The liquid synergetic decontamination on the atmospheric electricity principles

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Abstract. The article is devoted to the liquid substances’ disinfection nature-like technology synergistic aspects on the atmospheric electricity impact principles on the Earth's biosphere. In the thesis form, a method, technological aspects, the disinfected liquid interaction synergistic moments with the proposed device reproducible blocks effects are suggested. It is proved that on the synergistic interactions’ basis, the greening production processes in developing new areas efficiency increases dramatically.

Introduction Currently

Within the Earth, humankind, the biosphere and the techno-sphere mutually support and complement each other, but have no prospects for the development outside each other. The biosphere as a self-developing and self-regulating system uses the energy order from space in the mechanisms redistributing energy within the Earth geophysical, biological, geochemical shells.

The modern civilization development has given rise to three global problems (antagonism) of the collision between the techno-sphere and the biosphere: 1) a significant amount of biomass is taken from the biosphere for the needs of the techno-sphere, which leads to the biological species extinction. The species extinction result is the ecosystems degradation and destruction; 2) the territories occupied by ecological systems (60% of the land surface) are withdrawn from the biosphere. As a result - climate change and chemical composition of water, air, soil. 3) the biosphere pollution by waste practically indestructible in the natural environment. The main part of industrial waste cannot be included in the substance circulation [1].

The Problem Setting

Stopping on the third problem, we note that close attention is paid to the resources circulation, both at the state level and in the world. The authors more than once turn to this topic and decide on electrical technologies as effective ways of processing raw materials and materials.

“In modern conditions in the field of the processing industry, the production processes greening has taken a leading position in the overall global structure of environmental protection. Existing methods of processing raw materials and materials according to the method of exposure are determined by the processes that are largely dependent on the need for energy carriers to realize the raw materials required changes (transformations). The very analysis of these processes (Fig. 1.) indicates the electrical technologies wide possibilities, in which electrical energy is converted into other forms of energy while simultaneously carrying out the technological process, bypassing the transformation stages into other forms of energy for carrying out the corresponding process” [2].
There are natural phenomena capable of leading the self-purification of the biosphere from natural pollution. In our opinion, the atmosphere thunderstorm activity aspect, as the current technology of cleaning and disinfecting the air-water basin of the Earth, deserves attention. After a thunderstorm, the air is clear, fresh and clean, saturated with ions, the pH of precipitation is closer to a neutral state.

The combination of electrical phenomena and processes in the atmosphere as the electric field of the Earth, its ionization, electric currents in it, the volume charges of clouds and precipitation, lightning discharges and other meteorological effects affect the materials processing methods depth and speed [3].

**The Scientific Achievements’ Analysis**

A number of atmospheric processes lead to a partial separation of opposite charges and the spatial atmospheric electric fields formation. The surface layer turbulent regime is characterized by gas-dynamic flows, and the surface layer electric state diversity determines the organic and inorganic substances interaction mechanisms and organisms with atmospheric processes.

The electric field strength at the Earth’s surface is \( E \approx 120–150 \, \text{V/m} \) to \( 10,000 \, \text{V/m} \) during precipitation. In this case, air ionization occurs under the action of a number of factors, including electrical discharges in the atmosphere (thunderstorm).

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**Methods for processing raw materials**

- Physical methods of exposure
- Physical and chemical methods of exposure
- Chemobiological methods of exposure

**PROCESS**

- Physical: Mechanical, Hydro-mechanical, Thermal
- Chemical: Mass transfer
- Biochemical: Microbiological
- Chemical: Dehydration, Oxidation, Hydrolysis, Sulfation
- Biochemical: Catalysis of chemical processes by enzymes
- Microbiological: Fermentation, Molding, Oxidation

**Figure 1.** Processes and methods for the raw materials processing

For a general idea of the existence of a thunderstorm, we will use the classical three stages representation (Figure 2), on the basis of which, building the developing technologies possibility logic for atmospheric electricity, we use the method of analogies [3].
The Obtained Scientific Results Substantiation

The following issues are based on the thunderstorm development stages: 1 - pre-storm, the appearance of cumulus clouds in the electric and magnetic field of the Earth, (the initial stage of the formation of a thunderstorm) ≡ (Rising streams, analogue pipe Ranke with the crossed electromagnetic fields device); 2 - the maximum cumulonimbus cloud development phase in the electromagnetic field of the Earth and clouds (characterized by ascending, descending flows and lightning discharges) (Corona discharge in laminar and turbulent flow of fluid on its surface); 3 - after a thunderstorm, with possible modulation by the signs of analogy (the final phase of the existence of a thunderstorm in the Earth electric and magnetic field) ≡ (Descending flows, analogous to Schauburger funnel with a device of crossed electric and magnetic fields) [4].

![Image](https://via.placeholder.com/150)

**Figure 2.** Stages of thunderstorm development: 1- pre-storm; 2 - thunderstorm; 3 - after storm.

These thunderstorms formation stages can be modeled on the block diagram consisting of three blocks shown in Figure 3.

The pre-storm period is characterized by the thunderstorm activity impact factors on the Earth’s biosphere. The clouds formation as a period of exposure is determined by natural convection, terrain relief, the occurrence of warm and cold atmospheric fronts, and cyclones.

![Block Diagram](https://via.placeholder.com/150)

**Figure 3.** Representations of decontamination technology on thunderstorm principles.

The effects arising from this are characterized by: adiabatic expansion, orographic lifting of masses, upward sliding of masses, twisting of air masses towards the center of depression [5].

Based on the analysis of the thunderstorm activity effects on the biosphere, using the principles of analogy and similarity methods for modulating disinfection processes, the determining influence factors on the inactivation and lysis mechanisms of bacteria and microorganisms were determined.
Realization and reproduction of these effects are proposed in the following constructive structure of the device, represented by the blocks in Figure 3.

Block number 1. When the fluid is supplied to the hydro-cyclone, due to its constructive performance, Ranke effects are observed: tightening the mass to the center of the depression (breakdown cylinder with aerator); due to the taper organized orographic masses rise; the tubular aerator action contributes to the upward masses sliding, and the adiabatic expansion of the air leads to its cooling, convective lifting of the masses.

So, the effects similar to the thunderstorm formation initial stage are realized in this device. At the same time, it is necessary to pay attention to the device for producing crossed electric and magnetic fields - as an analogue of the Earth electric and magnetic fields action, in which all the processes take place.

From a physical point of view, it can be stated that all the processes of the biosphere interaction with the meteorological effects of pre-storm exposure occur in the electric and magnetic field of the Earth. Consequently, the resulting force and depth of impact carry a synergistic effect. The principles and conditions of self-organization are expressed in self-development, unity and complementarity, as the synergetic dignity, giving the opportunity for an innovative approach to the scientific problems study, based on the principles of using synergetic methodology.

Without setting a goal to reveal all sides of a synergistic disinfecting effect, we focus on the determining factors: - the funnels geometry, - the external electric and magnetic fields level, -the fluid flow rate.

Block No. 2. The lifted mass of fluid in a turbulent flow enters an up-flow sump in a tray, where it passes into a laminar flow and is sent to a corona discharge unit, after which the flow enters a descending sump. At the same time, the effects that are the characteristic of the technological aspects of the first block, plus effects that characterize the falling flows and the corona discharge interaction with the water surface, water saturation with ozone - as a disinfection factor together with a wide range of α, β, - electromagnetic radiation of the corona discharge are observed.

Block No. 3. The falling stream gets into the receiving funnel, where the processes are organized by analogy of the Schauberg funnel. The action effects are observed as a characteristic for the technological aspects of the first block with features of changing the vortex rotation direction contributing to a more complete dissolution of gases.

Summary
Without going into the recycling raw materials and materials nuances, it can be stated that the natural environment in the processing of organic and inorganic substances on Earth is considered how they manifest themselves. Based on the mechanisms of physical and chemical processes (PCP) in a substance when exposed to an external source of the field, there is a sense of the technological aspects’ broad consideration in the waste processing [6].

“Thus, the electric field of the Earth is an ecological norm of development on the planet, and every material medium, moreover, has its own field, the interaction of these fields is an energy factor that can affect substances and their boundary layers both selectively and integrally” [2]. The accumulated experience of using natural technologies allows introducing fundamentally new nature-like technologies that do not destroy the environment, but allow restoring the balance between the biosphere and the techno-sphere disturbed by human.

References
[1] Versilin N N, Verzilin N M 2014 Biosphere, its present, past and future (Moscow. Enlightenment, Moscow).
[2] Bulat A D, Filenkov V M, Obrubov V A, Strochkov V E 2018 Electrotechnological aspects of greening the processes of processing substances (Scientific journal "Innovations in Science", Novosibirsk: Publisjing house ANS “SibAK”) 5 (18) 76-80.
[3] Kashleva L V 2008 Atmospheric electricity (Tutorial, ed. RSHU, SPb). ISBN 978-5-86813-231-5.
[4] Gindilis I. M. 2014 *Analogy as a method of knowledge* (Delphis) 3 (79) 59–63.
[5] Basin M. A., Zavadovsky N. Yu. 1985 *The model of a double spiral vortex as a limiting form of the free surface of a nonstationary flow of an ideal incompressible fluid* (Works of the seminar on regional problems, KSU, Kazan) 22.
[6] Bulat A. D. 2002 *Electrophysical activation of cement binders* (Monograph: Publishing house of the Russian engineering Academy, Moscow).
[7] Kalinushkin M. P., Grachev Yu. G. 1987 *Vacuum dust removal at the enterprises of light industry* (Legprombytzdat, Moscow).
[8] *Pneumatic transport of bulk materials in tire factories and production of rubber goods (calculation and design)*, Moscow, 1981.
[9] Kutepov B. M., Nepomnyashchy E. A. 1976 *Calculation results and regularities of the entrainment of the solid phase from a hydro-cyclone* (Theoretical Foundations of Chemical Technology) 10 (3) 433–437.
[10] Portenko N. I., Skorokhod A. V., Shurenkov V. M. 1989 *Markov processes* (VINITI, Moscow).
[11] Azarov V. N. 2004 *Comprehensive assessment of dust conditions and the development of measures to reduce the air content of the air environment of industrial enterprises* (dis. Dr. techn. Sciences, Rostov-on-Don).
[12] Boguslavsky E. I., Azarov V. N., Sergina N. M. 1999 *Mathematical model of the process of trapping in dust collectors with counter-swirling flows with suction from the lower zone of the apparatus (Environmental safety and economics of urban and thermal power complexes, Volgograd) pp. 79–80.*
[13] Boguslavsky E. I. 1996 *Mass transfer efficiency in a centrifugal field of dust collecting devices with allowance for shock interactions of particles* (Herald of the universities. Construction) 5 76–80.
[14] Boguslavsky E. I. 1977 *Development and research of adjustable cyclone devices for cleaning air from sticky dust* (Cleaning ventilation emissions and protecting the air basin from pollution, Rostov-on-Don) pp. 73–74.
[15] Boguslavsky E. I. 1997 *Probabilistic-stochastic approach to environmental issues* (Basics of the approach, Rostov-on-Don) 1.
[16] Boguslavsky E. I., Didenko V. G. 1997 *Evaluation of the mathematical description of mass transfer processes in gas cleaning devices* (Advances in the theory and practice of heat supply, ventilation, air conditioning and air protection, St. Petersburg) pp. 39–43.
[17] Boguslavsky E. I., Azarov V. N. 1997 *Evaluation of the process of separation and accumulation of dust in the industrial premises* (RIC Rostov. state builds University, Rostov-on-Don) pp. 49–50.
[18] Boguslavsky E. I., Pyglov S. G., Kharchenko V. A. 1994 *Improving the reliability of the forecast of the overall efficiency of dust collection devices* (Reliability of machines and technological equipment, DSTU Press, Rostov-on-Don).
[19] Boguslavsky E. I. 1991 *Theory and calculation of the effectiveness of technical means of dust removal and the development on their basis of structures with a vortex mode of operation* (author. dis. Dr. techn. Sciences, Rostov-on-Don).
[20] Boguslavsky E. I., Kharchenko V. A. 1997 *Physico-mathematical model and algorithm for calculating the fractional efficiency of cyclone devices of pneumatic transport systems* (Rostov State Civil engineering University, Rostov-on-Don) 47.
[21] Sow S. 1971 *Hydrodynamics of multiphase systems* (Mir).
[22] Saffron L. M., Murakhovskaya L. I., Serdi I. V. 1997 *Perspective directions of development of ecology, economy, energy* (Odessa) pp. 32-37.
[23] Kazakova E. E., Skorokhodova O. N. 2003 *Water-dispersion acrylic paints for construction purposes* ("Paint-Media", Moscow).
[24] Kochurov I. V., Vitkovskaya R. F. 2012 *Local wastewater treatment in the production of water-dispersion paints* (Vestnik of St. Petersburg State University of Technology and Design) 4 15-18.
[25] Vitkovskaya R F, Kochurov I V 2013 Wastewater treatment of water-dispersion paints and varnishes (Water: chemistry and ecology) 8 43 - 48.
[26] Information on: https://iopscience.iop.org/issue/1755-1315/224/1.
[27] Potolovsky R V, Sakharova A A, Moskvicheva E V, Gerashchenko A A, Yuriev Yu Yu, Kalinovsky S A 2018 The use of sewage sludge production of styrene-acrylic paints as a secondary raw material for the production of water-dispersion paints (Bulletin of Volgograd state University of architecture and construction. Series: Construction and architecture) 54 (73) 141-147.
[28] Potolovsky R V, Batmanov V P, Sakharova A A, Belogorodskaya M Yu, Prikhodchenko A V, Mikhailov B V, Popov Yu B 2017 Development of low-waste sewage treatment technology produced by WD-PM (Bulletin of Volgograd state University of architecture and construction. Series: Construction and architecture) 47 (66) 282-294.
[29] Dovletoglou O, Philippopoulos C, Grigoropoulou H 2002 Coagulation for treatment of paint industry wastewater (Journal of Environmental Science and Health) Part A. 37 1361–77.
[30] Eremektar G, Goksen S, Germirli Babuna F, Dogruel 2006 Coagulation-flocculation of wastewaters from a water-based paint and allied products industry and its effect on inert COD (Journal of Environmental Science and Health) Part A. 41 1843–52.
[31] Andreev V S, Popechitelev E P 1981 Laboratory instruments for the study of liquid media (Mechanical Engineering).