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Management of Soil Gases and Biogases with Biodigesters, Made with PVC Geomembranes

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ABSTRACT

The Biodigester is a system where, when placing organic matter, it decomposes, producing gas and fertilizer. Biodigesters are most commonly used in pig farming. This system consists of a lagoon coated with a 0.80 mm PVC geomembrane coupled to a 150 g/m² polyester geotextile, covered by a dome made of 1.20 mm PVC geomembrane with internal polyester reinforcement, and between the pond and the dome there is a seal to prevent the gas outflow. There is also a 1.00 mm PVC geomembrane lagoon that receives the water that comes out of the Biodigester, water with a large amount of fertilizers. There are also pipes for the entry of tailings, for cleaning and for the exit of gas and water. A relief valve is placed in the Biodigester to control the internal pressure. It is an anaerobic system. PVC geomembranes are excellent in the manufacture of Biodigesters.

INTRODUCTION

Our main intention is to show another alternative of using PVC geomembrane. The Biodigester can, at a very low cost, solve a serious problem of pollution of nature, soil and air contamination, turning what was harmful into something useful (fertilizer and energy

GENERAL INFORMATION

There are several types of Biodigesters (Figure 1), in this case we will talk about the Biodigesters made with PVC geomembranes: at the bottom of it, which is actually a pond, usually a simple PVC geomembrane, 0.80 mm thickness without UV protection, and in dome, where the gas pressure occurs, a 1.20 mm thickness geomembrane reinforced with polyester mesh is used. The resultant water from the process is then placed in a pond to be used for irrigation, and usually this pond is made of 1.00 mm thickness PVC for exposed use.

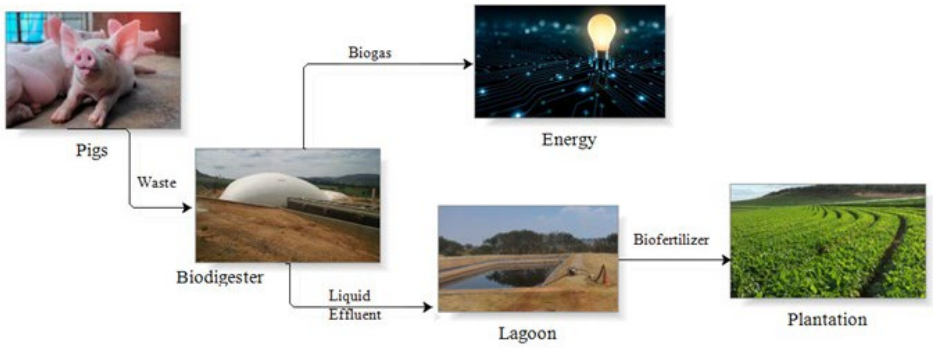

Figure 1. Diagram of the operation of Biodigesters.

Composition of the resulting gas:

- 50 to 70% - Methane (CH_4)
- 30 to 50% - Carbon Dioxide (CO_2)
- Traces - Hydrogen Gas (H_2S) - this gas is eliminated by reduction with iron (Fe).

  Note 1: Production and type of gas (proportion) may vary mainly depending on the type of food and climate.

  Note 2: It is important to eliminate the sulfuric gas, mainly because it can corrode the energy generator moved by the methane gas.

The supply is made in the turnkey system, i.e. it is delivered ready for operation, including the gas-powered generator.

SEQUENCE OF SIZING AND ASSEMBLY OF A BIODIGESTER

Data for calculation of Biodigester volume.

- It is estimated that one pig produces 0.25 m³/day of waste. It is ideal to keep solid wastes at 5%, and the rest, water.
- Normally, Biodigesters are made for 2000 swine, and the maximum recommended size is for 4,000 pigs. If the farm has, for example, 8000 pigs, it is best to have 4 Biodigesters, with each Biodigester having a capacity to serve 2000 pigs (Figure 2).
- The creation of 2000 pigs allows the generation of 80 kW/hour of electricity. In this case, 1800 m² are used between the lower lagoon of the Biodigester, dome and the water catchment pond of the process.
- The flow of the residue within the Biodigester, from entry to exit takes 35 days.

Figure 2. Biodigester set.

Feeding the Biodigester. Normally the feeding of the Biodigester with the pigs' tailings is done by gravity, the animals are confined in an area where the height is sufficient for the displacement of the tailings by gravity.

Internal pressure of the Biodigester. The internal pressure of the Biodigester is controlled by relief valves (Figure 3). The choice of 1.20 mm thickness PVC geomembrane with internal polyester reinforcement for the dome was based on its resistance to the required working pressure.

Pre-assembly of the Biodigester. Both the lagoons (the Biodigester and the water storage) and the dome of the Biodigester are already leaving the factory ready, welded by high frequency machine. Pipes for both tailings inlet and outlet and outlet pipes are also installed in place. The pipes are made of rigid PVC.

Figure 3. Gas outlet pipe.

Assembly of the Biodigester. The estimated time for the assembly of a Biodigester with a capacity to serve 2000 pigs is from 60 to 90 days, including the water catchment pond and the connection to the generator (Figure 4).

Figure 4. Connection to the water catchment pond.

Particular attention is given to fixing the dome to the bottom lagoon to avoid gas leakage. A mechanical fastening is made.

Agitators are placed inside the Biodigesters to avoid accumulation of organic mass inside them (Figure 5).

Figure 5. Internal agitation.

MAINTENANCE OF THE BIODIGESTER

If a hole occurs in the Biodigester, the repair is done first with adhesives, and after the seal, the weld of the repair is reinforced with hot air machine.

CONCLUSION

Food production sometimes also produces tailings that can cause damage to the environment, such as pig farm. The use of Biodigesters minimizes these harmful effects, reducing odors, reducing the emission of harmful gases to the atmosphere, as well as practically eliminating the bacteria existing in the rejects of pig farming. Added to this is the advantage of converting the methane gas into electricity and the water left in the system can be used as fertilizer.