IV International Scientific-Technical Conference

6–8 February 2020, Kielce
(Poland, Ukraine, Croatia, Slovakia, Sweden, USA)

ACTUAL PROBLEMS OF RENEWABLE POWER ENGINEERING, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

Book of abstracts

Part I

KIELCE 2020

6-8 February 2020, Kielce (Poland, Ukraine, Croatia, Slovakia, Sweden, USA)
Under the general editorship Prof. doctor of science Anatoliy Pavlenko

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ISBN 978-83-65719-84-3

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TECHNOLOGY FOR PRODUCING BIOPESTICIDES IN A MICROWAVE FIELD

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Introduction. Insufficient financing of the agricultural sector and increasing environmental standards necessitates the search for new methods of extracts for pest control. The use of modern, resource-saving and safe methods for producing extracts using the intensification of the process of the release of biologically active substances is a topical issue today. The development trend of the world market of biopesticides, where the United States takes the leading place (40% of the global volume), causes an urgent need to develop this issue in Ukraine, which in turn will reduce the purchase cost of products and improve the quality of the plant material grown. The treatment of plants with biopesticides affected by bacteriological or fungal diseases leads to increased land fertility and product quality, improved soil microbiota, and an increase in the yield of main crops. Today in Ukraine, 1,092 drugs are used as pesticides, most of which are banned in European countries. Despite the known dangerous impact on the environment and harm to humans, introducing a ban on the use of chemicals is quite difficult. Due to the development and implementation of a number of biopesticides in the agronomic sphere, the insecticidal and herbicidal spectrum of actions is expected to reduce the use of chemical pesticides and insecticides by 6 times, bringing the share of agricultural enterprises with organic farming to 20%. Thus, the creation and use of highly effective biological products for agriculture is the most important task, the solution of which will ensure the production of environmentally friendly products and the preservation of the ecosystem.

The technology for producing biopesticides is a complex and little studied process, requiring a large number of additional factors. Increasing the efficiency of the process of extracting the target component (TC) from plant material in order to reduce energy costs can be achieved by exposing the extractant to a microwave field [1]. During microwave (MW) extraction, the process of the release of substances is accelerated, which may be the result of the local nature of heating, and the synergistic combination of two transport phenomena: unidirectional gradients of heat and pressure. The intensification of the extraction process under given conditions occurs due to the grinding of the solid phase (plant matrix), destruction of the cell walls by microwave, the inclusion of the molecular

mechanism of internal mass transfer, turbulization of the extractant due to shock waves at the liquid-plant material interface [2].

The technological scheme of a pilot plant for extracts in a microwave field is shown in Figure 1. The installation is a closed variable-action system with the ability to adjust the material feed rate, temperature control and recirculation.

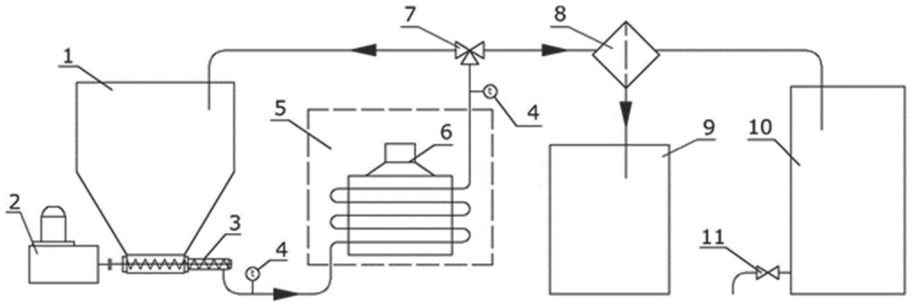

Fig. 1. *Technological scheme of extracts in the MW field: 1 – capacity for supplying material; 2 – electric motor with gear; 3 – auger; 4 – thermometer; 5 – microwave heating chamber; 6 – magnetron; 7 – three-way valve; 8 – filter separator; 9 – collection capacity; 10 – the capacity of the collection of extract; 11 – drain cock*

The feedstock is loaded with a container for feeding material 1, at the bottom of which a screw 3 is located. Using a dispenser, the solvent is fed into the working tank 1 and thanks to the screw mechanism designed for grinding and pushing the plant mass into the microwave heating chamber 5, where the plant mixture is heated to a predetermined level temperature, which is set for each target component based on the reference data. The speed of advancement of the material through the pipe channels is regulated by an electric motor with a reducer 2. At the exit from the chamber 5, the temperature is automatically measured by a thermometer 4, if the specified parameter values have not been reached, the plant material is returned to the material supply tank. To collect the finished extract, a container 10 is used, before it enters the primary filtering process (separation of the solid phase) on the filter separator 8. The installation provides for the use of reusable circulation of plant material, which is associated with the properties of the plant cell, namely, the complexity of the destruction of the plant shell. Another important point is the lack of pre-treatment of the material before loading, namely, mechanical grinding and wetting of the material.

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