Chapter 9
Modeling of Electrohydraulic Technology in Agriculture

Jorge Vinna Sabrejos
The Antenor Orrego Private University, Peru

Alexander Anatolievich Belov
https://orcid.org/0000-0002-9216-9852
Federal Scientific Agroengineering Center VIM, Russia

Alexey N. Vasilyev
https://orcid.org/0000-0002-7988-2338
Federal Scientific Agroengineering Center VIM, Russia

Victor Nikolayevich Toporkov
Federal Scientific Agroengineering Center VIM, Russia

Andrey Anatolievich Musenko
Federal Scientific Agroengineering Center VIM, Russia

ABSTRACT

The authors reveal the relevance of modeling electrohydraulic technology in terms of determining the parameters that cannot be measured by existing methods and technical means. The purpose of the chapter is modeling of electrohydraulic technology in agriculture. By modeling, the authors are developing an installation for obtaining nutrient solutions under irrigation conditions in order to increase the yield in greenhouse vegetable combines while ensuring the environmental friendliness of the process. The authors used the methods of research, analysis and calculation of technical means and control systems applied to high-voltage electro-technological installations of agricultural use. Mathematical patterns are established and a logically based relationship is established between the changes in electrical conductivity of water as a result of electrohydraulic processing.

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INTRODUCTION

Technologies for the production of various materials with the desired properties using the electrohydraulic (EH) effect have been developed for a long time (Yutkin, 1986). The advantages of these technologies are the high efficiency of the processes due to the possibility of the formation of materials of a given structure from the source material (peat, water, etc.), which gives a significant technical and economic effect and obtaining an environmentally product with minimal negative impact on the environment.

Currently, consumers' attention is drawn to organic food. Environmentally product is a product that is made from natural raw materials according to modern technology, which ensures minimal ingress of foreign bodies into the product, does not contain any impurities, and is obtained without the use of mineral fertilizers, pesticides and in the absence of man-made impacts. The products of farms that use predominantly organic fertilizers of natural origin, and sell their products in markets and supermarkets are in great demand. However, due to the limited nature of such fertilizers and the duration of the processes of their formation, the cost of organic food is still quite high.

To improve the quality and economic indicators of agricultural enterprises is possible only by using cheap raw materials. Currently, there is an increasing interest in the application of electrohydraulic technologies in agriculture and national economy. This is due to the fact that in recent years there has been a tendency in the Russian Federation to reduce the fertility of the soil. The soil cover is most susceptible to pollution, thereby losing the ability to restore properties, as well as the reproduction of fertility. According to minimal estimates, about 30 million hectares of productive land have been lost in Russia over the past 15 years.

The applied doses of mineral and organic fertilizers do not compensate for the loss (at harvest) of the nutrient yield in the soil. It can also be used effectively in greenhouses and electrohydraulic sterilization of soil with simultaneous fertilizer. Electrohydraulic processing of peat, including crushing, sequential settling and drying, also has great prospects. To study and evaluate the technological and technical features of the processes during electrohydraulic processing, a theoretical base is needed, which is not sufficiently represented in modern literature sources. The solution of these problems contributes to the modeling of technology and technical means for its implementation.

BACKGROUND

To increase the gross production of greenhouse products, it is important to provide plants with all the necessary nutrients that are found in the soil (especially in peat) in large quantities, but in a form inaccessible to plants. In various countries, original technologies are being developed that allow nutrients to be made available to plants in the form and, in most cases, exclude the addition of other fertilizers, restoring lost fertility to the soil (Feng et al., 2016).

The advantage of these and other technologies using high-voltage pulsed discharges is the high efficiency of the processes, the absence of a negative impact on the environment. This technology is designed to solve the problem of environmental safety. During electrohydraulic processing, most of the soil is ground to particles with a diameter of 0.002 mm. The size of the resulting surface becomes larger than even the most highly dispersed silty fractions of ordinary soil. This contributes to the cost-effective transfer to the solution of the nitrogen and phosphorus, trace elements contained in the soil and in the air, which, in a soluble state, are easily absorbed by plants. Under natural conditions, this takes years,