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COOKING TABLE ANALYSIS OF METHODS OF ELECTROTECHNOLOGICAL PROCESSING OF SEED

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Annotatsiya. *Maqolada qishloq xo‘jalik ekinlari urug‘iga, osh lavlagi urug‘i misolida, elektrotexnologik ishlov berib, samaradorligini oshiradigan qurilmalarni tahlil etish natijalari keltirilgan.*

Аннотация. *В статье приведены результаты анализа устройств, повышающих эффективность путем электротехнологической обработки семян сельскохозяйственных культур на примере семян столовой свеклы.*

Abstract. *The article presents the results of an analysis of devices that increase the efficiency of agricultural crop seeds, using the example of beetroot seeds, by electrotechnological treatment.*

Tayanch so‘zlar. *osh lavlagi, ekin, urug‘, nur, elektrotexnologiya, qurilma, saralash, geometrik, uzunlik, eni, qalinligi, tozalash, massa, dona, elektr maydon, unuvchanlik, elektron, oqsil.*

Ключевые слова. *столовая свекла, культура, семена, луч, электротехнология, устройство, сортировка, геометрический, длина, ширина, толщина, очистка, масса, штука, электрическое поле, всхожесть, электрон, белок.*

Keywords: *beetroot, crop, seed, light, electrotechnology, device, sorting, geometric, length, width, thickness, cleaning, mass, grain, electric field, germination, electron, protein.*

Introduction

It is known from scientific sources that in order to obtain high-quality, biologically similar seeds with high germination and potential yield in laboratory and field conditions, it is necessary to sort agricultural seeds by electrotechnological processing according to all their important physical and mechanical properties. When sorting agricultural seeds by electrotechnological processing, an electric field of different values is applied to them, taking into account all their important physical and mechanical properties. As a result, unlike pneumatic and mechanical methods, in an electric field, agricultural seeds are sorted by all their important physical and mechanical properties, namely mass, density, geometric dimensions, electrical resistance, dielectric absorption and other similar important properties. In addition, the electric field has a positive effect on seeds, increasing their germination in laboratory and field conditions and accelerating the growth and development of seedlings, ultimately increasing the yield of agricultural crops [1,2].

Since the electric field on the surface of the working body of the electric sorter device, which increases the efficiency of sorting of agricultural seeds by electrotechnological processing, is created as a result of the friction of two dielectric materials against each other and between electrodes with opposite signs, patent searches were conducted on triboelectric and dielectric devices. Patent searches were conducted on the basis of the latest news received over the past 40 years on the QXMITI fund and the Internet site [3].

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large seeds (corn, beets, pumpkins, melons, cotton, etc.). They were developed by the All-Union Research Institute of Agricultural Mechanization in 1980. However, they did not go beyond experimental trials.

A group of biologists and physicists have developed a device that processes certain beet seeds with an electromagnetic field. The main disadvantages are the high electromagnetic field emitted by the device and the difficulty in ensuring uniform seed treatment.

Electrical action on biological objects induces an organism response consisting of accelerated development resulting from metabolic activation. Stimulating a biological object through electrical exposure is considered effective because electrical action is associated with an electromagnetic field possessing a specific frequency and intensity.

Furthermore, any electrical action applied to a biological object involves not just a single factor, but a complex of various factors. For instance, when treating a bio-object in an electric field, the complex of factors—aside from the primary field—may consist of alternating components of the electric field, broad-range electromagnetic radiation, acoustic vibrations, ions, and so forth.

The relative weight of each electrical effect varies: some are of decisive importance, others are insignificant, and a third group is completely absent. Therefore, the issue of dosing electrical exposure can be considered from the following perspectives: first, taking into account the energy of the factor playing an essential role in this process; second, ensuring that the impact energy qualitatively aligns with the energy of the living system.

If a cell is considered as a living system, the membrane potential and its associated energy changes trigger the cell's response to external influences; thus, electrical action is the most effective.

Ultraviolet rays have a positive effect on beet seeds, disinfecting them and providing them with pre-sowing germination. Many years of research by practitioners have shown that the treatment of seeds with ultraviolet radiation is an environmentally friendly "green energy" technology and does not require the use of toxic chemical stimulants and salts, while providing their disinfection and pre-sowing stimulation and accelerating the initial growth processes, enhancing plant growth and development. UBNs effectively destroy microorganisms on the surface of seeds, activate chemical and biological processes, which leads to an increase in their germination, germination energy and the yield of the treated crops.

As a result of research conducted by engineers of the Kharkov Electrotechnical Company together with scientists from the Institute of Electrophysics and Radiation Technologies of the Ukrainian Academy of Sciences, an experimental device for pre-sowing treatment of seeds with ultraviolet stimulation was developed in 2008. This device allows processing up to 4 tons of seeds per day.

In 2009, together with the Ukrainian Academy of Sciences and the Kharkov Electrotechnical Company, a drum device for ultraviolet irradiation with a photochemical activator of seeds (microelements and biostimulants) was developed for uniform irradiation of seeds.

According to their research, absorbed energy moves within the atomic system of molecules without being dissipated, locating weakly bound sites between interlinked atoms and breaking them. This process, known as photolysis, produces molecular fragments within 60 minutes that exert a strong effect on living organisms.

In addition to photolysis, exposure to ultraviolet (UV) radiation triggers denaturation in biopolymers. When a living biological organism is exposed to UV radiation of a specific wavelength, the electric charges of the molecules decrease, causing them to aggregate (clump together) and lose their enzymatic and hormonal activity. This phenomenon is called denaturation. In proteins, photolysis and denaturation caused by UV light occur side-by-side as independent processes. Photolysis primarily occurs under UV radiation with wavelengths of 280–300 nm,

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whereas denaturation is induced by UV radiation in the range of 250–265 nm.

The most sensitive cellular process to UV radiation is cell division (renewal). Studies demonstrate that exposing bacterial cells to a UV dose of 10 J/m^2 halts up to 90% of cell division; nevertheless, cellular viability is preserved, and the division process recovers over time. Changes occurring in nucleic acids under UV exposure suppress metabolic processes in proteins and acids, adversely affecting cellular reproduction and renewal [2].

Ultraviolet radiation consists of light invisible to the human eye, with wavelengths ranging from 10 nm to 400 nm, much of which is filtered out by the atmosphere before reaching the Earth's surface.

This radiation is divided into three main spectral bands:

1. Short-wave UV: 200–290 nm
2. Medium-wave UV: 290–350 nm
3. Long-wave UV: 350–400 nm

Short-wave UV radiation carries high energy and possesses the capacity to alter and disrupt biological molecules. Proteins absorb radiation most strongly at wavelengths of 220–240 nm, while nucleic acids absorb peak energy around 260 nm. Exposure to short-wavelength radiation causes chemical bonds to alter or break, rendering proteins non-functional and causing nucleic acids to lose their biological properties.



Figure 1. Village economy crops laboratory stand for ultraviolet irradiation of seeds

Under short-wave UV exposure, water undergoes photolysis, leading to the formation of free active radicals and hydrogen peroxide. Hydrogen peroxide, in turn, breaks down organic molecules, resulting in the loss of cell viability. Short-wave UV generally exerts a negative impact on plant life; however, literature notes that extremely low doses can occasionally stimulate growth

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by up to 50%. A universal formula for determining UV exposure parameters in plants does not exist, as every plant species requires individualized determination of its optimal stimulative dose.

Medium-wave UV radiation is divided into two bands: wavelengths of 290–310 nm and 300–350 nm. Continuous exposure of plants to high doses within these wavelengths leads to plant mortality. However, studies show that applying low doses of medium-wave UV radiation for up to 20 minutes daily can stimulate plant growth. Such experiments have been conducted on tomatoes, sunflowers, and cotton, resulting in accelerated flowering and improved quantitative and qualitative yield parameters [2].

Long-wave UV radiation is harmless to both humans and plants. It exerts a highly positive effect on the growth of mountain plants, yielding beneficial results even during prolonged exposure alongside natural sunlight. Consequently, the synthesis of alkaloids and essential oils increases.

There are also reports that long-wave UV radiation produces positive results in the cultivation of dill and parsley. Utilizing long-wave UV radiation in combination with supplemental lighting lamps in greenhouses yields favorable outcomes.

As noted earlier, the radiation wavelength that inflicts the most damage on cellular DNA is UV in the 250–265 nm range. Under exposure to this wavelength, adjacent thymine molecules within cellular DNA form covalent bonds with each other (dimerization). This process severely impacts the biological organism, reducing the electrical charges of these molecules and causing them to lose their enzymatic and hormonal functional states. According to biochemical studies, irradiating a biological object with UV light at wavelengths of 280–320 nm leads to the cleavage of these bonded dimers. This repair process is driven by an enzyme called photolyase. The enzyme recognizes the defect within the DNA structure, and upon activation by the energy of light quanta, the thymine bond is broken. The cell recovers from this state of stress, leading to a stimulation of its biological processes.

However, along with its advantages, electrotechnological processing of agricultural seeds also has certain disadvantages, which negatively affect their widespread use in technological systems for seed preparation in agricultural production. For example, air temperature and relative humidity have a negative impact on the quality and stability of sorting beet seeds in a coronal electric field. In addition, for sorting agricultural seeds in coronal electric and electrostatic fields, expensive sources are also needed that generate a high-voltage electric field of about 30-40 kV. In order to widely introduce the technology of sorting agricultural seeds in an electric field in seed preparation systems, it is necessary to eliminate the above-mentioned disadvantages [2,4].

A thorough analysis of the results of many years of research and design work, as well as laboratory and field experiments, has shown that the use of the dielectric method in sorting beet seeds allows you to eliminate the above-mentioned shortcomings. This is because, unlike corona electric and electrostatic methods, the technological process of sorting beet seeds using the dielectric method can be carried out in a variable and constant electric field without charging with free charges. Sorting seeds using the dielectric method without charging with free charges allows you to reduce the negative impact of external temperature and humidity on the technological process.

Based on the above, this article aims to develop an energy- and resource-efficient electric sorting device that increases the technological efficiency of sorting beetroot seeds in order to obtain high-quality, biologically similar seeds with all important physical and mechanical properties, high germination and potential yield in laboratory and field conditions, and to justify its structural dimensions and operating modes.

The goal is achieved by creating electric fields that arise under two different conditions, that is, between electrodes with opposite signs and as a result of rubbing two dielectric materials against each other, on the surface of a working body made of a single dielectric drum, increasing

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the value of the electric attraction force, and sorting the seeds of agricultural crops in it according to all important physical and mechanical properties, and separating them into separate fractions according to the angle of refraction.

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