

## Advanced Technique in Aqua and Agriculture

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### Short Communication

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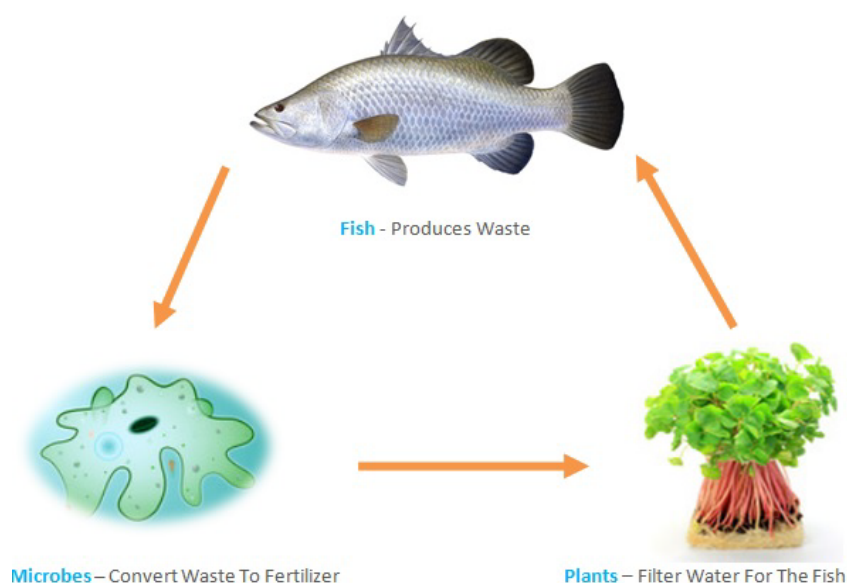
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#### ABSTRACT

Aquaponics is a method to growth plants and fishes. This method is recent advancement in technology. In this method both agriculture and aquaculture is been clearly specified. The utilization of food source fishes, a waste is excreted by the released waste through nitrification bacteria again can be a growth factor for plants. This is the cycle that takes place in aquaponics. This is mutually useful for both fishes and plants it can also have a benefit economically which sound good in society. In the present review article its is clearly stated that history and how to construct and maintain the aquaponic system.

### HISTORY

The combination of aquaculture and Hydroponics elevates Aquaponics. This means that raising fish is integrated with soil less growing plants and this benefits both. The waste of fish is organic feed for plants, simultaneously fishes can be made as filters for water<sup>[1-9]</sup>. It also nitrifies bacteria in third phase. Here it clearly converts Ammonia breakdown into nitrates and then remaining solid particles of vermicompost can be acted source of food for plants<sup>[10-12]</sup>. Let us go through a details of Aquaponics in **Figure 1**.



**Figure 1:** Structure of aquaponics.

This cultivation is been initiated by Aztec for agriculture in islands which are known chinampas. In the lake shallows of islands plants remain stationary, waste material are collected from canals and surroundings to irrigate plants. Soon this technique

is been utilized by China, Thailand and Indonesia to grow the paddy fields <sup>[13-18]</sup>. In china floating acqua systems were setup in china for growing rice, wheat and other crops. It has crossed nearly two and half acres. A group has made research to increase growth of root rapidly in aquaponics system and terminate the loop of solid waste. Many advantages have put forward to aquaculture, But it has not much favoured for fish and can be added advantage only for plants with less pH. This study is very interesting such that this system can be constructed by any individual for the cultivation of plants. It can be excluded sometimes as soil is also important for growth.

## **Materials and methods to construct an aquaponic system**

### **Parts of an aquaponic system**

#### **A tank to grow fish**

Material requires for fish tank is a glass or plexi-glass aquarium or clean container can be used that can withstand water: it can be a plastic tub, bucket or barrel. For a mini aquaponic system an aquarium acts as pool and also a food container. Whereas large systems can require a barrel or drum which can easily sustain for water and fish. Depending on the size of the fish also system should be designed such that flow of water can be maintained and fulfill the required feed for fishes. Estimating the integration of the fish size the tank should be manufactured. Basically the capacity of tank should be between 3-20 gallons, with a larger tank depending on the space. While in mini systems a tiny, sterilized plastic amphibian cage, it can hold about 3 gallons and can be cost effective. Fish aquariums of nearly 10-20 gallons can be better. As the larger tank area of grow bed area can be varied and used for cultivation that can support. As per the calculations tank should be approx.1-2 ft<sup>2</sup> for 10 gallons of fish tank <sup>[19-23]</sup>.

#### **Gravel bottom of tank**

Gravel is part that nitrify bacteria which converts ammonia to nitrite and modified to nitrate, that can be utilized by plants. For a pets colored gravel acts as natural. The size of pebbles should be approx 1/8 th part of the tank. To maintain properly it should be washed thoroughly by this it can be free from dust particles. Improper cleaning may cloud the water tank <sup>[24-28]</sup>.

#### **Water pump and tubes**

A water tank can be run through a small water pump that can cover the bed to grow. During the pumping of water into the beds, this should revert the feed from the fish tank <sup>[29]</sup>. The outlet of the tubing should be sufficient as per the grow bed in the tank.

#### **Air pumps, air stone and tubing**

As air is most important requirement for both the fish and plants. The interlink between air pump and air stone is Tubing it is attached at the below of the tank. Breaking of bubbles is done by air stone that pass outside the flow <sup>[30]</sup>. It can be carried through out for micro bubbles also, that can generate the oxygen levels in water <sup>[31,32]</sup>.

#### **Beds required for plant growth**

Selection of bed is merely important for growth of the plants. It should be adjusted on the top of the tank such that it can withstand the flow of the water that can coincides the stream. The bed should be a bit large then the tank. Medium required for the growth of plants is been maintained in the tray. This container is made of rubber, which is made to sit on the top of the tank <sup>[33-39]</sup>. It clearly specifies that container must be 3"-8" deep.

A plastic tub can also be utilized by large scale systems. It can be sealed with plexi-glass and non toxic silicon glue <sup>[40-42]</sup>. In small scales such as aquarium a light can also be inserted, this clearly specifies the flow of the water.

#### **Growth medium**

This should selected depending on the required plants to grow. Basically this system donot intake any soil substances, But this is basically to hold the plants <sup>[43-45]</sup>. It can be used if it is necessary by medium mediated system. coconut coir is one of the best medium for growth. Here are some other mediums that can be used for good growth clay pebbles, pea gravels, peat moss. The content of the medium should be more such that it can be made in the container <sup>[46-49]</sup>. The nutrients are necessary for both plants and fishes. The consumption of nutrients should be equally beneficial such as consuming purified water by the fishes and of inorganic nutrients for plant growth <sup>[50]</sup>.

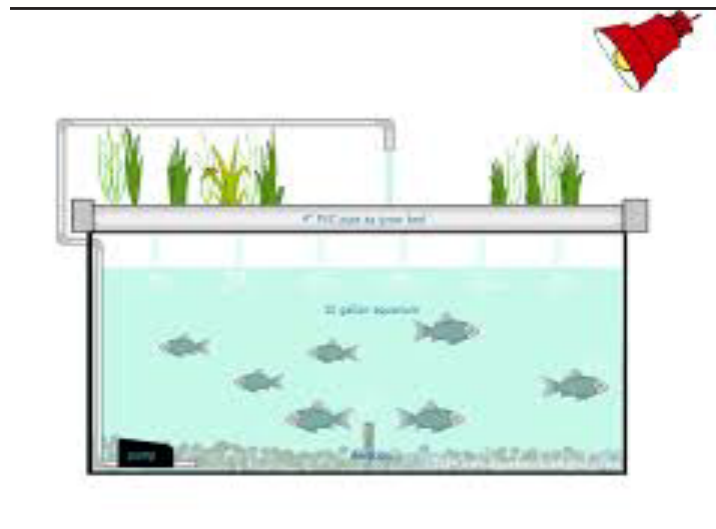
#### **Additional components**

##### **Heater**

This can be used for tropical fishes. Many select ornamental fish for this system which is originated from tropical waters and temperature should be maintained atleast 78°F. There are 2 types of heaters they are submerged and tank side mounted. Requirement of heater is been choosen depending on tank size <sup>[50-59]</sup>. For general fishes such as goldfish the temperature can be 70-76°F there is no need of any heater.

## Light

To monitor the aquarium a florescent light is enough to observe the fish status. There may be a chance of light in the system. In the system when low level lights are used for plant growth. Though it is artificial light that can be utilized for plants healthy growth [60-67]. As artificial light donot penetrate into the fish tank as shown in **Figure 2**. To protect the fish from algae these lights are used at low levels. In growing beds bright sunlight may make ill [68-72]. So, the light levels should be low.



**Figure 2:** Source of light for fish tank.

## METHODS FOR ASSEMBLY

Gravel should be washed and kept below the tank. Every hole should be drilled at  $1/8$ " or  $3/16$ " for 2 square inches. At one end of the corner growing bed, can be drilled  $1/2$ " hole to pump the water from it. Where as growing bed is set above the tank, for feed a water pump of half hole is made. With an empty space of  $3/4$  height in tank is made for beds to grow. The rest of the tubes can be winded with electrical tape. Medium is been adjusted at the top of the bed with small holes punched at 2 inches by tube in the growth bed. These are covered with the medium. Fill the tank with water and plug the pump with the water to grow. A trickling is attached to pump the water in the tank such that medium can enhance water continuously [73-80]. The flow of the water should be controlled by the adjusting the pump. An air pump is attached that can be made for air stone along the air tubing. Flow of the water should be steady that can increase to obtain the fresh water. Checking the pH is also necessary such that can be 6.8-7.2 not more or less than the range. It is must that for every 24hours chlorine and should be eliminated by chlorine remover. The pH must be maintained 7.0 as the pH increases stress in the fishes, if it is low then the delay of nitrification takes place which leads to stress for fishes in the tank. Fishes are drawn in the tank and made sure that  $1/2$ " of fish per gallon water. After a month density can be increased to 1" per gallon of water. It can be made approximately 4 weeks to plants in the system, few seeds can be added such that density can be extended [81-86]. This can be made to build the system.

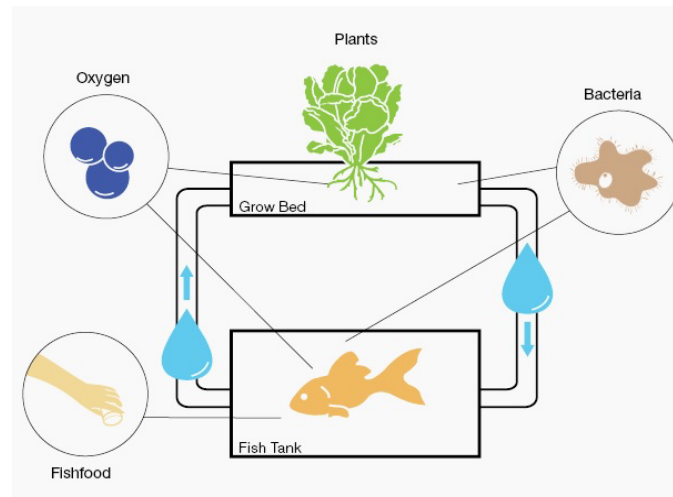
### Selection of fish and plant

Selection of fish is very important, mostly fishes like goldfish as it can sustain at normal temperature.

Other fishes like angel fish, guppies etc are also used for the system. The fishes are grown in small tanks i.e aquariums. These are also chosen in such a way that growth of fishes should delay. If it is for larger tanks with local species then feed and temperature may vary. A garden can be designed in such a way that house plants, spinach, herbs, lettuce. The required plants should sow in the cubical manner, it can also be called as Jiffy cubes or loose the growth medium for your cube in growing bed. Tiny seeds are placed between two papers which act as bed that has warm temperature and moist. Plants which are already existing in the hydroponic system can yield a good result [87-95]. Cleaning of plants is very important that no contamination and free from dirt, pest etc. Leafy vegetables such lettuce, spinach and herbs or houseplants such as philodendron, dracaena, dieffenbachia and anthodium (**Figure 3**). Plants such aquatic plants in the fish tank can also be preffered. Those plants of natural habitat fish can be helpful for purify water easily.

### Nitrification

As it is known that excrete of fish such Ammonia excreted from the gills. Quantity of ammonia may be toxic and can effect both the fish and plants. Initially this process starts the nitrification in soil, water and air that breakdown from nitrite to nitrate. In system bacteria initiates nitrify in the fish tanks and growing beds. This nitrate is utilized to grow and flourish it is mainly consumes by plants and helpful to purify the water necessary for fishes [96-99].



**Figure 3:** Source of fish to grow in aquaponic system.

### Maintenance of the system

Fish feed is the source of the system, merely for fishes. Feed should be little rather having large quantities that can minimize the wastage. Consumption of fishes is also very low. The time of consumption can be 5 minutes for fishes. Tropical fishes are good for this system as they can vary the diet with brine shrimp or blood worms can make them healthy. As per some assumptions water level varies easily i.e, it can be by plants that absorb and some may be by evaporation (**Figure 4**). Refilling of the tank is necessary, for about 10-15% of fresh water <sup>[100,101]</sup>.



**Figure 4:** Aquaponic system placed in exhibition.

## CONCLUSION

Aquaponics is the method in which a proper growth is achieved for both fishes and plants. Economically it is beneficial in business. It can be implemented for small scale productions and can yield a good results. This technique is useful by hydroponic system with nutrients that produce fast growth, quality plants required for present society. Plants such as leafy crop that can be lettuce and a fruiting crop like tomatoes has given best output by the system. Denser fish populations can produce more plant growth that increase fish waste and nutrients in the water. Some countries are now likely to put forward this technique for better results in agriculture and aquaculture.

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