



**CLOSED-CYCLE INTENSIFIED TECHNOLOGY FOR SUSTAINABLE BIOCHEMICAL PRODUCTION
OF ALTERNATIVE FUELS FROM AGRICULTURAL WASTES**

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Biomass becomes an alternative “green energy” source of major interest. Our research is aimed at development of intensive technology of biomethane production from agro-industrial wastes, using the stimulating phyto-catalysts. Another scope is elaboration of innovative technologies for reaching high methane contents in biogas which do not represent a risk to environment and local communities.

To test the elaborated biogas technology, a bioreactor design was developed. As a feedstock for biochemical digestion a post-distillery vinasse in a mixture with cattle manure was used. As micro-additives to biochemical process, the proposed substances were used both as pure extracts and in the form of crushed seeds, bark and parts of plants. In the laboratory tests a series of approaches were used, including chemical, biological, microbiological, physical-chemical methods and instruments.



The proposed technology is based on the use of natural phyto-catalysts introduced in the digested biomass in micro-concentrations of 10^{-3} - 10^{-5} % [1]. They are obtained by extraction from natural vegetable feedstock and wastes. Phyto-catalysts promote 1,5-2 times acceleration of methanogenic process and increase in biomethane contents in biogas up to natural gas level. Biomethane contents in biogas is thus increased from 62% with caloric value of 5232 kcal/m³, to 89-93% with caloric value of 8010 kcal/m³. In our experiments we succeeded to reach the 20% higher degree of biological treatment, compared to the treatment with aerobic microorganisms. In addition, stabilized biomass residues (digestate solids) obtained can be used as organic fertilizers. While using microfiltration after the biochemical treatment, the treated water meets the irrigation standards, and forming concentrate can be repeatedly introduced in methanogenic process, thus increasing the biomass digestion degree from 50-60% up to 80% and more for biogas production.

The original intensified technology was elaborated which makes it possible to produce biogas from agricultural wastes with higher contents in methane [2]. A series of useful products was obtained, among them treated water for irrigation, stabilized sludge, containing no pathogen microflora to be used as soil fertilizer, or sludge enriched with vitamin B₁₂, formed when cobalt compounds are introduced in methanogenic process, being a valuable obligatory forage additive for cattle and poultry.

References

1. Covaliov, V., Malina, J.F. et al. (2014): Application of Bioactive Substances in the Biogas Tehnology. Water Sci., Technol. Library, Vol.69, Publ. Springer, 225-241.
2. Patent application Nr. 2015-0107 (MD). Phyto-catalytical agent for stimulation of methanogenesis processes. Covaliov V., Bobeică V., Covaliova O., Nenno V.