MODIFIED PROCESS AND BIOREACTOR FOR CYANOCOBALAMINE (VITAMIN B_{12}) AND BIOMETHANE PRODUCTION

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A novel strategic approach is discussed towards the intensification of methanogenic process to produce the high-caloricity biogas and enhanced yield of vitamin B_{12}. It involves the integrated solutions envisaging the combination of new technologies and modified bioreactor design.

The complex scheme was elaborated of anaerobic treatment intensification of alcohol vinasse in order to enhance the biogas yield and obtain the vitaminized forage additive. The scheme implies the combination of technological processes with adding of phyto-catalysts and auxiliary components [1].

The mechanism of methanogenesis processes is considered, including four main stages. The first and the second one include the hydrolytic disintegration of complex organic molecules for the simpler compounds – lower acids and alcohols, ammonia, hydrogen sulphide, etc. On the third, acetogenic stage, the microbiological splitting processes occur of alcohols and fatty acids with the formation of H_2, CO_2, formiate, acetate. 80 % of hydrogen thus emitting on the acetogenic stage is formed from water and 20 % of hydrogen - from the organic components. A series of reactions occur on the fourth stage of complex enough biochemical process, when the disintegrated components, such as H_2 and CO_2, are transformed into the biomethane with the involvement of microorganisms' symbiosis, following the general type reaction: $CO_2 + 2H_2 \rightarrow CH_4 + 2O^*$. The certain role in the formation of protonated or molecular hydrogen is played in the biochemical process by dehydrogenase (enzyme), which catalyses the hydrogen detachment reactions from one type of organic substrate and its transfer towards the another one. Under the real conditions, the methane yield in biogas composition makes 55-65 %, the rest being CO_2 and insignificant admixtures of CO and H_2S, which decrease the biogas caloricity.

Therefore, we have studied the possibility to rise the CH_4 contents and accordingly, to minimize CO_2 amount in biogas composition. Two ways were studied which have shown the positive results.

The first one includes application of type new natural compounds with phyto-catalytic properties which made it possible to rise CH_4 contents up to 88-92%, intensifying essentially, at the same time, the methanogenesis process.

The second way implies the dosing of electrolytic hydrogen into the biochemical process, which made it possible to bind the remaining CO_2 amounts during the methanogenic process and transform it in CH_4. This approach is based on our previous works and ensure the low power consumption for electrolysis and increased current yield for hydrogen.

The integrated approach towards to the resolving of this problem permitted, due to the adding of microadditives containing cobalt and ferro-cuanide complex, to produce, along with biomethane, cobalamine as well. It is mainly formed in the inner-cellular state and its contents are 1.5-2 orders higher than that obtained by the conventional technology. A new type of integrated reactor was developed [2].

References:

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