BIO-SUSHY

SUSTAINABLE SURFACE PROTECTION BY GLASS-LIKE HYBRID AND BIOMATERIALS COATINGS

4th BIO-SUSHY e-NEWSLETTER

IN THIS ISSUE

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AXIA INNOVATION

1. Welcome to the 4th BIO-SUSHY Newsletter

Dear BIO-SUSHY community,

As we wrap up a productive year, we are delighted to share the 4th edition of our e-Newsletter. This issue highlights key advancements in developing PFAS-free coatings, including coating technologies, SSbD implementation, and tools supporting market adoption.

We proudly celebrate being named **CORDIS Project of the Month** and provide updates from our M18 project meeting at MaterialsWeek 2024, alongside a preview of the upcoming M24 meeting at ITENE. Our participation in events like Polymers 2024, IndTECH 2024, and ETCC24 reflects our strong industry and academic engagement.

Explore our latest blog articles and join us in upcoming events as we work toward a sustainable future for textiles, food packaging, and cosmetic glass packaging industries.

Thank you for your support!

Warm regards,
The BIO-SUSHY Team

BIO-SUSHY Consortium at the MaterialsWeek 2024 in Limassol, Cyprus

2. Project Progress

Timeline

PROJECT START
01/01/2023

Cluster Kick-off Meeting with Sister Projects

Online
January 2024

1st BIO-SUSHY SSbD Training

Online
26 November 2024

M17

Milestone 4

Intermediate assessment of coatings functional properties, performances, environmental impact

June 2024

M18

BIO-SUSHY named as CORDIS Project of the Month

June 2024

M23

M24 Project Meeting at ITENE

Valencia, Spain
5-6 February 2025

M26

PROJECT END
31/12/2026

Public deliverables

Some of our deliverables have been approved, and since they are set as public, you can consult them for free. Click on them to download.

Number	Title	Lead beneficiary	Nature
D3.1	Knowledge and data exchange infrastructure specifications	7P9	Report
D5.1	Corporate Image and Communication Tools	AXIA	DEC*
D5.2	Plan for the Dissemination and Exploitation including Communication activities (PDEC) updated	AXIA	Report
D5.5	Report on the standardisation landscape and applicable standards	UNE	Report
D5.6	Web-based project management platform, management manual & templates	Materia Nova	DEC*
D6.3	Data Management Plan	7P9	Report

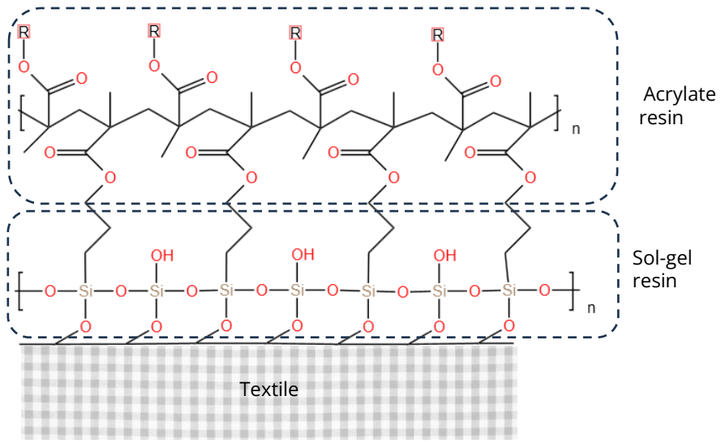
*DEC: Websites, patent fillings, videos, etc.

3. Research Highlights

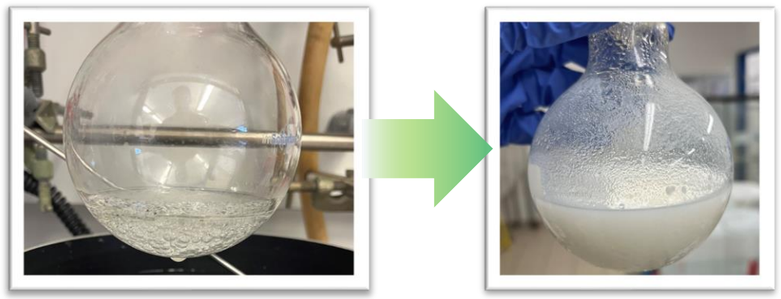
Novel coating development

Applus+ RESCOLL is the leader of work package (WP) 2 on the development of novel coatings. Over the past few months, Applus+Rescoll has been **synthesizing acrylate** to successfully form a stable solution with a suitable viscosity and to mix well with their **sol-gel resin**.

Coating application on textile



Acrylate resin synthesis



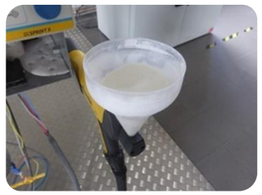
Overview of the objective and progress in the coating development for textiles using a combination of acrylate resin and sol-gel resin. Through process optimization, which included synthesis duration and catalyst percentage, a successful synthesis of acrylate/sol-gel resin with good viscosity and protocol compliance was achieved.

For **SiKEMIA**, the main goal during this period was to **optimize the functionalization process of $CaCO_3$ particles and cellulose** to enhance their hydrophobic properties while maintaining their dispersibility in the formulations.

This work has directly supported the overall objectives of the BIO-SUSHY project by providing hydrophobic particles for glass packaging and textile applications, contributing to surface roughness essential for achieving omniphobic, fluorine-free coatings. These contributions strengthen the project's capacity to achieve its key deliverables and milestones.

Wood K Plus focused on developing thermoplastic powder coatings by **increasing the bio-based content in coating formulations** with the same target values for grease resistance and water repellences as previously identified for food packaging use cases. Interesting toxicity assessment results have been observed (Univ. Leeds) when testing individual coating components, e.g., lignin and modified lignin. Thus, the future strategy in developing powder coatings will be to design coatings with an. **optimum lignin/thermoplastic polymer content without potential leaching of the coatings**

1) Compounding



2) Grinding

3) Spray coating

4) Hot pressing

The four sequential steps involved in developing organic powder coating formulation. It begins with 1) compounding, where raw materials are mixed to create a uniform blend, followed by 2) grinding to produce a fine powder suitable for application. The powder is then applied to a substrate through 3) spray coating, ensuring even coverage. Finally, the coated substrate is subjected to 4) hot pressing, where heat and pressure are applied to cure the coating and achieve optimal adhesion and finish.

As of today, **Ecozema** has been involved in testing the coating provided for the cardboard substrate on an industrial scale. The selected best performing powder coating formulations (according to the KIT rating and grease resistance targets KPIs of packaging use cases) will be tested in the future, considering extrusion coating as a technology (for scale-up procedure) as one of the common state-of-the-art paper coating technologies.

Materia Nova is developing a laboratory sol-gel formulation and a specific spray tool for applying the coating inside bottles and containers. In this last period, Materia Nova achieved the first preliminary results on **PFAS-free hydrophobic sol-gel coating applied inside glass containers.** Materia Nova is also working on the coatings' Life Cycle Assessment of the three case studies.

The cream slip test is used to evaluate the slipperiness properties of a cream product. In this case, we compared the slipperiness of two inner glass surfaces: a glass surface coated with our PFAS-free coating pigmented to visually detect its presence and uniform application (left), and a reference glass uncoated (right). Start: just after putting a drop of cream product; End: containers after several minutes. Uncoated glass shows cream residues contrary to the sol-gel coated one highlighting its promising sliding properties

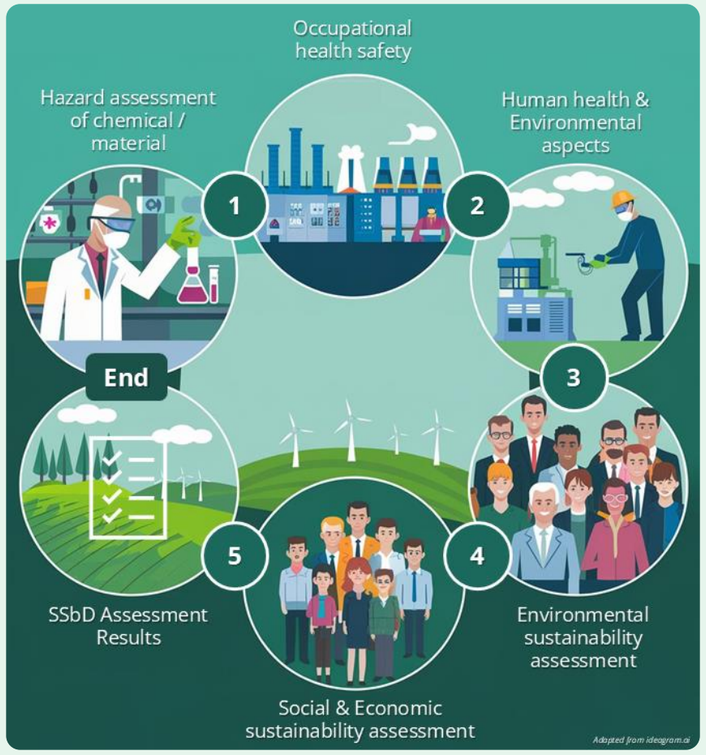
IFTH is contributing to communication and dissemination by attending roundtables and conferences and communicating about the project. For example, IFTH

participated and presented at RECIT, a French textile stakeholders roundtable, and attended the International **Sol-Gel Conference** in Berlin to meet and discuss with sol-gel experts.

SSbD Framework and Toxicology Assessment

During the last months, **ITENE** worked on continuing the SSbD assessment for the three case studies, with a special focus on **step 2** of the framework, and **conducting experimental toxicological studies on coating samples**.

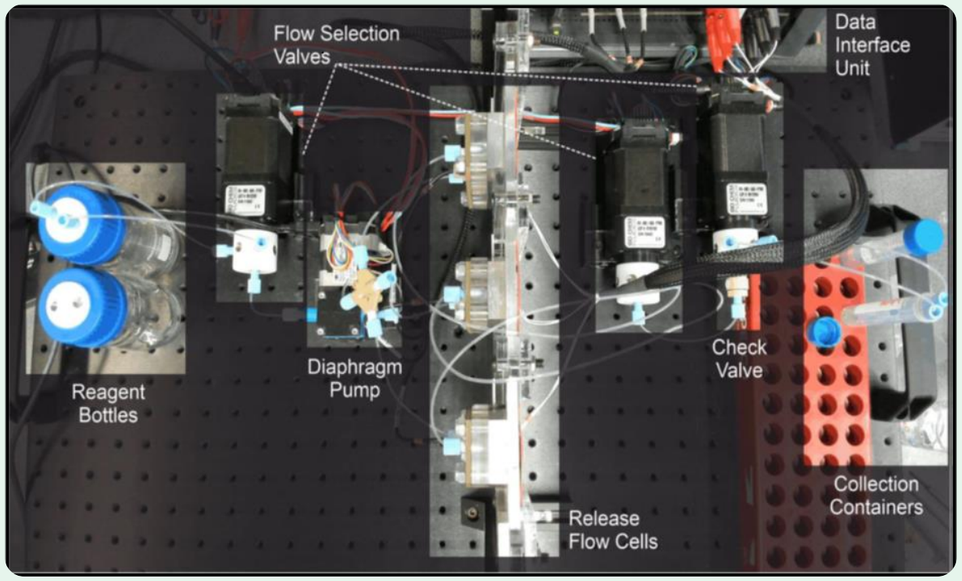
ITENE is conducting detailed analyses on the safety of the raw materials used to formulate the coatings. This work, carried out on the first coatings made, is fundamental in decision-making to guide the production process towards obtaining safer products.



SSbD methodology and steps.

University of Leeds is responsible to screening the coatings developed in the project.

For this purpose, they have been using an **electrochemical (bio)membrane sensor** to measure (bio)membrane activity in coatings, formulations, and compounds. Moreover, they also use **a release flow cell technology** to subject coatings to artificial weathering conditions for screening of the resultant leachate for (bio)membrane activity.

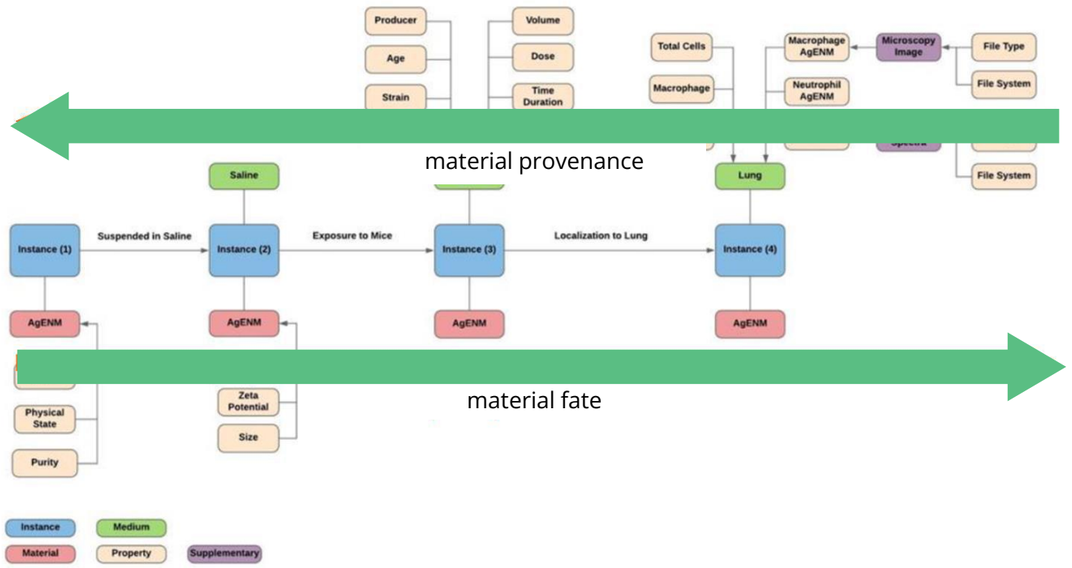


The mini release accelerator, used in combination with the bio-membrane sensor, is used to assess the toxicity of our novel coatings.

Computational Tools

Seven Past Nine's main goal during this period was to **control the quality of the information on the starting materials** extracted from safety data sheets and public databases. This was needed since they found errors and inconsistencies (more minor in the SDS and more severe in the public databases like PubChem) in the chemical characterization data. **Workflows** have been created to validate the information based on different sources and provide some quality evaluation of entries to be used for **further extraction of physicochemical and toxicity/sustainability data** from these data

resources. These are currently further automated and integrated into the general data collection workflows.
Additionally, further discussions with partners (ProtoQSAR, RESCOLL, WoodK+) and integration of their data took place and will be intensified in the next period).

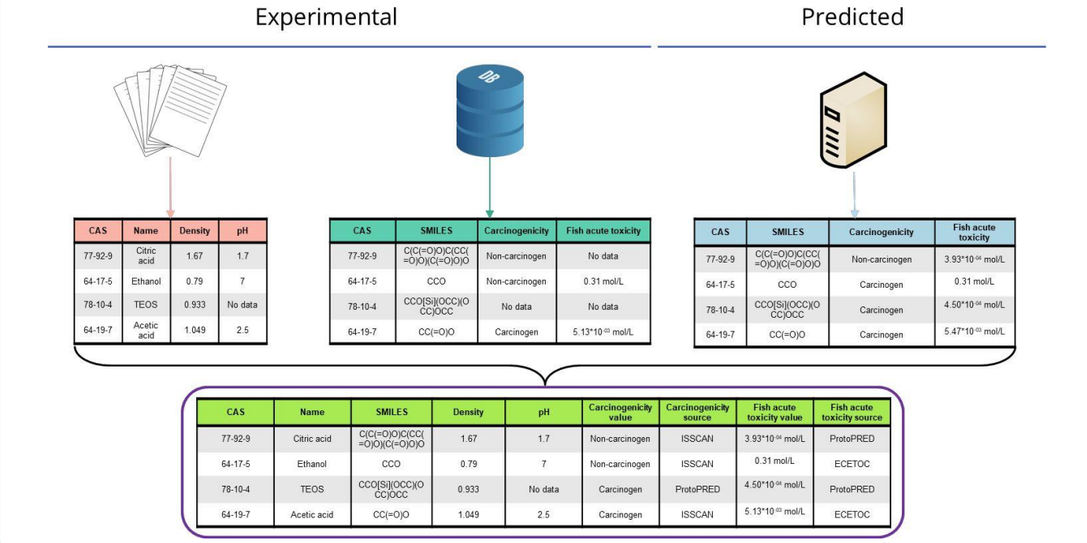


An instance map visualizing a nanomaterial's fate in a mesocosm experiment, looking at its effects on mice's lungs. Following the instance map backward, the material provenance can be extracted, describing the material and its previous life cycle stages.

The **CNR** unit has significantly progressed in **developing multi-scale modeling techniques** for PFAS-free food tray packaging.

Through **molecular dynamics (MD) simulations**, CNR team identified promising bio-based materials with repellent properties comparable to traditional PFAS coatings. The team's sophisticated modeling approach evaluates critical performance indicators while investigating material safety and leaching behaviors. By reducing experimental testing and providing detailed material insights, CNR's research supports BIO-SUSHY's goal of creating sustainable, safe packaging solutions that can effectively replace harmful PFAS-based materials.

ProtoQSAR is advancing in developing a **computational workflow to extract existing experimental data** from public databases, complementing it with predicted data from QSAR models. These advancements focus on **developing the code and integrating several databases** and QSAR software results as information sources. During this period, meetings with ITENE have been held to plan possible next steps and functionalities, such as automatically assigning a score to chemicals to perform the SSbD assessment.



CAS	Name	Density	pH
77-92-9	Citric acid	1.67	1.7
64-17-5	Ethanol	0.79	7
78-10-4	TEOS	0.933	No data
64-19-7	Acetic acid	1.049	2.5

CAS	SMILES	Carcinogenicity	Fish acute toxicity
77-92-9	C(C(=O)O)C(CC(=O)O)(C(=O)O)O	Non-carcinogen	No data
64-17-5	CCO	Non-carcinogen	0.31 mol/L
78-10-4	CCO[Si](OCC)(OCC)OCC	No data	No data
64-19-7	CC(=O)O	Carcinogen	$5.13*10^{03}$ mol/L

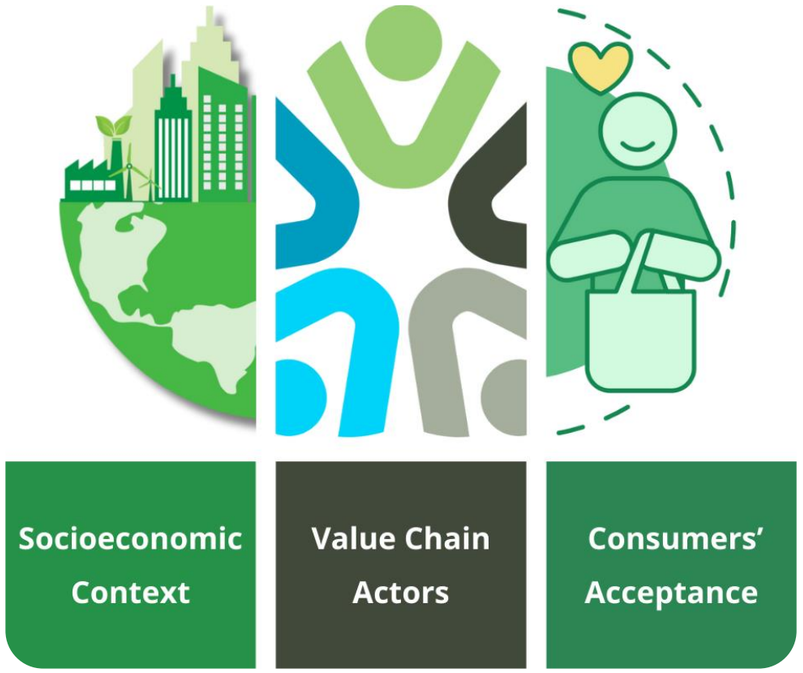
CAS	SMILES	Carcinogenicity	Fish acute toxicity
77-92-9	C(C(=O)O)C(CC(=O)O)(C(=O)O)O	Non-carcinogen	$3.93*10^{04}$ mol/L
64-17-5	CCO	Carcinogen	0.31 mol/L
78-10-4	CCO[Si](OCC)(OCC)OCC	Carcinogen	$4.50*10^{04}$ mol/L
64-19-7	CC(=O)O	Carcinogen	$5.47*10^{03}$ mol/L

CAS	Name	SMILES	Density	pH	Carcinogenicity value	Carcinogenicity source	Fish acute toxicity value	Fish acute toxicity source
77-92-9	Citric acid	C(C(=O)O)C(CC(=O)O)(C(=O)O)O	1.67	1.7	Non-carcinogen	ISSCAN	$3.93*10^{04}$ mol/L	ProtoPRED
64-17-5	Ethanol	CCO	0.79	7	Non-carcinogen	ISSCAN	0.31 mol/L	ECETOC
78-10-4	TEOS	CCO[Si](OCC)(OCC)OCC	0.933	No data	Carcinogen	ProtoPRED	$4.50*10^{04}$ mol/L	ProtoPRED
64-19-7	Acetic acid	CC(=O)O	1.049	2.5	Carcinogen	ISSCAN	$5.13*10^{03}$ mol/L	ECETOC

Schematic example of the compilation of a comprehensive table with all the necessary information to perform the SSbD assessment using different data sources

Social Acceptance, Standardization, Dissemination & Exploitation

ZSI, the Centre for Social Innovation, is finishing Deliverable 1.3, which **analyzes the three BIO-SUSHY value chains** to strengthen the coating solutions' uptake. Interesting to see is that the combination of rising attention for PFAS and the increasing traction of sustainable economy initiatives is creating a fertile ground for the work of BIO-SUSHY. Explaining the details of this development and exploring the consequences for the project will drive the deliverables arguments. Furthermore, as part of their work, they also participated in the MaterialsWeek in June in Cyprus. It was interesting to present there, especially because it made for an interesting interdisciplinary experience in which they discussed social acceptance and public trust among material science and chemicals experts.



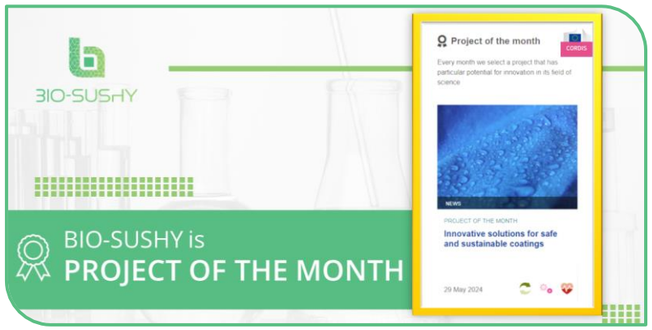
Social acceptance in the BIO-SUSHY project.

UNE is working on the D5.7. This "Second report on the contribution to standardization and standardization roadmap" records the actions performed and the **results of the interaction with the standardization system**. These interactions are addressed to the standardization committees previously identified (D5.6), where the relevant stakeholders in the pertinent fields are represented.
The three main technical committees (TC) (CEN/TC 134 "Resilient and textile floor coverings," CEN/TC 194 "Utensils in contact with food," and CEN/TC 392 "Cosmetics") will be updated with the new project outcome. They have also received a Regulatory & Compliance survey to gather insights on our BIO-SUSHY coatings.

In this last period, **AXIA Innovation GmbH** has focused on collecting and analyzing feedback from the various stakeholders and distributing forms for consumers, stakeholders, and regulatory and compliance bodies. This work will contribute to the deliverable D1.3 on **assessing the value chains** (led by ZSI and set to be public).
While continuously **updating the communication channels** with news about the blog articles, events attended, and activities, AXIA **developed preliminary individual business plans** for each industrial partner and conducted SWOT and PESTLE analyses for each value chain. AXIA helped partners define their Key Exploitable Results (KERs), exploitation routes, and preliminary IP strategies. The work has been included in D5.3, the mid-term Plan for Exploitation Dissemination and Communication (PDEC) of results, due by the end of month 24, halfway through the project timeline.

4. News

BIO-SUSHY Named CORDIS Project of the Month



In June 2024, we achieved a significant milestone by being selected as the Project of the Month by CORDIS, the European Commission's Research and Innovation information service. CORDIS's monthly selection process identifies projects that demonstrate exceptional innovation and impact. This recognition highlights our work developing sustainable, PFAS-free coatings for textiles, food packaging, and cosmetics. Read the article here.

Our Blog Articles

We publish a blog article every four months to provide insights into the main concepts behind the BIO-SUSHY project. If you are new to BIO-SUSHY and want an accessible and engaging way to learn the project's concepts and goals, the blog articles are an excellent starting point.

In our last article, Blog #5, we explored the **social acceptance** of our bio-based coatings.

The blog articles are periodic; the next one will be out by the end of February 2025.

M18 Project Meeting at MaterialsWeek 2024

The BIO-SUSHY project hosted its Month 18 project meeting during the MaterialsWeek 2024 conference, which took place from June 17–21 at the Crowne Plaza Hotel in Limassol, Cyprus. MaterialsWeek brought together diverse R&I communities to discuss on collaboration and address challenges in materials science, with a focus on SSbD, circularity, and resilience.

During the hybrid meeting, the BIO-SUSHY team had a chance to discuss the project progress, share insights, and align on the due milestone on "Intermediate assessment of coatings functional properties, performances, environmental impact".

On the other hand, the conference saw several presentations from our partners, including ZSI, 7P9, CNR, Wood K Plus, and ProtoQSAR. In particular, ProtoQSAR's presentation on "Database Generation Workflow for Supporting SSbD Risk Assessments" earned the "Data & Tool FAIRness Competition Award" from the PARC project, recognizing the efforts in implementing FAIR principles.

Data & Tool FAIRness Competition Award given to ProtoQSAR at the MaterialsWeek 2024 on June 2024 (Limassol, Cyprus).

SSbD Training

On November 26th, we hosted our first online training session focusing on Sustainable and Safe-by-Design (SSbD) principles. The virtual event brought together project partners from ITENE, Wood K Plus, and the University of Leeds.

The SSbD training covered the SSbD framework's application in safety assessment, different lignin types, project-generated toxicity data, and practical implementation strategies. Participants engaged in a discussion that examined the complex safety considerations of lignin compounds, bridging theoretical principles with practical approaches to developing environmentally responsible materials.

Click here to watch the recordings and download the slides from the presentations. In the following months, more training sessions are planned.

Upcoming M24 Project Meeting in ITENE

The upcoming project meeting, hosted by ITENE and on February 05-06 in Valencia (Spain), will mark an important halfway point for our project and provide a deep overview of the current progress and the next steps.

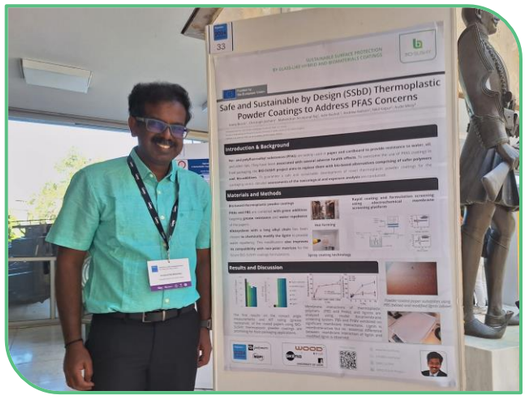
The External Advisory Board will also participate in the first-day meeting. It will be presented with a general project overview and a 1.5-hour session for each of the three case studies (paper-based food tray packaging, glass cosmetic packaging, and textile).

The second day of the meeting will be limited to project partners. It will start with a general assembly and continue with specific presentations for each project work package.

5. Events participation

Polymers 2024

On May 28-31, 2024, we participated in the Polymers 2024 conference in Athens, Greece. This event, which had over 300 participants, provided a platform for our partners to present their work on sustainable polymer applications and their efforts to address pressing environmental concerns, particularly around PFAS.



Project partners AXIA Innovation and Wood K Plus presented two posters during the conference:

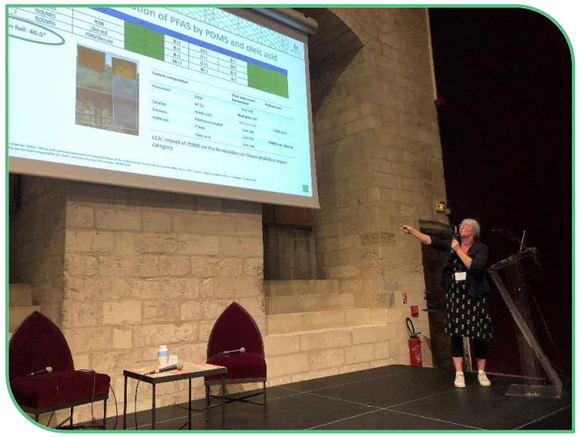
- "Utilizing Bio-Based Coatings To Address PFAS Concerns – A Strategic Analysis Using PESTLE and SWOT Tools": This poster offered a detailed strategic analysis of bio-based coatings, employing PESTLE and SWOT frameworks to evaluate their potential as sustainable alternatives to PFAS-containing materials.
- "Safe And Sustainable By Design (SSbD) Thermoplastic Powder Coatings To Address PFAS Concerns": This research focused on developing innovative thermoplastic powder coatings that prioritize safety and sustainability, addressing the growing regulatory and environmental challenges associated with PFAS.

IndTECH 2024

From June 3 to June 5, 2024, our project coordinator, Mireille Poelman (Materia Nova) and our 7P9 and Acumenist partners participated in the INDTech 2024 conference in Namur, Belgium. The conference focused on smart manufacturing, sustainability, and advanced materials, and BIO-SUSHY had a dedicated booth in the exhibition space with other EU-funded projects.

Moreover, our project coordinator delivered a presentation during Session 1, "A New Generation of Advanced Materials Fit for the Circular Economy." The talk showcased BIO-SUSHY's groundbreaking work in developing novel PFAS-free coatings and their potential to drive the transition toward a circular economy.

European Technical Coatings Congress (ETCC) 2024



MATERIA NOVA represented the BIO-SUSHY project at the European Technical Coatings Congress (ETCC) 2024 in Avignon, France, presenting "Safe and Sustainable by Design Replacement of PFAS in Water and Oil-Repellent Glass-Like Hybrid Coatings" to an engaged audience of 50-70 participants. Our project coordinator's presentation, part of the SUSTAINABILITY session, highlighted our innovative approach to developing safe alternatives to PFAS that maintain water and oil repellency without the harmful environmental impacts of traditional coatings. With 250 attendees from various industry sectors, the congress provided an excellent platform for showcasing BIO-SUSHY's commitment to sustainable materials science.

6. Future events

EVENT	DATE	PLACE	ACTIVITY
STS Hub 2025	11-15 March 2025	Berlin, Germany	Abstract submitted by ZSI on *Examining a future with bio-based chemicals: Between critical analysis and constructive engagement*
European Coatings Show	25-27 March 2025	Nuremberg, Germany	Presentation by Applus+Rescoll: Development of alternatives PFAS in textile applications using sol-gel technology in a SSbD strategy Presentation by Wood K Plus: *BIO-SUSHY PFAS free solution with focus on thermoplastic based powders for food packaging applications* Presentation by Materia Nova: *Safe and Sustainable by design hydrophobic oleophobic PFAS-free ceramic-like coating for glass packaging* Booth SiKEMIA
SICT 2025	23-25 April 2025	Albufeira-Algarve, Portugal	Possible workshop with sister projects
SETAC Europe 35th Annual Meeting	11-15 May 2025	Vienna, Austria	Training session by ITENE and Wood K Plus: *Safety and Sustainability Assessment in the context of EU SSbD Framework* Abstract submitted for poster presentation by ITENE: *Contributions on the development, implementation and assessment of SSbD alternatives to PFASs in the packaging industrial sector* Booth ProtoQSAR

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