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DETAILED CHARACTERIZATION OF THE LIQUID FRACTION OF DIGESTATE FROM INDUSTRIAL SCALE ANAEROBIC CO-DIGESTION AFTER SOLID-LIQUID SEPARATION

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Abstract

Increasing number of anaerobic digestion (AD) plants results in the generation of large amounts of digestates. Liquid fraction of digestates contains high concentrations of various chemical compounds making its treatment and disposal problematic. Furthermore, little information about the composition of this liquid fraction is available in the literature. Hence, the objective of this study was to characterize the liquid fraction of digestates obtained from full-scale co-digestion plants in order to have a better knowledge of its composition and to identify the important parameters to take into account for its treatment and disposal.

Samples of liquid fraction of digestates after solid-liquid separation from 12 industrial co-digestion plants were collected. The plants were operated with different types of co-substrates, operating parameters (hydraulic retention time (30-80 days), temperature (35-55°C), feeding (11-43 kg of raw substrate/day/m³) and type of solid-liquid separation (screw press, centrifugation and vibrating screen). Samples were filtered at 9 different sizes, from 100 µm to 1 kDa. Physical (particle size distribution, particle size length: width ratio, turbidity, UV-VIS spectrophotometry, 3D fluorescence spectroscopy, conductivity), chemical (chemical oxygen demand (COD), total nitrogen, ammonia, total solids, volatile solids, alkalinity, total organic carbon, inorganic carbon, carbohydrates, metabolites, cations, anions) and biological characterizations (Biochemical oxygen demand (BOD)) were performed on either on each of the 10 fractions of the liquid digestate or on the dissolved matter fraction. The sizes were grouped into suspended particles (>1.2µm), coarse colloids (1.2µm to 0.45µm), fine colloids (0.45µm to 1kDa) and dissolved matter (< 1kDa) [1]. 3D fluorescence was analyzed on the fraction < 1 kDa [2]. In the presentation, the detailed results of the characterization of the 12 samples will be shown. Examples of results for COD and N are summarized in Table 1 according to sizes.

Table 1: Range of COD (g/L), COD (%), BOD/COD and total nitrogen in 12 liquid fractions of digestates

	COD (g/L)	COD (%)	BOD/COD	Total nitrogen
Total	1.7 to 78	100%	0.09-0.54	1-6.5 g/L
Suspended solids	1.4 to 67	60-96%	-	11-65%
Coarse colloids	0 to 4	0-11%	0.13-0.53	0-8%
Fine colloids	0.08 to 6	2-16%	-	0-13%
Dissolved matter	0.2 to 9	2-18%	-	26-80%

The results show a high variability for COD (1.7 to 78 g/L) depending on the type of co-substrates, operating conditions and solid-liquid separation. Furthermore, most of the COD (60 to 96%) is in the fraction > 1.2 µm that is linked to suspended solids. BOD was always very low indicating a low biodegradability, even for the fraction < 1 kDa. 3D fluorescence is distributed into 37-54% protein- like, 27-36% fulvic-acid like, 11-15% glycolated protein-

like, 6-10% melanoïdins-like and 1-4% humic acid-like. As COD is mainly in suspended solids and the organics matters have low degradability, physico-chemical post treatments can be proposed for the treatment of digestates liquid fraction.

References

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