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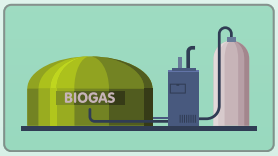
What is biomethane and how it is used

Biomethane is an **upgraded form** of **biogas**. Once the biogas is produced, biomethane can be purified from it representing a valid, renwable alternative to natural gas. In fact, impurities as CO_2, H_2O and other components are removed during the purification process.

Organic material
(Feedstocks)



Biogas plant
(Anaerobic digestion)

Blend of gases (biogas):

- 40 - 85 % methane
- 25 - 50 % carbon dioxide
- Traces of other components

(Purification process)

Biomethane

Biogas is normally produced thanks to the activity of bacteria under anaerobic conditions (absence of oxygen), that are able to decompose organic materials. This happens in a digester, a structure that enables decomposition of organic matter under controlled conditions.

End-use applications

Biomethane injection in natural gas grid

Biofuel for transport

Electricity

Heat

Different sources of feedstock for producing biomethane

Agricultural waste

Feedstock, primarily consisting of manure, crop residues, expired food, agricultural production errors, and harvest leftovers, is divided into two categories of substrates: pure and impure. Most agricultural feedstock falls into the pure category.

Sewage sludge

Mainly, sewage sludge is used to produce biomethane in wastewater treatment plants. Noteworthy, is an important step of the purification process, where oxygen is introduced into the wastewater to facilitate reduction of the organic matter content by the bacteria in the sludge.

Organic municipal solid waste (OMSW)

The feedstock, primarily solid and dry waste from households and commercial establishments like supermarkets and restaurants, undergoes anaerobic treatment using plug flow reactors or silo fermenters. Due to the limited mixing within these reactors, the feedstock often requires pre-processing.

Industrial wastewater

Industrial wastewater, is usually composed by effluents from industrial plants and companies in the field of food and beverage or paper. The main difference from sewage sludge treatment lies on the presence of anaerobic treatment first.

Industrial solid waste

The main feedstock comes from food processing, pharmaceuticals, organic chemicals and paper manufacturing. Solid feedstock from industrial waste can be co-digested with other feedstocks.

Waste from landfills

In landfills, the organic component undergoes decomposition thanks to the action of bacteria to produce biogas first, so there is no much need of reactor processes. There are two types of landfills: closed and open. Close landfills provide a much more conducive anaerobic environment for microorganisms to produce biogas, which can then be collected using several methods.

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Feedstock characteristics overview

Since the choice of the feedstock is fundamental for many reasons, let's explore the several aspects that we must consider before using one type of feedstock rahter then another.

The **composition** of the feedstock is very important and will have repercussions on the biogas yield and efficiency. In particular, easy digestible carbohydrates, will result in higher yield in terms of biogas production.

Concerning the **nutrient content** of the feedstock, it will affect the growth of the microorganisms digesting the raw material. Specifically, if we have a high level of phosphorous and nitrogen, the result is a faster growth of the microorganisms, that reflects in a higher yield.

Furthermore, another two important aspects to be considered when choosing the different feedstocks, are **availability** and **cost**, since feedstocks that are more available and less expensive will be favoured.

One of the factors that influence the availability, is **seasonality**, since there are some feedstocks that may be available only during some period of the year.

The **quality** of the source, also has repercussions on the type of feedstock, influencing at the end the biogas yield.

Finally, **processing** is also a crucial aspect to be considered when dealing with several types of feedstocks. In fact, it is often required that pre-treatment is used before feedstock is processed in the biogas plant. This includes many types of different techniques that require specific technologies to make the feedstock more accessible for the activity of bacteria.

Biomethane as output from biogas production

Biogas is composed by:

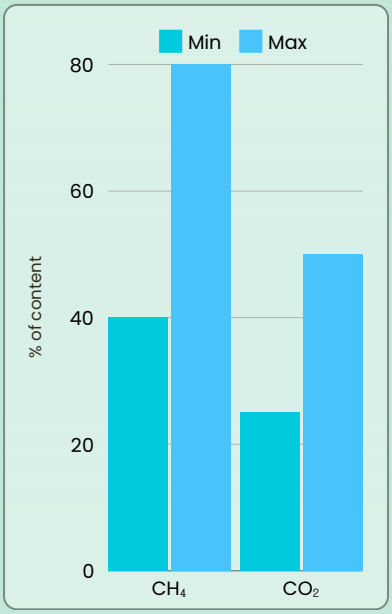
- methane;
- carbon dioxide;
- other components in traces.

Methane and **carbon dioxide** content may vary due to the use of different substrates (lipid, protein, carbohydrate etc.), but also because of the digester operating conditions and the degree of air injection for in-situ H_2S oxidation.

Since the variety of feedstocks can be wide, other than methane and carbon dioxide, several other minor components can be present as impurities.

Regarding **H_2S** content, it depends mostly on the substrate type, on the sulfur content, digester operating conditions and injection of air or chemicals for in-situ H_2S oxidation.

The **NH_3** content is dependent mostly from on the substrate type (as for H_2S) and on digester operating conditions.



About the project

GreenMeUp is an Horizon Europe Coordination and Support Action started on the 1st of August 2022, that will continue through 31 July 2025. The project is carried out by a Consortium of 14 partners from 10 European Countries. GreenMeUp is coordinated by CRES - Centre for Renewable Energies Sources and Savings (Greece).

PARTNERS

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