

ANNOTATION

Dissertation work in the specialty "6D071900-Radio Engineering, Electronics and telecommunications" for the academic degree of Doctor of Philosophy (PhD) on the topic "research and modeling of a high-frequency corona discharge ozonator"

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Assessment of the current state of the scientific and technological problem (tasks) being solved

The discharge that looks like a Corona that forms around the electrode is one of the electrical discharges. One of the most economical processes for the synthesis of oxygen - containing ozone gas is air or pure oxygen. According to the modern concepts of Corona discharge, its spatio - temporal structure consisting of individual microdischarges. Adjusting the microdischarge parameters can improve electricity.

Corona discharge is used in ozone processing systems. Through ozone are environmentally friendly methods of disinfection of water and air contaminated in industry, during cleaning.

Corona discharge ozone treatment systems are the circuit combination of high voltage power supply system, ozonator discharge chambers and pneumatic air supply system or oxygen, are the main component of ozonator equipment. In addition, the ozonator equipment includes a process control system which consists of ozone electrosynthesis, protection, control and cooling system.

Modern ozonators, based on the power supply system. It is powered by a sinusoidal or pulsed high voltage source. The frequency of the generator is usually 1 kHz or higher than one. The cooling system of the ozonator Chambers is carried out by air or water. Fuses, circuit breakers and many other devices are used to control and protect the system. To control the parameters of the electrosynthesis process, electrical measuring devices, flow meters and oxygen concentration are required.

The dissertation discusses the main problem of increasing the concentration of ozone by regulating the frequency. Ozone processing efficiency can be improved by regulating heat around the corona discharge. A successful solution to this problem will achieve the following results:

- improving the energy efficiency of the process of ozone synthesis;
- reducing the likelihood of electrothermal destruction of dielectric resistance;
- simplify the layout of the cooling system for discharge chambers.

The degree of development of the topic. The study of the high-frequency Corona discharge system is the main topic of the works of modern domestic and foreign authors. For Example, A. A. Abdykadyrov, N. K. Kozhaspaev, Sh.A.Bakhtaev, A. A. Bokanova, K. V. Kozlov, V. I. Gibalov, V. G. Samoilovich, M. V. Sokolova, G. J. In systematic studies by scientists Pietz, U. Kogelschats, M. R. Gazanchay, etc., the main problem is to increase the efficiency of ozone processing in barrier and dam discharge. It should be noted that the S. V. Shapiro and a team of other authors use the Joule - Thomson effect to cool the gas in the

ozonator. However, in the scientific literature, this method does not give clear results in reducing heat generation in the ozonator discharge zone.

The purpose of scientific work. The crown operating at the upper frequency is to increase the energy and economic efficiency of the ozonator based on discharge.

To achieve this goal, the following tasks were solved in the dissertation:

1. Creation and study of a mathematical model of the process in the generator system of an ozonator based on a high-frequency corona discharge;
2. Experimental study of the energy efficiency of the ozonator generator system based on Corona Discharge;
3. Determination of the parameters of the upper electrode to determine the maximum efficiency of the installation system.

The scientific novelty of the dissertation is as follows:

1. In order to increase the energy and economic efficiency of the Etro - 03 ozonator installation based on high-frequency corona discharge, the design solution of the new device is protected by the copyright certificate of the Republic of Kazakhstan, that is, a patent of the Republic of Kazakhstan.

2. The parameters of the pulse of the micro-discharge generated around the corona electrode are determined, for example: the maximum length of the micro-discharge, the development time, the maximum current and the theoretically calculated values are well consistent with the experimental data obtained in the dissertation.

3. It was found that an increase in the active resistance in the circuit increases the length of the microrastric pulse, and the length of the microrastric does not depend on the active resistance of the electrical circuit.

4. The corona is close to the upper voltage electrode based on the discharge and the values of Joule energy losses are calculated and the operating modes of the ozonator are determined.

Theoretical and practical significance of the work.

Mathematical laws of the evolution of corona discharge current have been established around the corona electrode. At the same time, elements of the technology for creating Corona electrodes have been developed, which will allow creating a new design of ozonator installations. The presented design increases productivity by up to 20% percent at a certain time.

Methodology and research methods. In the course of the research work, comparative oscillograms, as well as experimental studies of electricity, models of physical parameters, performance and temperature were developed. Mathematical modeling was carried out using the theory on accumulated and distributed parameters in electrical circuits.

According to the design solution of the device, the problem of supplying high-frequency voltage to the ozonator cooling system and the corona electrode was studied.

Sending for protection, i.e. issuing rules.

1. A new method of increasing the efficiency of the ozonator system has been established that it is necessary to reduce the temperature formed around the microrazre, that is, in the chamber, as well as reduce the resistance of the corona electrode.

2. Mathematical models of ozone formation systems caused by discharge around the corona electrode have been created.

3. Working models of ozone processing systems through a corona discharge caused by high-frequency voltage, determination of electrical power parameters, measurement, comparison and performance of electrodes at various active resistances, which allows us to conduct an oscillographic study, were determined.

4. According to the results of theoretical and experimental studies of the proposed ozonator based on the corona discharge Etro-03, an increase in the productivity and energy efficiency of ozone processing systems was determined.

The degree of reliability of the results. The results of the data obtained from the research work are confirmed by a conditional comparison between theory and experiment. The accuracy of mathematical models is limited by accepted analogies and assumptions. In the same way, the accuracy of the results obtained from the research work is limited by the accuracy of the instruments for measuring the experimental work. Also, according to the scientific research work, deviations in the parameters of the power supply system and the air supply system were revealed.

Approbation of work. The main results of the dissertation were presented and discussed in the following scientific directions:

1. Abdykadyrov A., Korovkin N., Mamadiyarov M.M., Tashtay Y., Domrachev V. Practical research of efficiency of the installation ETRO-02 ozonizer based on the corona discharge. REEPE 2020 Conf. Venue: Moscow Power Engineering Institute (MPEI) 2020 International Youth Conference on Radio Electronics, Electrical and Power Engineering (REEPE) Date of Conference: 12-14 March 2020 ISBN:978-1-7281-5656-9.

2. Abdykadyrov A., Korovkin N., Mamadiyarov M.M., Tashtay Y., Syrgabayev I., Marxuly S. Research of the process of disinfection and purification of drinking water using ETRO-02 plant based on high-frequency corona discharge. 2021 3rd International Youth Conference on Radio Electronics, Electrical and Power Engineering (REEPE), Date of Conference: 11-13 March 2021 ISBN:978-1-7281-8399-2.

3. Abdykadyrov A., Mamadiyarov M.M., Marxuly S., Smailov N., Zhunusov K., Kuttybaeva A., Amanzholov A., Orazbekov A. Investigation of the Efficiency of the Ozonator in the Process of Water Purification Based on the Corona Discharge. Jurlan of Ecological Engineering 2023; 24(2):140–151 ISSN 2299-8993, CiteScore – Q2.

4. Abdykadyrov A. A., Mamadiyarov M. M., Marxuly S., Akylzhan P. study of the efficiency of disinfection of drinking water by an ozonator installation based on a high-frequency corona discharge. Scientific works VIIREiS, 2022, No. 4 (49).

5. Abdykadyrov A. A., Mamadiyarov M. M., Marxuly S., Kuttybaeva A. E., Aliyev A. study of the problem of solar power supply of the Etro-03 ozonator plant based on water disinfection. Scientific works VIIREiS, 2022, No. 3 (49).

6. Abdykadyrov A. A., Mamadiyarov M. M., Dosbayev ZH.M. Examination of the crown electrode based on the upper voltage. Current scientific research in the modern world was published 4 (24) April 2017.

7. Abdykadyrov A. A., Mamadiyarov M. M., Safarova A.M. experimental analysis of Crown electrodes in the ozonator unit. Satpayev's innovative technologies are key to the successful decision of fundamental and applied tasks in the ore and oil and gas sectors of the economy of the Republic of Kazakhstan, Almaty 2019. at 14-18, ISBN:978-601-323-145.

8. Abdykadyrov A. A., Mamadiyarov M. M., Safarova A.M. solubility and self-distribution of ozone in water. Satpayev's innovative technologies are key to the successful decision of fundamental and applied tasks in the ore and oil and gas sectors of the economy of the Republic of Kazakhstan, Almaty 2019. at 18-22, ISBN:978-601-323-145.

9. Abdykadyrov A. A., Mamadiyarov M. M., Alibi N. M., Kozybay B. K. wastewater treatment in the Kapshagai reservoir using ozone technology. the solubility and self-distribution of ozone in water. Satpayev's innovative technologies-key to the successful decision of fundamental and applied tasks in the ore and oil and gas sectors of the economy of the Republic of Kazakhstan, Almaty 2019. with 6-10, ISBN: 978-601-323-145

10. Abdykadyrov A. A., Mamadiyarov M. M., Kudaibergenova B. K., Yeshchanov B. S. features of neutralization of biologically harmful substances in the Vyacheslav wastewater storage facility by ozone technology. Satpayev's innovative technologies-key to the successful decision of fundamental and applied tasks in the ore and oil and gas sectors of the economy of the Republic of Kazakhstan, Almaty 2019. at 11-14, ISBN: 978-601-323-145

Publications. Research of the main provisions and results of the dissertation is published in 11 publications, including 3 articles, publications recommended for publication by the Higher Attestation Commission of the Republic of Kazakhstan. One patent was ordered for the invention.

Personal contribution of the author. The upper frequency Crown has developed a new design of the Etro - 03 ozonator unit with a power of 2 kW, a frequency of 13 kHz, a voltage of 8 kV, based on the discharge. He also developed a mathematical model according to the parameters determined by the research work. Corona conducted experimental research, theoretically discussing the system of reducing the temperature around the electrodes of an ozonator based on discharge.

The structure and scope of the work. The dissertation consists of an introduction, sections of 4 main chapters, conclusions, 2 appendices, completed on 106 pages, 53 Figures and schemes, 25 tables, a bibliography in 104 titles.