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*Stable increase of organic loading rate in anaerobic membrane bioreactors working at ambient temperature*

# Popular science article

How to recover energy from wastewater treatment? Or how to turn wastewater into gold? Well you have to know that every year, a lot of industries (like slaughterhouse or dairies and beverage industries producers) release a lot of wastewaters into the environment without any valuable reuse. It's a big waste, because wastewater can be valorise. One good way to do it is to produce biogas from it, thanks to the anaerobic digestion (fermentation in a closed environment, without any oxygen). That process allows to recover energy (with the biogas released) from the wastewater treatment, which can also decrease the energy cost!

However anaerobic digesters can't handle large volume of feeding due to the washing out of the micro-organisms producing methane into the outlet. One solution is to use an anaerobic membrane bioreactor, which is a reactor coupled with a membrane that maintain particles and micro-organisms into the reactor, allowing to treat larger volumes of wastewater. Moreover, the use of an anaerobic membrane bioreactor working at ambient temperature (25°C) instead of higher temperatures (37°C) is interesting as it would decrease the energy consumption of the reactor.

Nevertheless, how to start that kind of reactors while keeping the process stable is still unknown. In one hand, a too quick start-up would lead to the failure of the reactor, as the anaerobic digestion would be saturated .In the other hand, a too slow start-up wouldn't be cost-effective. Then a suitable speed of start-up for the wastewater feeding has to be determined.

The aim of the work was to evaluate the stability of the reactor during two different start-ups, using stability indicators found in the scientific literature. Two anaerobic membrane bioreactors were used (see the photo), fed with synthetic wastewater (prepared with milk powder, in order to mimic a real wastewater). One reactor was first used to perform a slow start-up (with several step-increases of the feeding) after a long adaption time for the micro-organisms. The second reactor was used to perform a quick start-up from a short adaption time, in order to figure out if both long adaptation time and slow start-up are really needed in order to avoid the failure of the reactor.

The first reactor fulfilled all the stability indicators during its operation, which means that the reactor has handled the start-up without any failure in the anaerobic process. However, the second reactor didn't meet any of the biological benchmarks; it failed. Finally, for both reactors, fouling of the membrane was found to be limiting in order to continue the start-up. The membrane fouling rate was too high to properly operate the reactors. Reasons for the membrane fouling were investigated (accumulation of fat in the reactor, thickness of the sludge, use of fat-free milk powder), without any relevant results… Investigation must continue! In conclusion, a step-increase start-up of the feeding was successfully carried out while monitored by stability indicators, which found out to be powerful monitoring tools to control the anaerobic digestion process.