Substitution of Pb stabilizers in PVC, a 15 years journey

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Stimulation of Substitution within circular Economy perspective, in the metals sector: concepts and examples

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Introduction

- Function
- Why substitution?
- VinylPlus® Voluntary Commitment
- Path to substitution
- Ensuring continued recycling
Lead Stabilisers

Why were they used for?

- PVC, like all thermoplastics, must be stabilised to protect the articles; as such, it does also contribute to maximise the use of resources.
- Lead salts (like other metals) are efficient stabilisers for PVC, remaining firmly embedded in the plastic matrix.

Why were they substituted?

- In 2000, the Vinyl 2010 supply chain initiative was built around a Voluntary Commitment, which includes, among other objectives, the replacement of lead stabilisers in the EU by the end of 2015.
VinylPlus – A United PVC Value Chain

- Resins
- Stabilisers
- Plasticisers
- Converters

200 companies

The Natural Step

NGO

150 Recycler partners
Key figures of the European PVC industry (EU 28+2)

- Turnover: 20 billion €
- 20,000 companies (most of them SMEs)
- Direct employment: 160,000 jobs (excluding installers)

640,000 tonnes of PVC recycled

+ 1,200 thousand direct jobs in recycling plants
VinylPlus Voluntary Commitment

35 measurable and concrete targets organised around 5 challenges

1. **Controlled-loop Management**  
   *(waste management, recycling, use of recycled PVC)*

2. **Organochlorines**  
   *(emissions, transportation)*

3. **Sustainable use of additives**  
   *(responsible ‘recipe’)*

4. **Energy efficiency**  
   *(reduction of consumption)*

5. **Sustainability awareness**  
   *(transparency, accountability and stakeholder engagement)*
35 measurable and concrete targets organised around 5 challenges

Sustainable use of additives

- Voluntary substitution of virgin stabilizers
  - Cd in 2000
  - Pb by 2015
- Studies on additives hazards and risks during use
- Manage legacy additives
- One step beyond: additives sustainability footprint
The last 15 years....

Tonnes of formulated stabilisers per year

YES we can...

Pb and COS from 2000 till 2016

Source ESPA
ELSA – European Lead Stabilisers Association   ECOSA – European Calcium Organic Stabilisers Association
COS – Calcium-based Stabilisers   Pb – Lead-based Stabilisers

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... and we did it!

This is a success example of the European PVC industry voluntary commitment

We can proudly say that we have achieved our goal to “replace Pb-based stabilisers in PVC applications in the EU-28, by the end of 2015”.

This was inspected and confirmed by an external audit company.
Substitution not a smooth exercise

- Initially a price difference with alternatives
- Need R&D and adapt processes
- Facilitation by stabilisers producers in order to find technical solutions and ensure maintained performance and quality
- Tens of millions of € have been invested to ensure the transition
But there is still a long road ahead for the global PVC industry

Figure II: how in the world PVC resin (expressed in K tonnes) is stabilised (2015)

Rest of Asia; Africa & ME
N.E. Asia
CIS & Baltic states
W&C Europe
C&S America
N. America

COS – Calcium-based Stabilisers
Sn – Tin-based Stabilisers
Pb – Lead-based Stabilisers
LMM – Liquid Mixed Metals Stab.
Pb stabilizers restriction

- Following the achievement of the Voluntary Commitment and the substitution of virgin Pb stabilizer use for the manufacture of PVC articles, Echa has been mandated to prepare a restriction dossier.

- **Aim:**
  - Contribute to Pb release minimization as advised by EFSA (to avoid potential impact on children intellectual development through higher blood pressure)
  - Formalize and confirm industry voluntary commitment achievements
  - Avoid Pb in imported PVC products (esp. Since PVC import tend to increase in the last years)

- Annex XV report submitted in December 2016
- Final Echa opinion in February 2018
Benefits Associated with PVC Recycling

**CO₂ savings of up to 90% are achieved when PVC is recycled:** recycled PVC’s primary energy demand is typically between 45% to 90% lower than virgin PVC production (depending on type of PVC and the recycling process).

**For each kg of PVC recycled, 2 kg of CO₂ are saved** (according to a conservative estimation). On this basis, CO₂ savings from PVC recycling in Europe is now at around 1.2 Mt/year.

On average one employee is needed to recycle 500 t/year of PVC (TAUW study). Hence the **639,648 tonnes of PVC recycled in 2017 contributed to the creation of more than 1,200 direct jobs in recycling plants.**
Ensuring recycling

- PVC with Pb stabilisers has been used in mainly long life applications from the construction sector
  - Window and pipes: average lifetime between 50 and 100 years
  - Cables: average lifetime: about 25 years
- For rigid PVC, the proposed restriction by Echa confirms that recycling is the waste management option leading to the lowest releases of Pb in the environment, therefore a risk management measure in itself
- It furthermore reduces exposure potential by excluding direct indoor contact or potential high contact to skin (hence multilayer outdoor decking favoured)
- Note VinylPlus: the analysis for Pb in recycled products is different from the introduction of Pb virgin stabilizer in new products: Pb in recyclate originates from waste and hence is already in the EU environment/technosphere. The objective is to minimize release of existing « Pb reservoir ». Addition of new virgin Pb stabilizer increases the Pb accumulated in the environment.

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For soft PVC, the Echa follows the same approach:

- Monolayer product allowed for mats for stables and greenhouses
- Multilayer hoses, traffic management, road furniture, roofing and waterproofing, professional footwear provided enclosed in a layer of virgin PVC

Applying the restriction as such immediately equates to a ban of 121 kT recycled products since current products are monolayers.

And a loss of societal benefit of 233 million € per year compared to landfill and 316 million € per year compared to the incineration.
SEAC acknowledges that whilst there may be technical alternatives, those are not tested or available at industrial scale immediately.

SEAC could not recommend a specific transition period

EC now to formulate proposal

Time to market of new applications estimate: 7 to 8 years
  - Research 4 to 5 years
  - Industrial implementation +3 years

Also need more technology options that encapsulation in a PVC layer (use of other materials, coatings...
Preventing legacy additive challenges: Additive Sustainability Footprint

- **Voluntary** tool to **assess** and **promote** the sustainable production and use of additives in PVC products. Assessment done over the **entire life cycle** of the additive and its use in a finished article.

- Qualitative, top-down approach to identify **sustainability hotspots** vs. the science-based TNS definition of sustainability.

- Tool using **ISO compliant inputs** (LCA data, EPD), expert judgement and guidance from sustainability experts (TNS).

- **Complement** but does not replace the more quantitative, bottom-up LCA schemes, such as EPDs and PEFs.

- Takes a **wider perspective** (incl. societal) allowing to identify innovative pathways towards improved sustainability.