

## Research Trip Summary Report

### Task 2. Foreign mobility of WUST doctoral students

#### I. Data of the doctoral student

1. Full name: **Daniel Szopa**
2. Year of studies: **3<sup>rd</sup>**
3. Educational discipline: **Chemical engineering**

#### II. Foreign research trip (research visit)

1. Research institute in which the foreign research was implemented: **Universitat Politècnica de València**
2. Name and surname of the host person (mentor): **Prof. Dr. Jose V Garcia-Perez**
3. Dates of the research trip: **05.11.23 – 05.12.23**
4. Title and date of a seminar delivered during the research trip: **Ultrasonic hydrolysis is a cost-effective method of producing biostimulants from high-protein materials, 04.12.23**
5. Description of work carried out during the research trip:

The research examined the influence of various types of ultrasound application methods such as ultrasound baths, and the power of ultrasound on the chemical hydrolysis of mealworm larvae. To determine the impact of individual parameters, the ultrasonic hydrolysis parameters were optimized, including the concentration of the extraction medium, the power of ultrasound, and the time of application. In the optimization process, the influence of the mass ratio of solid to liquid was omitted due to the desire for a direct comparison with conventional hydrolysis to determine the benefits of ultrasound application. The effect of temperature was neglected due to process specifications and the impossibility of using constant temperature when using ultrasound. Each obtained sample was analyzed for total nitrogen content as a measure indicating the hydrolysis efficiency for comparative purposes. Ultrasonic hydrolysis was performed at the optimal points obtained during statistical analysis in the STATISTICA program, which was sent to Poland for amino acid profile analysis and in vivo tests.

6. Description of the main results obtained:

The research resulted in:

- It was determined that ultrasounds allow the hydrolysis time to be shortened from 6 h to 12.5 - 15 min.

- In the case of alkaline hydrolysis using KOH, the total nitrogen content increased by approximately 0.25%.
- For acid hydrolysis using H<sub>2</sub>SO<sub>4</sub>, a reduction of the total content by approximately 0.6% was achieved.
- It was established that the key issue in the examination is the concentration of the extraction medium and the strength of the waves.
- Potential future paths of methodology development were indicated, related to examining the mass ratio of the solid-to-liquid phase, and modifying the equipment to work with denser, less liquid media to increase ultrasound propagation.

7. Future collaborations (if applicable):

Due to the short time needed to conduct the research, it would be worth extending the scope of the study on ultrasonic hydrolysis by examining other parameters affecting chemical hydrolysis and modifying the equipment following the conclusions acquired during the trip. The cooperation will continue in terms of finalizing research in writing a scientific publication and further comparison of the obtained hydrolysates, e.g. in terms of amino acid profile.

8. Title and date of a seminar presenting the results of the trip delivered at Wrocław University of Science and Technology after returning from the research trip: **Ultrasonic hydrolysis is a cost-effective method of producing biostimulants from high-protein materials, 18.12.23**

### III. Doctoral student's signature

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(Date)

.....  
(doctoral student's signature)

### IV. Confirmation and information from the host

1. Confirmation of compliance of the information contained in the report: I CONFIRM / DO NOT CONFIRM. *(In justified cases, the confirmation of the host may be sent by e-mail to the Dean's Office of the Doctoral School email: [interdocschool@pwr.edu.pl](mailto:interdocschool@pwr.edu.pl))*

2. Additional information and comments



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(Date)

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(signature(s) of Host)

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