



A Solution for PVC Pipes Waste Legacy Additives Extraction

Project Circle

PVC4PIPES Conference
October 17, 2024
Prague, Czech Republic



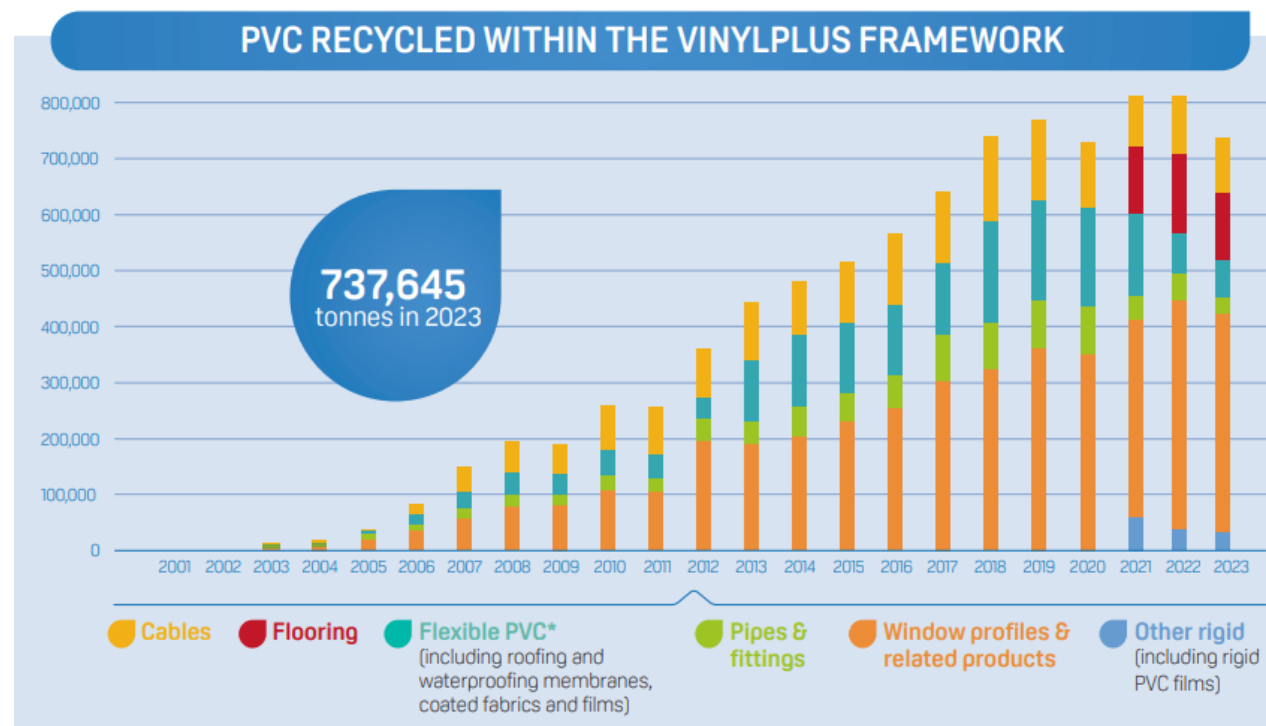
Advanced recycling technology development

Project Circle roadmap

- Objective
 - Develop the technologies to recycle all PVC that's non mechanically recyclable
- Aim
 - Development of Dissolution, Pyrolysis and Gasification technology
 - First industrial dissolution technology plant by 2030
- Feedstock
 - PVC waste that can't be recycled mechanically, like composites and legacy additives containing ones
 - Need for sorting on PVC application and presence/absence of legacy additives

Mechanical recycling of pipes

Pipes is 1 of the main PVC application of the mechanical recycling



| | Tonnage recycled 2022 | | | Tonnage recycled 2023 | | |
|-------|-----------------------|---------------|--------------|-----------------------|---------------|--------------|
| | Total tonne | Post-consumer | Pre-consumer | Total tonne | Post-consumer | Pre-consumer |
| Pipes | 49 664 | 10 955 | 38 709 | 30 471 | 6 983 | 23 488 |

Tonnages of PVC recycled in the EU-27 plus Norway, Switzerland and the UK, within the operations of Recovinyl AISBL in the framework of VinylPlus

REACH Regulations applicable to pipes

Treat for the mechanical recycling of post-consumer pipes?

Restrictions on stabilisers

- If the concentration of **lead** $\geq 0.1\text{wt}\%$ of the PVC material, it shall not be placed on the market or used in PVC articles. This restriction applies as of November 29, 2024
 - Provisions to support the circular economy
 - 24 M transition period for PVC articles containing recovered **flexible PVC, i.e., until May 28, 2025** to comply with the restriction
 - 10 years derogation for PVC articles with recovered **rigid PVC** (lead $< 1.5\text{wt}\%$), i.e., until May 28, 2033. **To be reviewed in 2028**
- If the concentration of **cadmium** is $\geq 0.01\text{wt}\%$ of PVC material, it shall not be placed on the market

Restrictions on plasticisers since 2019

- Sum of **DEHP/DOP, DBP, DIBP and BBP** $\leq 0.1\text{wt}\%$ in plasticised material articles
- Since February 2015, only EU-based organisations that have successfully applied for an exemption to use DEHP/DOP, DBP and BBP or can use those phthalates in manufacturing

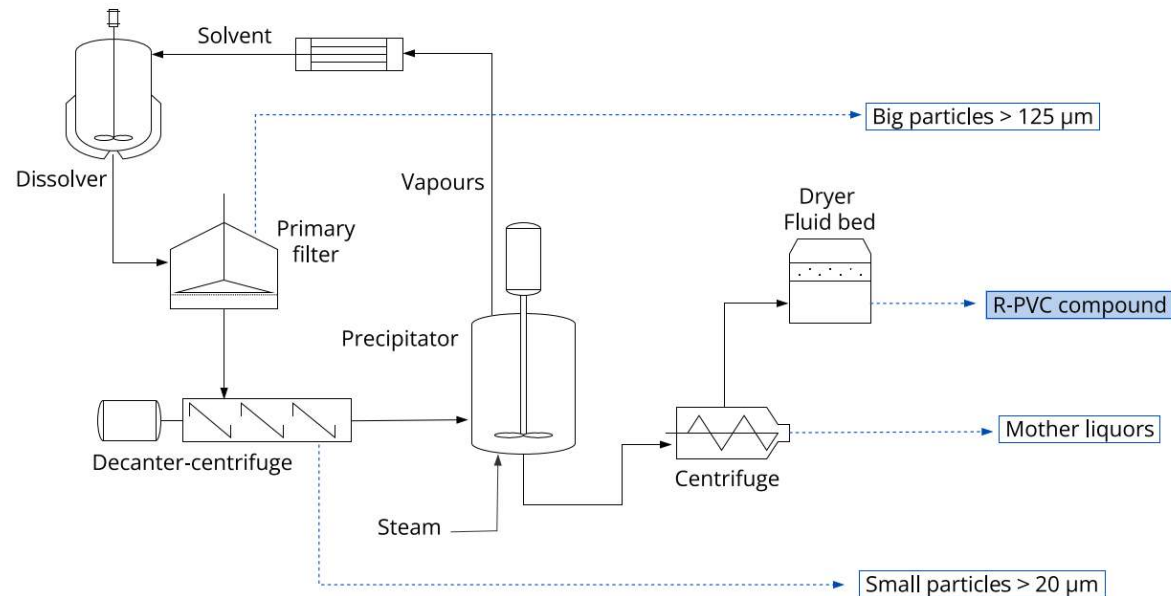
Vinyloop technology, industrial operation

Vinyloop plant closed due to REACH evolution on DEHP/DOP, DBP, DIBP and BBP

Vinyloop™ plant – Ferrara
2002 - 2018



- 2002-2018: Vinyloop® Industrial plant at Ferrara (Italy)
 - >15 years years of industrial experience with Tarpaulins & Cables
 - Fibers separated from PVC compound
 - Elimination of residual contaminations
 - Production of rejuvenated PVC compound
- Nominal capacity
 - Waste input : 10 000 T
 - Rejuvenated-PVC: 8 500 T



- Plant closed and dismantled due to REACH evolution on *legacy additives*
 - Plant not designed for the extraction of additives (stabilisers, fillers, plasticisers, etc.) from the PVC compound
- Some rigid application have been processed; limited volumes

Dissolution technology development

From Vinyloop™ to Vinyloop™ -D technology

- Lab-scale testing
 - Pb and Cd extracted from rigid PVC applications
→ *REACH compliant*
 - DEHP/DOP, DBP, DIBP and BBP extracted from profiles
→ *REACH compliant*
- Pilot plant testing
 - Two pilot plants in operation at R&D centre in Jemeppe-sur-Sambre (B)
→ *Legacy additives extraction efficiency confirmed*
- Industrial operations
 - Aim: first industrial unit by 2030



Dissolution technology development

From Vinyloop™ to Vinyloop™ -D technology

- Walloon consortium CIRCPVC
 - Covers the entire chain, from collecting PVC waste at construction-demolition sites to production of rPVC not containing legacy additives



- Belgium national consortium DISSOLV
 - Aims at demonstrating the circularity of flexible PVC waste (flooring, carpets and tarpaulins) and recycling all extracted additives



What else?

