CAMBI

Thermal Hydrolysis

For Sustainable Sludge Managment

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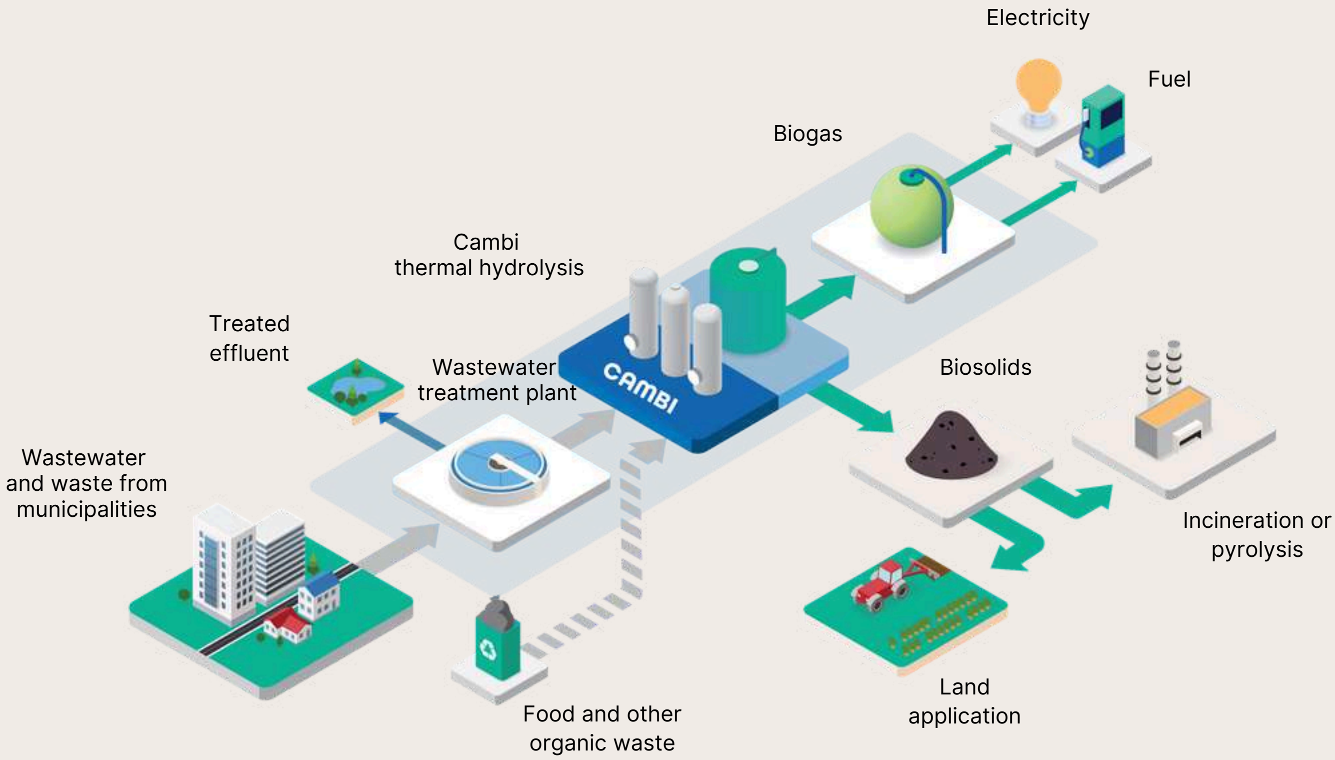
How Does Thermal Hydrolysis Work?

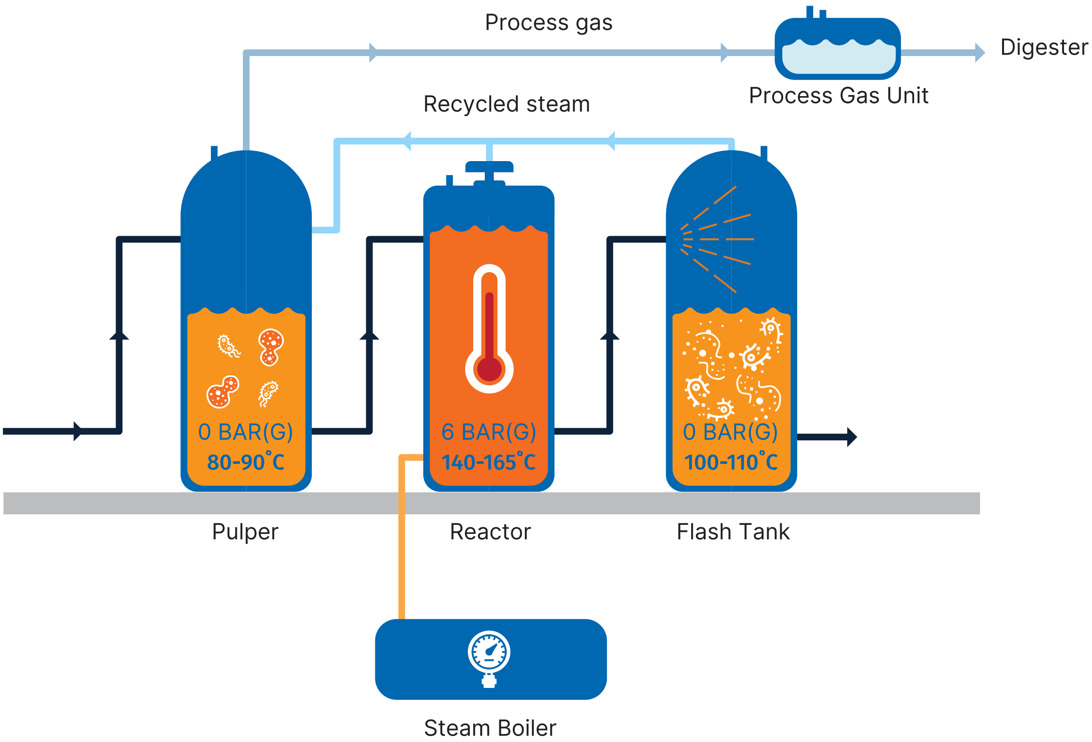
Thermal hydrolysis is a process technology applied in wastewater treatment plants with anaerobic digestion. It treats sewage sludge and other biowastes with steam under pressure to make them easier to break down during digestion.



Cambi's core offer is its patented thermal hydrolysis process (THP) technology, a treatment process for wastewater solids and other organic waste fractions. The THP comes with multiple cost-saving and environmental benefits: coupled with anaerobic digestion, it increases biogas production, reducing the use of non-renewable energy sources, and produces easy-to-handle, nutrient-rich biosolids that are suitable for all outlets.

The Cambi process can be partnered with anaerobic digestion in three ways: THP before anaerobic digestion, THP after anaerobic digestion, and THP in between digesters. THP before anaerobic digestion is the most common configuration.

A simplified illustration of the thermal hydrolysis process is shown and described below.



From the wastewater treatment plant's primary and secondary treatment units, raw sewage sludge is collected and dewatered to 16-18% dry solids. The thickened sludge is continuously fed into the pulper. The pulper has the role to homogenise and pre-heat the sludge to a temperature close to 100°C, using steam recovered from the flash tank.

From the pulper, the warm sludge is fed continuously to the reactors, in a sequential process that ensures sealed batches of sludge in each reactor.

Once a reactor fills up, sludge flows to the next available one. When the reactor is full and sealed, steam is pumped to raise temperatures to 140-165°C at a pressure of about 6 bars. The thermal hydrolysis process is typically set at 20 to 30 minutes for each batch, to ensure sterilisation.

From the reactor, the now sterilised and hydrolysed sludge is passed to the flash tank, which operates at atmospheric pressure.

The sudden pressure drop leads to substantial cell destruction for the organic matter in the sewage sludge. The steam generated by the pressure release is returned to the pulper to pre-heat the incoming sludge.

Leaving the flash tank, the sludge is cooled to the typical temperature for anaerobic digestion, by adding dilution water and in heat exchangers. Then it is fed to the anaerobic digesters.

Where Does Thermal Hydrolysis Fit?

- Thermal hydrolysis is best suited for large volumes of homogeneous organic residues. The feedstock is usually sewage sludge, collected from urban areas to wastewater treatment plants, through municipal sewage networks.

- The main feedstock is primary and/or secondary sludge. In some cases, food waste, digested or dewatered sludge may be brought from other locations and mixed with the sludge.

- Most medium- and large-size wastewater treatment plants recover energy from the sludge via anaerobic digestion. The resulting biogas covers local energy needs or is sold as electricity or natural gas. Thermal hydrolysis is a sludge treatment technology typically used in conjunction with anaerobic digestion.

- The Cambi process is optimally integrated into sludge lines processing at least 10 tonnes of dry solids/day.

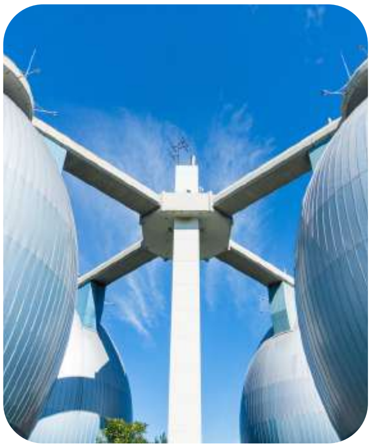
- After anaerobic digestion, the biosolids product is dewatered before utilisation or disposal. In alternative configurations with available digester capacity, the Cambi process can take place after anaerobic digestion, to further maximise dewatering efficiency.

- By investing in thermal hydrolysis, water utilities gain new options for sludge biosolids disposal, such as delivering it to farmers for agriculture. This recycling approach doesn't only adhere to circular economy principles but is often also the biosolids outlet with the lowest costs.

- In areas where agricultural utilisation is impossible, THP is a cost-efficient treatment step before pyrolysis or incineration. The produced biosolids will typically be significantly reduced in both volume and water content, markedly lowering drying costs. The resulting biosolids will also have a relatively high calorific value, making it good feedstock for thermal processes.

What Are the Economic Advantages?

Thermal hydrolysis is often the technology with the lowest annual operational costs for biosolids management in medium-size and large wastewater treatment plants.



Up to five times higher digester throughput

Thermal hydrolysis accelerates the hydrolysis step in anaerobic digestion, allowing higher digester loading rates and lower hydraulic retention time. The digester throughput per unit of volume is up to five times compared to conventional digestion. Build fewer, smaller digesters in new projects, or avoid new digesters during capacity expansion projects.

Much lower biosolids volume

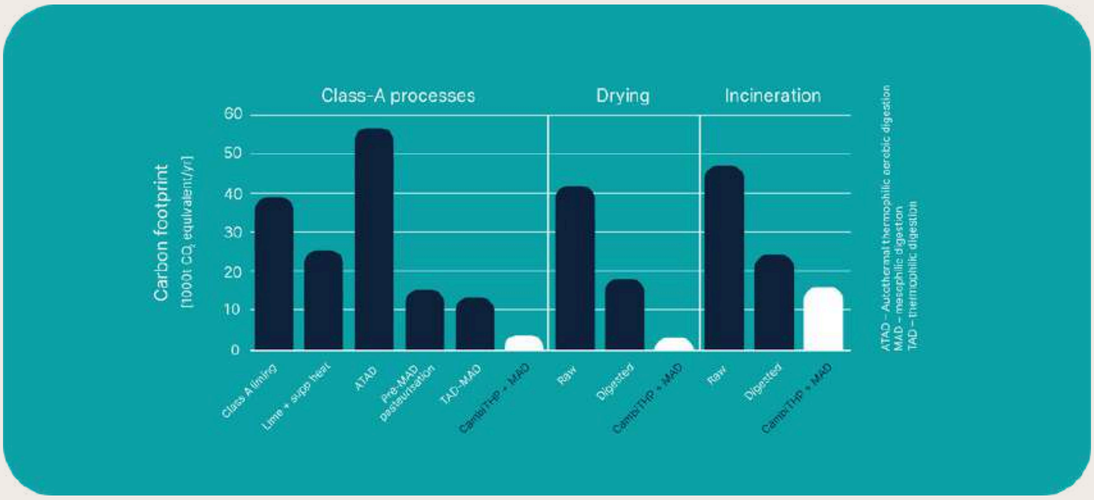
Thermal hydrolysis turns more organic matter into biogas and increases dewatering efficiency after anaerobic digestion. In short, as little as halved volumes of organic matter and water to be handled, significantly reducing costs. The biosolids product has consistent quality over time and is easy to stack, store, load, transport, tip and spread.

Significantly higher biogas production

Thermal hydrolysis exposes sewage sludge to high temperature and pressure. As steam explosion destructs the cell walls, more volatile solids in the sludge get transformed into biogas during mesophilic anaerobic digestion. The same volume of sludge, pre-treated via thermal hydrolysis, can yield up to 50% more biogas compared to conventional digestion.

How Does It Benefit the Environment?

Cambi's thermal hydrolysis process has been cited in many studies as the sludge treatment option with the least environmental impact.



Lowest Carbon Footprint by Far

Thermal hydrolysis reduces the climate gas emissions related to biosolids management.

- By increasing digester throughput, THP allows new plants to build smaller digestion facilities, which lowers carbon emissions during construction. Existing plants can often increase their treatment capacity without building new digestion facilities or increasing their spatial footprint.
- By improving dewatering, it reduces fossil fuel emissions related to biosolids transport.
- By increasing the amount of biogas released from sludge during digestion, it reduces methane emissions from biosolids post-dewatering. The biogas then replaces fossil fuels in the energy mix.
- When biosolids are used as soil products, they often replace more carbon-intensive alternatives. Alternatively, the thermal processing of better dewatered biosolids is less energy-intensive.

Excellent Quality Biosolids

Sludge sterilisation at high temperature and pressure, followed by steam explosion, effectively destroys both pathogens and bacteria. The subsequently digested biosolids are without pathogen regrowth and have negligible odour, with benefits for the local working environment and no complaints from nearby communities. They surpass the most stringent regulations for organic waste treatment, so-called Class A.

Cambi THP B6 at Basingstoke, England

Cambi THP B12 at Xiahongmen, China

Cambi THP B6 at Psyttalia, Greece

Cambi THP B2 at Medina, OH, USA

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