A rumen based process for the sustainable, efficient and economic production of biomethane, proteins and fertilizers

ARES Technology - Hamburg - Germany

Some disadvantages of common biogas plants

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Typical biogas plants use two or more large digesters.

They require significant space and investment costs.

The retention time of the substrate is very long (30-180 days).

They use liquid manure and other animal slurries whose fermentative performance of the microbial community is poor.

They need specially cultivated energy crops.

The microbial system in the bioreactors decomposes only the readily soluble sugars, starch, proteins and fat. Therefore it‘s necessary to use the fruit-parts of the cultivated plants to obtain energy.

Common biogas plants are unable to decompose the fibrous non-food-parts of the plants. Thus between 20 to 50 % of the applied substrate will remain as a residue.

Producing energy crops leads to a competition regarding land use.

The RuminoTec ® - Process

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A breakthrough technology with a focus on the rapid decomposition of cellulose and hemicelluloses using a natural microbial system which even ruminants apply.

The process is using the most frequently natural materials.

The digestion-process needs only hours not weeks, so the applied biomass will be converted into biogas very quickly (usually within 48 – 72 hours).

The continuously working process makes it possible to use only the fibrous-parts respectively the non-food-parts of plants.

The bioreactor system can be fabricated in standard containers. All modules can be installed on-site very quickly. In addition, they can easily be shipped by truck, train or ship.

The process is able to produce additional important side-products like proteins and fertilizers.

Ecological benefits

The technology represents a complete new ecological way concerning the production of biomethaane and biofuels because no espeacially cultivated energy crops are necessary. Therefore there is an enormous potential of applicable biowastes, fibrous residues, pest plants, weeds, seaweeds and also pestcide-resitant „superweeds“.

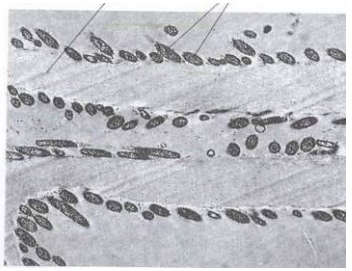
That allows to regard additional and very important ecological aspects like the protection of biodiversity, drinking water, soils and climate. All that will be achieved through a wide domain of usable plants and their environmentally friendly cultivation (regarding a restricted use of fertilizers, pesticides and the avoidance of soil erosion).

Minimizing the atmospheric input of fossil carbon by using biomass makes it possible to achieve international agreed carbon dioxide reduction targets.

Implications of over-fertilization

Residues of a common biogas plant

cellulose fibre **bacteria**



Ecological benefits cont`d

An artificial rumen based bioreactor can provide more than biogas, e.g. synthesis of microbial proteins (circ. 25 kg of microbial biomass per m^3 bioreactor volumina/ d) and the provision of fertilizers.

No genecitally modified organisms (plants or microorganisms) are required.

Also herbicide-resitant weeds can be used as a high-potential substrate.

Additional positive secondary effects can be observed like the biological degradation of some phytotoxic compounds. Therefore also contaminated biomasses can be used as a substrate.

Economic benefits

Agricultural food production creates many side-products (i.e. foliage etc.) that cannot be used for human consumption. Now these residues can be effectively applied for energy production.

This makes it unnecessary to cultivate energy crops. Now it‘s possible to use an enormous quantity of residues from agriculture, food industry and landscape conservation.

In addition it‘s also possible to use pest plants, weeds or grass growing everywhere (i.e. landscaping and set-aside land).

The capability to use an extreme wide range of vegetable materials, residues and wastes offers an important monetary benefit to the user because it‘s not necessary to buy or cultivate expensive energy crops. So operating costs can be held on a very low level.

Because of the high daily decomposition rate it‘s possible to reduce the required volume of the bioreactors considerably.

Economic benefits cont`d

To realise the same amount of energy, as little as a tenth of the volume of a common biogas plant is needed.

Smaller biogas plants which can be manufactured using standard units, provide to realise significant cost savings.

The bioreactors will be fabricated as standardised containers which can be shipped by truck, train or ship. Therefore the technology can easily be applied all over the world.

Every kilogram of cellulose offers approximately 400 litre of pure methane. This corresponds to 4 kWh of calorific energy.

The fermentative process generates biogas of exellent quality (CH_4: 52-54%, CO_2: 46-48%, H_2S<20ppm). No problems with impurities will occure.

The artificial rumen bioreactor is also able to produce microbial proteins as a by-product which can be used as a feed for animal nutrition purposes.

Economic benefits cont`d

No liquid manure will be needed. That fact allows an effective production of biogas at places where no industrial lifestock farming occurs.

The enormous fermentative performance creates opportunities for additional possible substrates who can become more important in the future, e.g. algae and seaweeds. Initial experiences show that the application of seaweeds induces increased production of microbial biomass.

In contrast to thermal and pyrolytic processes the amount of humidity inside the used biomass is not important.

The process allows the recycling of important plant nutrients (like N,P,K) and assures the humus content keeping the soils fertile.

The modular construction of this new type of biogas plants allows the plain realisation of user-defined amounts of energy depending only on the quantity of available substrates.

Economic benefits cont`d

The process is using the cellulose and the hemicelluloses as the most frequently natural raw material. Therefore the costs of substrates are very low.

Regarding the dry-matter of the applied substrates, a daily decomposition rate between 15 and 30 percent can usually be observed.

Using residues from agriculture, food production or landscape conservation in many cases the substrates will be allocable for free.

The facilities are fully reusable and recyclable.

Biogas can easily be stored and used just in time. This is important to keep the electrical grid stable and to assure a secure energy supply.

Biogas generation offers also an important contribution regarding energy independence.

Markets

Biogas plants using this new technology are well suited for renewable energy plants (includig power-to gas and hybrid-power-generation) and renewable energy investments.

Also this technology is well suited for decentralised energy supplies.

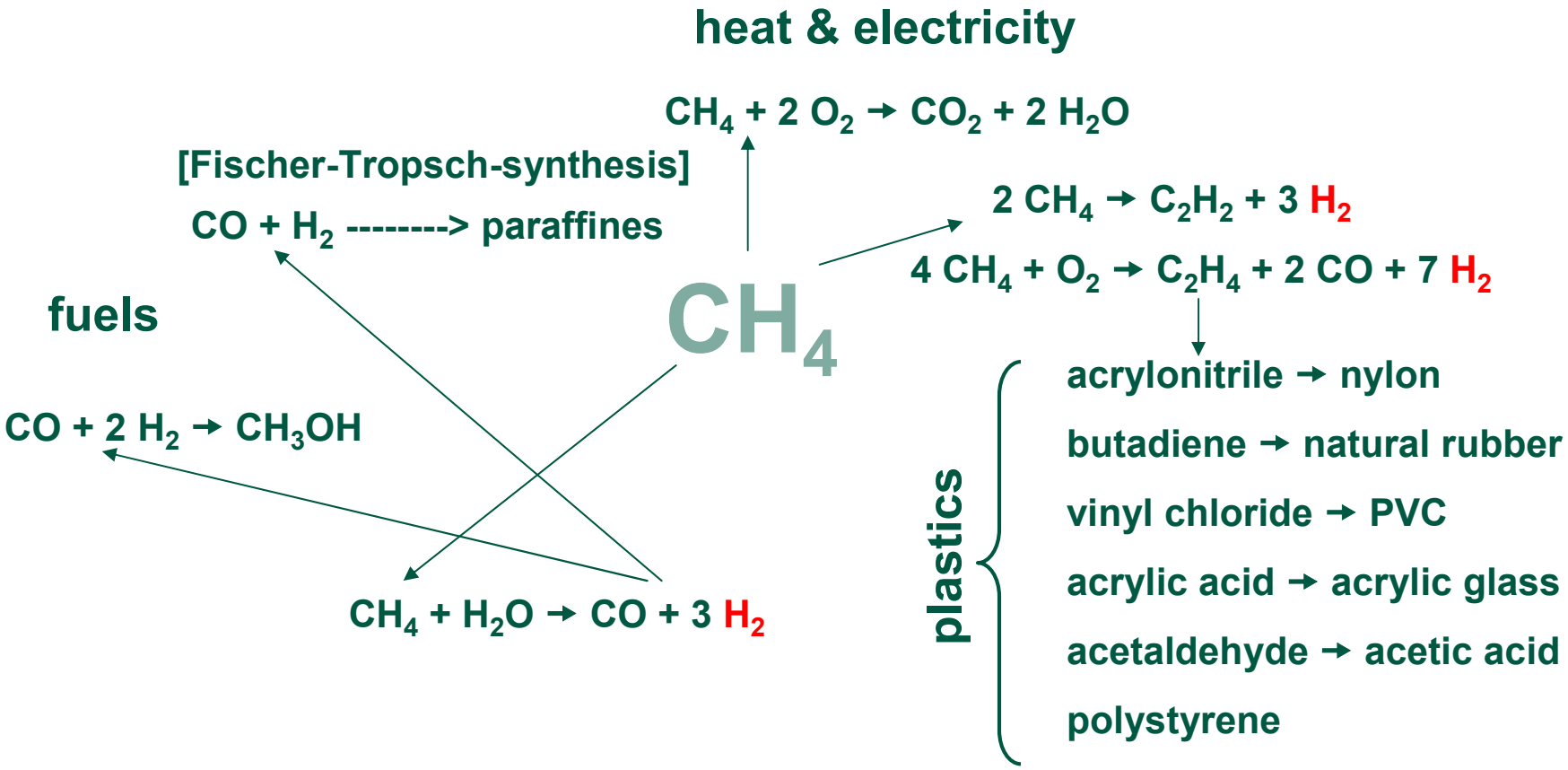
The ecological and economical benefits are opening a window to numerous local, national and international markets.

The amount of usable substrates make a lot of applications becomming real.

This makes the technology interesting for

- agriculture (using non-food-parts, residues and wastes)
- food production (using residues and wastes e.g. draff, bran, beet)
- trade and industry (using residues and wastes e.g. waste paper, cardboard)
- power supply industry
- landscape conservation
- waste management industry

Methane – a multipurpose raw material



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