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BIOSAFE APPLICATION OF BIOENGINEERING CONSTRUCTIONS FOR WASTEWATER TREATMENT

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The problems of cleaning up polluted domestic wastewater in small towns are an important issue for ecology and biosecurity of the environment. The most suitable methods are the treatment of domestic wastewater in cleaning artificial ecosystems through the passage of physical, chemical and biological processes under the typical purification system (preliminary, primary, secondary, tertiary purification).

The main traditional high-tech biotechnologies that can be used for the secondary treatment of sewage of small settlements: aerobic systems with suspended microorganisms of active sludge (aeration basins with sludge recirculation - aerotanks; cyclic action reactors - SBR; membrane bioreactors - MBR; circulatory oxidation channels - oxidation ditches); aerobic systems with immobilized microorganisms (drip biofilters - TF; disk biofilters - RBC).

In addition, technologies for bioengineering ponds with a horizontal subsurface flow of sewage are effective for natural high-tech cleaning, taking into account economic and climatic conditions. In particular, in Ukraine, the projects of bioengineering treatment facilities of the Constructed Wetlands type are being implemented, which is devoted to researches of recent years.

Pollution of surface water by domestic sewage requires a long-term study on the biosecurity of water bioresources in the discharge of household waste, which in the scale of small cities, taking into account the economic and climatic conditions of Ukraine, is an environmental problem, for which a significant attention is being paid to effective biotechnological methods of protection that do not require significant costs and can be applied on a large scale with energy saving and obtaining useful products (environmentally friendly fertilizers, biogas, etc.).

Alternative natural-like biotechnologies may be used for the secondary treatment of wastewater of small settlements: biological stakes - waste stabilization ponds, aerated ponds - aerated ponds (lagoons), constructed wetlands - bioengineering rates. Bioengineering rates in Ukraine are often referred to as bioengineering structures or bioplate structures.

The purpose of the study of integrated bio-treatment facilities (constructed wetlands) was to determine the safety of the use of various biotechnological methods for the study of the bio-clearing process through the integrated application of microbial remediates and phyto-remediates, as well as the development of a general scheme for the purification of domestic sewage, especially from the excess nitrogen contamination on the basis of bioengineering ponds taking into account the principles of sustainable development.

Biomonitoring of the environment with the use of bioindication (higher plants) and biotesting of its individual components (Anamox bacteria), which involves neutralization,

storage, and recycling of waste, are carried out to address the issues of purification of local aquatic ecosystems.

Anaerobic ammonium oxidation (anammox-process) is anaerobic oxidation of ammonia to free nitrogen using nitrite as an electron acceptor and is a prerequisite for the development of the latest state-of-the-art technologies for purifying sewage from nitrogen compounds.

Traditional nitride nitrification technology using chemolithoatotrophs consists of three stages: oxidation of ammonia to nitrite (nitrite); oxidation of nitrite to nitrate (nitrate); the transformation of nitrates into free nitrogen with the addition of organic compounds (denitrification). The anammox-process consists in direct oxidation of ammonia with nitrite to free nitrogen. Only half the ammonium is pre-oxidized to nitrite. The process takes place under anaerobic conditions in a wide range of temperatures. The end product is inert gaseous nitrogen, which is easily removed from the reaction medium.

A personally important task for the improvement of an ecology of the environment with the use of bioengineering ponds with microbial and phytotherapy is to increase the efficiency of removal of nitrogen and xenobiotic compounds from wastewater. Based on the use of bioremediation, a technological scheme for the purification of water drains with the use of biocomplex by inoculation of active biomass of anammox bacteria and settling of higher plants has been developed, which will improve the efficiency of removing pollutants and nutrient nitrogen in these ecosystems and functional parameters of wastewater by intensifying in bioengineering rates with sub-surface flow.

The efficiency of nitrogen removal (ammonia pollutant 50 mg NH_4^+ / dm^3) was studied in three phases (stability, phytoremediation and microbial remediation) in a model system: the reactor (d = 0.3 m; h = 0.28 m; V = 19.5 dm^3) filler (gravel d = 4-8 mm), plants (Juncus effuses), consumption of synthetic sewage waters -1.8dm^3, circulation rate - 40 dm^3 / day, water residence time in the reactor - 7.5 days with sampling - weekly.

Advantages of anammox technology using are the reduction of energy costs in comparison with traditional nitrification - denitrification up to 60-90%; no need for an additional source of carbon; reduction of CO_2 up to 90%; Reducing the amount of excessive active sludge; high efficiency of nitrogen elimination; smaller watermark process.

The technology of integrated bio-treatment plants such as bioengineering ponds according to the principles of sustainable development is environmentally acceptable and the most economically most promising biosafety direction in the system of domestic sewage treatment, water treatment, and also the purification of contaminated soils.

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