## *RESEARCH*

Ashraf, M.M.; Ikram, S.; Hussain, M.; Siddiqui, F. **A comprehensive review on utilization of waste biomass for production of biogas by hydrolysis and anaerobic digestion using *Neocallimastix frontalis*.** *Earth Sciences Pakistan (ESP)* 2024, 8(1), doi: 10.26480/esp.01.2024.47.54.

**Abstract:** Bioenergy is generated from biomass by anaerobic digestion, and it is considered a sustainable solution for the globe to overcome energy demands. In Anaerobic digestion the organic material breaks in the absence of oxygen and produces biogas, initially, it produces methane and $CO_2$. The *Neocallimastix frontalis* anaerobic fungi are used to break down complex organic material, helping to enhance anaerobic digestion. *Neocallimastix frontalis* is present in the herbivore's rumen enhances the enzyme activity and enables the breakdown of lignocellulosic biomass. The structure of lignocellulosic is complex so it becomes a challenge for enzymatic degradation. The steam explosion pretreatment method is used for making the lignocellulosic substrates digestible. It makes the structure of lignocellulosic biomass more accessible for enzymatic breakdown and enhances microbial fermentation that helps to lead the biogas production. Anaerobic digestion produces digestate, which is a nutrient-rich fertilizer that promotes sustainable agriculture practices that produce biogas. In future, more studies are required to use *Neocallimastix frontalis* in anaerobic digestion process improvement. This may help not only in improving the mode of biogas production, it also used in addressing strengthening global energy and environmental issues. This involves the identification and implementation of genetic engineering technologies and advanced biotechnology techniques that promote the development, and commercialization of enzymatic profiles and biogas generation systems. Moreover, the evolution of bioreactor design, process optimization, as well as microbial engineering, are some of the developments of these technologies as such, deployment of such technologies in diverse industries. Agriculture will further complement climate change mitigation efforts and the accomplishment of sustainable development goals.

Thongbunrod, N.; Chaiprasert, P. **Efficient methane production from agro-industrial residues using anaerobic fungal-rich consortia.** *World Journal of Microbiology and Biotechnology* 2024, 40, 239, doi: 10.1007/s11274-024-04050-7.

**Abstract:** Anaerobic digestion (AD) emerges as a pivotal technique in climate change mitigation, transforming organic materials into biogas, a renewable energy form. This process significantly impacts energy production and waste management, influencing greenhouse gas emissions. Traditional research has largely focused on anaerobic bacteria and methanogens for methane production. However, the potential of anaerobic lignocellulolytic fungi for degrading lignocellulosic biomass remains less explored. In this study, buffalo rumen inocula were enriched and acclimatized to improve lignocellulolytic hydrolysis activity. Two consortia were established: the anaerobic fungi consortium (AFC), selectively enriched for fungi, and the anaerobic lignocellulolytic microbial consortium (ALMC). The consortia were utilized to create five distinct microbial cocktails–AF0, AF20, AF50, AF80, and AF100. These cocktails were formulated based on varying of AFC and ALMC by weights (w/w). Methane production from each cocktail of lignocellulosic biomasses (cassava pulp and oil palm residues) was evaluated. The highest methane yields of CP, EFB, and MFB were obtained at 337, 215, and 54 mL/g VS, respectively. Cocktails containing a mix of anaerobic fungi, hydrolytic bacteria (*Sphingobacterium* sp.), syntrophic bacteria (*Sphaerochaeta* sp.), and hydrogenotrophic methanogens produced 2.1–2.6 times higher methane in cassava pulp and 1.1–1.2 times in oil palm empty fruit bunch compared to AF0. All cocktails effectively produced methane from oil palm empty fruit bunch due to its lipid content. However, methane production ceased after 3 days when oil palm mesocarp fiber was used, due to long-chain fatty acid accumulation. Anaerobic fungi consortia showed effective lignocellulosic and starchy biomass degradation without inhibition due to organic acid accumulation. These findings underscore the potential of tailored microbial cocktails for enhancing methane production from diverse lignocellulosic substrates.