Première injection de lixiviat dans un digesteur anaérobique suivi par méthode géophysique.

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First leachate injection monitoring in farm scale solid state anaerobic digestion plant by electrical resistivity tomography

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Anaerobic digestion (AD) has a high growing potential worldwide due to its combined environmental benefits such as reducing greenhouse gas, producing renewable energy, organic amendment and fertilizer. In France, 400 plants were recorded in 2015 which mainly handle agricultural residues using both liquid and solid state processes. The successful and efficient degradation of organic matter in AD needs balanced physical-chemical conditions for microbial development. Moisture content in the media, particularly, was found to be of great importance. Nevertheless, no information is available on the hydrodynamics of the circulation of the leachate through cattle manure or other agricultural residues. Moreover, agricultural residues and mixtures are particularly porous and heterogeneous and no data was found on the efficiency of those systems to humidify homogeneously such a substrate.
The hydrodynamic flow characteristics and transfer time of the leachate are essential to design the optimal liquid injection system that will permit to reach uniform moisture content. Already applied in landfills for in-situ characterization of leachates flow through municipal solid waste (MSW), ERT was proven to give reliable results. The results led to the enhancement of the leachate injection system design and enriched the knowledge of MSW behavior. The non-intrusive, non-destructive and 3 dimensional response of the ERT method seems adapted to the study of the leachate infiltration through agricultural effluents in a SSAD plant. We present the first results of the use of 3D time-lapse electrical resistivity tomography performed during a leachate injection in a waste deposit cell in France (20 m3 of leachate was injected during 10 h). 72 electrodes and a Syscal PRO resistivity meter was used. For the inversion, the apparent resistivity have been interpreted taking into account (i) the boundary condition of the waste deposit cell (insulating boundary around the waste deposit cell) and (ii) the effects of temperature (indeed between the surface and the bottom of the waste deposit cell , we measured the variation of temperature in the range of +/-25 °C). The result highlighted the conductive character of this porous media with a resistivity included between 0.5 ohm.m and 10 ohm.m depending on the saturation state; we will show that the infiltration is clearly located by electrical resistivity tomography and that this media is very heterogeneous with complex infiltration shape. The first results suggest the interest of the 3D electrical resistivity tomography to study injection leachate injection in a SSAD plant.