

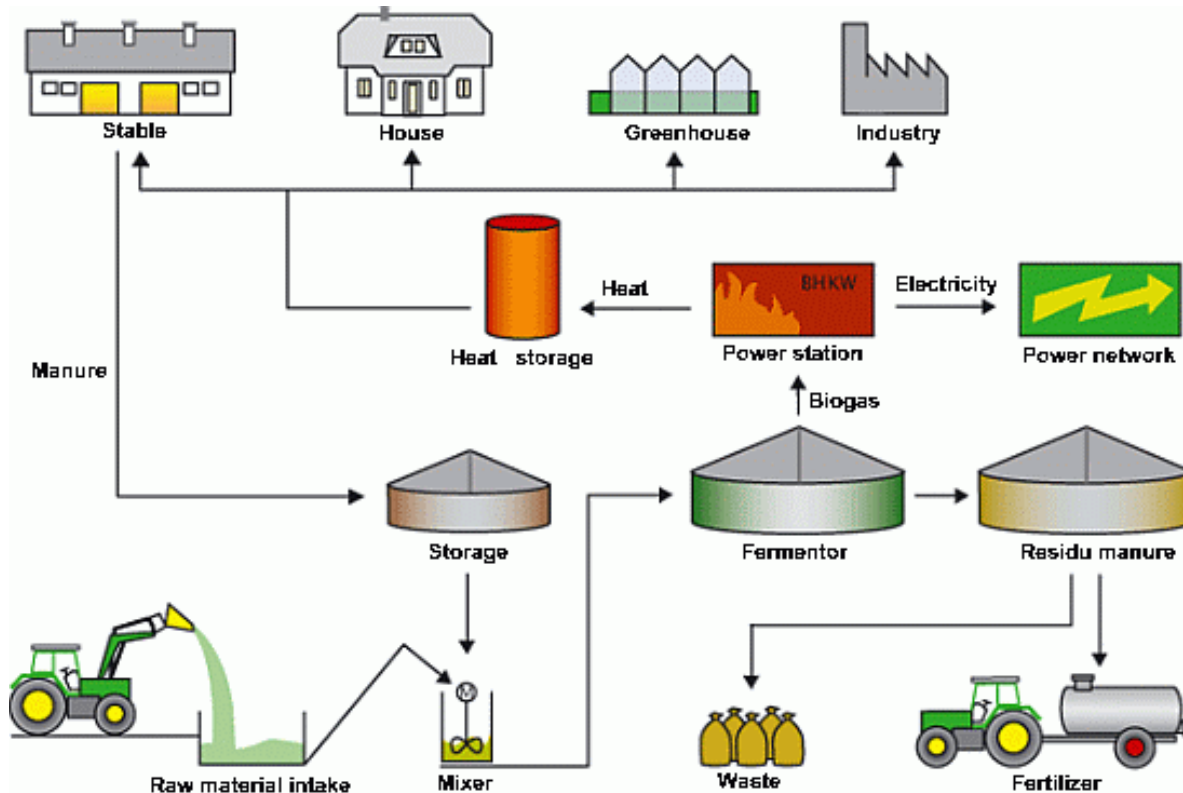
The BioGas Industry, February 2007

History

The BioGas industry has been around for many years, the earliest signs of use of BioGas go back to the Persians in 650AD. Only until recently it took a flight, mainly in Germany during the 80's. Since that it has gained a lot of attention and interest from various sides.

What is BioGas?

BioGas is the current name commonly used for this industry in which biomass is converted into (methane) gas. The biomass can be a natural agricultural waste product or a special grown crop for the process. The biomass is mixed with some water and fermented in a tank. The bacteria produce gas (Methane (CH_4), Average 65%, Carbon dioxide (CO_2), average 33% and some others), this gas is cooled and (if necessary) stored, than it can be used to create energy and heat. The figure below gives an idea of the production process.



The applications of Biogas:

One production round of gas can be simultaneously used for the following applications:

- Use gas for creating electricity, this electricity can be sold to the power networks.
- Use the heat, gained from producing electricity to heat houses, stables, greenhouses, factories or other structures.
- The residue manure is a very fertile fertilizer and can be used to fertilize the fields.

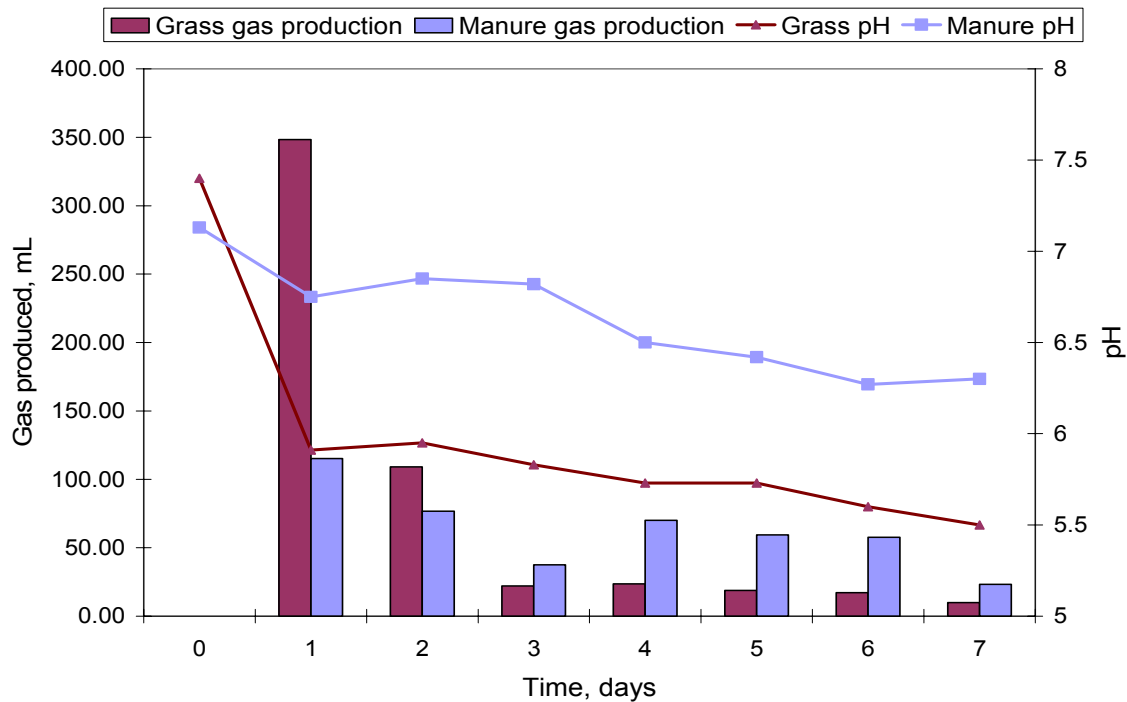
pH value

The optimum biogas production is achieved when the pH value of input mixture in the digester is between 6 and 7. Note that this is the INPUT value, the optimum value in the fermentor should be between 7,6 and 7,8 pH.

The pH in a biogas digester is also a function of the retention time. In the initial period of fermentation, as large amounts of organic acids are produced by acid forming bacteria, the pH inside the digester can decrease to below 5 pH. This inhibits or even stops the digestion or fermentation process.

Methanogenic bacteria are very sensitive to pH and do not thrive below a value of 6,5pH. Later, as the digestion process continues, concentration of NH_4 increases due to digestion of nitrogen which can increase the pH value to above 8.

When the methane production level is stabilized, the pH range remains buffered between 7.2 to 8.2.



Conclusion:

- The pH value has a direct effect on the amount of electricity that can be produced.
- Optimum electricity production between pH 7,6 and 7,8
- Critical pH values are beneath 6,5 and above 8,4pH

Measuring and controlling the pH

As mentioned above the pH can be a critical factor in the process and can optimize production of gas and therefore electricity and heat. There are two meters we can advise for this application:

1. pH testers, for routine measurements and checking the online pH electrode
2. Alpha PH2000, for continuous measurement and controlling the pH and for notifying the plant holder if anything goes wrong.

Add 1: The pH testers give an accurate status of the process. The advantages are that testers are inexpensive, easy to use, durable and very portable. Of course, also handheld meters can be used, but for most users this will be a little bit overdone.

Add 2: The Alpha PH2000 has 2 set points, one alarm contact, a wash cycle contact and a 4/20mA output. All these features can be used in this process:

- Setpoints:
 - Set setpoint 1 to low, at pH 6,5. When the pH value goes beneath pH 6,5, you can get a warning or you can let the system automatically dose chemicals in order to increase the pH level
 - Set setpoint 2 to high, at pH 8,0. If the pH value is higher than pH 8.0 you can get a warning or you can let the system automatically dose chemicals in order to decrease the pH level
- Alarms:
 - Connect to GSM system to send SMS to cell phone when something is wrong and the systems needs attention.
- Wash cycle:
 - In some cases it might be necessary to clean the pH electrode regularly. You can set the wash contact in such a way that cleaning of the electrode is performed automatically on pre-programmed intervals. During the washing cycle the controlling function of the meter will be temporary shut off, this to prevent unnecessary dosing during the calibration process.
- 4/20 mA output:
 - When the system is already complete automated with a PC you can use the 4/20 mA output to send the information about the pH continuously to the PC for monitoring and controlling.

Temperature

The methanogens are inactive in extreme high and low temperatures. The optimum temperature is 35 degrees C. When the ambient temperature goes down to 10 degrees C, gas production virtually stops. Satisfactory gas production takes place in the mesophilic range, between 25 degrees to 30 degrees C. Proper insulation of digester helps to increase gas production in the cold season. When the ambient temperature is 30 degrees C or less, the average temperature within the dome remains about 4 degrees C above the ambient temperature.