullin, R.S.V. 1983. Choice of tilapia species for aquaculture. p. 64-76. In: L. Fishelson and Z. Yaron (eds.). International Symposium on Tilapia in Aquaculture. Tel Aviv University, Israel.

Shelton, W.L. 2002. Tilapia culture in the 21st century. p.1-20. In: Guerrero, R.D. III and M.R. Guerrero-del Castillo (eds.). Proceedings of the International Forum on Tilapia Farming in the 21st Century (Tilapia Forum 2002), 184p. Philippine Fisheries Association Inc. Los, Banos, Laguna, Philippines.

Schoenstein, Gil. 1996.
Hydro-organics: growing basil during the off-season. Small Farm Today I 3 I):39-42.

Skagg, Kevin. 1996.
The urban gardener. American Horticulturist: 9- 10.

Tesi, Resh. 1995. Growth response to fertilisation of sweet basil (Ocimum basilicum L.). Acta Horticulturae 390: 93-97.

APPENDICES

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														

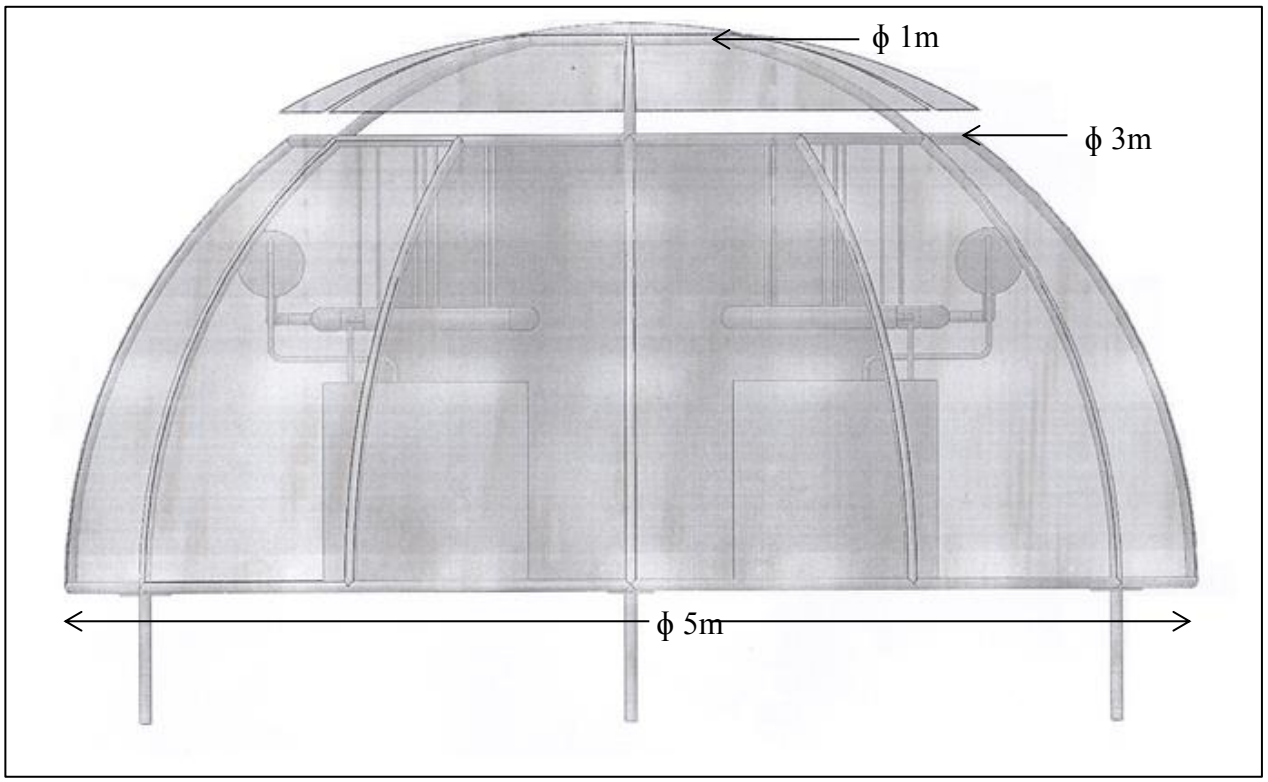

Figure 5.1: Aquaponic house front view