

INNOVATIVE THERMOCATALYTIC EQUIPMENT AS A SOLUTION TO THE  
PROBLEM OF ENVIRONMENTAL POLLUTION

<sup>1</sup>Vinokurova Alexandra Nikolayevna, <sup>2</sup>Ahmedov Jonibek Otabekovich

Student of the 2nd course of Energo-mechanical faculty

Navoi State Mining Institute<sup>1,2</sup>

*alexandria08081999@mail.ru, ahmadovjonibek2@gmail.com*

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**ANNOTATION:**

This article will introduce you to the specialization of the development, production and implementation of innovative catalytic thermal equipment, technological capabilities that enable it to handle waste of 2-4 class of danger.

**Keywords:** catalytic thermal equipment, drum oven, Markov chain, power facilities, environmental security, waste, heat mass transfer process, the chamber incinerators, rotary incinerators, complexes for cities, crematorium.

**INTRODUCTION**

**A description of the problem**

For almost all the subjects of all countries one of the main tasks in the field of environmental protection – solving the problem of disposal and recycling of household wastes, among which the biggest problem is the waste generated in the residential sector due to the complex morphological structure and distributed sources of education.

Sanitation of the major cities from solid waste residential sector is one of the most complex and important tasks facing municipal authorities. From the prompt removal and safe disposal of the waste depends on the security of the populations and the environment.

**2. Brief description of the innovative catalytic ex equipment**

At the moment, a model of a rotary kiln, which is based on the mathematical apparatus of Markov chains. The model allows to determine the concentration of a key component in any elementary volume of the circulation circuit of the machine at any point in time and to calculate the statistical characteristics of homogeneity. The model can be applied for optimization of the combustion process, at the expense of productive post-combustion of polymer waste fractions.

A technology of forming on the surface of ceramic or metal catalytically active nano coating by viginia in the surface of the intermediate films of amorphous or glass-ceramic nature in the temperature interval of softening the latter.

Based on the accumulated considerable theoretical and experimental material developed mathematical models of kinetic and gas-dynamic processes occurring during the conversion of harmful gas emissions of different thermal power plants. Based on these models, methods have been developed for calculating catalytic converters, including determining the shape of the carriers, their required surface, relative position in a given volume, quantitative parameters of the distribution of catalytically active centers on the carriers.

An effective method is used to intensify heat and mass transfer processes in the working space of incinerator units by enriching atmospheric air with technically pure oxygen supplied to the oxidation of organic substances in the reaction zone, which made it possible to increase the temperature in the reaction zone, accelerate the oxidation of toxic gases to inert CO<sub>2</sub> and H<sub>2</sub>O, and reduce the amount of flue gas.

High energy efficiency of using the generated heat in the process of thermal processing of waste is 0.65-0.70 according to the formula for its assessment proposed by European legislation.

This innovative thermocatalytic equipment is divided into 4 types:

1. Chamber incinerators;
2. Rotary incinerators;
3. Cremators.

### **3. Chamber incinerators**

#### **1 - Download Site**

System download waste eliminates the possibility of flue gases and flame from the furnace into the atmosphere.

#### **2 - Combustion Chamber**

Temperature of 1100-1300°C. equipped with agitator to intensify the process of combustion. Modern multi-layer lining of the furnace chamber.

#### **3 - Oil burner**

Burner universal, working on all types of liquid fuels, including waste oil.

#### **4 - Camera afterburner**

Maintains a constant temperature of 1150-1200°C with a gas shutter speed of 2.5 seconds.

#### **5 - Site chemical neutralization**

Supply system of the alkaline solution to neutralize acidic compounds in the exhaust gas (the binding of the oxides of chlorine, fluorine and sulphur).

#### **6 – Node heat transfer**

- generation of thermal energy
- lowering the temperature of leaving flue gases

#### **7 - Bag filter**

Designed for fine cleaning of flue gases from fine dust.

#### **8 - Exhauster**

Allows the flow of the flue gas flow over the truck.

#### **9 - Adsorption filter**

For cleaning flue gases from gaseous toxins and polyaromatic compounds (odors). Has a high absorptive capacity for a wide range of toxic substances including polycyclic aromatic hydrocarbons, mercury compounds, lead, cobalt, arsenic, vanadium and others.

#### **10 – Chimney**

Combustible waste:

- Medical waste class "A", "B", "b" and "G" consisting of syringes, ampoules, vials, needles, small metal instrument, dressing material, wool, textiles, rubber, plastics, pathological waste, as well as new viral and bacterial wastes, contaminated blood, medicine and other biological waste, etc.;
- Industrial and manufacturing waste, including plastics, tars, resins, paints, textile, used oil, etc.;
- Biological waste;
- Municipal solid waste.

Fig.1 Scheme of chamber incinerator

#### 4. Rotary incinerators

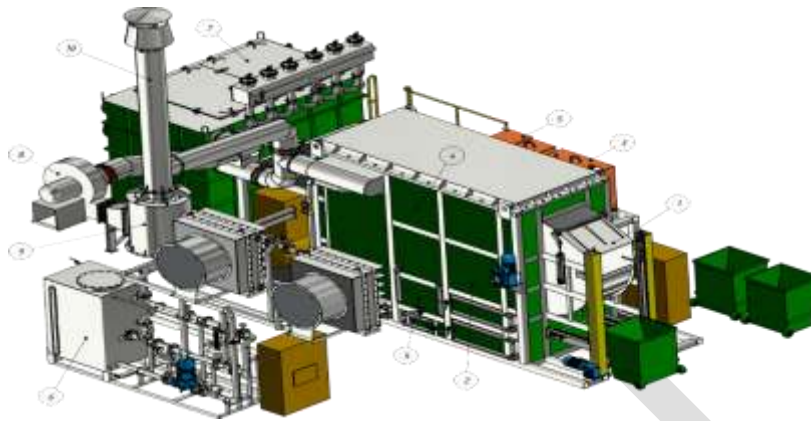


Fig.2 Scheme of rotary incinerator



**1 - Crane-beam with a motor grab**

To load waste into a hopper of the furnace.

**2 - Hopper for receiving waste**

Storage of waste operational reserve for 4-5 days.

**3 - Hopper feeder**

Bunker reserve for 7-8 hours.

**4 - The Rotary kiln**

Uniflow type, with a friction drive. Temperature of 1100-1300°C. Modern multi-layer lining.

**5 - Ash camera**

For discharging residual ash out of the oven, reheating of flue gas and waste liquid non-combustible waste.

**6 - Afterburner**

Maintains a constant temperature of 1150-1200°C with a gas shutter speed of 2.5 seconds. Equipped with a catalytic reactors 1 and 2 stages and the heat exchanger for cooling the flue gases.

**7 - Site chemical neutralization**

Supply system of the alkaline solution to neutralize acidic compounds in the exhaust gas (the binding of the oxides of chlorine, fluorine and sulphur).

**8 - Bag filter**

Designed for fine cleaning of flue gases from fine dust.

**9 - Exhaust fan**

**10 - Adsorption filter**

For cleaning flue gases from gaseous toxins and polyaromatic compounds (odors).Has a high absorptive capacity for a wide range of toxic substances including polycyclic aromatic hydrocarbons, mercury compounds, lead, cobalt, arsenic, vanadium and others.

**11 - Chimney**

**12 - Heat Exchanger node**

- generate thermal energy;
- lowering the temperature of leaving flue gases.

Combustible waste:

- Medical waste class "A", "B", "b" and "G" consisting of syringes, ampoules, vials, needles, small metal instrument, dressing material, wool, textiles, rubber, plastics, pathological waste, as well as new viral and bacterial wastes, contaminated blood, medicine and other biological waste, etc.;
- Industrial and manufacturing waste, including plastics, tars, resins, paints, textile, used oil sludge, etc.;
- Biological waste;
- Municipal solid waste.

## 5. Cremators

Fig. 3 Scheme of cremator



**1 - Download node**

The waste loading system eliminates the possibility of flue gas and flame entering the furnace into the atmosphere.

**2 - Combustion chamber**

The waste combustion process takes place in a furnace on concrete grates. The complex is equipped with an ejection system that creates the necessary vacuum in the furnace. The chamber is equipped with a combined multilayer lining.

**3 - Oil burners**

The combustion chamber is equipped with two rows of burners, which ensure a constant stay of waste in the flame zone. The first row is aimed at a portion of waste to cover it with flame. The second row is located under the grates to ensure the most efficient burning of waste.

**4 - Afterburner**

Afterburning of toxic gaseous products at temperatures up to 1200 ° C.

### **5 - Ejection smoke exhaust system**

Provides a vacuum in the combustion chamber and cooling the exhaust gases in front of the chimney.

### **6 - Chimney**

Provides a vacuum in the combustion chamber and cooling the exhaust gases in front of the chimney.

Disposal of biomaterial of organic origin (corpses of animals, birds, laboratory material, medical waste, slaughterhouse waste, etc.). During the heat treatment, the temperature in the complex reaches 850 ° C, which allows you to reliably destroy organic matter (including those infected with pathogens of dangerous diseases).

## **6. CONCLUSION**

### **Solution to the problem**

Enterprises use the developed thermocatalytic technology for integrated waste processing, which ensures the extraction of commercially valuable material resources from waste and the burning of the tailings to produce heat and electricity, while observing the environmental and sanitary standards of various countries.

The environmental safety of waste processing in combination with alternative (inexhaustible) energy production is the most appropriate and has become more widely used in the world practice of waste management, including in developed countries of Europe, the USA and Japan. In addition to energy conservation, the thermocatalytic processing of waste solves an important social problem of cleaning settlements from debris, as well as preventing greenhouse gas emissions.

## **REFERENCES**

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