PolyStyreneLoop

A unique recycling solution suitable for EPS and XPS waste containing HBCD

23 March 2018
Background

1975

Expanded & extruded PS
Flame retardant (HBCD) required for fire safety of buildings

2016

POP
Because of its persistency in the environment, HBCD is considered a pollutant

2017

Incineration des déchets
The only treatment to destroy HBCD, but not a desired option

2018

PolyStyreneLoop
A solution >>
The PolyStyreneLoop LIFE Project

1st July 2017 : Launch of the project for 4 years → 1st July 2021

Objective

“to enable the recycling of construction waste EPS and XPS and at same time destructing the HBCD, while recovering the bromine in line with the new POP regulations by demonstrating an innovative recycling process of 3000 tons recycled PS/year and organizing the EPS/XPS value chain by means of a collaborative model which will trigger further replication throughout Europe”
Budget of the PolyStyreneLoop project

Almost 9 M€ including 2.7 M€ of EU grant

- Synbra Technology BV (coordination), expandable polystyrène producer
- ICL, notably bromine producer and mineral-based products and compounds manufacturer
- Fraunhofer-Gesellschaft, institute for applied research
- Cooperative PolyStyreneLoop, actors from the polystyrene value chain
The cooperative PolyStyreneLoop

7 November 2017: official launch of the cooperative PolyStyreneLoop representing all the polystyrene value chain

Around 60 entities, partners, members and supporters, from 13 pays

Know how providers – Flame Retardant producers - EPS bead & XPS producers - EPS converters - Industry sectors & associations - System applicators - Styrene recyclers - Waste collectors - Machinery suppliers
Scope of PolyStyreneLoop project 2017-2021

PolyStyrene Loop plant

- Testing solvents
- Collection, cleaning, compaction
- Replicability and transferability
- Monitoring environmental impact
- Monitoring socio-economic impact
- Dissemination
- Networking
Expected results

- Demonstration plant
  - Capacity to recycle 3,000 tonnes of EPS/XPS waste per year to produce 2,100 tonnes/year of PS gel and 43 tonnes/year of bromine

- Collection system able to supply this plant with the required EPS/XPS waste quantities

- Avoidance of the annual emission of 210 tonnes of carbon monoxide, 25 tonnes aromatic hydrocarbons and 10 tonnes of aliphatic hydrocarbons

- Reduction by 12,000 tonnes/year of greenhouse gas emissions (78%) compared to the baseline scenario (incineration) and saving of 150,000 GJ of energy
Demonstration plant

- Start early 2019
- Based in Terneuzen, in the South of the Netherlands, adjacent to ICL plant
A double closed loop

- **Demonstration plant**
  - **CreaSolv® technology**
    - Designed by CreaCycle GmbH, specialist in plastics dissolution and recycling, and developed with the Fraunhofer Institute
    - Safe physico-chemical process to separate the compounds
  - **Outgoing polystyrene** free of foreign polymers and impurities: the **same** properties as the **virgin material**

- In parallel, incineration of HBCD, according to the regulation, and bromine recovery, also recycled
Today marketed re-extruded PS quality from CreaSolv® process.

Creasolv® Process

EPS/XPS waste → Dissolution → Purification → Precipitation → PS Drying → High quality PS

- Inert impurities
- Solvent recovery
- Impurities including HBCD
- HBCD destruction (incineration)
- Bromine recovery

Existing bromine recovery unit

Impurities including HBCD

Today marketed re-extruded PS quality from CreaSolv® process

PS Recyclat from CreaSolv® process

Bromine recovery
Recovery of PSE / XPS insulation waste containing HBCD

Today

Production
(4-6 weeks)

Use for building insulation
(≈ 50 years)

Incineration with energy recovery

Today Use for building insulation (≈ 50 years)
Recovery of PSE / XPS insulation waste containing HBCD

Tommorow: close the loop

Production (4-6 weeks)

Polystyrene and bromine recyclate

Use for building insulation (≈ 50 years)

Recovery with PolyStyreneLoop
HBCD from EPS construction and demolition waste

Estimated annual quantity of HBCD in EPS waste from construction and demolition that will be disposed of until 2060 (calculation based on the consumption with a lifetime of 50 years +/- 25 years for insulation boards and considering 1% cut offs becoming waste at the construction site)

Final Report “Study on waste related issues of newly listed POPs and candidate POPs” (BIPRO, Consortium ESWI, Enviroplan, Umweltbundemat, 25 March 2011)
Capture packaging and demolition waste streams

- EPS packaging waste, with or without flame retardant
- EPS and XPS insulation waste from building demolition, likely to contain HBCD
- Consolidated, pre-treated (separation of unwanted components) and compacted to 300 kg/m³
- Target streams geographical origin
  - Netherlands
  - Belgium
  - Germany
  - France
Collection and pre-treatment of waste streams

Phase 1
- Identify relevant waste streams (specification)
- Establish pre-treatment facility and organize transport to demoplant in Terneuzen (transport logistic enterprises and polystyrene suppliers)

Phase 2
- Test feasibility of decentralised pre-treatment and PSLoop plants in Germany
- Organize transport of HBCD slurry to Terneuzen, Netherlands

• Assure legal compliance for transport & pre-treatment
• Monitor quality of input streams
Collection and pre-treatment of waste streams

Collection of EPS/XPS waste containing HBCD (demolition & packaging)

Transport

Consolidation and sorting centers: separation of PSE/XPS from other components

Unusable components such as coatings

Compaction

Transport

Shredding

CreaSolv® Process

Specification of basic material at the demolition or collection side influences costs for collection & pre-treatment

Transport

e.g. metal

Transport

Incineration

Transport

e.g. plastics

Transport

Landfill

PSE/XPS with impurities
Networking of collection and pre-treatment companies

- Objective: create a value chain for EPS/XPS with recycling and collection companies by demonstrating a standard collection and pre-treatment system

- Need for a reliable waste stream to operate

- Key stakes to deal with: demolition, sorting, compaction and transport of waste

- Collection of the first compacted waste already started
LIFE: 10 year roll-out strategy of PSLoop ® recycling plants

Legend

City (Country)

Radius (200 km)

More plants after 2030
LIFE: PSLoop ® roll-out strategy
Project start timeline

2017

• Presenting and positioning PolyStyreneLoop as part of the Circular Economy at national and international level including the European Commission
• Launch and General Assembly

2018

• Preparing – collection of EPS/XPS waste
• Permit / engineering and building of demonstration plant
• Communications and workshops / conferences

Début 2019

Start demonstration plant
What actions to inform about the project and to support it?