RESEARCH

Juhász-Erdélyi, A.; Huszár, M.; Farkas, A.; Maróti, G.; Wirth, R.; Szuhaj, M.; Bagi, Z.; Kovács, K.L.; Kovács, E. **Ruminal microbe consortia for biogas production from lignocellulosic substrate.** *Fermentation* 2026, *12*, 247, doi:10.3390/fermentation 12050247.

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Abstract: Lignocellulose is degraded in the rumen by diverse microorganisms. This study aimed to select the top ruminal microbes associated with an anaerobic fungus (AF) capable of forming consortia that facilitate biogas production from wheat straw. The workflow included the following steps: (1) batch reactors, divided into three compartments with porous membrane bags containing wheat straw, were assembled. The outermost compartment was inoculated with freshly collected rumen content. The first microbes colonizing the wheat straw in the innermost compartment within 72 h were identified. (2) Synthetic consortia were assembled comprising the following identified microbes: an anaerobic fungus (AF) (*Neocallimastix lanati*); methanogenic archaea (M) (*Methanobrevibacter ruminantium* or *Methanobrevibacter gottschalkii*); bacteria (B) (*Butyrivibrio hungatei* or *Succinoclasticum ruminis*). (3) Wheat straw was subjected to 7-day pretreatments with these synthetic consortia. (4) The pretreated straw served as substrate in biochemical methane potential (BMP) tests that used a biogas reactor digestate as the inoculum. The pretreated straw produced elevated biomethane yields; nonetheless, this process needs further optimization. The cross-kingdom AF + M + B consortia increased methane production by 35–70%, and superior volatile fatty acid production was confirmed via HPLC. The results suggest novel strategies for advanced practical biogas/biomethane technologies.