



## NATIONAL METALLURGICAL ACADEMY OF UKRAINE

### PROCESSING OF BIOMASS AND OTHER ORGANIC WASTE TO PRODUCE WOODY COAL, HEAT AND ELECTRIC POWER

Biomass and organic waste are processed in heat generator via thermooxidative pyrolysis resulting in pyrolysis gas and coke (woody coal) production. Unpurified pyrolysis gas is utilized further as a fuel for heat energy generation.

Coke residue undergoes activation to be used as a technological product, activated coal, in the pyrolysis chamber outlet zone. Alternatively, coke can be used as energy product by way of its direct combustion or subsequent gasification.

Distinguishing features of this technology are as follows:

- autothermal character of the thermooxidative pyrolysis process, which makes it possible to design autonomous units for biomass and organic waste processing right on the site of its formation;
- relatively low temperatures of pyrolysis process (500-600 °C) resulting from mildly oxidative atmosphere in the heat generator;
- virtually complete utilization of biomass and its waste at the expense of complex application of all pyrolysis products.

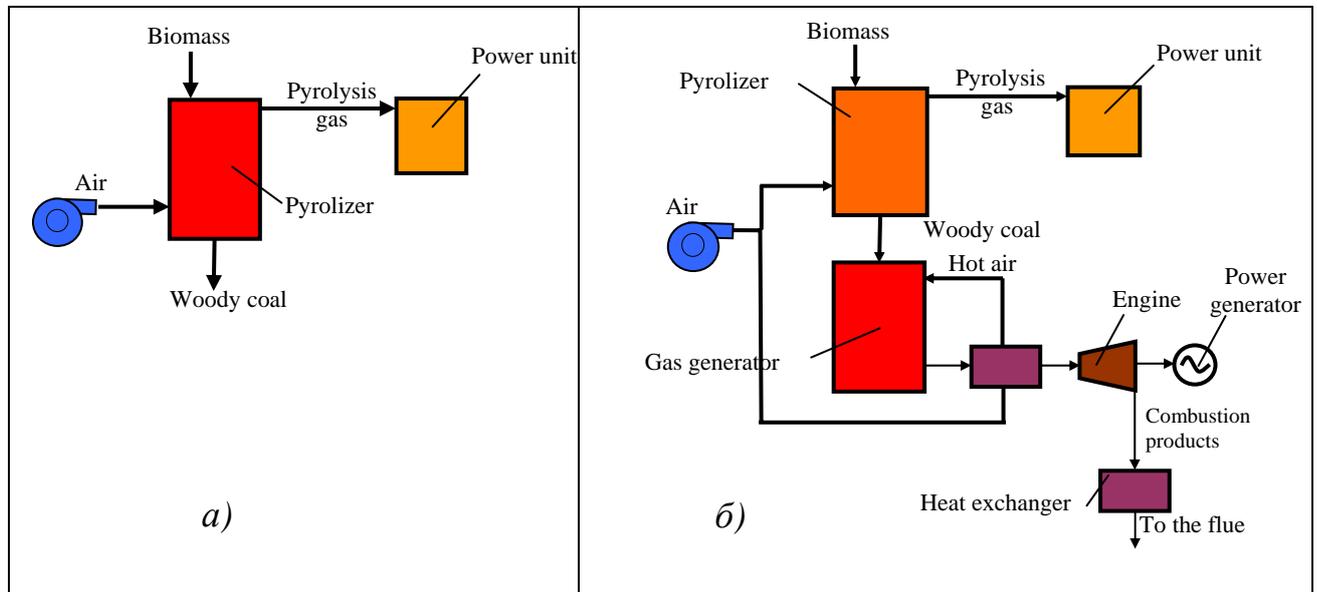
The figures below present different methods of the complex technology realization. Technology of biomass and its waste utilization for heat energy generation is shown in Figure a). This method allows to obtain highly heated combustion products and coke residue ,woody coal, that can be activated in the pyrolizer.

Figure b) demonstrates the way of biomass and its waste are utilized to generate heat energy and generator gas further to be supplied into the internal combustion engine, connected to electric power generator. This method allows to recover heat and electric energy.

Biomass and its waste are utilized completely in both ways, partially substituting natural gas in the technological unit.

The pilot thermooxidative pyrolyzer of the capacity 70 kWt in respect to fed biomass made it possible to raise the overall process efficiency to 90-95%, whereas heat energy recovery efficiency amounted to 45%. The heat generating capacity of the resulting pyrolysis gas was 16 Mjoule/kg.

The technology can be effectively applied to processing of different biomass waste: sunflower husks, buckwheat and rice hulls, nut shell, wood shavings and sawdust etc.



Methods of the complex technology realization.

- a) – production of woody coal and heat energy;
- b) - production of power and heat energy