FUNDING PROGRAMME: HORIZON 2020

SUBPROGRAM: Research and Innovation Action

Horizon 2020
European Union Funding
for Research & Innovation

TITLUL PROIECTULUI/ACRONIM:
Understanding exposure and toxicity of Micro- and Nano-Plastic contaminants in humans, POLYRISK

CONTRACT NO.: 964766HO_2021

TOTAL PROJECT BUDGET: 5.991.077,50 Euro **INCDTP'S BUDGET:** 120.047,50 Euro

PROJECT STARTING DATA: 01.04.2021 **PROJECT ENDING DATA: 31.10.2025**

PAGINA WEB: https://polyrisk.science/

PARTNERS

Coordinator: Utrecht University (UU)

Utrecht University

Co-coordinator: Vrije Universiteit Amsterdam (VU)

VU UNIVERSITY AMSTERDAM

Partner: INCDTP

INCDTP

Parteners: Stichting VUmc (VUmc), German Federal Institute for Risk Assessment (BfR), Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA),Norwegian Institute of Public Health (NIPH), University Medical Centre Utrecht (UMCU), Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Ideaconsult Ltd. (IDEA),Health and Environment Alliance (HEAL), Fraunhofer-Center für Silizium-Photovoltaik (CSP), European Research Services (ERS).

GENERAL OBJECTIVES:

- Presenting the risks of microplastic and nanoplastic particles (MNPs) that are ubiquitous in the environment and are likely to enter the human body through inhalation and ingestion. The most bioavailable MNPs, with sizes ranging from sub-microns to nanometers, pose the greatest analytical challenges for chemists. Based on innovative science, stakeholder engagement and strong communication, POLYRISK aims to rapidly reduce current uncertainties about the risk of MNPs and support EU efforts to ensure that public health is adequately protected from the potential risks of MNP pollution.
- Developing a human health risk assessment strategy that will combine highly advanced sampling, sample pre-treatment and analytical methods to detect MNPs in complex matrices, updated fit-for-purpose hazard assessment technologies and multiple real-life human exposure scenarios.
- Focusing on key toxic events related to various chronic inflammatory diseases.

SPECIFIC OBJECTIVES/ EXECUTION PHASES:

Objective 1: Develop and apply innovative sampling, sample preparation and assays to assess internal (human matrix) and external (abiotic) exposure to MNPs

Objective 2: Develop and apply a set of human in vitro tools for testing epithelial transfer and immunotoxicity of MNPs.

Objective 3: Assessment of exposure and biological effects of MNPs in real-life scenarios

Objective 4: Establishment of a risk assessment strategy and determination of the risk to human health for MNPs
Objective 5: Management of data for current use in the development of the MNPs risk assessment strategy and for future in silico predictions

Specific objective -Textile Study

- **Assessment of occupational exposure to textile fibres and effect biomarkers in Romania**

• Determination of the concentration of airborne particles in nr/m^3 and µg/m^3 from the proximity of workplaces, offices and outdoors at 3 times of the production process.

• Collected air samples from the production processes of synthetic fibre textiles, respectively weaving and clothing and complex characterisation of PES and PP particles (SEM, Raman, GS-MS, etc.).

• Collection of biological samples (saliva and blood) before and immediately after the end of the work shift and after (± 16 hours after exposure).

• Measurement of exposure to MNPs and determination of immune system markers.

• Disemination

SCIENTIFIC CONCEPT:

The overall concept of POLYRISK project was built on the following hypotheses, which are all well-established based on state-of-the-art knowledge and our own preliminary studies:

(1) Health risks of MNP, as being comparable with nanoparticles and airborne pollutants, can be best evaluated according to the IATA approach, within the Adverse Outcome Pathway (AOP) framework and using ranking classification approaches.

(2) Risk is a function of hazard (i.e. potential toxicity or effect) and exposure (the amount of substance reaching the biological target). To assess risks, it is essential to find out what the actual internal exposure is: this is the bioavailable fraction. External exposure measurements do not allow us to determine the bioavailable fraction but they are critical to measure for decision makers wishing to know what measures to take to mitigate against risks.

(3) MNP are likely to directly affect various immune cells, in particular innate immune cells such as macrophages and neutrophils. Epithelial cells, regarded as 'front-line' cells in the defense of an organism to the outer world, are also considered being part of the innate immune system. Activation of this innate immunity by particles has been shown to enable inflammation and allergy to co-exposed proteins.

EXPECTED EXPLOITABLE RESULTS:

-Report on available MNP test materials (size 1-100 µm)

-Harmonized methods for sample pre-treatment and MNP analysis report

-Intermediate reports of real-life scenario-specific exposure concentrations resulting in cumulative final report

-Harmonized datasets of MNP in general population human blood for human exposure assessment

-Data-reports on MNP-specific transfer values, direct epithelial effects and effects on specific immune cells

-Harmonized methods for immunotoxicity testing of MNP with Standard Operating Procedures originating, derived from different tasks

-Guidance document for tiered approach immunotoxicity testing of MNP

-Database on exposure and biological effects of MNP exposure available for all five human studies

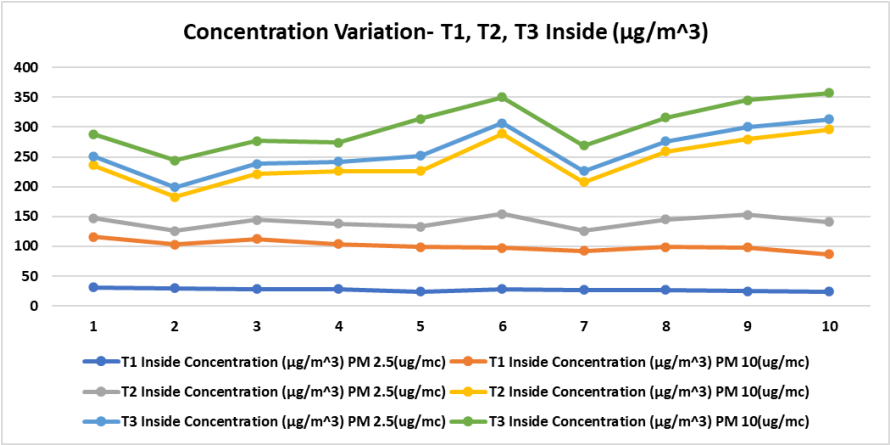
-Report linking measured textile fibre workplace exposure and health effect biomarkers

-Report on human risk assessment strategy for MNP

-Report on risk assessment of selected POLYRISK scenarios

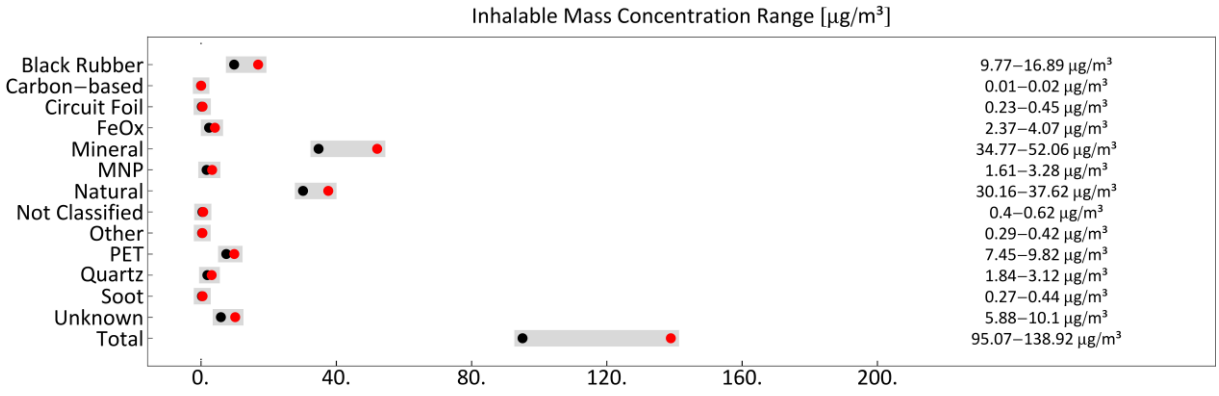
OBTAINED RESULTS:

- Assessment of the degree of human exposure to micro- and nanoplastics originating from textiles;
- Determination of airborne particle concentration, expressed as particle number per cubic meter (particles ranging from 0.3 to 10 µm) and micrograms per cubic meter (particles of 2.5 and 10 µm), in textile companies processing synthetic polymer materials;



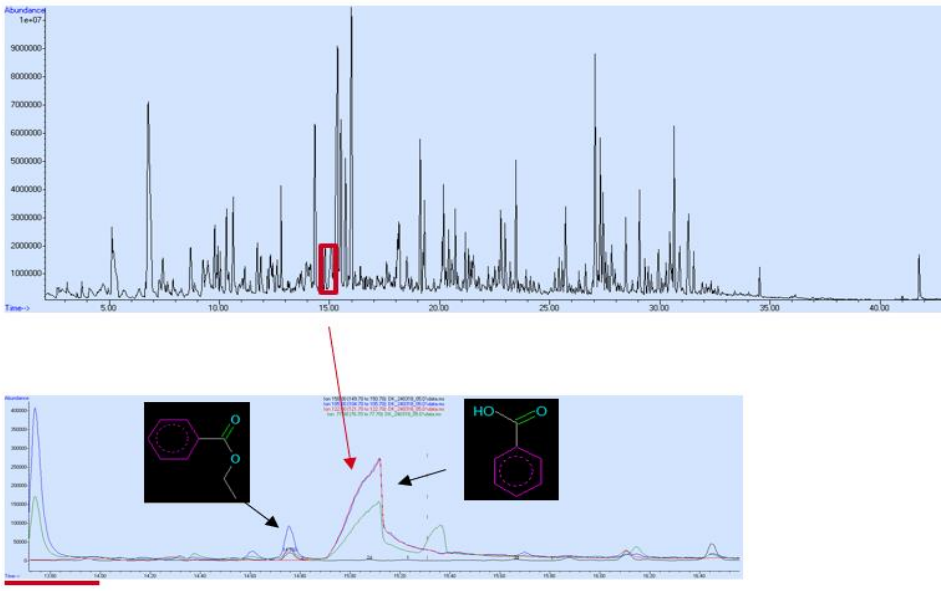
.Concentration of airborne particle (µg/m3)-T1, T2, T3-Inside

- Investigation of the temporal evolution of airborne particle concentration at three locations (production area, office, and outdoor) at three time points (start of work shift, end of work shift, and after 16 hours), with comparative analysis against legal exposure limits;
- Collection of polyester (PET) and polypropylene (PP) particles in the proximity of workplaces and office areas;
- Development of sampling procedures (SOP) using SI filters, including the design and fabrication of holders for selective collection of particles sized 1 µm and 10 µm;
- Development of sampling procedures (SOP) using quartz and polycarbonate filters;
- Determination of collection efficiency correlated with particle concentration and air volume sampled during collection;
- Statistical interpretation of variability in the obtained datasets using specialised software;

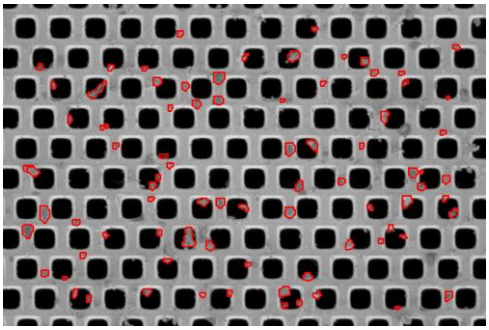


Extrapolated particle inhalable mass concentration in µg/m³ for the particle classes.

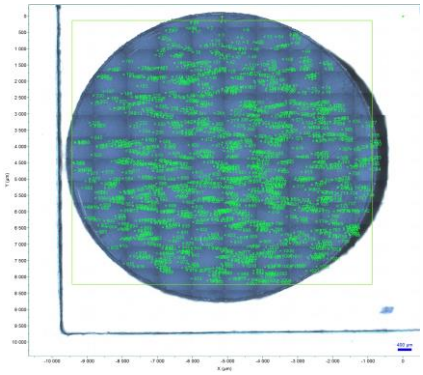
- Investigation of collected particle characteristics through application of advanced analytical techniques including µRaman spectroscopy, FT-IR spectroscopy, SEM (Scanning Electron Microscopy), TED-GC-MS (Thermal Extraction Desorption - Gas Chromatography - Mass Spectrometry), and others.



Total ION Chromatogram -PES



SEM image - PES



Raman mapping -PES

- Collection and characterization of biological samples;
- Evaluation of the cytotoxicity of PES particles;
- Publication of the results in scientific journals and participation in relevant scientific conferences and events.

DISSEMINATION, PATENT APPLICATIONS, AWARDS:

WoS published papers:

- **Visileanu Emilia, Alexandra Gabriela Ene, Catalin Grosu**, Miclea Paul-Tiberiu, **Razvan Scarlat,** *The Structural Influence of Airborne Particles on their Toxicity,* Adv. Mater. Lett. | Issue (April-June) 2023, 23021718, p: 1-8, DOI: 10.5185/amlett.2023.021718
- **Marian-Catalin Grosu, Emilia Visileanu, Alexandra Gabriela Ene, Razvan Victor Scarlat,** Virgil Emanuel Marinescu, *Collection and Characterization of Synthetic Airborne Particles*, Adv. Mater. Lett. | Issue (January-March) 2023, 23011714, p: 1-8, DOI: 10.5185/amlett.2023.011714
- **Emilia Visileanu, Marian Catalin Grosu,** Paul-Tiberiu Miclea, Korinna Altmann, and Dirk Brossell, *Methods for the Collection and Characterization of Airborne Particles in the Textile Industry,* Human Systems Engineering and Design (IHSED2023), Vol. 112, 2023, 1–12, DOI: 10.54941/ahfe1004

SCOPUS published papers:

- **Emilia Visileanu,** Korinna Altmann, Raluca Stepa, Maria Haiducu, Paul Tiberiu Miclea, **Alina Vladu, Felicia Dondea, Marian Catalin Grosu** and **Razvan Scarlat,** *Comparative Analysis of Airborne Particle*

Concentrations in Textile Industry Environments Throughout the Workday, Microplastics, volume 4, issue 2 (June)-2025,pag.199-216.

BDI published papers:

- **Visileanu, E., Ene, A. G., Scarlat, R., & Grosu, M. C.** (2024, February). *Characteristics of plastic particles in the industrial environment*. In AIP Conference Proceedings (Vol. 2924, No. 1). AIP Publishing.
- **A.F. Vladu, E. Visileanu,** R.N. Albulescu, A. Albulescu, *Evaluation of Skin Irritation Potential of Airborne Particles*, Proceedings of the 11th International Conference TEXTEH, DOI: 10.2478/9788367405386-029, P: 207-212;
- Iuliana Scarlat, Raluca Stepa, Maria Haiducu, **Emilia Visileanu, Marian Cătălin Grosu,** *Workers exposure to synthetic textiles microfiber*s, MATEC Web of Conferences 389, 00080 (2024) https://doi.org/10.1051/matecconf/202438900080
- **Grosu Marian Catalin, Visileanu Emilia,** Albulescu Radu, **Ene Gabriela Alexandra,** *Evaluation of Exposure to the Action of Plastic Particles in the Industrial Environment*, CORTEP 2024 IASI-RO DOI: xxxxxx/xxxxx, SCIENDO, ACCEPTED for publication
- **Visileanu Emilia,** Stepa Raluca, Altman Korinna, Miclea Paul Tiberiu, **Vladu Alina, Dondea Felicia, Scarlat Razvan, Grosu Catalin,** *Experiments to assess pollution levels in the textile materials processing industry Annals of the University of Oradea , Fascicle of Textiles, Leatherwork.* Vol.2, no2/2025 pag.100-

Scientific communication:

- **Visileanu Emilia, Alexandrea Gabriela Ene, Alina Vladu,** Albulescu Victor, *The Influence of the Concentration of Plastic Particles in the Air on the Level of Cytokines*,Advanced Nanomaterials and Nanotechnologi Conference,10-11.10.2024, Londra.
- Paul-Tiberiu Miclea , Korinna Altmann , Yosri Wiesner and **Emilia Visileanu,** Real-life airborne micro- and nano-plastic particles and fibres on a porous membrane filter system from a textile factory suitable for both: vibrational and mass spectrometry, POSTER, SETAC, Dublin,2024
- **Emilia Visileanu, Marian Catalin Grosu,** Paul-Tiberiu Miclea, Korinna Altmann, and Dirk Brossell, *Methods for the collection and characterisation of airborne particles in the textile industry*, 5th International Conference on Human Systems Engineering and Design: Future Trends and Applications (IHSED 2023)-, Dubrovnik, Croaţia.
- **E. Visileanu, A. G. Ene, R. Scarlat, M. C. Grosu,** *Characteristic of plastic prticles from the industrial environment.* International Conference on Nanomaterials, Nanofabrication and Nanocharacterization, Liberty Hotels Lykia, Oludeniz, Turky*, 22-28.04.2022*
- **Emilia Visileanu, Alexandra Ene, Marian Catalin Grosu**, Paul Miclea (Fraunhofer, Germania) Razvan Scarlat,*The structure influencer of airborn particles on their toxicity* International Conference on Nanomaterials & Nanotechnolog, 28-31.08.2022-Stockholm, Suedia
- **Marian- Catalin Grosu, Emilia Visileanu, Alexandra Ene, Razvan Scarlat**, Virgil Marinescu**,** *Collection and characterization of synthetic airborne particles,* International Conference on Nanomaterials & Nanotechnolog, 28-31.08.2022-Stockholm, Suedia

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