Development of verified safe and sustainable PFAS-free coatings for food packaging and upholstery textile applications

Informe

Información del proyecto

ZeroF

Identificador del acuerdo de subvención:
101092164

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Inversión en las prioridades políticas de la Unión Europea

Agenda digital	○	Aire puro	◐
Inteligencia artificial	○	Acción por el clima	◐
Biodiversidad	○		

Coordinado por
TEKNOLOGIAN TUTKIMUSKESKUS VTT OY
Finland

Este proyecto figura en...

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Periodic Reporting for period 1 - ZeroF (Development of verified safe and sustainable PFAS-free coatings for food packaging and upholstery textile applications)

Período documentado: 2023-01-01 hasta 2024-06-30

Resumen del contexto y de los objetivos generales del proyecto

ZeroF develops safe-and-sustainable-by-design (SSbD) coating alternatives to replace PFAS compounds in food packaging and upholstery textiles value chains. The developed coatings will have limited water absorption, high oil/ grease resistance for packaging and high water and oil repellency for textiles. We propose the development of coatings from reasonably-priced precursors so that the end product remains under the targeted 20% increase compared to current alternatives. To reach the environmental impact target of >25% improvement, we use renewable feedstock, non-toxic compounds and improve higher process efficiencies. PFASes are replaced by two chemistries, cellulose fatty acid esters for packaging and silane-based organic-inorganic hybrids for textiles. The project includes three work streams: food packaging, upholstery textiles and SSbD analysis. Both food packaging and textile workflows follow a similar path (chemical development, formulation, coating, and validation). The SSbD analysis actively analyses the data regarding environmental impacts (Life Cycle Assessment, Life Cycle Cost, and Environmental Footprint) and toxicology (e.g. hazard and law, Green Toxicology principles). Computational methods are employed to model the toxicology and performance of developed chemistries in-silico, to reduce in-vitro testing and to generate tools for certification and standardization process. Certification and regulatory roadmap are developed to identify future regulatory needs and knowledge gaps. SSbD models are developed within the EC-suggested framework to be easily adapted to other sectors beyond the project scope. A mix of research and industrial partners able to cover both packaging and textile coating value chains including end-users comprises the consortium.

Trabajo realizado desde el comienzo del proyecto hasta el final del período abarcado por el informe y los principales resultados hasta la fecha

ZeroF details a series of sophisticated experimental activities and notable advancements in the field of biomaterial solutions. The primary focus has been on the synthesis of biobased and organic-inorganic complexes, as well as various biobased waxes. This work aimed to elucidate the intricate relationships between the conditions and properties of coatings, alongside evaluating the coatings' manufacturability.

A notable achievement includes the development of a biobased coating system utilizing polysaccharide fatty acid esters. This system was explored through a variety of polysaccharides, fatty acid chains, and degrees of substitution to optimize its performance. In the realm of organic-inorganic hybrid coatings the progress has been in formulating water-based solutions to be compatible with textile end-uses and developing new solutions that enhance hydrophobicity and oleophobic performance. This advancement is crucial for improving the safety, sustainability and functionality of coatings.

ZeroF emphasizes collaborative efforts with partners and in the project we have spend special attention for sharing information and material between the partners. For example in packaging work stream has provided several batches of the established coating system for further development and application in textile coatings and vise versa. Moreover, the exploration of biowaxes in wet processes has been instrumental in understanding their performance characteristics, both in coating applications and wet additions.

In laboratory scale, good hydrophobicity and oleophobic performance for textiles has been achieved with contact angles comparable to the PFAS systems and application specific testing is under way. In packaging side new powder coating setups have been estabilished and laboratory results are very promising in the case of water vapor and Cobb test. Additional developments are under way to ensure good oil barrier as well as KIT results.

Furthermore, in ZeroF we have initiated the first iteration of the Safe and Sustainable by Design (SSbD) framework implementation by the consortium. This initiative is of significant relevance to policy development, supporting key action plans such as the Green Deal, Chemicals Strategy for Sustainability, Zero Pollution, and the Circular Economy.

Avances que van más allá del estado de la técnica e impacto potencial esperado (incluida la repercusión socioeconómica y las implicaciones sociales más amplias del proyecto hasta la fecha)

The project is half way completed and the results of the extensive work done with polymer / organic-inorganic complex synthesis and biomaterial derivization is currently being tested against the application specific requirements. The main improvements to current state of the art have been:

Development of water based Ormocer systems, that could be utilized in textile industry where the industry has moved away from solvents due to the safety and environmental reasons

Improvement of Ormocer properties to better match the properties of PFAS. This would allow the fabric, and clothing manufacturers to substitute the PFAS based systems with less harmful alternatives

Development of novel modified polysaccharides and coating formulations. The developed information has given the project team valuable knowledge of the structure-property relationships and allowed us to increase the performance of the coatings, without increasing cost or implying additional burden to the environment

ZeroF project logo

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