Project title

Public report

Project within FFI Circularity
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Fordonsstrategisk
Forskning och
Innovation

Content

FFI in short

FFI, Strategic Vehicle Research and Innovation, is a joint program between the state and the automotive industry running since 2009. FFI promotes and finances research and innovation to sustainable road transport.

For more information: www.ffisweden.se

1. Summary

Car companies are restricted from using recycled plastics in the car interiors due to potential emissions from the plastics. In the project Volvo, Glenntex, and Sotenäs symbioscentrum developed consortium to utilize Glenntex's novel solution to help utilize postconsumer Swedish ocean plastics (ocean plastic) inside cars, thus introducing material circularity. For this, a novel graphene-based gas-barrier was developed by Glenntex. This was used to cover the ocean plastics to produce plaques. This gas-barrier was designed to prevent particles and emissions from the ocean plastics from passing through into the car cabin, thus finding a new method to use postconsumer/ recycled plastics inside cars. The secondary goal of the project was to have a car interior component that, in the end of cycle of the car interior component, the laminate can be peeled off and the plastic component can be recycled and reused inside cars. The project succeeded in achieving this goal of create a product that can be circularity and open new markets for local ocean plastics.

The secondary goal of the project was to provide material value for Swedish ocean plastic. Generally, these materials are expensive to collect and demanding to recycle. Due to this, the material is expensive and have limited applications. Many of which are in downcycling. Through this project, we indirectly investigated the potential to upcycle ocean plastic and provide use cases of such plastics that would make it more accessible. This too was successfully achieved in the project.

2. Sammanfattning på svenska

Bilindustrin har länge haft utmaningar med att använda återvunnen plast i bilinteriörer, främst på grund av risken för utsläpp från materialen. I vårt projekt tog vi fram en ny lösning för att göra det möjligt att använda svensk havsplast i bilar och samtidigt främja en cirkulär användning av material. Glenntex utvecklade en innovativ grafenbaserad gasbarriär som applicerades på havsplasten. Barriären är designad för att hindra skadliga ämnen och partiklar från att nå bilens kupé, vilket öppnar nya möjligheter för att använda återvunnen plast i fordon.

Ett annat viktigt mål var att skapa en bilinteriörskomponent där gasbarriären enkelt kan avlägsnas i slutet av komponentens livslängd, så att plasten kan återvinnas och återanvändas i nya bilar. Projektet lyckades med detta och har därmed bidragit till att skapa en cirkulär produkt som kan bana väg för nya marknader för svensk havsplast.

Vi ville också höja värdet på svensk havsplast, som ofta är dyr att samla in och svår att återvinna. På grund av detta är materialet kostsamt och används ofta till nedgraderade tillämpningar. Genom projektet utforskade vi möjligheterna att uppgradera havsplasten och hitta nya användningsområden som kan göra materialet mer attraktivt och värdefullt. Även detta mål uppnåddes framgångsrikt inom projektet.

3. Background

As large automotive industry players such as Volvo works to reduce its environmental footprint, one area that's gaining attention is the use of sustainable materials, especially among Swedish car manufacturers. With the growing concern about plastic pollution, particularly in our oceans, the idea of incorporating recycled ocean plastics into car manufacturing is becoming more appealing. It's an opportunity that offers social, economic, and environmental benefits. But it's not without its challenges. The main issue is that these post-consumer plastics can be inconsistent and often contain various contaminants, which can affect their performance in car interiors. For example, ocean plastics might carry chemical, physical, and biological contaminants that could influence the smell, feel, and overall safety inside vehicles. This makes it tough for manufacturers, who often end up relying on virgin plastics even though there's a strong desire to switch to more sustainable alternatives.

To tackle these challenges, the consortium is working on adapting Glenntex's gas-barrier technology specifically for the automotive industry. Their goal is to not only improve the barrier's ability to prevent the release of unwanted chemicals and physical contaminants but also to ensure that these recycled materials meet the strict safety and durability standards required for cars.

By finding a viable way to use recycled ocean plastics in car interiors, the consortium partners are helping the industry reduce waste and cut down on the use of virgin plastics. This project also aligns with global sustainability goals, particularly SDG 12 (Responsible Consumption and Production), SDG 14 (Life Below Water), and SDG 09 (Industry, Innovation, and Infrastructure).

If this project succeeds, it could change how recycled materials are viewed and used in high-performance applications, leading to greater acceptance and integration of sustainable materials across various industries. Moreover, demonstrating the usefulness of ocean plastics could open the door for their widespread application and help bring down material costs. By overcoming the technical hurdles associated with using ocean plastics in car interiors, Glenntex and its consortium are not just advancing their own technology; they're setting a new benchmark for innovation and sustainability in the automotive sector.

4. Purpose, research questions and method

The project aimed to advance the use of Swedish ocean plastic in the automotive industry, by adapting the partners gas-barrier technology for overcoming environmental and safety challenges of postconsumer/ocean plastic. Our work seeks to contribute to the circularity and sustainability of automotive manufacturing, emphasizing the integration of recycled materials like ocean plastic.

We asked 4 research questions in the project.

1. How can the gas-barrier technology be modified and applied to develop car interior components maximum ocean plastic and maximum material circularity.
2. What are the most effective processing techniques for adapting the gas-barrier technology, ensuring scalability, workflow efficiency, and optimal adhesion/removal when layered with ocean plastic?
3. How does the can interor components produced with gas-barrier laminate and ocean plastic perform in terms of flame retardancy, abrasion resistance, and gas permeability when applied to ocean plastic. Will it clear the standards required to be adopted.
4. What potential new partnerships can be developed to accelerate the adoption and further development of gas-barrier technology, supporting circularity in the manufacturing of plastic car interior components?

To achieve our goals, we begin by developing a gas-barrier laminate that meets the design criteria of the automotive industry. The focus was to then shift to identifying and optimizing the processing techniques necessary for successful adaptation, considering factors such as scalability and workflow efficiency.

Later, we produced the plaques (representation of the parts) and conduct rigorous characterization tests to assess its flame-retardant properties, abrasion resistance, and gas permeability. This evaluation was done to ensure the plaques maintains its integrity and functionality in the targeted application in car interiors.

Finally, we will seek to identify new R&D partners, market needs, and strategies for greater adaption of the technology for material circularity to support the ongoing development of this technology, enabling further advancements in circularity within the automotive industry, with potential applications beyond car interiors.

5. Objective

The main objective of the consortium is to introduce properties such as the transparent, flame-retarded, abrasion resistance, to the gas-barrier laminate, specifically for implementation in car interiors. These requirements were designed to achieve realistic success parameters. Transparency was dropped as a criteria as automotive grade plastic conditions were taken, which is usually black. This also implied that such a design could be widespread applied in a project and not just in high-end car design. Automotive grade PP was used as a reference and maximum utilization of post-consumer ocean plastic (PP) was the central focus.

Scalability and circularity of the technology was another central theme of the project. At the scale of the feasibility study, specific processing methods were selected and identified.

The project was designed to be experimental research initiative with the goal of modifying the microstructure and surface properties of the gas barrier laminate. Thus, from the perspective of displaying the potential of the technology and feasibility transparency and investigating PA was identified as non-requirements, which initially was assumed to be part of the objective.

6. Results and deliverables

The project successfully demonstrated the technical feasibility of its objectives. By the project's conclusion, the technology had not only been developed but also shown to be scalable. With this technology, ocean plastic that previously didn't meet automotive standards was now suitable for industrial applications. Samples were produced with up to 92% ocean plastic. These results were encouraging.

The project underscored the significant value of utilizing degraded Swedish ocean plastic, delivering technical, environmental, and social benefits. These benefits align with the project's core goals: to enhance material circularity in automotive interiors and to increase the value of ocean plastic.

Various production techniques were explored. We found that different approaches were needed at the lab scale versus full-scale production. Due to the unique characteristics of ocean plastic, several limitations were identified during lab testing, which informed the design of our scaling strategy.

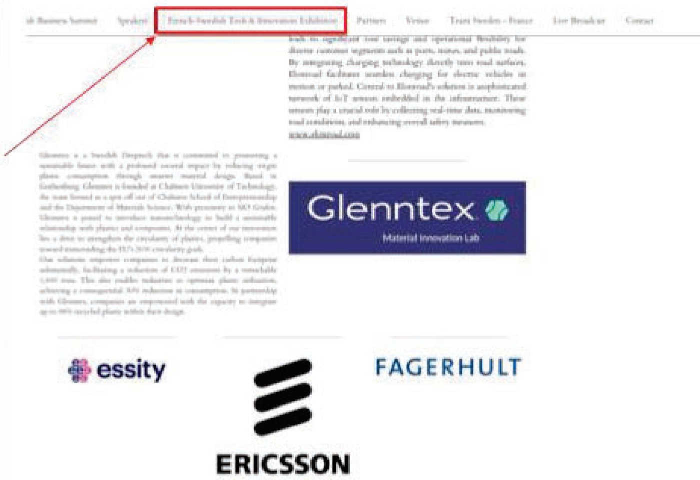
Multiple interviews were conducted with companies to identify future research partners, early adaptors of the technology, and other industries that can adapt the technology. This has led to a comprehensive understanding of the potential of the technology and market needs.

7. Dissemination and publications

7.1 Dissemination

How are the project results planned to be used and disseminated?	Mark with X	Comment
Increase knowledge in the field	X	The results and the usefulness of the technology was presented at conferences and international events.

Be passed on to other advanced technological development projects	X	The results, knowledge, and business cases studies in this project has helped be the basis for identifying and further expansion applicability of the technology.
Be passed on to product development projects		-
Introduced on the market		
Used in investigations / regulatory / licensing / political decisions		



The objective and the benefits of the project was presented during the French Swedish Business Day in Paris.

https://www.frenchswedishbusinessday.com

7.2 Publications

Direct scientific publications were not generated due to the confidential nature of the project.

8. Conclusions and future research

The project showed that ocean plastic can be economically and safely be used inside automotive car interiors with a circular outcome. This acts as the bases for future projects and this results will be converted into higher TRL project to test in full scale.

9. Participating parties and contact persons

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Maria Pettersson

Glenntex
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