The technology of processing and recycling organic waste

V M Nikolaeva, A I Borisov
Federal State Autonomous Educational Institution of Higher Education "M. K. Ammosov North-Eastern Federal University"
Introduction

Recently, such areas as engineering ecology, industrial ecology, technical ecology, etc. have become widespread. Environmental engineering is a system of engineering and technical measures aimed at preserving the quality of the environment in conditions of growing production. This is not a new direction in the development of ecology; it is environmental engineering and nature conservation. Successful solution of environmental problems by engineering methods is possible only if the specialist has certain knowledge in the field of ecology. An engineer must be able to evaluate his production from an environmental perspective, i.e. have environmental thinking. Historically, nature conservation has developed as a system of measures aimed at preserving individual landscapes, natural monuments, rare plants and animals, organizing nature reserves and wildlife sanctuaries. Landscape is a natural geographical complex in which all the main components - relief, climate, water, soil, vegetation and wildlife - form a single system. In modern conditions, this is not enough. It is impossible to turn the whole Earth into a reserve. The use of natural resources is an inalienable property of man and the direction of activity of human society. Transformations in nature due to human activities are inevitable. The principle of non-interference in nature is unrealistic. Currently, the phrase “nature conservation” has a broader meaning: 1 - development of principles and methods for the restoration and conservation of natural resources (land, water, atmosphere, flora and fauna); 2 - a system of measures aimed at maintaining a rational interaction between a person and the environment. This system of measures should prevent the direct or indirect negative impact of the results of society on nature and human health. Specially, no one pollutes the biosphere; the impact on wildlife is always indirect. Adverse effects on nature - a consequence of the work of industrial and agricultural enterprises.

The side effect of production on the biosphere appears in two forms, discussed below. 1. Any technological processes are associated not only with the conversion and production of the necessary substances, but also with by-products that make up the so-called production waste. Evolution life on Earth passed in the absence of these substances, which appeared only as a result of industrial production. These substances, as a rule, are alien to the natural environment filled with living organisms. They are called xenobiotics (Greek xenos - alien, bios - life). Other non-xenobiotic substances appeared in excessive concentrations (ozone, phenols, sulfur, nitrogen, phosphorus compounds, etc.). Modes of biochemical processes in living cells “worked out” during long evolution. If a xenobiotic or an ordinary substance in excess occurs in the biochemical cycle of a plant or animal cell concentrations then impaired intracellular metabolism or metabolism cells (Greek, metabole - change).
Problem statement

The technology refers to the complete processing and recycling of organic waste with the production of electricity, thermal energy, recycled water and fertilizers.

There is known a way for processing of slurry waste water, for example, pork complexes, implemented as a line with technological operations of collection and separation of flow into liquid and solid fraction, aerobic treatment of liquid fraction, sludge processing, decontamination of flow, stabilization of sludge when bringing the degree of liquid fraction treatment to the parameters required for its discharge into water bodies. The disadvantages of this method are not getting biomethane, electric and thermal energy, liquid fertilizers because of the lack of biogas collection processes and processing of liquid and solid fractions into thermal and electric energy.
Findings

There is a known method for non-waste treatment of farm effluents, which allows to carry out methane fermentation of liquid fraction with biogas emission, its utilization with obtaining hot water, use of obtained hot water for heating of digester, gasholder, dryers, treatment of biomass fermentation with separation of sludge disposed as fertilizer. The disadvantages of this method are: not getting biomethane as well as electricity and liquid fertilizers because of the lack of processing of the received heat energy into electricity, as well as burning of biogas instead of solid manure fractions during the production of heat energy.

The other method, closed to the developed technology, includes operations on collection of manure, digestion of manure in anaerobic environment with biogas production and collection, separation of fermented manure with obtaining solid and liquid fractions, used for fertilization, with utilization of waste gases and air from production facilities. However, this method has insufficient efficiency of waste processing and utilization processes.

The significant increase in the efficiency of processing and utilization of animal wastes due to the use of the biofuel produced, saving the biogas produced, increasing energy efficiency, obtaining mineral fertilizers and utilization of own wastes is achieved in a patented technical solution.
Conclusion

Organic waste has now become a serious environmental problem in all Russian regions without exception due to soil, groundwater and air pollution. Improving the efficiency of organic waste processing and utilization, mainly in the livestock sector, is an urgent scientific and technical problem.

The technology developed under the patent provides for: evaporation of the liquid phase of fermented waste, burning part of the homogeneous mass, obtaining biomethane from biogas with saturation of water with organic substances, collecting air from production facilities, purification of waste gas from solid volatile impurities with saturation of used water with minerals.

The developed technology is highly efficient, as it provides increased output of biomethane, increase in thermal and electrical energy, and meets the requirements of the environment.

Control of the technological process on the basis of the controller with proportional-integral-differential law of regulation, supplemented with intellectually determined each time forecast component, contributes to a significant increase in production efficiency.