I. SCIENTIFIC REPORT

EXECUTION PHASE NO. 1/2024

Project title:

ASSESSMENT OF THE IMPACT OF NON-THERMAL PLASMA TECHNOLOGY ON PLANT GROWTH AND DEVELOPMENT IN INDOOR FARMING

Contract no. 7BMBE/2024

Project code: PN-IV-P8-8.3-PM-RO-BE-2024-0011

Phase I/2024 (November 22 – December 31, 2024)

Phase name - Identification of the technical requirements of the non-thermal plasma activated water production system for indoor agriculture

- **General objectives:**

The general objective of the project is to research the use of non-thermal plasma-activated water in indoor agriculture to optimize plant growth and development processes, to assess the economic impact and sustainability of implementing this technology, and to analyze its effects in protected spaces. The project also aims to develop and validate an effective strategy and protocol for the application of this technology, with a view to achieve a more efficient, sustainable, and environmentally friendly indoor agricultural system.

- **Objectives of the implementation phase:**

To study the technical requirements of the non-thermal plasma reactor for the indoor agricultural system (controlled environment) and to identify the technical specifications and specific operating conditions.

- **Scientific and technical description**, highlighting the results of the phase and the degree of achievement of the objectives:

Phase results	**Degree of achievement of objectives**
Definition of the requirements for the non-thermal plasma (NTP) reactor and the associated power supply	100%
Analysis of the electrical parameters specific to NTP reactors	100%
Project website	100%
Visits to the laboratory in Belgium	100%
Visit to the laboratory in Romania	100%

The NTP reactor model for obtaining activated water to study its influence on plant growth

During this phase, the technical requirements of the non-thermal plasma (NTP) reactor for indoor agriculture (controlled environment) were analyzed, and the technical specifications and specific operating conditions were identified.

The experimental reactor will be designed to produce activated water through a simple and efficient system, using a set of essential components. Its structure is designed to ensure a controlled process with reproducible and easily configurable parameters. This experimental model will ensure the production of activated water in accordance with the identified needs for plant growth, being easy to implement in laboratory experiments. The technical requirements of the experimental reactor model are:

Reactor components

- ***Stainless steel tubular electrodes***

The reactor includes two tubular electrodes made of stainless steel, a material chosen for its corrosion resistance, chemical stability, and optimal electrical conductivity. The electrodes will be placed in an enclosure to ensure uniform distribution of the electric field.

- ***Transparent enclosure***

The electrodes will be mounted in a transparent enclosure that will allow visualization of the process and ensure resistance to temperature variations and the effects of reactive solutions.

Power supply

The electrodes will be connected to a direct current pulse generator capable of delivering controlled voltages within a predetermined range. This generates electrical pulses with adjustable duration and intensity, ensuring the production of activated water.

This system is adaptable to identified requirements and allows:

- Adjustment of power supply parameters: voltage and pulse frequency can be adjusted to evaluate the influence of different activation levels on water.
- Electrode size and water volume: the model is configurable to allow experiments with different amounts of water, adapted to the needs of the study.

During the visits carried out as part of the project, the advantages of this non-thermal plasma reactor configuration were identified:

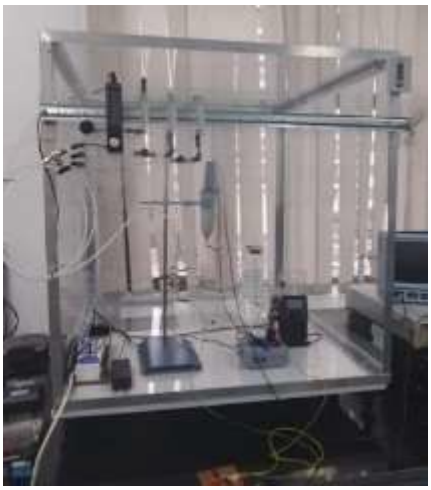
- The use of electrodes as inlet and outlet paths reduces the need for other auxiliary components, simplifying the reactor design.
- The flow of water and gas will be well directed, allowing maximum interaction with the electrical discharge and optimizing the water activation process.
- The air introduced together with the water helps to maintain a stable discharge and generate a greater number of reactive species, improving the quality of the activated water.

When treating water with non-thermal plasma discharges, precise adjustment of voltage, current, frequency, and pulse duration determines the efficiency of the process and the characteristics of the activated water, contributing to improved quality of experiments and practical applications. The main electrical parameters analyzed:

- ✓ Applied voltage (U)
- ✓ Electric current (I)
- ✓ Power consumption (P)
- ✓ Pulse frequency (f)
- ✓ Pulse duration

Also, during this stage, the planned research visits were carried out as follows:

Between December 2 and 5, 2024, researcher from the Gembloux Agro-Bio Tech Laboratory/University of Liège traveled to Iași and visited the Gheorghe Asachi Technical University Laboratory. During the working visit, important aspects of the project's implementation were analyzed, and the equipment needed to carry out the activities set out in the project implementation plan and those that could be carried out in the laboratory in Liege, Gembloux Agro-Bio Tech, Belgium, were identified.



Between December 9 and 12, 2024, researchers from Gheorghe Asachi Technical University Laboratory traveled to Belgium, to the Gembloux Agro-Bio Tech Laboratory/ Université de Liège to identify the

facilities and equipment available to the partner in Liège for the development of the non-thermal plasma activated water system and for studying its effects on plants. They also analyzed the plant growth chambers and determined the equipment needed to monitor and adjust the parameters necessary for plant development in indoor agriculture.