

Study of microplastics formation from wood plastic composites and evaluation of prevention possibilities (MicroWPC)

Project funder – **Latvian Council of Science**

Project name – **LZP FLPP 2022/1**

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Project's progress report for the period **01.07.2024. – 30.12.2024.**

During the reporting period, the project's mid-term report was prepared and submitted. The results obtained on the formation of microcracks in recycled plastics (PP, LDPE, LLDPE, HDPE) under UV radiation are summarized in a paper published in the journal *Polymer Degradation and Stability* (Q1). Weathering tests are being continued, collecting microplastics (MPs) generated from wood polymer composites (WPCs), and the photodegraded WPC surfaces are also characterized to identify surface changes that could indirectly serve as indicators of the initiation of the MPs formation process. In-depth studies are being conducted to understand the mechanism behind the formation of these plastic particles in WPCs, with the aim of identifying the best solutions for preventing their formation.

The MPs collected during the process (referred to as 'real' MPs) are analyzed using gravimetry, ATR-FTIR, microscopy, DSC, and other methods, and the resulting data are processed. Preliminary results indicate that the polymer and wood type, and additives have a significant impact on MPs formation. The size and chemical composition of the MPs depend on the UV cycle during which they were collected. The results concerning the properties of the collected MPs, along with the characterization of 'artificially' obtained MPs (produced with cryogenic mills), will be used for preparing a publication that will highlight the main differences between the two MPs collection methods. During the reporting period, a second scientific paper on WPC weathering and surface changes, ultimately resulting in surface erosion and the detachment of plastic particles (wood shavings exposure) with a size of < 500 μm, was prepared and published in the journal *Forests* (Q1). Work continues on the characterization of WPC surfaces (gravimetry, photofixation, optical microscopy, SEM, contact angle measurements, surface roughness, ATR-FTIR, and spectrophotometry), which allows the identification of various factors that play a significant role in the MPs formation process. The weathering test developed is also being applied to commercial WPC products (decking boards), which will allow the assessment of MPs formation risk in optimal and durable compositions. The students and researchers involved in the project attended a webinar on MPs titled "Which properties of microplastic particles are relevant for their interactions with cells?", organized by SFB 1357 Microplastics. We are actively following and participating in the activities of COST Action CA20101 PRIORITY (Plastics Monitoring Detection Remediation Recovery). During the reporting period, one student was approved and participated in the training program organized by COST Action CA20101 in Ireland.

Publicity and training:

- BSc. Lotārs Oliveris Vasiļjevs participated in the COST Action CA20101 (PRIORITY) training program, "Sub-micron IR Spectroscopy for Advanced Microplastic Analysis," held at University College Dublin, Ireland. The program covered the fundamental principles of sub-micron infrared

spectroscopy, its potential applications, and included practical training in applying the method (Figure 1). Additionally, it provided an opportunity to establish connections for potential future collaborations.

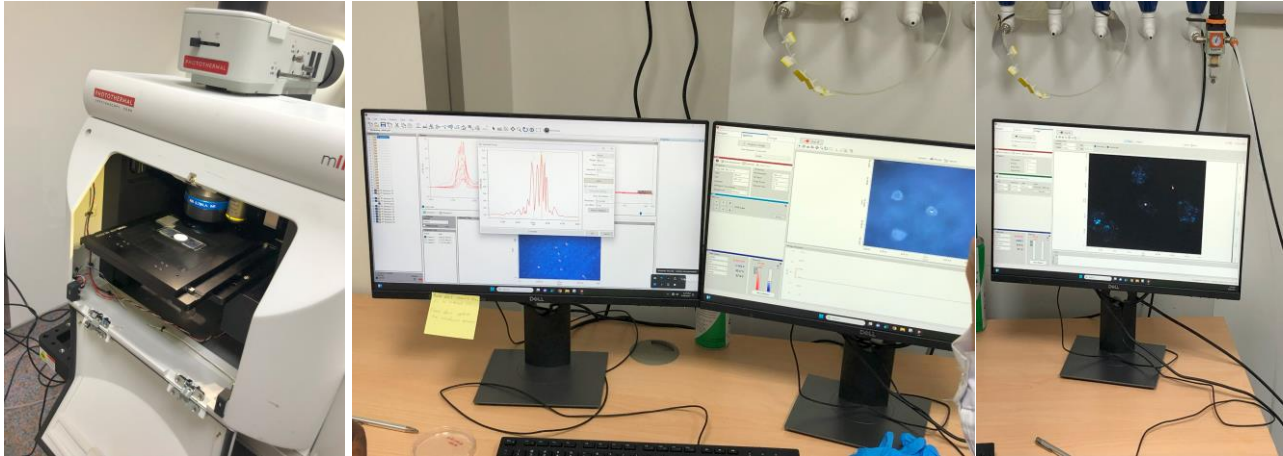


Figure 1. Participation in the COST Action CA20101 training program at University College Dublin, Dublin, Ireland

- A scientific research paper titled "A Step to Microplastic Formation: Microcracking and Associated Surface Transformations of Recycled LDPE, LLDPE, HDPE, and PP Plastics Exposed to UV Radiation" was published in the scientific journal *Polymer Degradation and Stability*. The paper discusses the formation of microcracks in recycled plastics (PP, LDPE, LLDPE, and HDPE) under UV radiation and the mechanisms behind crack formation (Figure 2). The publication is available [HERE](#).

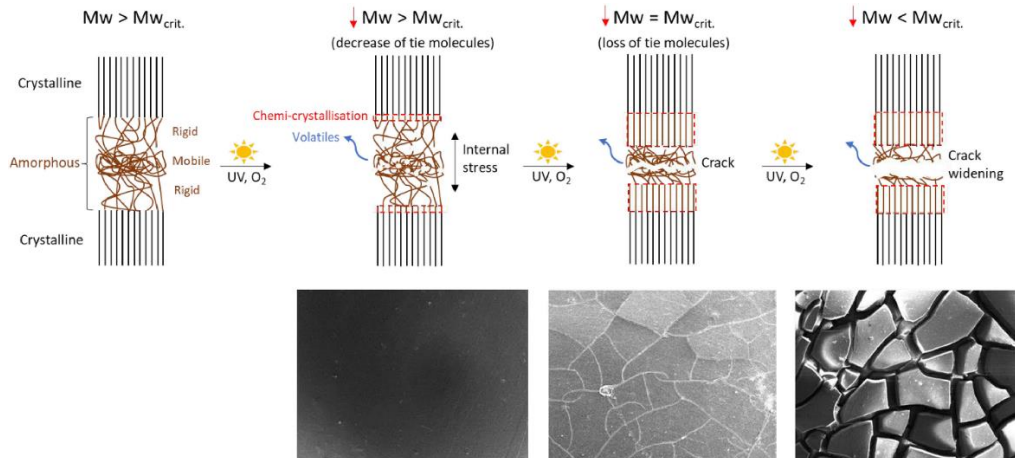


Figure 2. Schematic representation of the microcrack formation mechanism and SEM images illustrating the corresponding stages.

- A scientific paper titled 'Changes in Wood Plastic Composite Properties After Natural Weathering and Potential Microplastic Formation' was prepared and published in the journal *Forests*. The paper presents the results of a study on wood plastic composites (WPC) exposed to natural weathering, changes in surface properties, and analyzes the potential risks of microplastic formation (Figure 3). The publication is available [HERE](#).

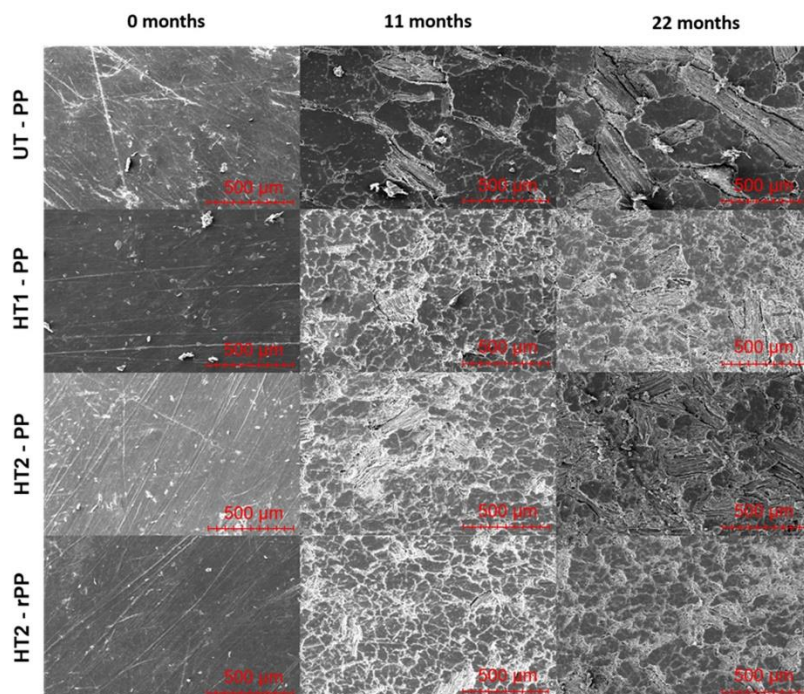


Figure 3. Microscopic images of wood plastic composite surfaces before and after exposure to outdoor conditions.

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