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Commentary

Types of Biogas Fermenters

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DESCRIPTION

When building a biogas plant, it is very important to choose the right biogas fermenter. From a fluid and structural point of view, an oval container is the best solution. However, this design is relatively expensive and its use is usually limited to large sewage treatment facilities. The Chinese fixed dome design is similar in shape but cheaper. The hemispherical CAMARTEC design is optimized for structural strength but does not optimally utilize the required drilling. A simplified version of such a digester design includes a cylinder with a conical top and bottom. They are much easier to build and some are on the market as off-the-shelf units. Their disadvantage lies in their disadvantageous surface area-to-volume ratio. The height of the cylinder should be the same as the diameter. Flattened bottles are very popular on farms as they are often a cheaper solution for small-scale bio methane production. Fluid dynamics are of little concern, as rectangular parallelepiped fermenters are commonly used in batch feed systems, which are primarily used for solids fermentation.

TYPES OF SMALL FERMENTERS

Fixed dome biogas plant

The fixed dome system consists of a closed dome-shaped cooking can with an immovable rigid gas holder and a replacement shaft, also known as an expansion tank. The gas is stored at the top of the fermenter. When gas production begins, the liquid fertilizer is pushed into the expansion tank. Gas pressure increases with the amount of gas stored, that is, with the difference in height between the two sludge levels. If the gas in the gas tank is low, the gas pressure is low.

Floating drum plant

The floating drum system consists of an underground fermenter and a movable gas holder. The gas holder floats directly on the fermentation suspension or on its own water jacket. The gas is collected in a gas drum, which moves up and down depending on the amount of gas stored.

Low cost polyethylene tube fermenter

The Low Cost Polyethylene Tube Stove model consists of a tubular polyethylene sheet (two layers of 300 microns) wrapped in rubber bands made from recycled inner tubes with both ends bent around a 6 inch PVC drainage pipe increase.

Earth pit plants

Masonry fermenters are not necessarily unstable soils (such as laterite). To prevent penetration, it is sufficient to line the excavation with a thin layer of cement (a wire mesh attached to the excavation wall and plastered). The edge of the pit is reinforced with a masonry ring, which also acts as an anchor for the gas holder. Gas containers can be made of metal or plastic foil. If you use a plastic sheet, it must be attached to a square wooden frame that reaches into the fertilizer and is fixed there to counteract buoyancy. The required gas pressure is achieved by placing a weight in the gas tank. The overflow point on the surrounding wall serves as an outlet for liquid fertilizer.

Advantages

- Low installation cost (only 20% of floating drum installation).
- High potential for self-help approach.

Disadvantages

- Short service life can only be used with suitable impermeable soil types.
- The earth pit system is only recommended for installation in impermeable soil above the water table.

Those structures are particularly cost effective in relation to gas holders in plastic panels.

Ferro cement plant

The ferro-cement design can be used both as a self-supporting shell and as an earth pit support. The container is usually cylindrical. Very small systems (volumes less than 6 m^3) can be pre-manufactured. Like the fixed dome system, iron cement gas tanks require special sealing measures (the reliability is proven by gluing aluminum foil).

Disadvantages

- Mass consumption of essentially high quality cement.
- Processing must meet high quality standards.
- Use a lot of expensive wire mesh.
- Construction technology has not yet been fully tested.
- Gas storage tanks require special sealing measures. Ferro-cement biogas plants are recommended only if special ferro-cement know-how is available.

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TYPES OF INDUSTRIAL FERMENTERS

To give an overview, some fictitious designs such as those found in Europe have been selected. The design has been chosen so that all typical elements of modern biogas technology appear at least once. All designs are on the ground, which is common in Europe. However, there are underground structures.

Mixing pits

Vary in size and shape depending on the nature of the underlying soil. It is equipped with a propeller for mixing and / or chopping the substrate and is often equipped with a pump for transporting the substrate to the fermenter. In some cases, the substrate is also preheated in the mixing pit to avoid temperature shocks in the fermenter.

Fermenter or digester

Digester is insulated and made of concrete or steel. To optimize the substrate flow, the large fermenter has an elongated channel shape. Large fermenters are most often driven by slowly rotating blades and rotors, or infused biogas. Co-fermenters have two or more separate fermenters. The gas can be collected in a fermenter and usually with a flexible cover. The fermenter can also be completely filled and the gas stored in another gas tank.

Gas –holder

Gas holder is usually made of a flexible material, so protect it from the weather. It can be placed directly above the board to act like a balloon plant or placed in another "gas bag".

Slurry store

For storing liquid fertilizer in winter. The store can be open (like a traditional open slurry store) or closed and connected to a gas tank to capture the remaining gas production. Normally, stores are not heated and are only agitated before fertilizing the fields.

Europe's gas utilization factor, 95% of the time, is a thermal power plant, producing heat for farms, grids, and housing, greenhouses, and other purposes. Thermal power plants have the advantage of being able to produce the required energy with any mixture of gas and fossil energy. Therefore, it may react if gas production is low; energy demand is high, or vice versa.