The circular economy in action

CLOSED-LOOP RECOVERY OF POLYSTYRENE FOAM AND BROMINE

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Director PolyStyreneLoop Coop U.A./B.V.

26th of March 2018
Overview

► The cooperative – who we are
► Objective
► Historical analogy
► Organigram
► Where is polystyrene used?
► The PolyStyreneLoop project
► Structure/budget/scope
► WG Engineering & Permits
► WG Communications & Advocacy
► WG Collection and Pre-treatment
► The Technology
► Current Status
► Conclusions/key features
The cooperative – who we are

Coop and B.V.

Organisation: founded by Synbra Technology and ICL

Focus: demonstrating that PS foam can contribute to a Circular Economy

Members: industry representatives of the whole PS foam value chain

Goal: building and operation of a demoplant, further implementation of process all over Europe
The cooperative – who we are
(partners, members and supporters)

58 entities from 13 countries
Know how providers - FR producers - EPS bead & XPS producers - EPS converters - Industry sectors & associations - System applicators - Styrene recyclers - Waste collectors - Machinery suppliers
“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”
Historical analogy

► VOC creation - 20th March 1602
  • Revolutionising international trade
  • No longer one person paid for sailing a ship
  • Kickstarted the golden age
  • Unique multi-provincial cooperation

► PolyStyreneLoop creation - 6th November 2017
  • Revolutionising polymer recycling
  • No longer one company recycles waste
  • Kickstart of the golden age of polystyrene
  • Uncommon multi-national cooperation
Where is polystyrene used?

**EPS polymerisation**
- styrene
- pentane
  - EPS polymerisation in suspension
  - EPS beads
  - Expansion, moulding cutting
  - Sheet
  - EOL waste
- PS loop recycling

**X-EPS Extrusion**
- GPPS granulate beads
  - Extrusion Pentane
  - EPS beads
  - Sheet
- EOL waste
- PS loop recycling

**XPS**
- styrene
  - PS polymerisation mass continue
  - GPPS granulate beads
  - Extrusion pentane in line foaming
  - Sheet
  - EOL waste
- PS loop recycling
The PolyStyreneLoop project

▶ **Offers a solution...**
  - with an innovative process to turn PS foam waste into new high quality material, based on the CreaSolv®* Technology

▶ **Supported by authorities**
  - included in the UNEP Basel Convention as best available technology to handle HBCD containing waste
  - considered as an iconic project within the LIFE programme (the EU’s funding instrument for the environment and climate action)

*CreaSolv® is a registered trademark of CreaCycle GmbH*
1.2 Structure and budget for 2014-2020

LIFE Programme
€3,456.7 (2014-2020)

- Sub-programme for Environment
  - Environment & Resource Efficiency
  - Information & Governance
- Nature & Biodiversity
- Sub-programme for Climate Action
- Climate Change Mitigation
- Climate Change Adaptation
- Information & Governance

- €2,592.5 (75% of LIFE budget)
- €1,155 min (50% of ENV Sub-progm)
- €864.2 (25% of LIFE budget)
Budget composition

- Life grant (LIFE16 ENV/NL/000271)
- Loan Rabobank
- Member contributions

PolyStyreneLoop Budget (million €)

- Budget (million €)
  - 10
  - 9
  - 8
  - 7
  - 6
  - 5
  - 4
  - 3
  - 2
  - 1
  - 0

PolyStyreneLoop
Scope PolyStyreneLoop project during Life Grant period (2017-2021)

PolyStyrene Loop plant

- Testing solvents
- Collection, cleaning, compaction
- Replicability and transferability
- Monitoring environmental impact
- Monitoring socio-economic impact

Dissemination
Networking
## Working Groups

### A. Preparatory actions (if needed)

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<thead>
<tr>
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<td>A1</td>
<td>Infrastructure preparation</td>
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<td>A3</td>
<td>Engineering</td>
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<td>A4</td>
<td>Selection of contractor</td>
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<td>A5</td>
<td>Collection systems, cleaning and compaction systems of PS foams</td>
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<td>A6</td>
<td>Testing solvents</td>
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### B. Implementation actions (obligatory)

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<td>B1</td>
<td>Construction plant</td>
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<td>B2</td>
<td>Commissioning and testing plant</td>
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<td>B3</td>
<td>Testing collection system and compaction steps</td>
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<td>B4</td>
<td>Integral demonstration recycling process for different input streams and collection</td>
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<td>B5</td>
<td>Assessment of replicability and transferability</td>
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### C. Monitoring of the impact of the project actions (obligatory)

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<td>C1</td>
<td>Monitoring impact of the project on environmental problem targeted</td>
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<td>C2</td>
<td>Monitoring of socio-economic impact</td>
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### D. Public awareness and dissemination of results (obligatory)

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<td>General dissemination activities (visiting relevant events, publications, workshops)</td>
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<td>Networking with other recycle projects</td>
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### E. Project management (obligatory)

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<td>E1</td>
<td>Project management &amp; project monitoring</td>
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WG Engineering & Permits

► Engineering
  • EPC
  • Support ICL
  • from brown field to green field

► Permits
  • SPA WNP
  • support permit application
CreaSolv® plant engineering by EPC Engineering & Technologies

- Basic and Detail engineering, 3000 ton/annum PS plant capacity
- Pre-work to optimal civil engineering
- Advise on Plant and Land plot layout
- Hazop support

ICL-IP supporting engineering work

Full scale CreaSolv® polyolefin plant delivered to Unilever
## Engineering timetable

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## Authority Approval

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WG Communications & Advocacy

Nicolette Mulder
BLINCK

Lein Tange
PolyStyreneLoop Coop

Nicole Kambeck
BASF

Annette Schäfer
Eurneps

Eric Las
Stybenex

Website

PolyStyreneLoop

CIRCULAR ECONOMY TECHNOLOGY BUSINESS REGULATION NEWS ABOUT US

WELCOME TO POLYSTYRENELOOP

With our innovative recycling process we aim to set up an industry scale recycling process for HBCD containing PS foams.

www.polystyreneloop.eu

News

Primeur voor Terneuzen

Voor het eerst zal leedsteppingschimmel, officieel expanded polystyreen (eps), op industriële schaal volledig worden gerecycled. Dat gaat gebeuren in een volgend jaar te bouwen proeffabriek naast chemiebedrijf ICL-IP (voorheen Broochemie) in Terneuzen.

www.polystyreneloop.eu

Posters, Notice boards, brochures, ...
Communication tools

► Brochures
► Posters
► Notice boards
► Website
► Standardised Presentation: (Tech-HL)
► Media
  • National and international level (different angles)
  • Recycling (PRS)
  • Plastics (Plastics Europe-NRK)
  • Chemical (VNCI-CEFIC)
  • Economics uniqueness of the Cooperatief
WG Collection & Pre-treatment

► Status
  • WG in (1) the Netherlands/Belgium and (2) Germany installed

► Next steps
  • give follow-up to work packages WG’s
  • Contacts to demolition companies
  • Contracts for input and output
  • Find demolition sites
  • Test and research

► Goal
  • 3000 t/year PS recyclate output
Collection & Pre-treatment

➤ Pre-treatment
• Recognition and identification
• Demolition techniques B&C for ETICS and envelope system
• Sorting/Grinding/Compaction
• Storage and logistics
• Separate route for XPS containing asphalt

➤ Trials
• Industrial hygiene & ODSs during grinding
• Mw effects and heat during compaction
• XPS containing asphalt
• ...

➤ Innovations
• Collection
• Pre-treatment
Collection of PS 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)
- Assure legal compliance for transport & pre-treatment
- Monitor quality of input streams

**Phase 2**
- Test feasibility of decentralised pre-treatment and PSLoop plants in Europe
- Organize transport of HBCD slurry to Terneuzen NL
The Technology

The CreaSolv® Process
Solvent-based Recycling ... when other technologies fail

- Suitable for expanded polystyrene
- Safe, specific and effective solvents
- Separation of impurities

• Free of foreign polymers
• Free of impurities
• Properties of virgin plastics

CreaSolv® is a registered trademark of CreaCycle GmbH
The Technology

The CreaSolv® Process

- Technical feasibility approved by Fraunhofer IVV
- Plant concept developed by EPC Engineering & Technologies
EPS CreaSolv® Recycling Plants

The EPS recycling plant designed by EPC based on the CreaSolv® Technology consists of the following process steps:
Situational overview

➤ Landplot layout under revision to optimize:

- Traffic routing
- Utilities locations and tie-in
- Future extension possibilities
Current status

- establishment PolyStyreneLoop Coop U.A. and B.V.: a unique way of organizing the value chain to cooperate on sustainability
- raising € 2,1 million from the 56 members and supporters plus approval loan from the RABO bank (€ 4,5 million)
- Life Grant received from the EU commission € 2,7 million for the period 2017-2021

- Presentation of the PolyStyreneLoop project to the European Commission with the feedback: a „bulls eye“ project! Mentioned in the EU Commission Plastics Strategy
- Contracts Fraunhofer-IVV-EPC signed
- Contract ICL Terneuzen –PSLoop Service Level Agreement signed
- Permit ongoing and expect ready second half of 2018
- Construction to start October 2018
Conclusions / key features

► a tangible way to demonstrate an effective contribution to a Circular Economy

► a unique way of organising the value chain out of many small fish becoming one big fish

► demonstrates the PS value chain as a leading initiative that is positively uncommon in the polymer industry

► a long term commitment and runs for 100 years

► roll out is foreseen to locations all over Europe once more PS foam waste becomes available starting with Poland/Germany