

Selecting Aquaponics System Components

While a basic recirculating aquaculture system comprises a tank, a pump and a grow bed/bio-filter, there are many variations on the basic RAS theme. In this section, we consider the essential components and some of the performance-enhancing extras.

Tanks

The size of your tank(s) will be determined by a number of factors including:

- The amount of money you wish to spend.
- The species of fish you plan to grow.
- The amount of fish that you want to produce.
- The amount of space that you have.
- The level of management that you are willing to apply.
- The degree of risk that you are willing to assume.

Fish tanks come in all shapes and sizes and are made from a variety of materials including plastic, concrete, fibreglass and steel. They can be round, square, oblong or even long and narrow (called raceway tanks).

In practice, backyard fish tanks range in volume from a couple of hundred litres to ten thousand litres.....or more.

Plastic aquaculture tanks are usually round and may have a conical base to facilitate solid removal. They come in all sizes.

Square or rectangular plastic tanks are also available but will usually be smaller because of engineering constraints.

We've used food-grade plastic tanks with a capacity of 780 litres. These are about 1200mm by 1200mm and 780mm high and are very useful for urban aquaponics purposes.

A polymer-coated corrugated steel product has been successfully used to make round aquaponics tanks and grow beds. The manufacturer suggests that the tank be placed on a stand rather than directly on the ground.

Fibreglass tanks can be round, square, rectangular....any shape. Fibreglass is arguably the most durable material from which to make aquaponics tanks. It is inert, UV-resistant and very strong.

Some quite elaborate aquaponics systems have been constructed from industrial bulk containers (IBC's). These are large plastic vessels with a capacity of 1000 litres. They are contained within a galvanised steel frame and usually feature a pallet base. If they are really cheap, and you are certain about their previous use, they may be a useful tank option.

Some of the issues that attend IBC's:

- They will usually need to be partly buried if you are planning to have your grow beds drain into them.
- They are not UV-stabilised and will begin to fall apart over time.
- It's hard to know what has been stored in them. They are often used as mixing tanks for herbicides and pesticides.
- As demand for them has increased so has the price. Once they exceed \$200 in price, it's more cost effective to buy a new one.
- They will always look like IBC's.

Other recycled tank options include:

- Swimming pools—in-ground and above-ground.
- Used aquaculture tanks
- Surplus food and beverage industry tanks

As a general principle, if you are considering recycled containers of any kind, ensure that they:

- are made of inert materials so that they do not leach chemicals into the fish water
- have not been used to store toxic substances
- are UV-stabilised

Where you are relying on someone else's word about recycled containers, new food grade plastic or fibreglass containers are a much better option.

The ideal aquaculture tank is round and has a bottom drain (possibly even a double drain) and a sloping floor. Gentle circular movement of the water can be facilitated so that sedimentary solids are directed to the centre of the tank and into the bottom drain.

In the absence of the ideal fish tank, use whatever you can afford to get yourself started.

Smaller tanks can be used for sump tanks or filtration tanks.

Water Pumps

Water Pumps come in many sizes and types. When choosing a pump for your system, you'll need to consider the following:

- The volume of water that you need to move about.
- The capacity of your fish tank.
- Your choice of growing system
- The pumping head height

In the interests of keeping it simple (and less expensive), small submersible pond pumps are suitable for most urban aquaponics applications.

They are:

- Relatively inexpensive to buy
- Cheap to operate

- Easy to Install
- Reliable

The principal limitation of pond pumps is that they are best suited to low head applications. Flow rates will drop off rapidly once the pumping head exceeds one metre.

For larger aquaponics installations, submersible sump pumps are sometimes used but not all sump pumps are rated for continuous operation. Those that are, will be marked accordingly — so make sure that you check.

For the slightly more serious aquaponicist, I recommend the use of small external centrifugal water pumps. While they are usually a bit more complicated to set up, they are cheaper to operate, they will lift water higher and they are more reliable.

It's useful to seek advice from other aquaponicists about which pumps they have used and found to be reliable - or less so.

Depending on your application, it may pay to consider using two small pumps rather than one larger one. The benefit of multiple pumps is that, if one pump fails, the other will keep your system going long enough for you to discover the problem. This is simply good risk management.

A few more thoughts on pumps:

- In general, it pays to buy a larger pump than you really need. You'll have reserve capacity in the event that you decide to increase your growing system capacity or to add more bio-filters.
- Do not restrict the flow from your pump. If you have more capacity than you need, install a bypass into the discharge line and recirculate the surplus water back into your tank. It will help to regulate the flow, aerate the water and will maximise the life of the pump.
- While independence from the electricity grid is a worthwhile goal, solar-powered pumps add a new layer of complexity to the establishment of an urban aquaponics system. Keep it simple to start with. 240-volt (or 110-volt for US readers) pumps will provide reliable and inexpensive recirculation during your formative stages as an urban fish farmer.

Air Pumps or Blowers

Fish, plants and nitrifying bacteria all benefit from optimum dissolved oxygen levels.....and they will also suffer from the lack of oxygen. Fish, in particular, will begin to die within a very short time in water with low DO levels.

In fact, lack of oxygen is the principal cause of fish deaths in aquaponics systems.

While they are not all that efficient, air pumps or blowers may be the difference between a minor nuisance and a disaster. As such, they are very useful (and cheap) insurance in the event of water pump failure.

Valves and Fittings

Many of the valves and connectors used for micro-irrigation are suitable for use in small urban

aquaponics systems.

Bio-film will eventually block anything smaller than 13mm so 19mm or 25mm fittings are preferable.

In any case, all pipe work should be periodically back-flushed with water to prevent any blockages caused by the build-up of bio-film.

PVC fittings, while usually more expensive than micro-irrigation fittings, cater for higher flow rates and make for a tidier job.

PVC fittings have been used by innovative do-it-yourselfers to make all manner of interesting system components including airlifts, filters, standpipes, auto-syphons and media barriers.

Pipe and Tubing

We use the 19mm black poly tubing favoured by hydroponic growers - it has a thicker wall than the micro-irrigation product and it is more pliable. I cut the tube and push it directly onto the 19mm barbed fittings. I generally don't bother to use hose clamps unless I'm using 25mm (or larger) hose.

PVC pipe in the 25mm – 50mm range is widely used for backyard fish farming and is similarly easy to work with.

PVC pipe and fittings come in a variety of grades (stormwater, drainage, pressure, etc.) and developing an understanding of how they all work together is an important part of the art and mystery of backyard aquaculture and aquaponics.

Mechanical and Biological Filters

Capturing and oxidising solids is an essential function within a small aquaponics system and mechanical and biological filters are dealt with in appropriate detail in the section called Understanding Filtration.

Other Useful Equipment

- Bulkhead fittings - are a tidy way to create openings in tanks, bio-filter barrels or grow beds. They come in a variety of shapes and sizes and they enable hoses or fittings to be connected. They are sometimes referred to as tank outlets.
- Uni-Seals - perform a similar function to bulkhead fittings - they are less expensive and more versatile when undertaking more sophisticated plumbing arrangements.
- Venturis
- Standpipes and Drains
- Media Barriers
- Tank Heaters
- Airlifts

This list of equipment is by no means exhaustive. There are dozens of useful items – some off-the-shelf and others that are DIY innovations – that contribute to productive aquaponics systems.

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