Chapter 19
Researches of Technology Electrohydraulic Effect: Impact on Water

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ABSTRACT

The purpose of the chapter is to study the technology and technical means of electrohydraulic action on water. The authors justify the relevance of the research. The design of the original negative electrode tip is being developed to increase the density of the electromagnetic field and reduce power loss. The design parameters of the electrohydraulic installation are shown. Modeling of factors influencing the process of electrohydraulic treatment of water according to the Plackett-Berman plan and the random balance method is carried out; significant and insignificant factors are identified. The operation modes of the electrohydraulic installation are determined and optimized experimentally. The substantiation of the economic feasibility of using electrohydraulic water treatment technology in farms is being conducted. The prospects and scope of electrohydraulic technology are determined.

DOI: 10.4018/978-1-5225-9420-8.ch019

INTRODUCTION

According to statistics from the National Fruit and Vegetable Union, the gross yield of greenhouse vegetables in Russia as of October 2018 was 803 thousand tons. These figures were 25% ahead of the same period in 2017, including cucumbers – 490,6 thousand tons (+ 14,6%), tomatoes – 299,9 thousand tons (+ 46,8%), other vegetable crops – 12,5 thousand tons (+ 26,2%) (Belov, 2018). In this regard, the authors note the promise of exploratory research on improving the processes of vegetable growing in protected soil in order to increase the efficiency of agricultural production. The purpose of the chapter is the study of the technology and technical means of electrohydraulic action on water.

BACKGROUND

Plants need to be provided with nutrients that are in large quantities in water solutions of the soil, but in a form that is not digestible. To translate useful organics and minerals into a form that is easily accessible to plants, it is necessary to degrade the cellulose and lignin shell of membranes, inside which are located useful substances for plants. The most suitable for these purposes, in terms of cheapness, simplicity of execution and efficiency, is the electrohydraulic method, the essence of which is that during high-voltage pulsed discharges within a liquid, high and ultrahigh pressures reach to hundreds of thousands of atmospheres (Locke, Sato, Sunka, Hoffmann & Chang, 2006). These pressures can perform useful mechanical work when a complex of physical and chemical phenomena occurs. These are both resonant phenomena and high-intensity ultrasonic vibrations, as a result of which chemical bonds in molecules are destroyed, and then combined again, forming new substances that improve soil fertility. In nature, it takes tens and hundreds of years, and with electrohydraulic (EH) processing - less than a second (Müller, Gelfond, Eisert, 2014). Electrohydraulic effect (EHE) is developed by Yutkin L.A. for long ago (Yutkin, 1986). The fundamental and applied values of discovery are proved by the author. EH-effect is widely used in various branches of science and technology, including industry, medicine and agriculture (Kutter, 1969). The electrohydraulic effect is increasingly being used in various technological processes of plant growing. The authors propose to use this phenomenon for the treatment of water or solutions for irrigation in plant cultivation for agrotechnical purposes. Due to the cheapness and simplicity of devices for producing fertilizers by this method, this technology can be widely used in greenhouses, personal subsidiary and peasant (farmer) farms. The advantage of EH-technology is the absence of a negative impact on the environment (Mamutov, Golovashchenko, Mamutov & John Bonnenc, 2015). In addition, these same devices can also be used to treat water taken from any well. Studies have shown that in electrohydraulically treated water from any source, the amount of nitrogen compounds dissolved in water can increase hundreds of times even with a small expenditure of energy. Mostly this is characterized by the supply of air through the water under low pressure. After EH exposure, activated water promotes active leaching from the soil and passes into the soluble state of the chemical elements needed by plants (Toporkov, 2017). Thus, the authors have identified a proposal to use water for watering plants as a substitute for nitrogen fertilizer, which is considered more preferable than the introduction of chemical fertilizers into the soil or dirt, the impact of which is negative from an environmental point of view. In addition, is valuable the fact that the soil in the case of watering with water, rather than introducing by chemistry, can be reused seasonally throughout the year depending on the type of crop. This will have a positive effect on the economic component in terms of eliminating downtime of the soil or protected