PLANT SPECTRAL LIGHTING AND SPRINKLING WATER ACTIVATION DEVICE

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Abstract. The offered device is attached to a single-phase electrical power network through a voltage fourfold. Thereby, high straightened voltage electrolysis is created and is used for the activation of sprinkling water thus gaining the necessary cation for plant watering. At an output of the voltage fourfold clamps a water tank of two cylindrical capacities is attached. This tank in a water activation process performs common hydrothermal ballast resistance and electrolyser functions of several in a chain joined defective filament spectral luminescent lamps. The straightened voltage effectively fines and activates any extent of polluted water in the fractions of anion (lifeless water) and cation (live water) and simultaneously separates residues resulted in an electro coagulation process; whereas these residues may be used as plant artificial fertilizer. Due to the above mentioned, the capital costs decrease for 35 %, the operational efficiency of the device increases for 30 % and the productivity of plants increases for 20 %. Experiments on the cation and the anion influence upon plant development are carried out.

Keywords: hydrothermal ballast resistance, electrolyser, anion, cation.

Introduction

The content of the article is related to the horticultural branch and mainly may be used at sprout growing in greenhouses. There is known a device consisting of a glass container where electrodes are submerged and at the direct voltage source attached, and for the separation of anion from the common water mass a removable canvas bag is used [1]. The main drawback of the device is that at the anion bag (lifeless water) removal from the common water container water run-off back into the cation (live water) container partly occurs, thus due to neutralisation of mutually activated fractions a reduction of curing and growing stimulation capacities is created. Plant artificial lighting is not applied.

There is known also a device [2] which comprises a container with two glasses submerged under a common water layer where there are set metallic electrodes attached through a diode straightened phase voltage. The water layer of the common container above the glasses performs a current running role between the anode and cathode, whereas in the glasses anion and cation segregate. This device has the subsequent disadvantages.

1. A large number of application containers (three), difficult construction of their fastening and displacement technology.
2. In this case it is impossible to separate fractions of anion and cation selectively as well because they are in a direct contact with the neutral water layer above the glasses and mutual mixing and run-off are created.
3. Due to a relatively high current intensity 5 – 10 A the phase voltage straightened through the diode may cause electrical trauma.
4. A plant artificial lighting is not implemented here as well thus limiting diapason of the functions of the offered device.

A device that is more close to the existent issue consists of a sprinkling water capacity with several mutually enclosed sections that comprise flat graphite electrodes and is connected to a mono-phase electrical power network. These sections in the schemes of their single luminescent light bulb serve as hydrothermal ballast resistances [3].

Nevertheless, the construction of such device is not compact as well because each luminescent light bulb needs its own water container thus increasing capital expenditure by making great material usage. The plant artificial lighting is not effective enough because it is realised only with bulbs of one spectrum (white light) thus ignoring the favourable influence of several different light spectrums towards plant development. The sprinkling water activation process due to which cation fraction increases the plant additional productivity is not implemented in the device [4].

Materials and methods

The aim of the work is to improve the construction and exploitation of the device, to widen the diapason of feasible functions and to increase the plant yield.

The set aim is achievable by the voltage fourfold 3 made of condensers 8, 13, 15, 16 and diodes 9, 12, 14, 17, see Figure 1, [7]. The device is attached to a mono-phase electrical power network through the voltage fourfold 3, thus creating high straightened voltage electrolyser 20, which is used for the activation of sprinkling water by gaining cation 29 necessary for plant watering. A water container of two cylindrical capacities 22, 23 is attached to the output clamps of the voltage fourfold 3 and simultaneously performs common hydrothermal ballast resistances and electrolyser functions 20 in the process of water activation of several in a chain connected defective filament spectral luminescent light bulbs [5]. The voltage straightened by the voltage fourfold 3 effectively fines and activates water of any level of pollution in the fractions of anion 24 (lifeless water) and cation 29 (live water), simultaneously separating the residues 31 arisen due to the electrical coagulation. These residues may be used as plant additional fertilizers [6].

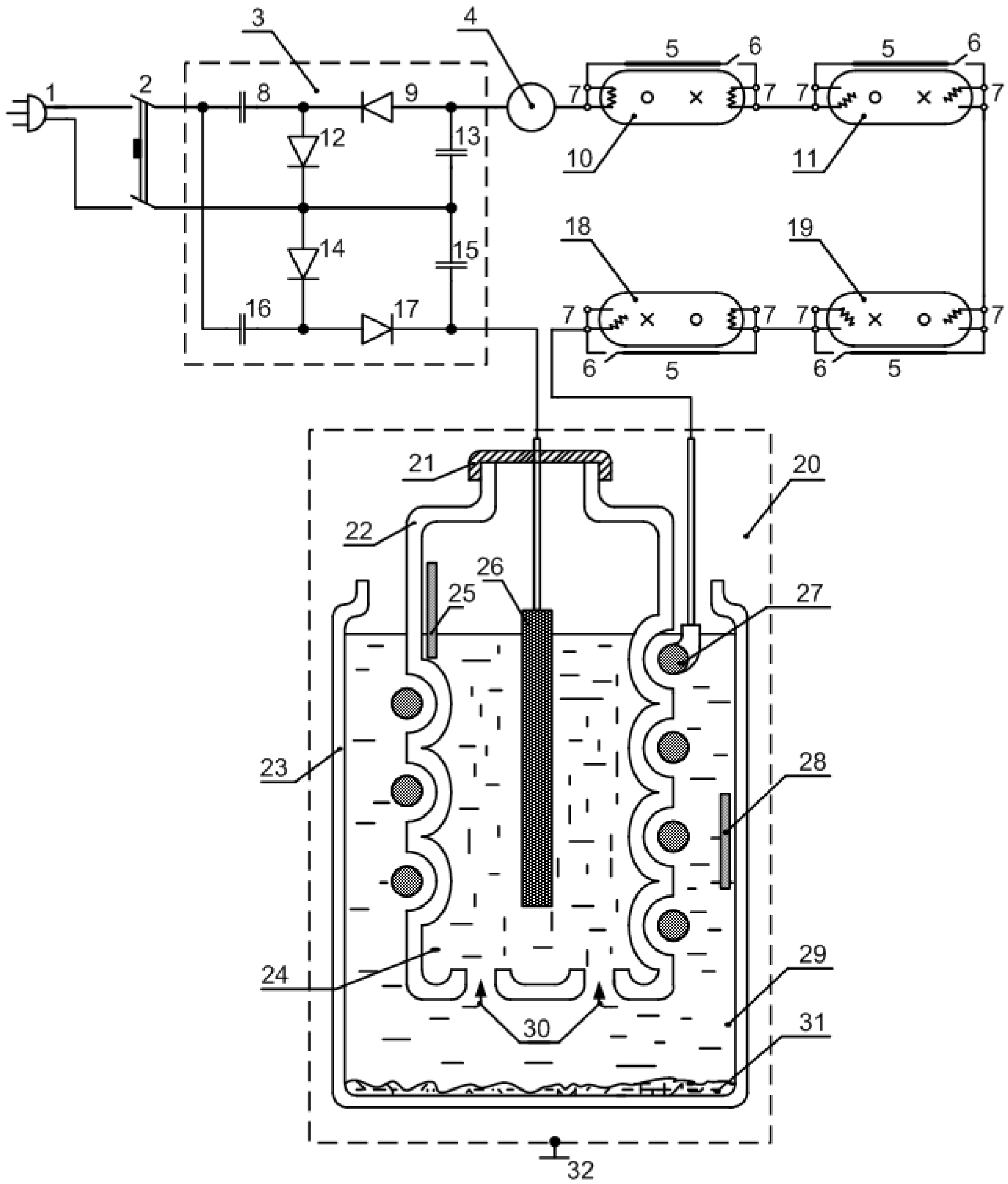

Fig. 1. **Plant spectral lighting and sprinkling water activation device:**
1 – plug; 2 – automatic switch; 3 – voltage fourfold; 4 – miliampermeter; 5 – surface additional electrodes; 6 – adjusted with switches; 7 – metal plate; 8, 13, 15, 16 – condensers; 9, 12, 14, 17 – diodes; 10, 11, 18, 19 – luminescent light bulbs; 20 – electrolyser; 21 – plastic cork; 22 – anion capacity; 23 – container; 24 – anion; 25, 28 – “pH” parameter indication plates; 26, 27 – electrodes; 29 – cation; 30 – perforation holes; 31 – simultaneously separating residues; 32 – security figure

In spite of the high straightened voltage level (≈1200 V), the current intensity is only 0.02 – 0.03 A. An automatic switch 2 applied in the scheme and a security figure 32 (metallic parts of the device that normally do not conduct current) fully secure the electrical safety of the device.

Within the smallest diameter anion capacity 22 (2 litter plastic profiled bottle) a graphite bar positive electrode 26 is set, but its outside is embraced by a stainless steel spiral 27 which serves as a negative electrode of the greatest diameter cation container 22 (5 litter glass jar).

In the narrowed upper part of anion capacity 22 through a plastic cork 21 a wire which comes out of the anode electrode is fastened, but in the lower part of capacity a perforation is made of small diameter holes 30 through which among electrolyser 20 electrodes a current flow is running.

The technological scheme of the device shown in the figure functions as follows.

After attaching the device to feeding 220V electrical power network with a plug 1 the sprinkling water activation process starts together with simultaneous plant lighting from the spectral luminescent light bulbs 10, 11, 18 and 19. Amount of the lighting light bulbs is adjusted with switches 6 which are set in circuits of their surface additional electrodes 5 [5]. The outputs of defective filaments are connected with a shunting metal plate 7. The course of water activation is controlled with „pH" parameter indication plates 25, 28 of miliammeter 4 and litmus paper. These plates are glued to the transparent inner walls of each container (at the end of the process the current intensity vanishes, but the ph gas parameter value for the anion is 10 – 12 and for the cation within 4 – 5). After the end of the activation process the plastic cork 21 must be unscrewed and the electrodes 26 and 27 taken out. The bottle neck is pressed with a special rubber valve (not shown in the figure) or a palm thus stopping the air atmosphere pressure towards the anion capacity 22 from above. Thereby, when water is removed from the cation container 23 it does not leak through the perforation holes 30 because there is created such a temporary hydro-regime state when the atmosphere pressure affects only from bottom and water from the container does not flow out. There is no equivalent analogue for such technology of separation of activated water fractions because at the already known technologies [1; 2] during the separation of anion and cation runoff of one or another fraction is unavoidable and their mutual mixing reduces the quantitative indices of the separated fractions. Current running through the electrolyser 20 heats its water up to the necessary temperature.

Results and discussions

In order to verify the efficiency of live and lifeless water impact towards plant development there were provisory experiments performed at the Latvia University of Agriculture, Institute of Agricultural Energetics.

1. Field onions.

Groups of single onion plants were watered in equal conditions with fractions of live, lifeless and neutral water.

During the growing process there were the following changes observed. The chives of those onions which were watered with the activated water fractions of anion and cation were a bit longer than those watered with the neutral water thus proving their stimulating influence upon plants in general. The size of the chives was not inspected.

2. Lettuce.

Little bit better progress by using the lifeless water. It proves that this water fraction has a positive impact upon some plant kinds as well.

3. Cut flowers – yellow tulips.

The flowers opened faster by using the live water. When using lifeless water the leaves of the tulips died faster (impact of metabolic changes).

There was carried out an experiment when a tulip which had died in a tray filled with tap water (Fig. 2) was put in a tray with the live water. The flower fully regenerated in 7 – 8 hours (Fig. 3). After putting this same flower back in the tray of neutral water it continued to blossom and did not differ from other flowers (Fig. 4).

Fig. 2. **The flower before putting it in a tray of live water**

Fig. 3. **The flower after taking it out of the live water tray**

Fig. 4. **The regenerated flower put back in the common neutral water tray, seen in the middle**

Successful exploitation of water activator may be reached by performing the following demands:

- current intensity of energy efficient device *I*, mA;
- length of electrical activation performance *t*, min;
- temperature of sprinkling water *T*, °C;
- "ph" number necessary for the fractions of activated water.

For the control of these demands the device was appropriately experimented (Fig. 5).

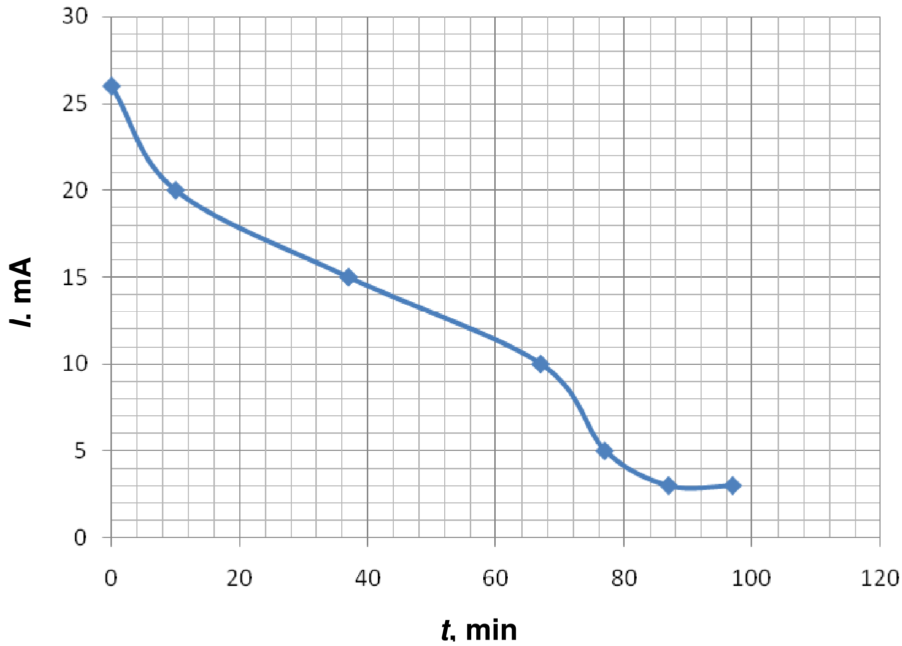

Fig. 5. **Current intensity in the process of electrical activation**

Conclusions

1. The targeted operating duration of the device is about 1.5 hours (each time when the current intensity reaches a constant minimal value).
2. At the end of the process the sprinkling water temperature is 31^0C whereas at the beginning it was 23 ºC.
3. Acid numbers "ph": cation 8.45 (live water) and anion 3.26 (lifeless water).
4. This experiment proves the positive effect of activated water.
5. There is made a multifunctional electrolyser which structures water and consists of two axially set cylindrical shape capacities that simultaneously serve as a hydrothermal ballast resistor in the chain of plant spectral luminescent lighting. The device receives electrical feeding from voltage fourfold; its high straightened voltage ensures also the high coagulation level of sprinkling water.
6. It is experimentally defined that the necessary electrical activation time of the device is the function from the minimal current intensity, water temperature and "ph" acid number.

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