

HOW TO INSTALL A POLYETHYLENE BIOGAS PLANT

By

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Acknowledgements:

Photographs by Francisco Aguilar (2000). Sarvodaya Institute for Bio-diversity Conservation.

Diagrams: Courtesy.- Aguilar, F.X. et al.(1999). El Biodigestor (Spanish).

In: Toward a better use of our natural resources. EARTH University. 28.

1. WHAT IS A BIOGAS PLANT ?

A biogas plant is commonly known as a BIODIGESTER. The biodigester is a technology that takes advantage of excrement from animals and humans in order to transform it into BIOGAS (methane gas) as a source of fuel, and ORGANIC FERTILIZER.

Biogas is produced by bacteria that decomposes animal manure. The residual material is known as effluent and is very high in nutrients, thanks to the bacterial action and absence of oxygen. These factors help to eliminate bad smells and pathogens as well.

A plastic bag, an outgoing biogas valve and a security valve compose a biogas polyethylene plant.



Fig 1. The biogas plant. Gampaha, Sri Lanka

2. BENEFITS OF BIOGAS TECHNIQUE

Biodigesters can be fed with animal and human excrement. For this reason, biogas plants help to diminish illnesses and reduce the population of insects like flies and mosquitoes.

Thanks to biogas production, it is no longer necessary to use firewood to cook. The use of firewood affects the environment because it promotes the destruction of the

forest and it also causes respiratory illnesses to people who cook with it. Biogas also saves money, replacing electricity or liquid gas as sources of energy for cooking.

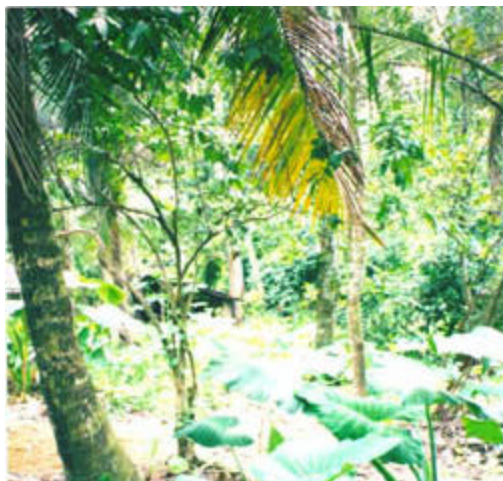
Effluent from the biogas plant can be used as organic fertilizer, and the application of chemical fertilizers can therefore be reduced. This way, farmers save money, and pollution of the atmosphere by chemical inputs is avoided. The same effluent can be used in fish ponds and to produce aquatic plants. Aquatic plants produce enough material to feed animals and/or to make compost.

3. STEPS TO INSTALL A BIODIGESTER FOR A RURAL FAMILY

Step 1: Materials

The recommended biodigester length for a small family is 10 meters. To install a biogas plant of this size, the materials listed below are needed:

- 28 meters of natural polyethylene plastic, 1000 gauges, 1.5 meters width.
- 8 used buckets (~20 L) of the same size or 2 cement pipes, 1 meter length, 12 inches in diameter
- 1 PVC screw (male adapter), 1 inch in diameter
- 1 PVC cap (female adapter) 1 inch in diameter
- 2 meters of transparent plastic hose of 1 ¼ inches in diameter
- 1 PVC "T", 1 inch in diameter.
- 2 - 90° PVC elbows, 1 inch in diameter
- 1 meter of pressure PVC pipe, 1 inch in diameter
- 1 flat PVC cap, 1 inch in diameter
- 2 round plastic or aluminum disks (20-15 centimeters in diameter with a central hole of 1 inch)
- 1 transparent plastic bottle - 1 gallon of capacity
- 3 used tires automobile tubes (rubber belts)
- 8 used plastic fertilizer sacks
- 1 galvanized metallic pipe, ½ inch in diameter 50 centimeters length
- 1 tube of PVC glue
- 1 steel wool
- An automobile or motorcycle as source of exhaust
- 1 plastic hose to take exhaust from the car to the place where the biodigester will be installed



Step 2: Biodigester location

Once all the materials are obtained, the biodigester location needs to be decided. The biodigester should be close to the animals, and it is also recommended to connect any human latrines to the biogas plant to eliminate another source of pollution. Lastly, the location should be near the kitchen where the biogas will be used. Next, proceed to dig a grave in the ground. This grave is needed to protect the biodigester from any damage (from wild and



Figure 2. Location where the biogas plant will be installed. Gampaha - Sarvodaya District Center, Sri Lanka.

domestic animals) and to help to maintain an appropriate atmosphere for the production of biogas.

An inclined gutter should be dug at each end of the grave. It should be the same width as the cement pipes.

It is necessary that the floor of the grave is in no way sloped, or else, the system will not work. Also, the walls should be totally flat and free of stones or roots that can break the bag.

Dimensions for the grave are as follows:

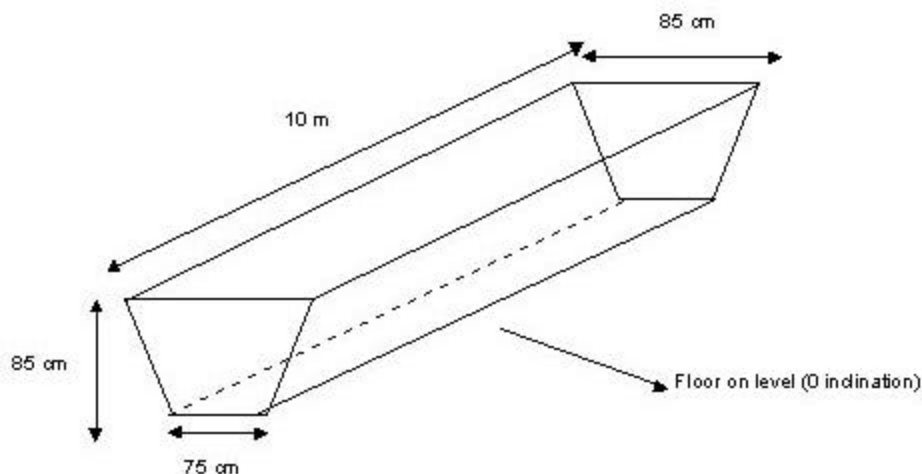


Figure 3. Dimensions of the grave, calculated for a plastic bag 1.5 m width.

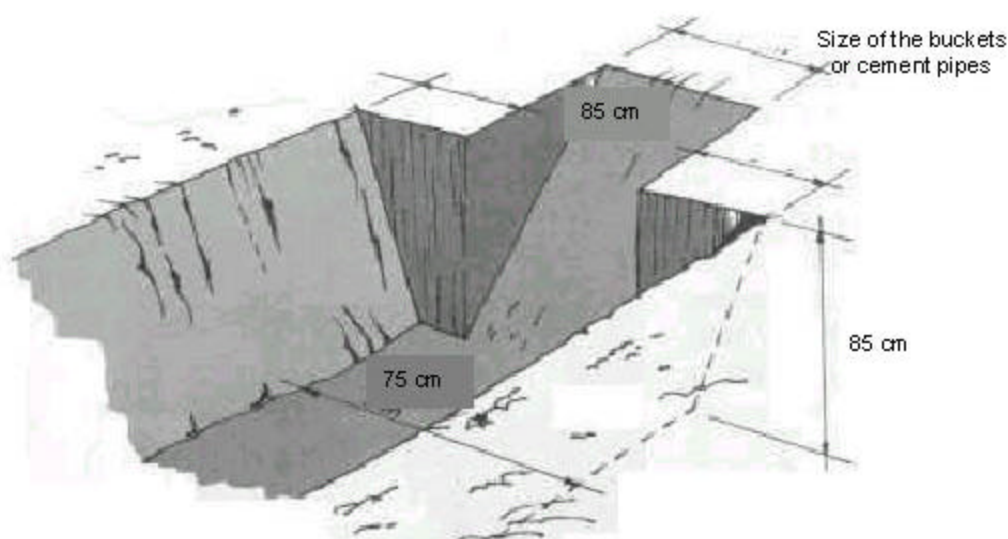


Figure 4. Details of the dug that should be dug at each end of the grave. Source. Botero *et al.*, 1999.



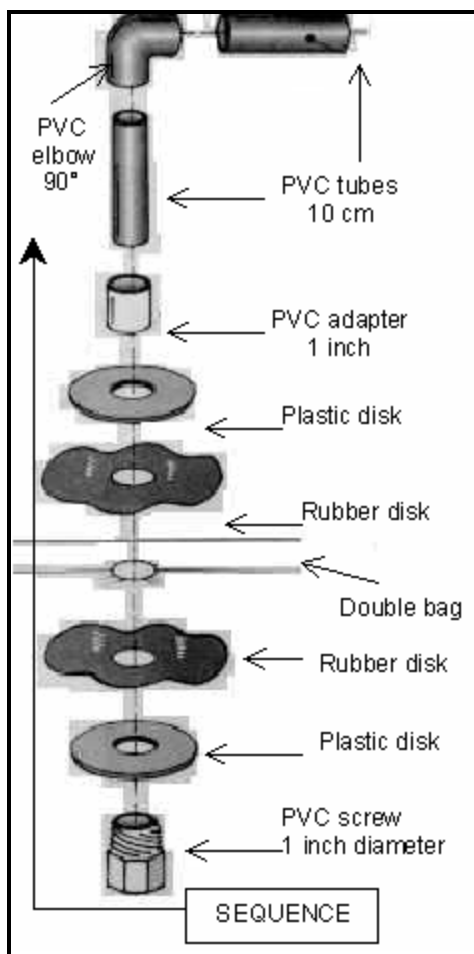
Fig. 5. Preparing the plastic bag. A person pulls one plastic bag through the other.

Step 3: Preparing the plastic bag

Extend the 28 m plastic bag on a flat floor that does not have any stones that can break it. It is better if this process is carried out in a hall room of the community centre. Then, fold the plastic in half and cut it in two 14 meters pieces.

Next, a person (with no belt, rings or anything that might break the bag) introduces the second bag into the first one by pulling it through the 14 m length of the bag. When the second bag has been pulled through, the system is now a double bag, 14 meters in length. Now, the bag is ready and should be folded and stored in a safe place until the day of installation.

Fig 6. Sequence of the installation of the outgoing biogas valve.



Step 4: Outgoing biogas valve

Four meters from one end of the double bag (nearest to the kitchen), make a small cut ($\frac{3}{4}$ inch) to introduce the 1 inch PVC screw. Between the screw and the double bag, place a plastic disk and a rubber disk (piece of used tire). Then, outside the double bag, place another rubber disk, then a plastic disk and the PVC adapter.

Next, place a 10 cm PVC tube, the PVC elbow and the second 1 inch PVC tube. Finally, place the plastic bag with the outgoing valve in the grave and pass the two ends of the double bag through the 1 meter cement tubes. Instead of cement tubes, you can use plastic buckets. Remove the bottoms of three buckets and connect them together to make a pipe. . You will need 4 buckets at each end (8 buckets total).

Step 5: Security valve