

Review of the Project:

HYDROCARBONS AND CARBOHYDRATES RELEASE DURING THE BIODEGRADATION OF SOLID WASTE FROM TANNERIES FOR BIOGAS PRODUCTION

In the project, the investigation of how environmental parameters function during anaerobic digestion (AD) of tanneries solid waste was performed. The evolution of the hydrocarbon and carbohydrates release, energy and treatment efficiency of the AD of the solid waste of tanneries monitored in batch laboratory-scale bioreactors was provided. 22 identical batch-scale bioreactors were assembled with leather shavings mixed with sludge. The efficiency of the treatment was assessed throughout the entire AD process (monitored every 10 days for the 100 day assay) in terms of biogas volume and composition, hydrocarbon and carbohydrates release with NIR spectra, total organic carbon (TOC), inorganic carbon (IC) and total nitrogen (TN) with a TOC analyzer, BOD₅ with a manometric device, volatile suspended solids (VSS) and volatile dissolved solids (VDS) with gravimetric method, pH with a Digimed pHmeter, chromium (III) oxide concentrations according to ABNT NBR13341 method and denaturation temperature with a differential scanning calorimeter. The main results showed that the assays produced on average 28.5 mL of cumulative biogas/g of VSS added with a maximum percentage of 63.7% of methane. The long lag phase, approximately 20 days, showed that the recalcitrance and complexity of the waste caused the hydrolysis phase to take longer to complete. The concentration of hydrocarbons and carbohydrates released in the medium showed the highest concentration in the initial phase of the process, with a maximum percentage of 27% at 20 days of the process, due to the initial solubilization of the residues, attributed to the hydrolysis and disintegration of macromolecular biopolymers to soluble monomers.

I would like to conclude by thanking to the committee of 2021 IULTCS Young Leather Scientists Grant for selecting **Dra. Caroline Borges Agustini** for the Professor Mike Redwood Young Leather Scientist Grant 2021 Sustainability/Environmental Award, who carried out this research successfully. The major findings suggest that AD of the tannery solid waste can be separated into three phases:

1. A long lag phase, where the microorganisms slowly adapt to the waste, approximately 20 days, when hydrocarbons and carbohydrates reach their maximum due to hydrolytic activity;
2. A log phase with a low metabolic rate of 15 mL of biogas/day, due to the complexity of the waste, where much of the chromium present is bound or adsorbed to the shavings, not inhibiting the process and hydrocarbons and carbohydrates reach their due to metabolic action;
3. A final phase where all the shavings were metabolized, all the chromium dissolved in the reaction medium and cell lysis occurs, releasing hydrocarbons and carbohydrates back into the medium, reaching a final intermediary value.



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