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INNOVATIVE PROSPECTS FOR DOMESTIC WASTE UTILIZATION IN UNDERGROUND GASIFIERS

In Ukraine, the waste management system is imperfect. It does not solve the problem of utilization of domestic and industrial waste. The average rate of domestic waste disposal per country is only 5%, industrial is about 30%, and in Sweden, for example, utilizes almost 99%. This is achieved through the development and improvement of technologies for collecting and recycling this secondary energy, which gives the opportunity to obtain additional electric power and heat energy. Simultaneous reception and use of these types of energy can significantly reduce the level of environmental pollution by reducing the share of thermal stations for the electricity generation that makes 40%.

The most widespread direction of domestic waste management is thermal utilization: combustion, pyrolysis, and gasification. The effectiveness of the thermal treatment method depends on the morphological composition of the waste, which contains 60 – 80% of the organic (combustible) raw material, the technology of collecting, sorting, regimes of the utilization process, the quality and quantity of final products obtained [1].

Incineration of domestic waste is the easiest way of it utilization. Long-term practice of using combustion technology has allowed to highlight the main advantages (obtaining electricity and heat) and disadvantages (formation of secondary toxic waste that, along with heavy metals, enters the environment with flue gases, waste water and slag).

The pyrolysis technology is the irreversible chemical change in the composition of waste under the influence of temperature and oxygen-eliminating. By degree of temperature influence on the substance of pyrolysis is divided into low temperature (450 – 550 °C) and high temperature (over 900 °C) [2]. The advantage of pyrolysis compared with direct incineration of waste is its effectiveness in terms of environmental pollution preventing. Due to pyrolysis, we can recycle non-recyclable waste materials such as tire covers, plastics, waste oils, et cetera. The primary products of pyrolysis process are thermal energy, combustible gases and solid products in the form of slag that are not pyrolyzed.

Gasification process involves waste processing in specially equipped chambers with controlled blast reagents supply (air, oxygen, steam, carbon dioxide or their mixture). When injection reagents in the gasification chamber, we get the generator gases with the calorific value of 4 – 6 MJ/m^3, and at the oxygen blast supply the calorific value increases by 2,5 – 3 times [3]. Gasification has a number of advantages over combustion and pyrolysis: high efficiency up to 95%, less intense NO_x formation, simple gas treatment system. But despite this, gasification also has products that need to be further used.

After analyzing the existing trends in the development of thermal waste utilization, the authors identified a major shortcoming inherent in the above technologies – the need to utilize solid residue (slag). In order to address this shortcoming, it is proposed to preliminarily conduct cryogenic preparation of household wastes with liquid nitrogen followed by utilization in the formed underground gasifier. These wastes will act as additional catalysts of the gasification process and will be supplied together with a blowing mixture in the oxidizing zone of the underground gasifier.

Thus, the situation with the waste leads to the development and implementation of a complex of technological and integrated solutions to dealing with them. The possibility of their utilization in underground gasifiers is a qualitatively new technology for their re-use, which allows receiving energy and heat in a closed ecological cycle.

References

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