

Project theme: Optimization of anaerobic digestion for improved methane yield and stable digestate production through homoacetogenesis

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In both simple and complex feed-stocks, trace/transition metals (TMs) influence rates of VFAs degradation by increasing the activities of the associated enzymes. Phosphate (Pi)-dependent activation of process intermediates is a necessary condition for degradation of VFAs. The most important VFAs are propionate, butyrate and acetate. 70% of digester methane is generated from acetate. This makes acetate metabolism, especially homoacetogenesis, from other VFAs important. More so, the roles of TMs and Pi in general acetate metabolism are poorly known.

Consequently, this investigation makes a 3-dimensional assessment of TMs effects on AD. The influence of inorganic phosphate (Pi) on AD energetics is also investigated. Additionally, TMs and Pi are investigated for their roles in VFAs degradation at thermodynamically low concentrations, which is an important determinant of digestate quality. The objectives are as follows:

1. Development of co-digestion index based on biogas yield relationship between carbon, nitrogen and TMs content of feedstuff;
2. Determination of VFAs change pattern and degradation efficiency in relation to TMs concentration;
3. Determination of the influence of TMs/Pi on the kinetics of VFAs degradation, acetate metabolism (homoacetogenesis) and digestate stability.
4. Assessment of yield potential of substrates selected for co-digestion, based on experimental results (Validation).