



The circular economy in action

**CLOSED-LOOP RECOVERY
OF POLYSTYRENE FOAM AND BROMINE**

**PolyStyreneLoop
AS PART OF
A CIRCULAR ECONOMY**



In contrast to the current practice of incineration or landfill, this unique recycling plant will be the first "Closed-Loop" recycling process for polystyrene foam mainly from building & construction waste, with or without impurities. Crucially, it demonstrates that PSLoop can fully contribute to the Circular Economy, by reducing the CO₂ emission, and as such preventing the increase of Climate Change.

Polystyrene (PS) foams are known for their outstanding insulation and shock absorbing abilities. They are well tried and tested for use in various applications. After they have been used, PS foams remain a valuable material source for new raw material and for a variety of products. Especially in the packaging sector, there are already many effectively successful recycling systems in place throughout Europe.

PS FOAMS CONTAINING HBCD

Since the 1960s, a flame retardant (HBCD) has been used in foam insulation boards. For many years, it was the best solution to ensure safety in case of fire and to meet national fire regulations. However, HBCD is now considered a pollutant. It can therefore no longer be used and has been replaced by another flame retardant. Millions of tons of PS foam waste can no longer be regularly recycled. A best practice agreement for the handling of this waste is essential. With the innovative recycling process used by PolyStyreneLoop (PSLoop), an industry-scale recycling process for HBCD containing PS foams will be developed. This technology has already been included in the UNEP Basel Convention as a best available recycling technology to handle HBCD waste.

The PSLoop demonstration plant (with the capability to handle 3 million kg of PS waste per year) is aimed to start up end of 2018. It is funded by many companies from the entire PS foam value chain, and has also attracted the support of a European LIFE Grant. The project will demonstrate the technical, economical and environmental viability of this new recycling process, and will lead on to further roll out the process at more plants in many countries throughout Europe.



THE KEY FEATURES

These are the key features of this project and how they are likely to impact areas such as science, technology, ecology and the economy:

- It creates a durable market place for PS foam products for the future.
- It uses a unique dissolution process for plastics with persistent organic pollutants (POPs), based on the CreaSolv® process.
- A high quality recyclate (Polystyrene and bromine) is obtained for re-use (upcycling).
- The project shows an innovative cooperative approach by bringing together PS foam partners from across the whole value chain.
- It receives strong support from national and EU authorities, in recognition of its contribution to the Circular Economy agenda.
- Experience and expertise are gained from the demonstration recycling plant, to prove the technical, economical and environmental feasibility of the CreaSolv® technology.
- After proof of concept, the intention is to roll out the technology across Europe, in order to be able to handle an increasing amount of PS foam waste in the future.



THE OBJECTIVE

In general, the PolyStyreneLoop project will demonstrate how PS value-chain partners have a strong desire to contribute to the Circular Economy and meet the requirements by ensuring technically, economically and environmentally sustainable recycling.

In particular, the project objective is to develop a safe and sustainable closed-loop treatment process for PS foam waste containing HBCD, creating as an output new raw materials that can be reused in new products.



THE SOLUTION

PolyStyreneLoop is developing an elegant solution with a physical recycling process, based on the CreaSolv® Technology. The applied technology turns PS foam waste into new high quality raw material. During the recycling process, all kinds of impurities, such as cement or other construction residues, as well as the flame retardant HBCD are safely removed and destroyed, while the valuable bromine component is recovered. A key project deliverable will be an industrial scale demonstration plant located in the Netherlands.



THE ORGANISATION

The PolyStyreneLoop Cooperative U.A. is a non-profit organisation founded by Synbra and ICL in the Netherlands. The focus is on demonstrating that PS foams can contribute to a circular economy. Members of the cooperative are industry representatives from the whole PS foam value-chain. The main goal of the Cooperative is the building and operation of the demonstration plant.



THE STRATEGY

The success of this project and the full-scale application of the innovative technology will ensure that the best available technique for recycling of the growing PS foam waste stream is implemented throughout Europe. That is indeed strategic thinking.



THE TECHNOLOGY

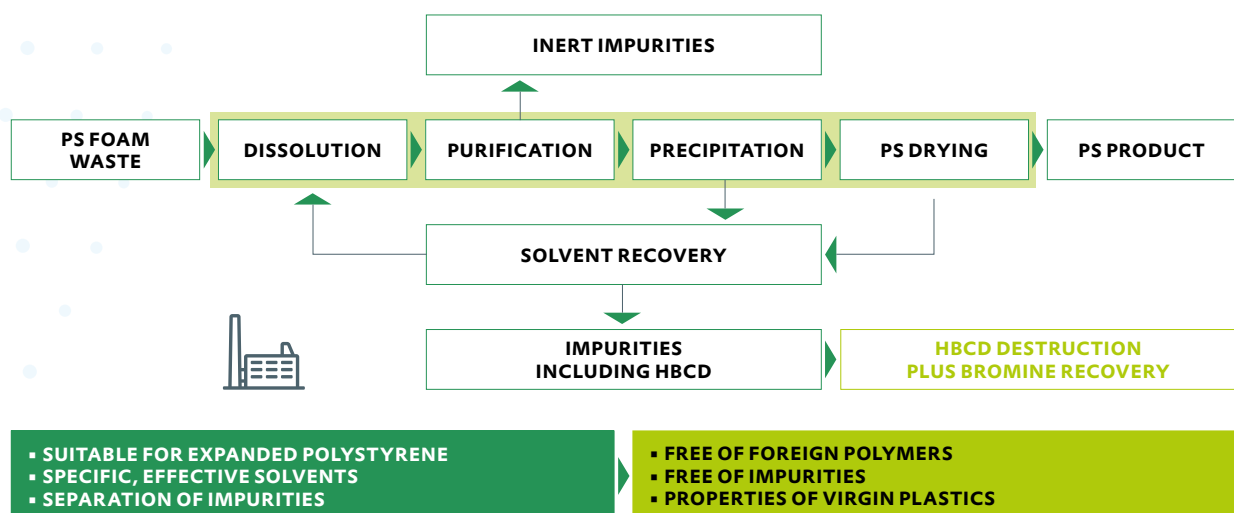
Plastic wastes are selectively dissolved using a specific proprietary solvent formulation.

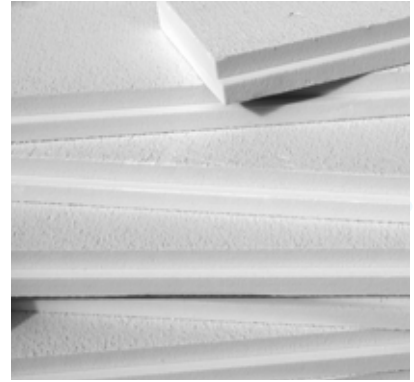
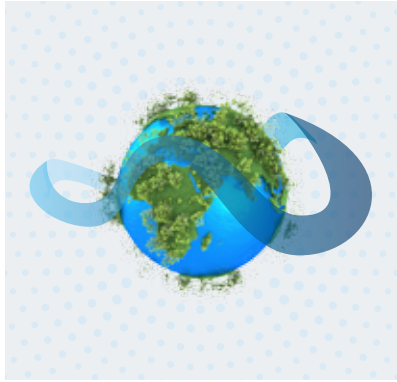
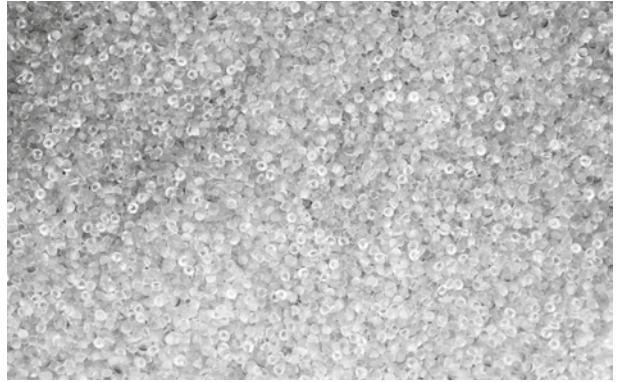
This dissolution is a physical separation process. It is a pre-treatment technology, which has the potential to recover plastic molecules and separate them from legislated additives (like HBCD). These legislated additives are today required to be destroyed in order to meet regulatory requirements (COMMISSION REGULATION (EU) 2016/293 of 1 March 2016).

The process consists of three steps. Steps 1 and 2 are pretreatment for step 3.

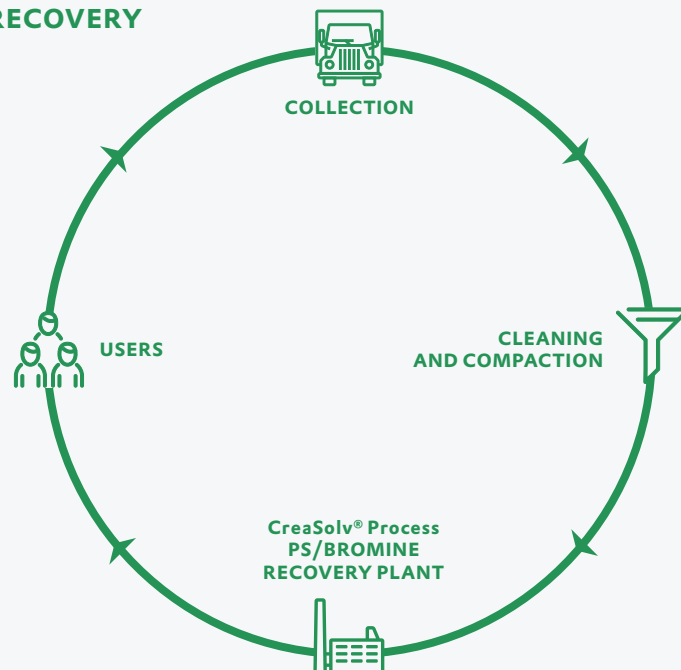
1. Firstly, the PS foam waste is dissolved in tanks containing a PS-specific liquid. The solid impurities (dirt, cement and the like) are separated through filtration and then incinerated.
2. Next, another liquid is added, which transforms the PS into a gel, while the additive (HBCD) stays in the remaining liquid. The PS gel is then separated from the process liquids. Once cleaned, this gel is transferred into granulated polymer and the liquid, together with the additive, is distilled and re-used in a closed loop; the additives remain as sludge.
3. This process is followed by the destruction of the HBCD additive within the sludge in a high temperature waste incineration. During the last step the elemental bromine, used in modern flame retardants, is recovered and can be reused to produce new products, thereby closing the loop.

PSLoop -CreaSolv® Process: SOLVENT-BASED MATERIAL RECOVERY





FROM COLLECTION TO MATERIAL RECOVERY



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The CreaSolv® Technology is a development of the Fraunhofer Institute in corporation with the CreaCycle GmbH. CreaSolv® is a registered trademark of CreaCycle GmbH.

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