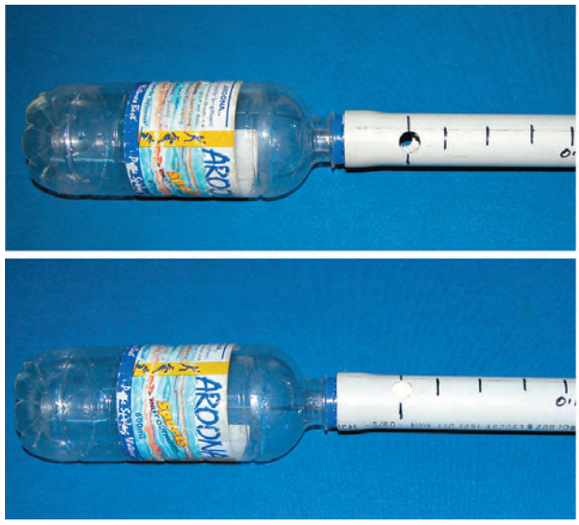
Project 2.15 Water sampler (Page 68)



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Project 2.17 Making a syphon (Page 70)

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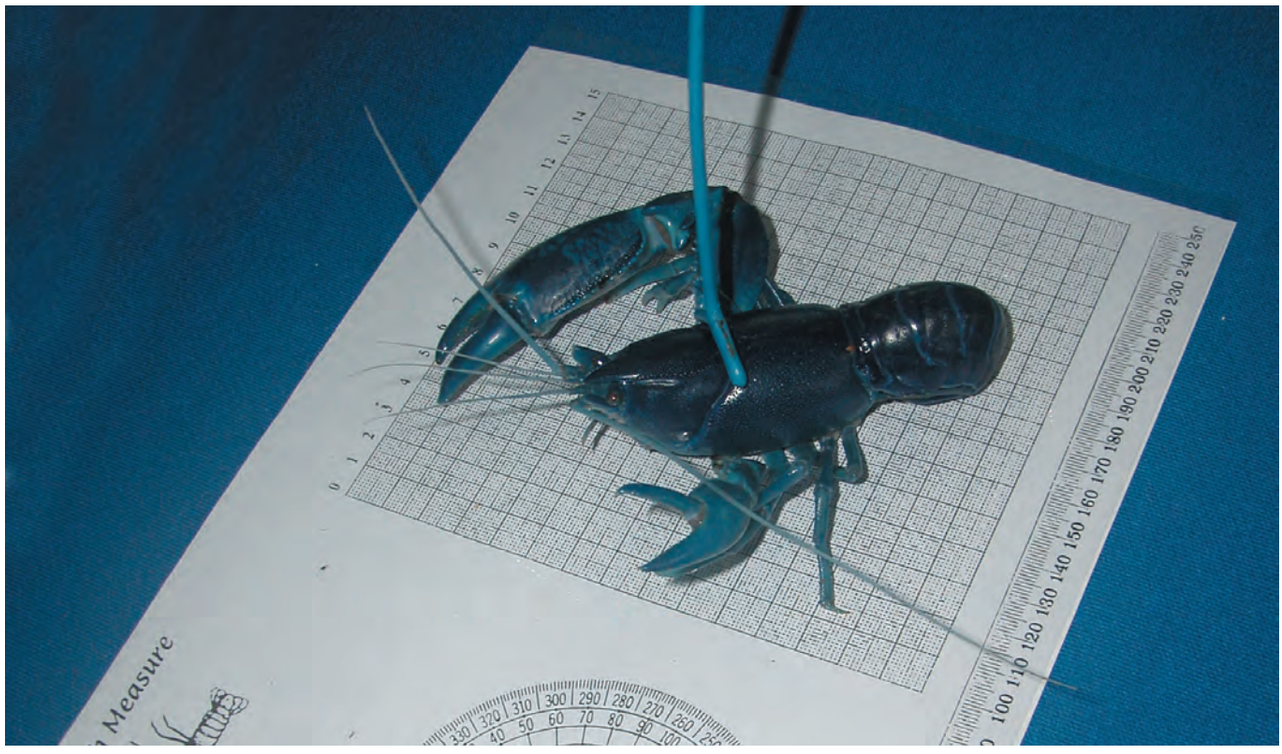
Project 3.6 Making a crayfish measurer (Page 82)



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PROJECT 1.1 USING POLY PIPE AND FITTINGS

Background

Pipes and fittings needed in many projects can be bought as single items or purchased in bulk from local hardware stores or retail chains. They have been manufactured for home garden irrigation systems, are well made and fit together perfectly giving nice airtight seals.

They are easy to use, a bit like playing with Leggo or Mechano making them ideal for students to design and construct simple aquaculture systems.

Polyethene pipe and associated fittings

Polyethene pipe and associated fittings as shown in Figure 17.1, are ideal for carrying and distributing low pressure air to a wide variety of growth containers and aquaria for school aquaculture exercises.

They are cheap alternatives to the more costly aquarium supplies.

Size

It is important to decide on a size. The projects in this book are based on the following sizes:

- Main lines - 13 mm pipe and 13mm fittings. (This allows interchanging with standard garden hose if necessary)
- Individual air lines - 3 mm pipe and 4 mm fittings. (The 3 mm pipe is a tight fit on the 4 mm fittings and while it may be a little harder to get on it does give the peace of mind that you know it will not blow off)

  On the individual air lines it is always better to use threaded fittings to allow the 3mm pipe to be screwed on tightly.

Materials

 # *13 mm fittings for main air line from pump*

- End plug, tap, joiner and elbow T

 # 4 mm fittings for individual air lines

- Screwed adaptor, barbed off-take

Procedure

Try to keep everything standard. 13mm for the main supply pipes and fittings and 3 mm pipe for the individual lines with 4 mm fittings.

There is nothing real hard about designing and constructing this:

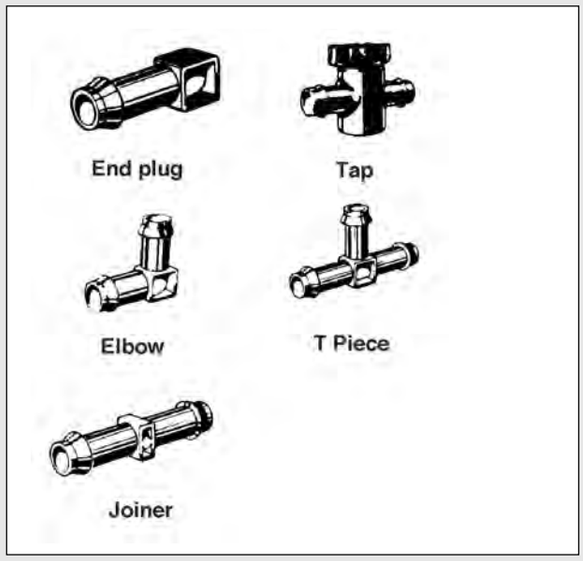
Step 1 Design your system.

Step 2 Write down the fittings you need and the lengths of pipe you require.

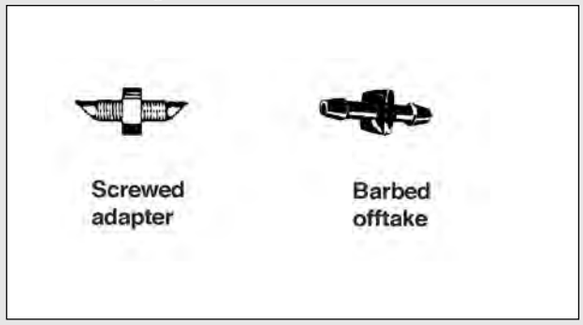
Step 3 Cut the pipe and place the necessary fittings in position pushing or screwing each fitting home.

Step 4 Use clamps and clips to mount the lines neatly.

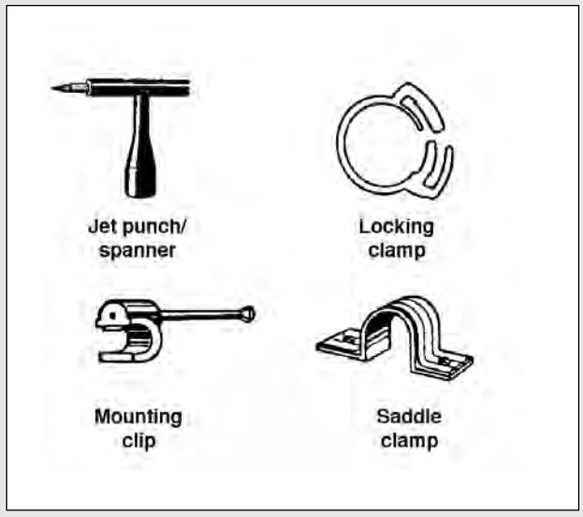
13 mm fittings



4 mm fittings



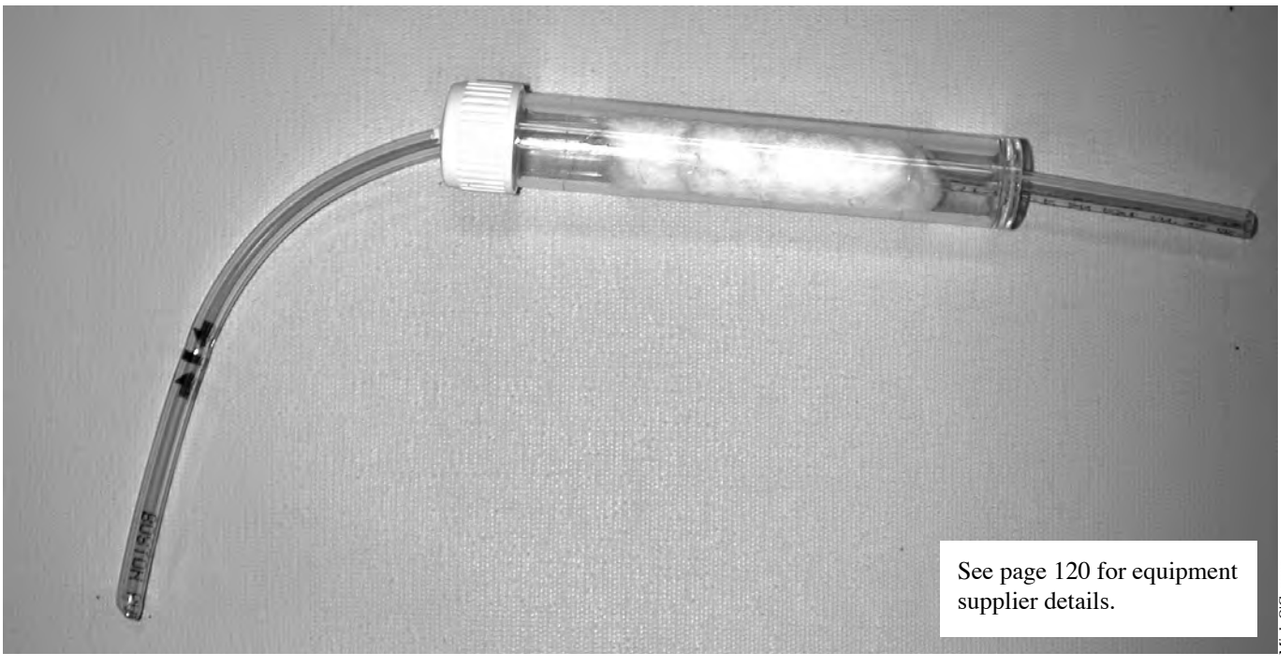
Hole punch and clamps



Kerry Kirzelman

Figure 17.1 Common poly pipe and fittings

PROJECT 1.2 MAKING AN AIR FILTER FOR ALGAL CULTURES



See page 120 for equipment supplier details.

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Figure 18. 1 Completed air filter

Background

Micro algae like all plants require carbon dioxide (CO_2) for photosynthesis.

- They obtain this gas from the air that is dissolved in the water in which they live.

When micro algae are grown in containers they have to have enough air to provide the carbon dioxide they need.

- This is not a problem when a small amount of liquid is put into a large container - the air can diffuse in and out through a cotton wool or specially designed filter plug as shown in Figure 18.2.

It does become a problem when algae are grown in containers with little free air, providing insufficient carbon dioxide for the algae to make food.

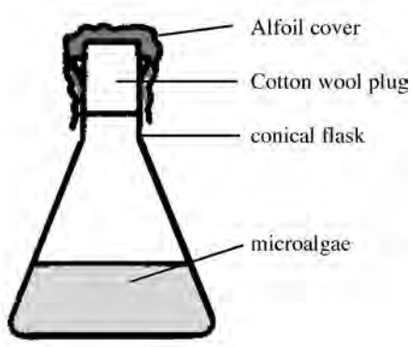

Figure 18.2 A small amount of liquid put into a large container is not a problem for a time
(Illustration Mick O'Connor)

A solution

To overcome this air must be pumped into the container as described in Figure 18.3 (below)

- Normal air will contain minute particles of dust and may also contain micro organisms such as bacteria and fungi that may be harmful to the algae or what the algae will be fed to.
- To minimise the risk of infecting the algal culture, the air being pumped in is filtered. A cotton wool filter is placed on the inlet tube, filtering the air coming in to remove micro organisms. Another similar filter is placed on the outlet tube to prevent microorganisms entering the culture as the excess air escapes.
- The double filter acts as a barrier. Air containing the needed carbon dioxide is provided continuously to the algae allowing them to grow while excluding airborne micro organisms coming back through the outlet tube.

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Project 1.3 over describes how to make this container

Figure 18.3 Algal growth container

Materials

For each filter you will need (See Figure 19.2)

- One 10mm X 100mm PET sample tube with plastic screw top. See page 120 for equipment supplier details.
- One flat bottom 10ml clear polystyrene cylindrical test tube with screw top
- Quantity of 3mm (1/8") clear PVC plastic tubing
- One sterile cotton wool ball
- Hand drill and 3 mm drill bit

Procedure

Step 1 Hold the tube securely and drill a 3 mm hole in the centre of the cap and the bottom of the tube as shown in Figure 19.1.

Step 2 Now unscrew the plastic lid off the sample tube and remove any drill shavings.

Step 3 Sterilise the tube and lid in bleach (see box below).

Step 4 Place a sterile cotton wool ball in the tube (Figure 18.1, Page 18).

Step 5 Insert the required length of plastic into the outlet and inlet holes (Figure 18.1).

Discussion

1. Explain why a filter is needed on the inlet air line.
2. Explain why a filter is needed on the outlet air line.
3. Discuss the benefits of making the filter out of clear plastic specimen tubes that can readily be pulled apart.
4. Explain the reasons for growing micro algae in 'closed' containers rather than open fish tanks.
5. Explain why sterilization is needed for equipment.

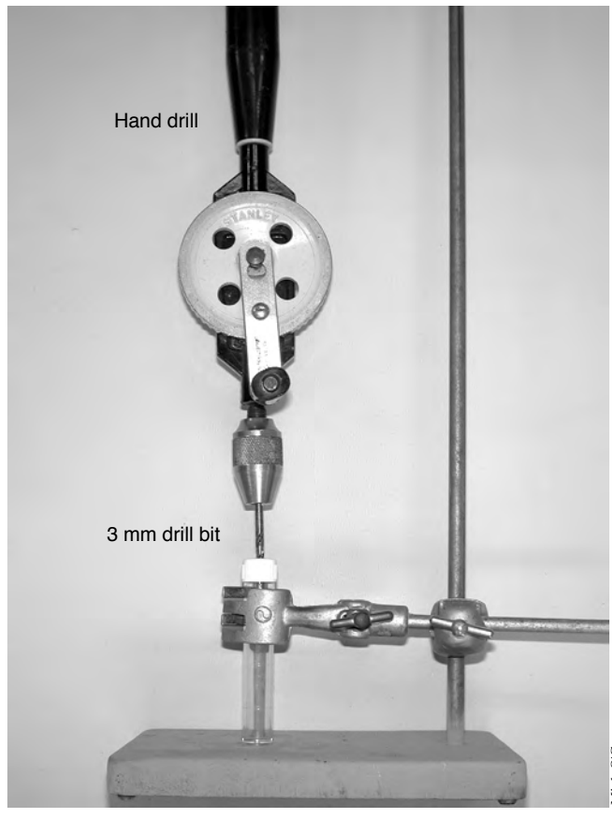

Figure 19.1 Drill a 3 mm hole in the centre of the cap and the bottom

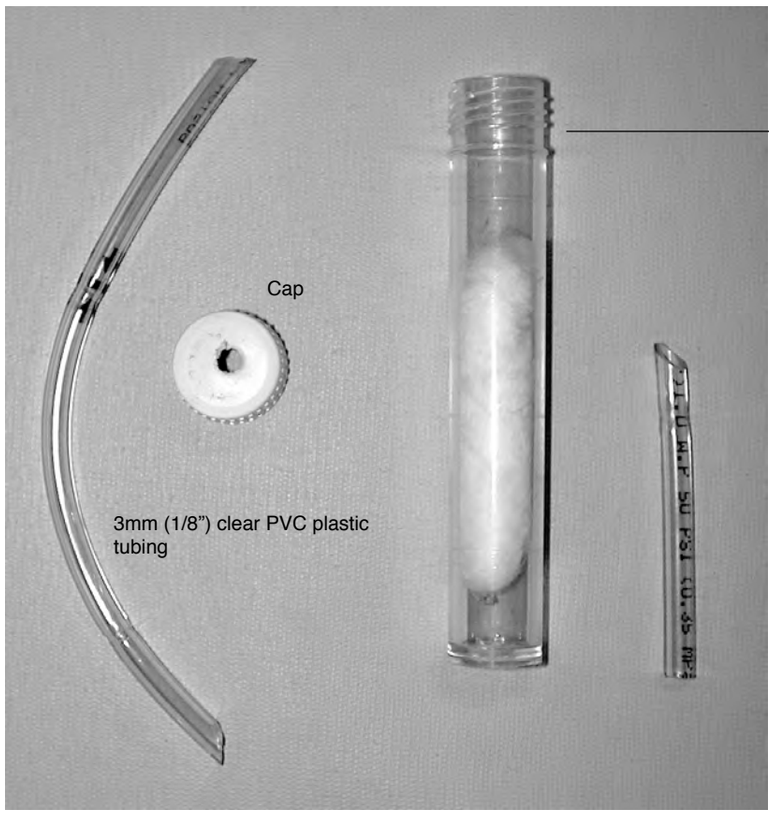

Figure 19.2 Parts ready for assembly

Sterilizing

A simple method of sterilization is to use household bleach.

- Follow the instructions on the bottle for nappies - dilution is usually 1/5 dilution
- Fill a container of known volume that will fit all the tubes and lids with water and use one part bleach to five parts water
- Immerse all equipment to be sterilized for one hour.
  - be careful of your clothing with bleach as it can leave nasty white marks on school uniforms!!

PROJECT 1.3 MAKING AN ALGAL GROWTH CONTAINER

Background

Micro algae are small plants which:

- Require light, water and carbon dioxide (CO_2) to carry out photosynthesis and grow.
- Produce a wide range of special fatty acids that eventually end up in fish.
- Are very important sources of food for a variety of marine and aquatic plankton and lavae.
- Live and grow in water, a medium that so many other organisms love to live in.

See page 4 for colour photographs.

Problems

Some organisms can be harmful to aquaculture species that algae are going to be feed to, so it is very important to keep them out of the growing vessel.

This is possible on a small scale, eg in a hatchery, but is not possible if the algae are to be grown in an open pond.

Solution

To minimise the risk of infecting the algae with organisms from the air, a closed container is used as shown in Figure 20.1.

- Filtered air (containing carbon dioxide) is pumped to the algae so it can grow by the photosynthetic process.

$$CO_2 + H_2O + \text{energy} \text{ -----> } \text{sugars} + O_2$$

- A readily available sealed access port to allow injection of nutrients is fitted in the top of the vessel.

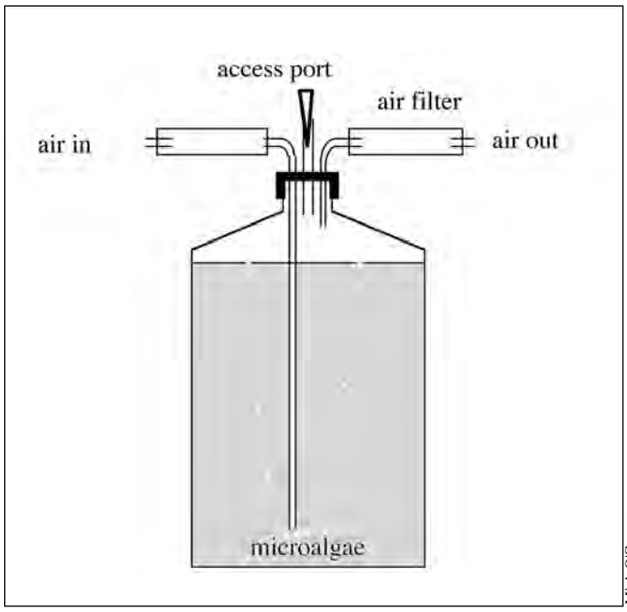

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Figure 20.1 A closed container is used to minimise the risk of infecting the algae with organisms from the air

Containers

See Figure 20.2. These:

- Should be large enough to grow the amount of algae required
- Made of a sterilisable material
- Made of clear PET plastic or glass to allow light to come into the algae

Materials

- One PET bottle with plastic screw lid
- 3 mm hand drill
- Quantity of clear PVC 3 mm plastic tubing
- Two air filters
- Golf tee

See page 120 for equipment supplier details.

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Figure 20.2 Materials required