

## **Use of Pulse Electric Field as a method to increase biogas production from wastewater sludge**

The process of treating wastewater generates sludge that needs to be disposed according to governmental legislations. Generally, the sludge needs to be further treated to ensure a number of parameters are below the allowed threshold values. One important parameter is the amount of organic material present in the sludge and degrading that material is also called sludge stabilization. The treatment and disposal of sludge can be the single most expensive step on wastewater treatment systems, for that reason, possibilities, methods and techniques that can help reducing that cost are constantly being pursued.

Anaerobic digestion (AD) degrades organic material generating biogas and it is one of the most common methods used within the European Union (EU) to stabilize wastewater sludge. This method transforms solid organic material (biomass) into biogas, decreasing the amount of organic material present in the sludge while producing clean energy. This process typically takes place in a digester, where sludge is submitted to a heated anaerobic environment (without oxygen). Pre-treatments are often used in order to optimize the anaerobic digestion maximizing biomass degradation and biogas production.

Pulsed Electric Fields (PEF) is a commonly used technology in the food industry to increase juice and olive oil extract, however, studies show that it also has the potential to be used as a sludge pre-treatment method as help increase biogas production. PEF consists of applying energy to the substrate being treated in order to generate pores into the cell's membrane (electroporation), making its content more easily available. Subjecting the wastewater sludge to this treatment prior to anaerobic digestion can help the microorganisms responsible for digesting the biomass have easier access to that organic material, increasing the overall biogas production.

PEF treatment can be characterized by a number of different parameters, one of them being treatment intensity, which is the energy input required from the treatment, generally expressed as energy/mass (J/kg).

This study compared the biogas production obtained from the digestion of sludge pre-treated by four different intensities with the gas produced from the digestion of untreated sludge and results showed that PEF-treated sludge generated up to 7.3% more biogas than untreated sludge and degraded around 7% more organic material.

Another impact of PEF treatment, besides electroporation, is the increase in the substrate's temperature. This can lower the energy required to heat the sub-sequent anaerobic digester, helping offset the energy required by the PEF treatment.