

New Products from Waste PVC Flooring and Safe End-of-Life Treatment of Plasticizers

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1. Introduction

Our dependence on plastics, driven by affordability and convenience, has resulted in a global environmental issue. Every year, millions of tons end up in landfills, oceans, and ecosystems. The current "take-make-dispose" economic model is unsustainable for plastics. We need a circular economy. A circular economy for plastics prioritizes keeping materials in use for extended periods. This means recycling, reusing, and minimizing waste. This shift benefits the environment by reducing pollution, but also creates economic and social advantages such as job creation, resource efficiency, and lower greenhouse gas emissions.

The EU-funded project Circular Flooring aims to enable circular use of plasticized PVC (PVC-P) from waste flooring by developing recycling processes that eliminate plasticizers including hazardous phthalic acid esters (e.g. DEHP). End-of-life flexible PVC floor coverings potentially contain 'legacy plasticizers' which may no longer be used today for reasons of consumer protection and which in the meantime have been replaced in the EU by safer alternatives. State-of-the-art recycling of such flooring with recovery of PVC in virgin-like quality therefore requires a technically sophisticated separation of these 'legacy plasticizers'. Circular Flooring meets this challenge with an innovative, dissolution based recycling process, which was developed by the Fraunhofer Institute for Process Engineering and Packaging IVV (Freising, Germany) and adapted to the special needs of plasticized PVC from old flooring.

2. Project Goals

Circular Flooring aims to enable a circular use of plasticized PVC from flooring waste by a recycling process (see Figure 1) that eliminates legacy phthalic acid esters that are not compliant with the EU REACH Directive. Additionally, a recycling process for recovering secondary legacy phthalate-free PVC from flooring waste will be developed, thus preventing usable resources from landfill or incineration. These are transformed into safe alternatives. Once recycled, a close cooperation with flooring manufacturers is planned to demonstrate that circular PVC and plasticizers are applicable in new flooring systems. Alongside the technical work, Live-Cycle-Assessments, health and safety assessments and economic feasibility studies accompany the work.

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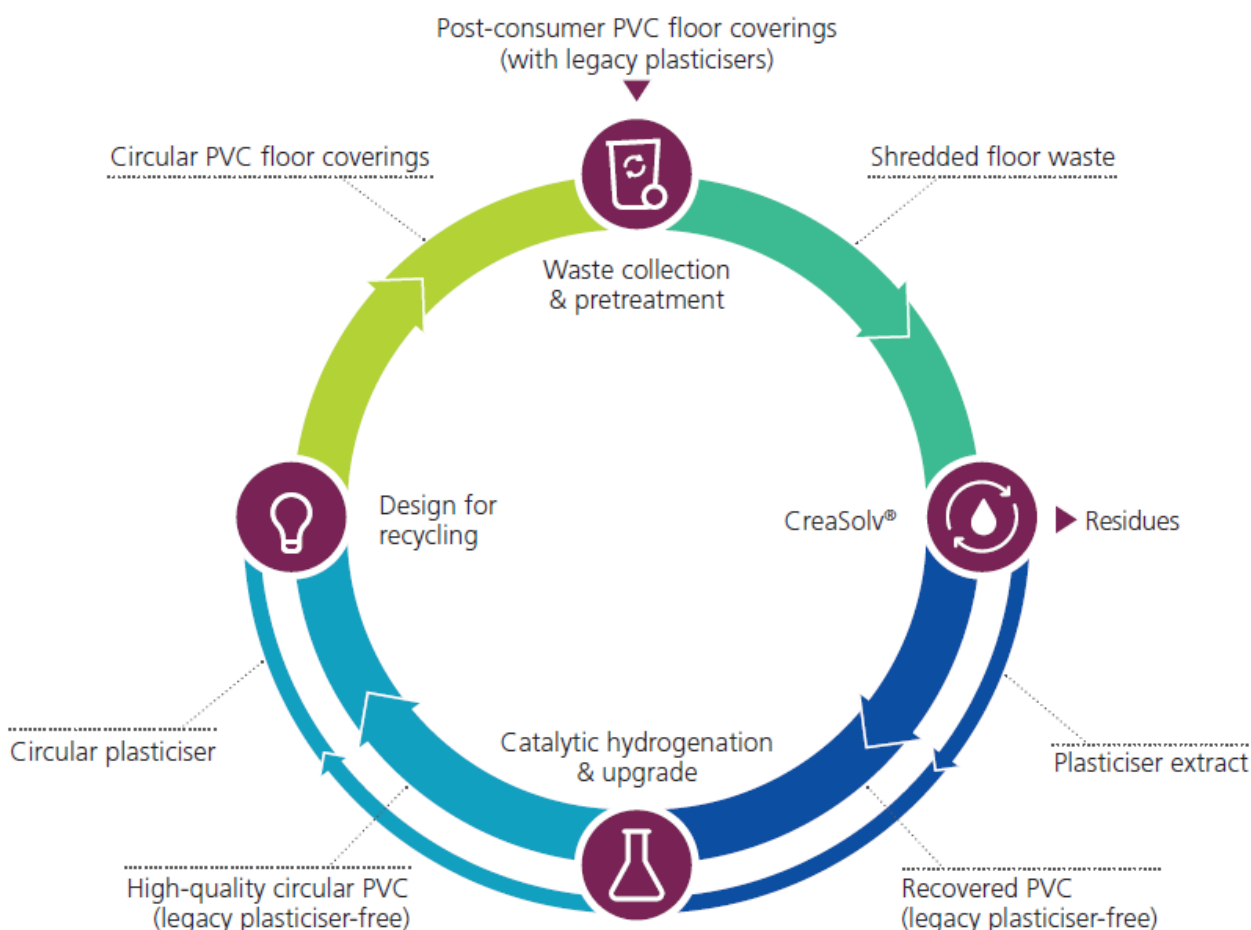


Figure 1: The recycling process

3. Impacts on European industry, society and the environment

In 2022, a total over 58.7 Mt of plastics were produced in Europe, whereas only estimated 13.1% of the production was gained from post-consumer material streams. The PVC share of the total European plastic produced is 9.1%, which corresponds to a total quantity of approximately 5.3 Mt⁴. Based on these figures, the impact of the project becomes clear as by implementing a dissolution based recycling process, the recycled share of the entire European plastic production would significantly be increased. Besides the raw materials consumption, current production of the vinyl chloride monomer entails a high energy demand and corresponding emissions, various by-products detrimental to the environment as well as an interrupted value chain in terms of resources recovery. PVC is often used for long-lasting products (> 25 years) and contributes already (because of its nature) to the environmental protection, in contrast to single-use or less durable plastics. Through a dissolution based recycling process, the PVC life cycle is considerably extended, and indispensable PVC usage would become more sustainable. The PVC industry, which employs > 500,000 people in Europe, will become stronger the future. In addition, the PVC recycling activities will create new jobs and by this strengthen the economy of European member countries.

⁴ Plastics Europe - Enabling a sustainable future (The Fast Facts-2023)

4. Conclusion

The Circular Flooring project stands as a testament to the potential of innovative recycling technologies in creating a circular economy for plastics in Europe. By successfully developing a method to remove hazardous additives from waste PVC flooring and transform it into high-quality recycled material, the project offers a sustainable solution for a widely used material. The environmental benefits are clear: reduced reliance on virgin plastics, minimized waste generation, and lower greenhouse gas emissions. Additionally, the project offers economic advantages by strengthening the PVC industry and fostering job creation in the recycling sector.

However, achieving a truly circular plastics economy in the EU requires a multifaceted approach. While the Circular Flooring project demonstrates technological advancements, broader challenges remain. Continued efforts are needed to increase demand for recycled plastics, establish stable regulations for recycling technologies, and ensure robust safeguards against hazardous substances. This necessitates collaboration across all stakeholders – policymakers, industry leaders, and consumers – each playing their part in fostering sustainable practices. By combining innovative solutions like Circular Flooring with a comprehensive and collaborative approach, Europe can pave the way for a more responsible and environmentally friendly future for plastics.