THERMAL METHODS OF MEDICAL WASTE DISPOSAL

Gladilina Elena

Student of the Department of Ecological Safety of Technical Systems of the Moscow Polytechnic University, Russia, Moscow

Kozhukhova Valentina

научный руководитель, Senior Lecturer at the Department of Foreign Languages of the Moscow Polytechnic University, teacher of the State Budgetary Educational Institution "School No. 2103", Deputy Director of ANO FPE East Siberian Educational Center, Russia, Moscow

ТЕРМИЧЕСКИЕ МЕТОДЫ УТИЛИЗАЦИИ МЕДИЦИНСКИХ ОТХОДОВ

Гладилина Елена Максимовна

студент кафедры экологической безопасности технических систем Московского политехнического университета, РФ, г. Москва

Кожухова Валентина Валерьевна

старший преподаватель кафедры «Иностранные языки» Московского политехнического университета, учитель ГБОУ «Школа № 2103», заместитель директора АНО ДПО Восточно-Сибирский образовательный центр, РФ, г. Москва

Abstract. The article is devoted to one of the urgent problems of modern ecology - the disposal of medical waste: medical masks, gloves and shoe covers. The authors of the article analyze the existing thermal methods of disposal of these wastes and consider possible ways to solve the problems associated with their disposal in Russia.

Keywords: medical waste, thermal disposal methods, medical masks, medical gloves, medical shoe covers, inceration, pyrolysis, plasma technology

Now all over the world, due to the current epidemiological situation, people use medical masks and gloves every day. The critical situation around the world regarding the disposal of medical waste poses a real threat to human health and the environmental safety of each state as a whole. Reducing the adverse impact of waste is possible with proper technical support for their disposal and compliance with sanitary and hygienic requirements for these processes. The situation is complicated by the fact that there are no legal acts and organizational conditions in the field of medical waste management.

Currently, 85% of medical waste is considered non-hazardous waste, however 15% is considered infectious, radioactive and chemical.

With a safe and environmentally friendly approach to the disposal of medical waste, the negative impact of waste on human health and the environment as a whole can be reduced or completely prevented.

One of the main problems of modern medicine is the disposal of medical waste. Any waste that is generated during the direct activities of medical institutions, the composition of such waste may consist of tissues (both human and animal), various body fluids, bandages, shoe covers, masks, gloves, excrement, pharmaceuticals, etc.

At the moment, in the Russian Federation there is a huge number of legal acts that regulate the collection, storage and disposal of medical waste, for example, SanPiN 2.1.3684-21 “Sanitary and epidemiological requirements for the maintenance of the territories of urban and rural settlements, for water bodies, drinking water and drinking water supply, atmospheric air, soil, residential premises, operation of industrial, public premises, organization and implementation of sanitary and anti-epidemic (preventive) measures. In this NPA, medical waste is divided into 5 classes:

• Class A, this type of medical waste is equated to MSW and is considered an epidemiologically safe type of waste (masks, gloves, shoe covers - used outside the health facility; personal hygiene items; care products for patients whose diagnosis is not related to infectious diseases, furniture, stationery.

• Class B, waste that has been infected or potentially infected with pathogens of pathogenicity groups 3-4 (any waste that has been contaminated with any biological fluids (materials or instruments), post-mortem activities, operating rooms, as well as food and waste that were in direct contact with infectious patients.

• Class B, these are wastes from the use of genetically modified organisms for scientific and medical purposes, as well as wastes from medicinal production and medical devices.

• Class G, this class represents a toxicological waste group (hazard class 1-4), the composition and level of which are identical to industrial waste, that is, among them: various medicines and preparations, installations and lamps containing mercury, as well as materials from pharmaceutical enterprises.

• Class D, radioactive medical waste (used fluorography units, unsuitable gamma tomographs, drugs for radiation therapy, used equipment for X-ray diagnostics)

Depending on the class of medical waste, different requirements for collection, temporary storage, transportation and disposal apply. It should be noted that mixing of wastes of different classes at all stages of collection and storage is not allowed, and the procedure for waste disposal is determined.

In accordance with SanPin, class A waste is disposed of to MSW landfills without any restrictions, as for class B and C waste, they are destroyed in facilities that are specifically designed for the disposal of medical waste by the thermal method (incinerators). However, this method has disadvantages, namely: during the operation of incinerators, various dioxins are formed. That contributes to the development of a variety of diseases, including diseases of the immune system, cancer and other violations of the detail of the human body.

Mercury is also one of the contaminants in incineration. It is a potent neurotoxin that weakens the motor, sensory and a number of other functions of the human body.

However, if equipment designed to clean air emissions is functioning properly, it will remove most air pollutants and bring their values to the limit.

Technologies that first provide for the preliminary decomposition of the organic component of the waste in an oxygen-free environment (pyrolysis) are alternative methods for the thermal processing of solid medical waste. After the pyrolysis process itself, the concentrated gas-vapor mixture (CGM) is sent to a special afterburner, where toxic substances are converted into less or completely safe ones, thanks to the controlled afterburning of gaseous products.

The main advantages of oxygen-free pyrolysis technologies for the destruction of organic materials, which ensure the environmental safety of emissions, as well as chlorine-containing emissions, are:

- It is possible to control the combustion at high temperatures of concentrated undiluted ASG, which ensures a high temperature of the entire volume of combustion products (1200-1300 ºC).
- Active chlorine, which is released during the pyrolysis of chlorine-containing materials, already in the thermal decomposition chamber itself quickly reacts with hydrogen, thereby forming a stable HCl compound, which is easily neutralized at the post-treatment stage.

Plasma technology is a high-temperature (1300-1700 ºC) impact with complete decomposition of medical waste. The principle of plasma treatment of waste is thermal decomposition with incomplete oxidation under the action of water vapor, air oxygen and pressure. Due to the high temperature, this technology allows the destruction of highly toxic hazardous medical waste.

This device can be divided into four main units: gasifier reactor, plasma generator, afterburner, cleaning system. The design of such devices can be of two types:

1. With an annular plasma torch, the flow along the perimeter of the chamber is distributed evenly.

2. With a central plasma generator - a hot beam is released into the loading center.

Among the advantages are: small dimensions of the equipment, the possibility of complete processing of medical waste, a decrease in the number of treatment facilities. However, there are also disadvantages, namely: a rather high consumption of electricity (however, the gas produced compensates for the energy costs - under ideal reaction conditions), high costs for servicing the plasma torches and repairing the plasma-chemical reactor.

Conclusions

In conclusion, it is worth noting that it is the thermal method of medical waste disposal that is the most effective in terms of neutralization. This method is used all over the world for the disposal of not only solid waste, but also medical waste. At the moment, there are several high-temperature technologies that are used: pyrolysis, insertion and plasma technology.

The choice of a specific method of thermal waste disposal depends on certain factors:

- Specificity of the area
- Fare
- Profitability
- Remoteness from the enterprise utilizing this type of waste
- Volume of medical waste

Unfortunately, the question of a safe, environmentally friendly and cost-effective way to dispose of medical waste still remains. But since recently the number of manufactured personal protective equipment has greatly increased due to the current epidemiological situation, this issue begins to rise sharply and is being considered more and more often.

Bibliography:

1. Avkhimenko M.M. Medical waste is an important hygienic problem // Collection of scientific papers / USSR Academy of Medical Sciences NII obshch. and communes, hygiene them. A.N. Sysina; ed. T.N. Krasovsky. M., - 1990. - S. 245-247.

2. SanPiN 1.2.3685-21 "Hygienic standards and requirements for ensuring the safety and (or) harmlessness of environmental factors for humans"

3. Kholyavko, T.I. Methods for the disposal of medical waste / T.I. Kholyavko. – Text:

electronic//CYBERLENINKA. - 2020. - Methods of disposal of medical waste (cyberleninka.ru) (date of access: 01.12.2021). – Access mode: scientific electronic library

4. Sharina I.A., Perepechko L.N., An'shakov A.S. Prospects for the use of plasma technology for the processing/destruction of industrial waste / Sharina I.A., Perepechko L.N., Anshakov A.S. – Text: electronic//CYBERLENINKA. - 2016. - Prospects for the use of plasma technology for the processing / destruction of man-made waste (cyberleninka.ru) (date of access: 01.12.2021). – Access mode: scientific electronic library