TORNADO

New routes of safe and sustainable by design water and oil repellent biobased coatings

NEWSLETTER: ISSUE 2

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1.TORNADO TECHNOLOGIES

TORNADO project will contribute to the transition to a safer circular economy by designing new water and oil repellent biobased coatings avoiding the use of PFAS.

To achieve this objective three different but interconnected innovations will be followed:

NEW BIOBASED BIOMONOMERS WITH WATER AND OIL REPELLENCE.

To develop and produce at lab and pilot scale two new biobased monomers obtained from vegetable oils following Safe and Sustainable by Design (SSbD) criteria. Each of them specifically designed to provide water and oil repellence through their functionalization with polydimethylsiloxane (PDMS) and polyhedral oligomeric silsesquioxane (POSS) and to be polymerizable by free radical polymerization processes.

NEW BIOBASED ORGANIC AND HYBRID COATINGS WITH WATER AND OIL REPELLENCE.

New biobased organic and hybrid **waterborne acrylic** coatings → New biobased waterborne organic and hybrid acrylic binders obtained from the previously developed functionalized biomonomers (copolymerized with commercial biomonomers or if necessary, with fossil-based ones) and specifically designed to bring added-value to the corresponding coating formulations for the packaging sector and for textile sector. Moreover, these binders will be polymerized by a scalable polymerization process (emulsion polymerization process).

New Biobased hybrid **sol-gel** coatings → New biobased hybrid sol-gel systems obtained from metal alkoxide precursors and the previously developed functionalized biomonomers and specifically designed to bring added-value to the corresponding coating formulations for kitchenware sector.

DESIGN OF NEW COATINGS FOLLOWING SAFE AND SUSTAINABLE CRITERIA.

SSbD concept will be introduced through the research and technology strategies towards advanced properties, environmentally friendly processes, circularity, human health, and safe environment biobased coatings. The improvement in environmental performance and circularity of the new coatings will be assessed through environmental Life Cycle Assessment, Life Cycle Cost, and social Life Cycle Analysis (LCA/LCC/s-LCA) of the proposed new coatings compared to traditionally used hazardous coatings. Recycling is also a significant issue. Extracting, collecting, and/or removing chemical substances from the macrostructure of the coated substrates represent a great challenge. All environmental and health aspects of the new coatings must be examined in the study by covering resource consumption of energy and materials and overall

emissions over the entire life cycle. This also includes relevant impurities and degradation products from the developed substitutes of PFAS. A strategy will be devised and implemented for efficient data collection, evaluation and in-silico prediction for determining exposure, hazard and fate properties as well as prediction of degradation products. Computational tools will be developed for efficient interfacing with publicly accessible and accepted QSAR-models to facilitate ease-of-use in-silico prediction of required physiochemical properties, toxicological end-points and degradation. Degradation and transformation products will be assessed iteratively to assess an expanded chemical footprint of the developed product.

2. PROJECT PROGRESS

TORNADO activities are aligned with the establish plan. During this period three deliverables have been submitted:

Deliverable	Title
D5.2	1st version Plan for the Dissemination and Exploitation activities including Communication (PDER)
D6.1	Project Handbook
D6.2	Data Management Plan

New functionalized biomonomers

New functionalized acrylated biomonomers with PDMS synthesis route has been defined. The new biomonomers show the require chemical structure to be polymerized by free radical polymerization process.

Safe and Sustainable by Design framework

During the first month of the project a number of in silico tools have been applied by IVL for the prediction of relevant hazard properties of the chemical substances involved in the development of the TORNADO coatings. Those chemicals include the acrylic functionalized biomonomers designed in TORNADOI and the precursors/intermediates and the processing aids involved in their synthesis/functionalization process as well as the chemical substances that will be involved in the synthesis of the waterborne biobased and sol-gel hybrid coating formulations. The hazard properties predicted in silico include environmental fate endpoints such as persistence and bioaccumulation as well as a series of human and eco toxicity endpoints e.g. carcinogenicity, mutagenicity, developmental toxicity, aquatic toxicity, endocrine disruption, skin sensitization etc.

3. ATTENDANCE TO EVENTS

GREENCHEMCO 2023

Last 29nd of June our partner NTT during the "**2nd CONFERENCE ON GREEN CHEMISTRY AND SUSTAINABLE COATINGS**" organized by the University of Pisa present an overview of TORNADO´s solutions in textile sector. The talk was given on Sustainable and performing coatings, organic and hybrids topic as the conference has a dedicated section of the conference on running and incoming European projects in green chemistry and biobased, circular economy.

International Asian Polymer Congress

8th International FAPS Polymer Congress was held at Bahçeşehir University (BAU), Beşiktaş South Campus, Istanbul, between the dates 12th and 14th September 2023. The main focus of this congress was on the amalgamation of green chemistry with polymer sciences for an eco-friendlier future. Our Colleagues from DENGE Kymia, Deniz Güneş and Ayşegül Budak present a poster entitle "**New routes if Safe and Sustainable by Design Water and Oil biobased Coating**" focused on biomonomers functionalization.

Congreso International Adhesión y Adhesivos

During the international Congress of Adhesion and Adhesives held in Malaga 16 and 17th of November, TECNALIA present the concept of TORNADO project as well as the upcoming TORNADO webinar event.

AMI2030 Workshop

Last 21st of November TORNADO project assist to AMI2030 Workshop entitle "Sustainable Materials" held in San Sebastian.
The main aim of the workshop was to present specific case studies focusing on the circularity aspect of materials research and innovation. The event also counted with an exhibition area to showcase projects & activities in the field of sustainable materials, where TORNADO project was shown.

4. UPCOMING EVENTS

EVENT	PARTNER	DATE
	INNOTECH	April 2024
	DENGE KYMIA	April 2024
85th PRAGUE MEETING ON MACROMOLECULES 11th CONFERENCE GCNPM	TECNALIA	June 2024

5. TORNADO NEWS

TORNADO M6 and General Assembly meeting took place in Denge Kimya facilities in Corlu (Turkey) on 21st and 22nd of September 2023. During the meeting the first results of TORNADO project were shared among partners. Moreover, the second day a Workshop was carried in which future actions were discuss. A very exciting meeting and discussions that allow us to continue working very hard on this challenging project.

TORNADO webinar entitle "**New water- and oil-repellent coatings**" was presented last 30th November.

- The future of PFAS (Per- and polyfluoroalkyl substances or perfluorochemicals – EU restrictions).
- How the TORNADO project could contribute to the transition to a safer circular economy by designing new water- and oil-repellent bio-based coatings that avoid the use of PFAS.
- Three different but interconnected innovations will follow:
    - New water- and oil-repellent bio-based biomonomers.
    - New organic and bio-based organic and hybrid coatings with water and oil repellency for the textile, packaging, and kitchen sectors.
    - Design of new coatings following safe and sustainable criteria (SSbD).

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