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BIOTECHNOLOGIY FOR THE DEGRADATION THE OF ENVIRONMENTALY HAZARDOUS ORGANIC WASTE AND PRODUCTION OF VALUABLE PRODUCTS

Oleksandr TASHYREV[1,2], Vira HOVORUKHA[1,2], Olesia HAVRYLIUK[2], Iryna BIDA[2], Galyna GLADKA[2], Larisa YASTREMSKAYA[3]
[1]*Institute of Environmental Engineering and Biotechnology*
University of Opole, Opole 45-040, Poland
[2]*Institute of Microbiology and Virology of the National Academy of Sciences of Ukraine,*
Zabolotnoho 154 str., Kyiv 03143, Ukraine
[3]*National Aviation University*
Kosmonavta Komarov Ave., 1, Kiev, 02000, Ukraine
e-mail: oleksandr.tashyrev@uni.opole.pl

Currently, the environment is continuously polluted by organic waste. Solid organic waste is produced in the greatest volumes, namely multi-component food waste and agricultural waste. In landfills, this waste rots, releasing huge amounts of toxic volatile and liquid organic waste. Modern technologies cannot ensure effective processing and detoxification of such waste, which leads to catastrophic environmental pollution. Hence, the need to create new effective waste treatment technologies is obvious.

The comprehensive microbial biotechnology for the accelerated treatment of environmentally hazardous organic waste to obtain valuable products from them was developed by us. Biotechnology is based on thermodynamic calculation of optimal conditions for the fermentation of organic waste with the formation of hydrogen. It has been shown that effective fermentation of solid natural polymers (organic waste) need pH = 7.0 and Eh = - 414 mV (picture 1).

A wide range of organic wastes have been examined: solid organic waste – multicomponent food and agricultural waste and liquid waste – industrial organics containing wastewater, dumps leachate, etc. Fermentation was significantly accelerated by the use of Granular Microbial Preparation (GMP), consisting of concentrated biomass of H_2- or CH_4-synthesizing bacteria (picture 2).

We have developed a biofermenter with an optimized design for fast and effective waste fermentation (picture 3). The following optimized engineering and technological parameters were obtained during fermentation. The duration of fermentation Td (detention time, days) was from 3 to 7 days. The degradation coefficient Kd (the ratio of the initial and final content of waste) is close to 80 – 110. The yield of gaseous energy carriers was 100-110 L H_2/kg and 50-60 L CH_4/kg of solid waste. At hydrogen fermentation the gas content was 40…50% H_2 and 50…60% CO_2, and at the methane fermentation - 60% CH_4 and 40% CO_2 [1].

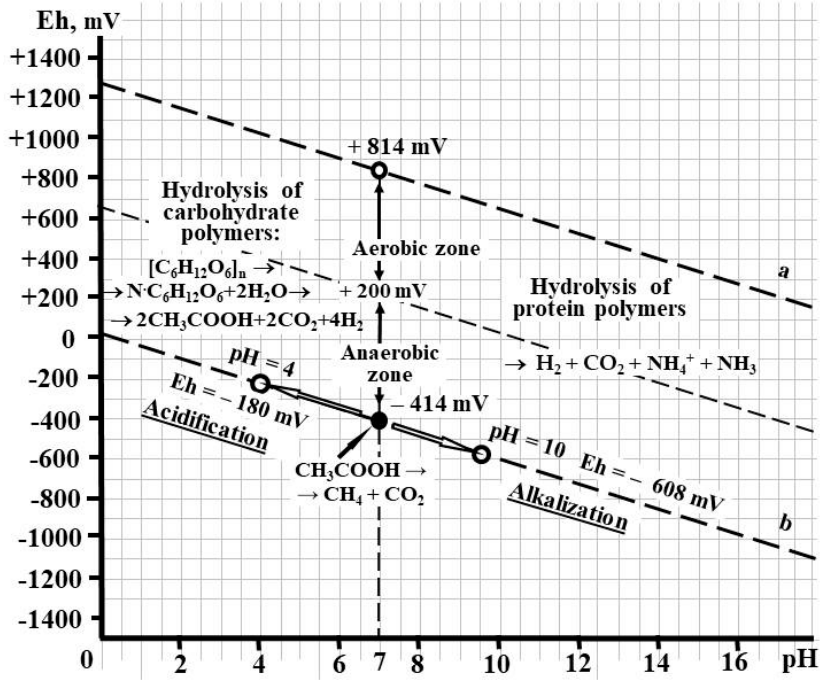
Dry unfermented lignin cellulose waste residues are dry solid fuel (30 g/kg of solid waste). After additional aerobic fermentation, biofertilizer can be produced from unfermented residues (20 g/kg of solid waste). Biofertilizer obtained from solid organic waste is suitable to optimize the cultivation of vegetables and other agricultural crops. Due to additional methane fermentation, the content of

soluble organic compounds in the leachate is reduced from 200 - 220 mg/l C, and the methane yield is 1 liter/liter of leachate [2]. Purified water after the treatment of liquid organic waste (dump leachate etc.) is suitable for the irrigation of agricultural fields [3].

Thus, on base of thermodynamic calculations, we have created a universal biotechnology that provides fast and effective fermentation of environmentally hazardous waste while simultaneously producing a number of commercially valuable products (picture 4)

Scope of application and implementation of Biotechnology is the next :

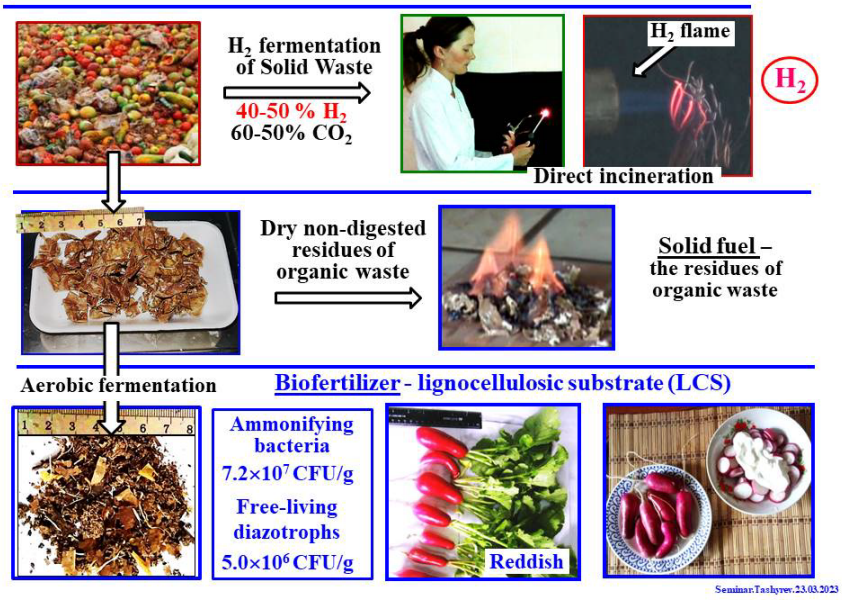
1. Adaptation of biotechnology to customer requirements and its further industrial implementation.
2. Creation of industrial biotechnologies for the production of valuable products from waste, replication and sale of technologies on international markets.



Picture 1. Thermodynamic calculations: optimal conditions for hydrogen and methane fermentation - pSh = 7.0 and Esh = - 414 mV. Acidification or alkalization leads to a significant shift in the redox potential away from the optimal value of the redox potential and inhibition of fermentation.

Picture 2. Granular Microbial Preparation (GMP), consisting of concentrated biomass of H_2- or CH_4-synthesizing bacteria.

Picture 3. Biofermenter for fast and effective waste fermentation with an optimized design.



Picture 4. Producing the number of commercially valuable products from ecologically dangerous solid organic waste.

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