THE PROJECT OF THE TECHNOLOGICAL LINE OF THE ELECTRONIC-BEAM DRAINS DISINFECTION IN THE INFECTED HOSPITALS' DIVISIONS AND TUBERCULAR CENTRES

V.V.Shlapatska*, V.G.Volkonsky*, V.I.Sakhno**, S.P.Tomchaj**
*"RADMA" of the National Academy of Sciences of Ukraine, Kyiv, **SC "INR" of the National Academy of Sciences of Ukraine, Kyiv

The purpose of the project was to create the electrophysical facility for the environmental protection from contamination by drains of the infected hospitals' divisions and tubercular centres and prevention of open water reservoirs.

In this project two main problems are solved: development of the economically approved methods of the radiative disinfection of contaminated drains; development of the inexpensive compact facility for the electron-beam disinfection of small volume drains (up to 25 cubic meters daily).

During the development work the authors have proceeded from the well-known fact, that only radiation disinfection methods, realized on the modern electrophysical engineering, can supply the solution of the indicated problem (1). The principles and real disinfection radiation facilities of the polluted waste water are used widely and practically in all industrialized countries of the world. It is precisely determined, that the disinfection radiation technologies have no the alternative both on the efficiency, and on technological perfection. It is well known that, simultaneously with the neutralization of the microorganisms, in these technologies other processes are also realized - the destruction of the organic contamination and surface-active substances, silt and various inclusions coagulate actively.

The radiation facilities are characterized by high profitability and ecological safety. Cost of processing at the radiation facilities depends directly on their capacity. For receiving high economic parameters it is expedient to create the high-capacity facility. Therefore the original cost of such type facilities is rather high and not always is accessible for municipal services of small cities or separate medical establishments. For Ukraine and Russia it is the only reason of low distribution of the disinfection radiation facilities in practical use. Especially it is important for small health service objects. And just here the disinfection problem has acquired a very acute character. Because of the infectious diseases amount increasing, including socially dangerous, tuberculosis and other heavy lungs diseases, the amount of activators of these diseases in the open water reservoirs is increased. Taking into consideration the long period of their existence in the open water reservoirs, the disinfection problem of drains becomes acute and very actual.

Analysis of the situation, with due regard for the objective economic aspects, shows, that the justified way for the problem resolving is the creation of the radiative technologies and facilities adapted for using by municipal services, hospitals and tubercular centres. It is determined, that typical volume of the infected drains of the hospital divisions and regional tubercular centres does not exceed 20-24 cubic meters. To use the expensive facility for these purposes is economically inexpedient.

The solution of this problem is the creation of the indicated capacity facility, which cost would not exceed the cost of the similar facility of thermal sterilization (autoclaving). It excludes the possibility of using typical industrial accelerators (even of the direct operation) due to their excessively high cost for our case, and accordingly the technologies of sterilization created for such type facilities.

Using the previous experience of the sea stuff waste radiation disinfection (2), the drain decontamination was carried out by the low energy electrons for the solution of this problem - only 0.4 - 0.5 MeV, and for the technology improvement the combined technique was used.

The scheme of facility is shown in Fig. 1. The technological line is designed for two- staged process of the disinfection realization. At first, waste water passes the first stage of the disinfection - processing by the air with the large contents of ozone. At the second stage - the water is irradiated with electrons. At the both stages of the process the electrophysical means are used: at the first - ozone generator, at the second - electron accelerator. For the effective irradiation of the whole water volume, it is foamed on all stages, by this the developed surface and qualitative processing of water with electrons of low energy is provided.

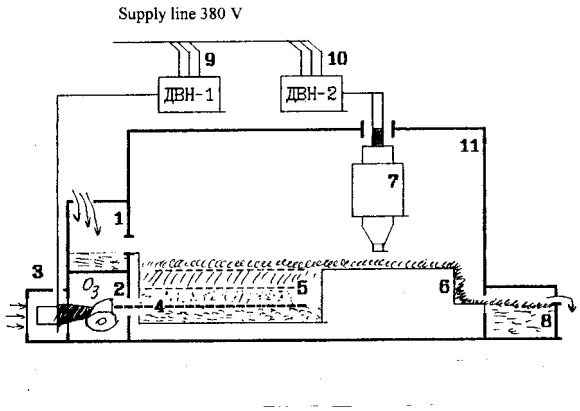

Fig. 1. The scheme of the disinfection device.

The offered disinfection scheme is based on the effects of the bactericidal and bacteriostatic ozone and electron influence taking into consideration the appropriate requests to their application. These requests are realized rather simply by using the modern charged particle accelerators, which are inexpensive and simple in operation.

The total profitability of the facility and its low cost is ensured by the original construction of the electron accelerator. For this purpose the construction

based on the high-capacity X-ray tube with excluded target unit is used.

Such type tube supplying from the voltage source of 400-500 kV with the capacity up to 100 kWt and pumped out to the vacuum of 10 mm of the mercury column by the electric-discharge pump of the NORD type, allows to receive the electron beams with the energy of 400 KeV and the radiation capacity up to 2.5 kWt. So, it makes possible to treat not less than 20 000 kg of the polluted drains by the doze 5 kGr per day (practical lethality of the tubercle bacillus).

The technological scheme of the radiation part of the facility is shown in Fig. 1. (Typical kinematic schemes and units of the starting filtration and brightening of waste water are omitted). Infected, previously filtered drains come to the accumulator (1), and further to the camera of pre-processing (5). Here during the disinfection process the bubbling of the liquid by the ozonized air takes place. For this purpose the electrical ozone generator (3) is provided. Passing through this generator the air is enriched by this highly active component and is used for the bubbling (2). On the liquid surface in the accumulator (5) the layer of foam is formed, which is mixed all the time. The liquid in the foam state is processed. Further the foam surpluses, which run out the camera boundaries (5) as a thin layer, flow on the working table surface (6), where they are irradiated with electrons from the accelerator (7). Disinfected foam flows into the accumulator (8) and is poured out into the standard sewerage system.

The biological protection of the process is reached by the location of the accelerator, ozonizer and entrance of the infected liquid accumulator in the isolated camera (11) with the appropriate thickness of the protective walls. All subsidiary devices – the sources of the high-voltage supply (9, 10) and power monitoring equipment are placed outside this camera.

During designing the experimental works were executed and the authors' experience in solving the similar problem for the sea stuff waste processing was used. The technological regulations of the disinfection process are developed.

Table 1

Irradiation dose (kGr)	Amount of the viable cells	
	Before the irradiation	After the irradiation
0.64	$1.6\ 10^{10}$	$1.9\ 10^{9}$
1.28	$2.2\ 10^{10}$	$8.3\ 10^{9}$
2.4	$1.9\ 10^{10}$	$1.9\ 10^{8}$
5,0	$1.6\ 10^{10}$	$2.0\ 10^{5}$
10.0	$4.1\ 10^{9}$	0

In Table 1 some experimental data obtained on the disinfection efficiency of the polluted drains with various parameters of dozes are shown. Knowing the value of starting contamination, it is possible to select the necessary modes of disinfection, to use optimum possibilities and resources of the facility, to prevent the excessive current consumption.

REFERENCES

1. I.N.Vishnevsky, V.I. Sakhno, S.P.Tomchay, N.V.Khalova // VANT, 1997, p.67-69.
2. A.F.Linev, V.I. Sakhno // Moscow, PTE, N6, 1973, p.18.
3. V.G.Mikhailov, V.A.Rezvov, A.A.Roschin, V.I.Sclyarenko, L.I.Yudin // Proc. of II International Workshop on Ciclotrons and its Usage, Dubna, 1989, p.360-365.
4. V.I. Sakhno, V.V.Tokarevskii, S.I.Azarov // Proc.of IX Workshop on dozimetry of intensive ionizing radiation. Moscow, VNIIFTRI Publ., 1992, p.43-44.