TORNADO

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

NEWSLETTER: ISSUE 3

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1.TORNADO APPLICATION SECTORS

Paper/paperboard food packaging:

PFAS compounds are often found in food packaging because of their ability to make materials resistant to grease and water and to prevent the food from sticking to the packaging. The grease-resistant properties of these substances mean that they're mostly found in food service papers and paperboard packaging products, which are commonly used by takeaways for foods like burgers, sandwiches and French fries PFAS may be used in:

- fast-food wrappers
- microwave popcorn bags
- take-out paperboard containers
- Pet food bags

In the context of food packaging, studies have shown that PFAS can migrate from the packaging into the food, adding to the overall PFAS exposure of the general population. The more we learn about these chemicals, the more reason there is for concern, and the more urgent it becomes to minimise emissions and exposure. By way of illustration, between 2008 and 2020, the European Food Safety Authority lowered the recommended safe levels of exposure to some PFAS by more than 99%. Long-chain PFAS have been used in fibre packaging for many decades to provide a functional barrier against oil and moisture.

How TORNADO Will Contribute to Packaging Sector

- Paper is a highly desirable material in the packaging, printing and labelling industry
- The food packaging industry is experiencing one of the most relevant revolutions associated with the transition from fossil-based polymers to new materials of renewable origin.
- Coating technology was proposed as an additional strategy for achieving a more rational use of the materials used within the food packaging sector
- TORNADO proposal aims to develop new waterbased biobased coatings able to provide to the packaging structures water and oil resistance to be a new alternative for more environmental packaging products.

	ADVANTAGES	DISADVANTAGES
PAPER	low cost light-weight good mechanical properties biodegradability renewability	poor water and oil resistance

Textile

The textile sector is said to be responsible for almost half of PFAS consumption

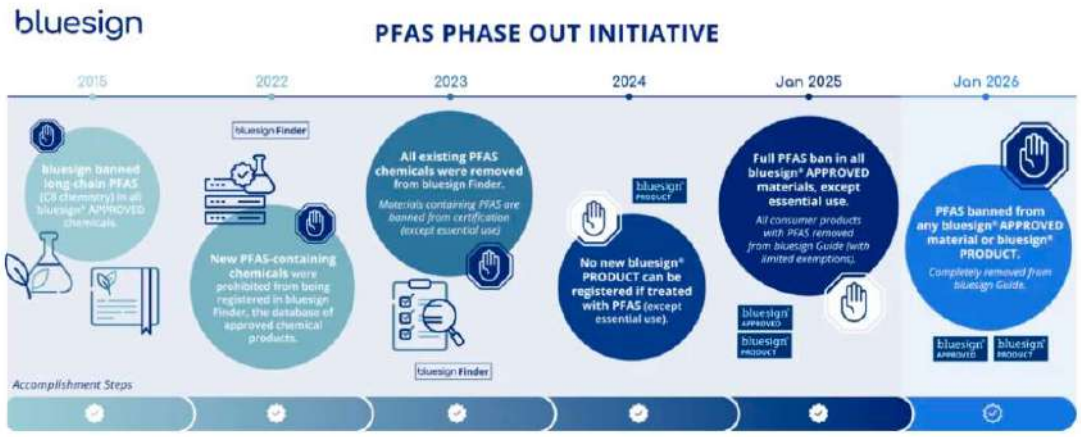
PFAS are widely used in the textile and leather industries as waterproof membranes and surface finishes to impart water-, oil-, and stain-resistance.

45 to 80,000 tonnes of PFAS are consumed annually within the EU for application in the so-called TULAC (Textiles, Upholstery, Leather, Apparel, Carpets) industries.

PFAS are banned by some international recognised certification as such The **Global Organic Textile Standard** (GOTS) that aims to ensure the organic status of textiles, from the harvesting of raw materials to environmentally and socially responsible manufacturing processes.

GOTS-Global organic Textile	
Substance Group	**Criteria**
PFAS	
All PFAS compounds including PFCA (incl FFOA), PFSA (incl. PFOS) FTOH, PFNA, PFDA, PFOSA, PTFE	**X PROHIBITED**

Organizations such as Bluesign that it is a global sustainability solutions provider serving the textile, apparel, and footwear industries part of the SGS Group. Bluesign helps companies to eliminate harmful substances from their supply chains, improve their environmental and social performance, and certify products, materials, and facilities to the highest standards. A timeline image present by Bluesign reflects bluesign's science-based approach to eliminating harmful PFAS-based substances



How TORNADO Will Contribute to Textile Sector

- Tornado will contribute to currrent understanding of water and oil repellency using a novel silicone chemistry and binder technology to replace PFAS.
- Tornado will help to create more compatible textile formulation compared to PFAS.
- Tornado is expected to contribute less energy consumption during the curing of binder as a coating.
- Tornado will contribute more affordable solutions for water and oil repellency.

Kitchenware

The fluorine polymers used for cookware coatings are very long chain plastic materials (>100,000 Daltons).

Fluorine polymers are ideal for making food contact materials due to their inertia and long life

The extreme chemical inertness based on raw materials not present in nature that makes doubts about sustainability especially in the production and processing phases of the polymers and at the end of the useful life of the coated articles.

How TORNADO Will Contribute to Cookware Sector

- **Safe during domestic use**, limiting the production of fluoropolymers will increase the commitment to research and push the market towards SUSTAINABLE ALTERNATIVE PRODUCTS as has already happened for single-use plastics.
- The raw materials involved in TORNADO project coating have **natural origins** such as soybean oil and inorganic materials such as silica and alumina.
- The process used for the vitrification and formation of the coating will be reduced in 200ºC resulting in a reduction in CO2 emission
- Lower presence of volatile substances

- At the end of its useful life even if burned or sent to the foundry, will not emit fluorinated substances into the environment but will transform into a mineral powder very similar to **natural sand**.

2. PROJECT PROGRESS

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

Deliverable	Title
D1.1	Biomonomesrs based on acrylation of soybean oil
D1.2	Functionalization of biomonomers with silicone chemistry
D2.1	TORNADO SSbD criteria strategies

New functionalized biomonomers

A new synthesis route for functionalized acrylated biomonomers incorporating PDMS has been successfully defined within the TORNADO project. These innovative biomonomers exhibit the required chemical structure to undergo polymerization via a free radical process, opening new possibilities for advanced material development in sustainable applications.

This achievement marks a significant step forward in our research efforts toward high-performance, bio-based polymer systems.

Waterbased biobased acrylic binders for textile and packaging coatings formulations

The TORNADO project has successfully completed its first preliminary synthesis using the miniemulsion polymerization process. These early trials demonstrated the ability to incorporate up to 25 wt% of bio-based functionalized biomonomers—an encouraging step toward developing high-performance, sustainable polymer materials.

This achievement highlights the project's progress in advancing innovative, eco-friendly solutions for the materials of the future.

Safe and Sustainable by Design framework

During the first months of the project a number of in silico tools have been applied 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 TORNADO 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

Meeting Pack 2024

The conference took place on 10 and 11 April 2024 at the **Valencia Conference Centre**. Attendees had the opportunity to discuss the environmental sustainability of food packaging and the need to combine it with the high-barrier functionality that the market demands of these products. Our partner **INNOTECH** had the opportunity to present TORNADO project research line in packaging sector.

Smart & Technical Textiles 2024

The leading international trade fair for technical textiles and non-wovens took place **from 23rd till 26th April 2024 in Frankfurt**, The Enterprise Europe Network was organized an international brokerage event for companies, research institutions and all stakeholders who want to explore joint projects, technical cooperation or new business contacts with partners from Europe and worldwide. Our partner **Sun Tekstil** had the opportunity of presenting TORNADO project.

International Fibre and Polymer Research Symposium (ULPAS)

The 14th International Fiber and Polymer Research Symposium took place last 24-25th May 2024 at Bursa, Turkey. Our colleagues from **Sun Tekstil** presented a poster entitle "***New routes of safe and sustainable by design water and oil repellent biobased coatings***" showing how TORNADO will face the challenge of replacing PFAS based coatings.

AUTEX 2024 World Conference 2024 (Association of Universities for Textiles)

The main aim of the workshop was toThe **AUTEX** conference brings together academics, researchers and industry partners from various universities, research and technological centres and companies who are interested in the amazing areas of fibres, textiles, clothing and more. The conference serves as a platform for exchanging ideas, presenting the latest developments and trends, proposing new solutions, promoting international collaborations, and networking.

Conference Topics:

- Advanced fibers and Materials,
- Innovative Functional Textiles,
- Technical Textiles,
- Composites and Membranes,
- Protective Textiles,
- Medical Textiles,
- Tissue Engineering,
- Implants,
- Smart, Interactive, and Multifunctional Textiles,
- and Textile Processing.

Our partner NTT present a poster entitle ***Showing how TORNADO will contribute to textile sector***.

Polymers for sustainable future 2024

85thPMM/11th GCNPM

The Polymers for Sustainable Future 2024 conference, which was held in Prague, Czech Republic, 24–28 June 2024, reflects current global problems and challenges in the field of polymers and plastics in relation to the environment. The goal of the conference was to bring the latest scientific findings in the field of polymer materials from both academia and industry, reflecting the current global problems associated with the sustainability of polymers and plastic pollution of the Earth.

The conference combined two traditional scientific meetings, the 85th edition of Prague Meeting on Macromolecules (PMM) and the 11th edition of the Green Chemistry and Nanotechnologies in Polymeric Materials (GCNPM). During the conference our partner TECNALIA in collaboration with Denge Kimay presented the oral presentation entitle **"New waterborne biobased acrylic binders with water repellency without the use of PFAS".** During the presentation the first results achieved in TORNADO related to waterbased biobased binder were presented.

4. UPCOMING EVENTS

EVENT	PARTNER	DATE
On-line webinar TECNALIA-Fluidex "**PFAS problemas, legislación y soluciones alternativas en recubrimientos y ligantes"**	TECNALIA	July 2024
	AIMEN/RINA	November 2024

	TECNALIA	November 2024

5. TORNADO NEWS

TORNADO M12 General Assembly

On February 14–15, 2024, the TORNADO consortium gathered in the beautiful city of Florence for its M12 General Assembly, hosted by our partner NTT. The meeting provided a valuable platform for partners to present and discuss the latest project results, fostering collaboration and shared insights.

The second day featured a dedicated workshop focused on defining future actions and strategic planning. The engaging discussions and collaborative spirit made this a highly productive and inspiring event, reinforcing our commitment to advancing this ambitious project.

PRESENTATION OF THE TORNADO PROJECT COORDINATOR TO THE PROPLANET CONSORTIUM

PROPLANET 12M Consortium Meeting Highlights Collaboration with TORNADO

The PROPLANET project held its 12-month consortium meeting on February 20–21, 2024, in San Sebastián, Spain, hosted by project coordinator TECNALIA.

During the event, Raquel Rodríguez, coordinator of the TORNADO project (also from TECNALIA), presented an overview of TORNADO to the PROPLANET consortium. This exchange fostered valuable synergies between the two initiatives, reinforcing shared goals in advancing sustainable and innovative solutions.

THE 1ST NON-PFAS SISTER PROJECT CLUSTER KICK-OFF MEETING

Successful Kickoff: First No-PFAS Cluster Meeting

The first No-PFAS cluster meeting, held on May 14th, was a great success! Partners from BIO-SUSHY, ZEROF, PROPLANET, and TORNADO came together for this inaugural event, united by a common goal: developing PFAS-free alternative solutions.

The meeting offered a valuable platform to align project goals, identify shared challenges, and explore opportunities for future collaboration. A special thank you to BIO-SUSHY for hosting and organizing this inspiring and productive gathering.