High resolution mass spectrometry analysis of samples from anaerobic digesters subject to saline stress

Location :
1. *INRAE, Unité de recherche PROSE (Procédés Biotechnologiques au Service de l'Environnement - Antony, 92)* https://www6.jouy.inrae.fr/prose/
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Context: Anaerobic digestion, or methanization, is a microbiological process of organic matter degradation that produces biogas, rich in methane, which can be energetically valued. It is commonly used to treat different types of organic waste at industrial scale. However, this bioprocess is not fully mastered and can still be improved. One of the main limits of anaerobic digestion is its great vulnerability to different inhibitors found in the waste, such as salt (NaCl) among others.

In a preliminary study, we evaluated the effect of saline stress on the performance of anaerobic digestion and microbial dynamics. To do so, 30 laboratory pilots have been set-up and ten different stress levels have been applied to generate more or less important disturbances of the microbial populations (addition of 0 to 50 g / L of salt). Samples were taken at 9 point points in these digesters and kept at -80 ° C.

Objectives: In order to deepen the results already obtained, we want to characterize the influence of salt levels on the metabolic pathways of anaerobic digestion. For this, we want to apply a non-targeted metabolomic approach using high-resolution mass spectrometry to the samples of the study described above.

The tasks entrusted to the trainee will consist in 1) setting-up a specific protocol for extraction of samples (liquid and solid) to allow for their HRMS analysis in direct introduction, 2) performing the preparation and analysis of the samples from the above study using high resolution mass spectrometry, 3) studying the dataset obtained with different bioinformatic and biostatistical methods in order to identify a series of ions of interest, 4) characterize more specifically some of these ions using a MS_n fragmentation approach.

The analyzes will be carried out mainly on a high-resolution mass spectrometer (FT-ICR Solarix XR, Ecole Polytechnique). A high-resolution mass spectrometer (LTQ-ORBITRAP XL), available in Prose, will also be used.

Profile of the candidate: The candidate must have a taste for laboratory work. Indeed the project is composed of an important experimental part, requiring rigor and thoroughness. The joint analysis of all the data will require a good capacity for synthesis and analysis. The data will be analysed with the R software that requires the use and modification of existing scripts. Depending on the duration of the internship, the study of the dataset obtained (3 and 4) will be more or less important.