UDC 613.155:537.568.011.57

T.V. Mytrofanova, postgraduate.
T.M. Nikitchuk, Ph.D., assoc.prof.
Zhytomyr State Technological University

CLASSIFICATION OF AEROIONIZER IN ACCORDANCE WITH AIR ION OBTAINING AND THEIR IMPACT ON HUMAN HEALTH

In recent years, increased attention has been paid to the problems of air purification and disease treatment caused by regular inhalation of contaminated air, both in Ukraine and abroad. It is evidenced by an increase in publications on the effect of air ions on human health, the study of the distribution of air ions on the premises and its dynamics, improving metrological base. The history of the use and development of artificial air ionization in life, defining positive and negative effects on the system of the human body is studied. Currently many devices that generate negative air ions in the room and optimize the ionic composition of air have appeared on sale. They differ in size, ion performance, design and so on. According to the principle of obtaining ions ionizers are divided into radioisotope, crown, thermionic, hydrodynamic, photoelectric. According to the appointment they divided into industrial, household and medical. A comparative description of the most popular health aeroionizers and air ion counter has been performed. The main advantages and disadvantages of these devices are described.

Keywords*: ionization; air ions; health; the impact of air ions; air.*

Introduction. Problem statement. The therapeutic effect of sea and mountain air has been known for a long time. Everything started in ancient Greece when Hippocrates found that the mountain air cures for many diseases. One of his most valuable ideas, which became the primary source for many scientists who through experiments began to develop a theory of the influence of air ions on the human body and creating aeroionizer, is airareas. Airareas are the so-called platforms for walks near the mountains or the sea as one of the treatment methods for many diseases [1].

At the beginning of XVIII century first devices were invented which helped receiving static electricity, and the first attempts to use the air with electrical properties for therapeutic purposes made [1].

Franklinization or electric shower, was named after an American scientist V.Franklin. The method consists in the influence the electric field of high voltage (50 kV) on the whole body or on its specific area with therapeutic purposes. Franklinization is the oldest method of electrotherapy, used and has practical significance today [1].

Problem setting. Everyone knows that we live in a modern world, and is it good or bad, but it is significantly different from what was even ten years ago. Advanced technology, city and town urbanization, cars, factories and so on not only improved our lives in terms of development and opportunities, but also had a negative impact on the environment in big cities, hence the health and well-being of people. Ecologists, who look after the state of air, are raising the alarm. They assert that the variety of chemical impurities appear in the air. The most common ones are dust, sulfur dioxide, nitrogen dioxide, carbon monoxide. There are impurities in the air of heavy metals such as cadmium, iron, manganese, copper, nickel, lead, chromium, zinc. All this affects the respiratory, cardiovascular and even the nervous system heavily. That is why the impact of the air on human health, methods of its refinement and the use of atomized air to improve human health is very important and urgent.

Work topicality. Air plays an important role in the life and health of people. The main components of air are nitrogen, oxygen and argon. However the major role plays oxygen. If we consider the problem of indoor air pollution, the situation is no better. Office workers spend a considerable amount of time on the premises. If the working time reaches eight hours, including holidays and weekends, it can be said that people "living" a quarter of their life in closed offices. Therefore the problem of air purification and disinfection is relevant both today and in the future.

Objective. The aim of the article is to study the history of the use and development of artificial air ionization in human life, to identify positive and negative impact on the system of the human body.

Current state. In the twentieth century a special leap in the development of air ionization research and its practical application took place. During this period of time the equipment for artificial ionization of air indoors was created. A.L. Chyzhevskyi, Russian scientist created the first device for artificial air ionization, is considered to be the ancestor of aeroionization. He held a series of studies and experiments, the results of which are fundamental hitherto [1].

A.L. Chyzhevskyi grounded principles of artificial air ionization process, developed equipment for the generation of air ions, proposed methodology of aeroionization, defined biological human dose and held a series of studies of the aeroionization impact on people and living organisms [2].

O.L. Korenivskia, O.I. Zaporozhets, V.A. Glyna, O.A. Nedobora, P.V. Liepihov and others are contemporary followers of A.L. Chyzhevskyi who have studied the air ions and the results of their experiments are described in scientific works.

Statement of the fundamental material. Ecologists prove that the environment, including air, has undergone significant changes. Along with the urbanization of cities, increasing the number of vehicles, plants etc. the number of negatively charged air ions in urban air has decreased. This leads to the fact that townsmen often suffer from various diseases, mental disorders and metabolic disorders. During the research of many modern scientists, including A.L. Chyzhevskyi, it was stated that the "right", close to the natural balance of positive and negative oxygen ions influences positively on the human body.

Firstly, the air quality affects the respiratory system. As a result, breathing with negatively charged air ions considerably improves the function of the mucous membranes of the upper respiratory tract, facilitating the treatment of lung diseases such as asthma, tuberculosis, pneumonia, allergies, hypertension and diseases of ear, throat and nose and

is a good means of preventing their occurrence. As a result of breathing by nasal or mouth cavities, gas exchange between air and lungs occurs. The air fills the lungs, saturates the blood with oxygen and transported to body tissues. That is, the air quality affects not only the respiratory system but also the cardiovascular system as the heart takes the most important role in pumping blood through the vessels.

Breathing with negatively charged air ions normalize blood pressure and stabilize it for a long time, that undoubtedly has a positive effect on heart activity. The risk of its overload is reduced, that can lead to pathological changes, appearance of chronic diseases and reduction of vascular tone.

It has been proven that the incidence of lung diseases has the same change period as the concentration of air ions in the environment. When the concentration of air ions in the air increases the number of lung diseases decreases, while reducing the concentration of ions provokes increasing of morbidity [3, 4].

With constant use of aeroionization an increase of mental and physical activity, muscle excitability are noticed, the accumulation of lactic acid is reduced, protein, carbohydrate and water metabolism, synthesis of vitamins are stimulated, blood sugar level is reduced, blood microcirculation is improved [5, 6].

Studies of pregnant women have shown that the use of aerotherapy improves their state of pregnancy and stimulates the production of breast milk after birth [2, 5, 6].

Consequently, negatively charged air ions have a wide range of applications and are good addition to the treatment of many diseases associated with respiratory or cardiovascular systems. Artificial aeroionizers should be used to prevent diseases and to improve health indoors and in rooms where people work on computers.

There are different types of classifications of modern aeroionizers They are classified according to the principles of obtaining ions, according to appointment, mobility, adjustable amount of ions.

Aeroionizer, as device produced air ions, is also called ion generator. Bulky aeroionizers are usually used in large common areas, such as factories and enterprises for the purpose of cleaning and disinfecting the air. Portable aeroionizers are used in home accomodation.

According to the ability to adjust the number of air ions, aeroionizers are divided into regulated and unregulated.

According to the principle of obtaining ions aeroionizer are divided into:

- radioisotopic;
- photoelectric;
- thermoelectric;
- hydrodynamic;
- crown.

In radioisotopic aeroionizers air ionization is due α, β, γ radiation of radioactive substances. During interaction with the radioisotope substance the formation of ozone and nitric oxide does not occur. It is a key advantage of this method, but due to the fact that the current radiation hazard, the use of this method for artificial ionization indoors is harmful to human health.

In photoelectric aeroionizers air ionization occurs with mercury-quartz lamps generating ultraviolet rays. Using this principle makes it possible to inject drugs by inhalation.

The disadvantage of the principle is that the generation of a large number of biologically gases such as ozone and nitrous oxide takes place.

In thermoelectric aeroionizers air ionization occurs as a result of the phenomenon of thermionic emission from metal. This principle is safe for humans, so it is possible to use indoors, in contradiction from the radioisotopic aeroionizers. The main advantage of this method is the ability to control the degree of ion unipolarity. When air is being ionizated, an increase in temperature and its contamination with dust particles is being observed. The main drawbacks of this principle of ion obtaining are high power consumption and low life of the emitter.

У таблицях 1 та 2 представлено порівняльну характеристику деяких марок іонізаторів і лічильників іонів, які можна зустріти на ринку України [7, 8, 9].

Hydrodynamic aeroionizers are characterized by ball electric effect in which dispersion and electrification water droplets occur. This principle is considered to be economical and safe at work. The disadvantage of this principle is the need to control the chemical composition of water, because it depends on the concentration of air ions.

Crown aeroionizers are characterized by the phenomenon of high-field emission from the cold cathode, accompanied by the quiet crown discharge. The advantage of this method is high performance, ability to change the degree of ion productivity, the possibility of reducing the concentration of ozone and nitrogen oxides. It does not affect the climate. The disadvantages include work with high voltage on the electrodes, necessity to regulate the voltage on the electrodes to reduce the occurrence of ozone and nitric oxide, the formation of heavy ions.

The drawback of all existing ionizers is the absence of indication possibility of the number of generated air ions and opportunity to regulate and establish the necessary dose of air ions. This limits the use of aeroionizers in medicine and explains the fact that aeroionizers are used at home for air improvement or in special research laboratories.

Therefore urgent is the task of creating devices for recording the number of ions formed by artificial and natural air ionization, development of ionizer adjustable to regulate the number of ions and switching the polarity, the development of effective methods of influence on the human body, that is possible after a detailed study of the impact of each dose on function indicators of man condition change.

Tables 1 and 2 present comparative characteristics of some brands of ionizer and ion meters, which can be found on the Ukrainian market [7, 8, 9].

Table 1

Comparative characteristics of famous brand ionizers

Name, manufacturer	Yantar–5, Russia	Elion–132 Zont, Russia	Aeroion–25, Russia	Energiya AI-1	Zenet XJ-210	Zenet XJ-802
Concentration ions at a distance 1 m, ion/cm^3	0,5–100000		$6 \cdot 10^4$	600—50000	1x103	1*104
Ionization area, m^3	up to 120 m^3	10 m^2	28 m^2		15 m^2	10 m^2
Continuous time operation	unlimited	10 hours	24 hours	8 hours		
Ozone concentration	0,03 mg/m^3	20 mg/m^3	–	–	–	–
NO_2 concentration	0,04 mg/m^3	–	–	–	–	–
Power supply	20 kilovolt		25 kilovolt	7 kilovolt		
Power consumption	8 watt	15 watt	1,5 watt	15 watt	8 watt	1,5 watt
Overall dimensions	225x175x105	400x320x300	350x670x x140 мм	210x210x x190 мм	90x94x210 мм	110x81x58 мм
Power	120*/220 В 50–60 hz					

Table 2

Ion meters specifications

Ion meters specifications	UT-8401 (TGU)	Sapfir-3k (KGTU)	MAC-01 (MIFI)
1. Measurement range of ion concentration, sm^{-3}	$5 \cdot 10^1$–$2 \cdot 10^6$ $5 \cdot 10^2$–$1 \cdot 10^7$	200– $2 \cdot 10^5$	100–$10 \cdot 10^5$
2. Permissible basic relative error, %	40 50	40–50	40–50
3. Ion mobility measurements, $sm^2 s^{-1} V^{-1}$	≥ 0,4 $3.2 \cdot 10^{-4}$–0,4	≥ 0,4	≥ 0,4
4. Air consumption, l /min.	2,7–270	230	120
5. Meter power consumption, VA (VT): Power supply, V	net 220	25 net 220	(0,75) accumulators 7,2
6. Dimensions, mm: – length – width – height	 525 250 335	 240 330 120	 190 105 65
7. Mass, kilo	12	4,5	0,9
The presence of primary information processing unit	no	no	yes

Conclusion. Thus, the article investigates the nature of air ions and their healing and therapeutic effect on the human body. Aeroionizer classification on the basis of principle of obtaining ions is considered. It is concluded that aeroionizer that generate air ions by crown principle acquired the most practical value. Ionization occurs under an influence of an electric field of high tension that is formed around the electrode with a small radius of curvature. Today, in terms of the antiterrorist operation in eastern Ukraine, where hospitals are full of soldiers with severe injuries that have heavily healed and festering wounds, the ability of acceleration of healing and disinfecting wounds is urgent. It will help to optimize treatment of soldiers and accelerate their return to the Fatherland defending.

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MYTROFANOVA Tetyana Vladyslavivna – postgraduate of department of radio engineering, electronic devices and telecommunications of Zhytomyr State Technological University.

Scientific interests:
– medical equipment;
– air ionization.
E-mail: StepUp.5@mail.ru

NIKITCHUK Tetyana Mykolaivna – Ph.D, associate of department of radio engineering, electronic devices and telecommunications of Zhytomyr State Technological University.

Scientific interests:
– biophysics of cardiovascular system;
– modeling and methods of pulse wave processing.
Phone: (093)920–65–06.
E-mail: tnikitchuk@mail.ru.