More Earnings for Biogas Plants

- What is important -

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Introduction

INNOVAS **has been established in 1994 by Dipl.-Ing. Stefan Reitberger und Anselm Gleixner as an civil law association. Both partners are still individually liable in the Company.**

Since this time we has researched in and has developed high efficient biogas plants for industrial use like for distilleries, diaries or food industry.

Why? The focus on this applications was always the improvement of economic situation, reducing of expenses but most important the safety along the production chain.

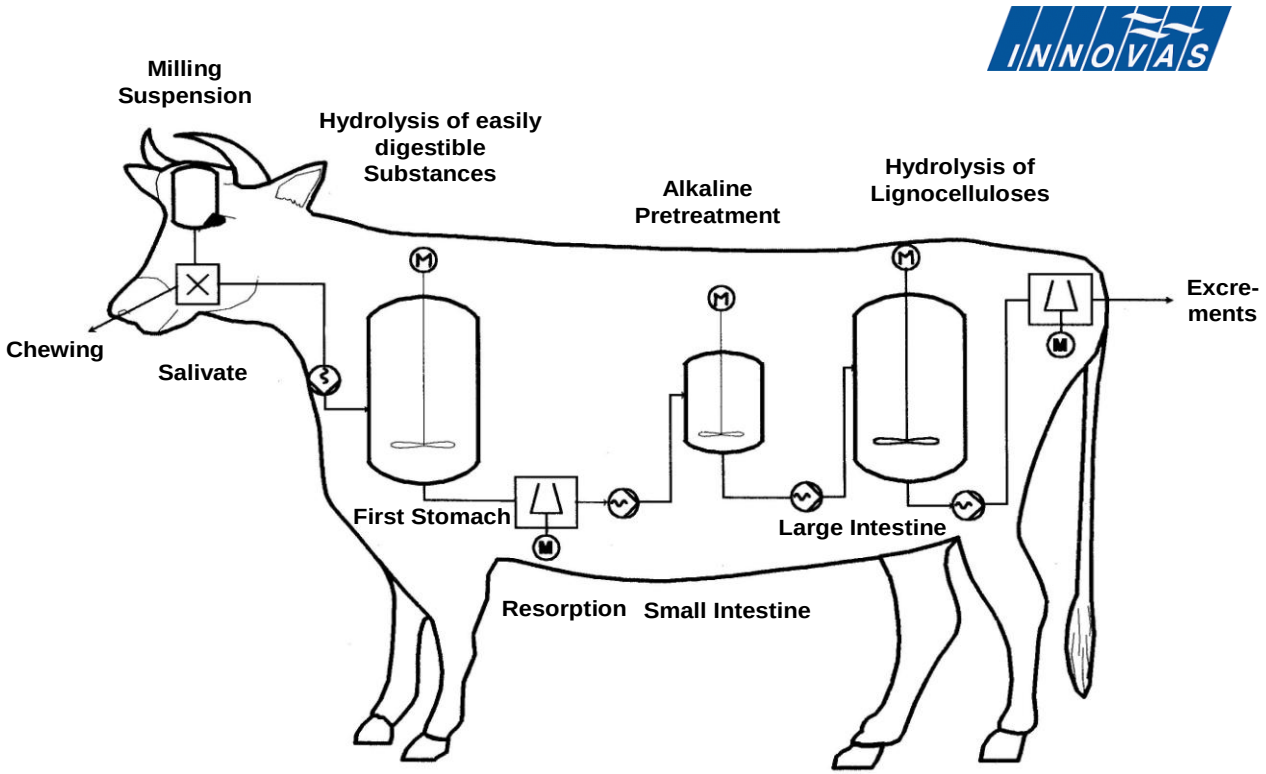
We are completely independent of any supply interests or must sell some products. Only the best solution and success of our clients is our objective, more than 25 Years of experience for your success.

We are providing independent and accurate consultancy only orientated to the needs of our clients, but we don’t sell any mystic liquids or powders and not any universal machines which makes anything right without knowing the reasons.

Fundamentals of Biogas Technology

Due to the short time we have not enough time to go deeper into the fundamentals of biogas technology. For more details to understand what is going on in a biogas plant I would refer to the disk you get.

But for a general understanding I would present the most perfect anaerobic system in the World….



The Hydrolysis analog to Ruminant Digestive

Requirements for the well function of a Biogas plant

- Lignin, wood and woody raw fiber is not fermentable; Cellulose and hemicellulose can be decomposed only with more efforts for making it anaerobically degradable; and such is only possible with Two-Phase Biogas Plants (means hydrolysis phase is separate from methanization phase).

  Such kind of Material needs a well pre-preparation.

- For the input material is the best possible cell disruption shall be made. As finer the substrate but as bigger their surface as better will be the degradation and as more is the biogas yield,
  The cell disruption could be made mechanically by milling, enzymatical or chemically.

- The fermentation substrate must be mashed homogeneous and readily flowable.

- The Temperature into the fermenter shall be stable within ± 2°C. Avoide temperature shock; fill no cold substrate into warm fermenter.

- Take care on right pH-Values for fermentation and hydrolysis.

- Compared to simple one-phase biogas plants a two-phase biogas plant has always a better degradation of the organic substrates, thereby bringing a significantly better biogas yield and higher methane content, at the same time.
  The separate, upstream hydrolysis is a true Turbo for each biogas plant.

- Not at least the plant must be well calculated and designed. The retention time must be long enough and adapted to the characteristic of the input material. The usual load factor in the fermenter tank shall be not more than 3..4 kg ODM/m³*d. Higher load factors (and thereby very short retention times) are only possible with special systems.

Possible Inhibitions and Interruptions

⇒ **Inhibition of the Biogas process could be caused by noncompliance of the process temperature, e.g. 35–40 °C on the mesophilic range. Also the process could be inhibited by strong temperature fluctuations, if for example very cold substrate is filled into the warm fermenter. Such is certainly one of the common causes of malfunctions.**

Corrective actions:

- **The fermenter shall be constructed with a sufficient insulation.**
- **Take care of stabile and constant temperature**
- **Warm up the substrates before filled in.**

⇒ **Disturbance of the biological balance by acidification.**
Critical values could be less than 6.8 pH and more than 8.0 pH

Corrective actions:

- **When feeding take care that only as much fresh material is dosed as the system could assimilate. Control the pH-value.**
- **When changing the material of after longer periods of non-operation increase the feeding slowly and gently.**

With an "Two-Phase Fermenter System" a overacidification is nearly impossible! Even if it comes to a overacidification, stop feeding and give the system time to adjust.

⇒ **Inhibition by higher salt and heavy metal concentrations.**
Salt concentrations could inhibit already at 10 g/l but adapted populations could allow up to 50 g/l.
With heavy metal concentrations it is difficult because some of this metals are necessary trace elements.

Corrective actions:

- **On critical material it's essential to make a substrate analysis before use.**
- **On critical input material it is recommended to check the conductance frequently**

⇒ **Disturbance of the biology by a high ammonia level.**

An ammonia concentration of more than 0,15 g/l could be critical. This could be caused by too much recirculation (with Nitrogen rich substrates) and thereby shifts the solution equilibrium of ammonium to ammonia. This is normally seen at the increasing of pH value > 8.0

Corrective actions:

- Frequently check of pH value.
- Reduction of the recycling or dilution with liquids low in nitrogen
- Possibly even any post-treatment of the effluent is necessary for use as recycling

⇒ **Disturbance of the biology by Hydrogen Sulfide**

The relevant literature sources indicates a possible inhibition of the biogas process on a H_2S concentration more than 50 mg/l but it's well known that adapted populations allows up to 1.000 mg/ H_2S.

Beside the inhibition of the biology by too much H_2S, there could be also another reaction disturbing the Biogas process.

In the anaerobic population are methanogenic bacteria and sulfur-reducing bacteria (SRB) living in symbiosis. Both are Achaea bacteria, the oldest live in our world.
When elemental sulfur is increased and the SRB reduce it to hydrogen sulfide, it comes to an competition situation.
Both bacteria groups compete with the available hydrogen dissolved in liquid.
In this situation the SRB are stronger (but are the older one…) and metabolize more H2 and this would disturb the metabolism of the methanogenic.
Not at least, such high concentration of H_2S is balanced dissolved in the liquid and part of the Biogas. This needs a more extensive desulfurization before the Biogas could be used.

Corrective actions:

- The dilution of sulfur rich substrates with sulfur less material.
- The precipitation of H_2S by using of ferrous based agents.

What's to do on insufficient performance

On the beginning of any actions a careful and thorough inventory has to be made to find out the reasons of poor plant performance.

- Are there organizational deficiency, methodical mistakes or lack of understanding by operational staff?

such problems could be eliminated by reorganization, training of staff but also by consistently documentation

- Is there a biological problem?

in such cases a complete analysis of input and output material must be made to see more

- Is there a technical deficit on the plant configuration? E.g. too short retention time or problems with acidification..

the plant configuration must be recalculated and the installed machinery must be checked if it suitable for the given input material.

Anyway if the improvement of the plant performance could be made by changing the process organization or up to a retrofitting of plant technology a carefully investigation of the given situation must be made.
An accurate specification of the basic situation and the task is the basic of any decision which has to be follow.

But, however one thing is not possible. The legendary "all-in-one device suitable for every purpose" on which nothing remains, which works for alone, for very low budget but maximal profit.

Conclusion

The Biogas technology is already very old and sophisticated. There are specialized and suitable techniques for different applications known and developed.

The reasons for an insufficient performance could be manifold. Without the knowledge of the malfunction no solution could be made. Healing by laying on of hands is not possible.

The performance enhancement, or if necessary re-design of the biogas plant configuration, should be carried out by a manufacturer independent expert. A plant construction company pretended to make any planning for "free", but the only interest of equipment supplier is selling his own goods.
This is comprehensible but is surely not always the same interest the plant owner has(!)

Don‘t hesitate to talk with us....

INNOVAS **Innovative Energie und Umwelttechnik**
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