# Microbial and phenyl acid dynamics during the start-up phase of thermophilic AD

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**Abstract**

The increasing energy demand and concurrent efforts to expand the spectrum of renewable, carbon-neutral energy sources pose the biggest challenges of humankind. Using a variety of organic wastes for biogas production, which would otherwise be deposited in an uncontrolled manner, could help to overcome these obstacles. One drawback of using organic wastes is the release of aromatic compounds like phenylacetate (PAA) or phenylpropionate (PPA) during the breakdown of lignocellulosic materials. Phenyl acids have diverse but yet poorly understood effects on the microbial community and thus on the overall biogas process. Hence, a closer look on microbial and phenyl acid dynamics during anaerobic digestion (AD) of common lignocellulosic materials is pending.

In thermophilic batch reactors, straw from grain was digested in different concentrations for 28 days. The reactors were analysed biochemically (biogas production and composition, phenyl- and volatile fatty acid concentrations) as well as molecular biologically (amplicon sequencing). Raw sequences were qualitatively checked and processed via *mothur* [1]. *Spearman's* rank correlation analyses were done in order to link high phenyl acid concentrations to microbial taxa.

While PAA and PPA concentrations were relatively low in all samples, concentrations of phenylbutyrate (PBA) increased during the AD of high overload samples. Surprisingly, biogas production was also highest at high-overload conditions and *Methanosarcina* spp. was the dominant methanogen. A cascade-like formation / degradation pattern – from PAA to PPA to PBA – could be observed in those samples. Microorganisms positively correlating with PAA and PPA concentrations (like *Tissierella* spp.) were different from those correlating with PBA concentrations (e.g., *Lutispora* spp.). An increase in PBA concentrations probably indicated a switch from easily-degradable substrates to more recalcitrant ones [2]. In future, these dynamics might help biogas plant operators to successively exploit complex lignocellulosic substrate.

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2. Prem, E.M.; Markt, R.; Lackner, N.; Illmer, P.; Wagner, A.O. Microbial and Phenyl Acid Dynamics during the Start-up Phase of Anaerobic Straw Degradation in Meso- and Thermophilic Batch Reactors. Microorganisms 2019, 7 (12), 657.