

UPVC Window Profiles containing Recyclate

Factsheet on the use of recyclates in UPVC window profile systems

The market acceptance of UPVC windows has grown among planners, architects and specifiers. This is based on the heat-insulating properties and the architectural scope of design that modern, energy efficient and low maintenance UPVC windows have to offer.

1. Resource and energy efficiency are closely connected to the UPVC window sector

Already over 20 years ago a renowned system house¹ took the initiative to build up a recycling site for old UPVC windows. It was the proclaimed aim to re-use the gained recyclate in new window profiles. Today, recycling systems for old windows exist in Western European countries. The European system houses, which we represent as an association, process PVC recyclate from old windows and production waste, corresponding to the European standard EN 12608-1. In 2018 about 325.000 tons PVC² from old windows have been recycled and partly used for producing new window profiles. Across Europe the recyclate content in new windows is on average 18%. The members of EPPA have committed themselves to increase this content to 25% on average by 2025.

2. Recyclate content in modern UPVC windows

The average *maximum* recyclate content in a window profile usually is around 50%. This is determined by the manufacturing process because recyclate is mainly used in the core of the profile. Based on the European standard EN12608 for UPVC window profiles, the visible surfaces of window profiles must be covered by virgin material. This ensures a high degree of weathering resistance and UV stability.

Recyclate content in UPVC window profile systems					
Statistics	Current (2018) dispersal in Europe	Ca. 18%	Technology	Recyclate content in main profile	Up to 50%, in single cases up to 70%
	Goal for 2025 in Europe	Ca. 25%		Recyclate content in main and auxiliary profile	Below 40%

Table 1: Recyclate content in UPVC window profile systems

Only few system houses offer profiles with a higher recyclate content. This technically challenging exercise is made possible by the extrusion of recyclate into the visible surfaces of a profile. Thereby, a recyclate content of up to 70% can be achieved (see figure 1, left profile cross section). Numerous system houses have decided against this for technical reasons. In case the recyclate is added to the visible surface the virgin cover layer needs to be thinner if the thickness of the section should remain the same. This may lead to a direct exposure of the recyclate if beads are removed after the welding of corners.

¹ Manufacturers of UPVC window profile systems are called system houses by experts within the sector.

² VinylPlus Progress Report 2017

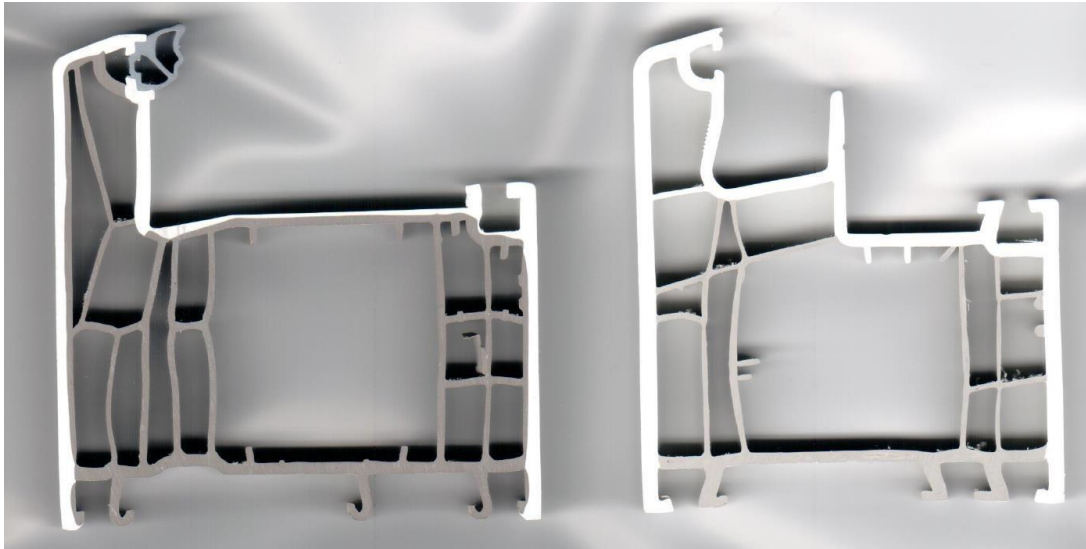


Figure 1: Profile cross section with a recylate core (grey, about 40%). The left profile also contains recylate in the external wall, thereby increasing the recylate content to over 40%.

Apart from these technical aspects it needs to be recalled that the amounts of post-consumer recylate currently available are not sufficient to include recylate into all new window profiles produced. This is another important reason underlining why system houses cannot cope with the requests of some communes to include more than 60% of recylate into their profiles.

Conclusion: The predominant part of modern UPVC windows (window sash + frame + window bar) has an overall recylate content below 40%.

3. The impact of recylate UPVC on quality

The quality and the performance of UPVC window profiles are key warrantors for the longevity and functionality of windows and doors. For decades, the system houses subject profiles and production to renowned quality controls such as the RAL GZ-716 in Germany, the NF 126 in France, KOMO BRL0702 in the Netherlands and ATG in Belgium. In particular the mechanical characteristics but also the type testing of the final windows are controlled as part of these quality certifications. The test reports since 1980 allow for a consistent verification that the recylates used in the core of the profiles are qualitatively equal to virgin material.

Conclusion: Quality controls prove that using recylate does not lead to a lowered quality or performance of the verified characteristics.

4. Mechanical recycling, dangerous substances and sustainability

UPVC is a long-lasting plastic which can be re-used many times due to its chemical composition and recyclability. Numerous construction products made from UPVC are being recycled today enabling us to keep the materials in the value chain for a longer time. This is equally true for its components. Mechanical recycling is in line with sustainability criteria³ but also keeps substances in the value chain that have been phased out by the industry years ago. Hence, new UPVC profiles may contain lead and cadmium stabilizers that are included in the recylate used in the production process. A recent study on the migration behavior has demonstrated that these substances are firmly embedded in the plastic matrix and do therefore not endanger humans or the environment⁴. Furthermore, the

³ TNS Sustainability Criteria, <https://thenaturalstep.org/approach/>

⁴ *Migration of Substances from recycled Polyvinylchloride* Mercea, P., Losher, C., Petrasch, M., and Toşa, V., John Wiley & Sons 2017

European Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals prescribes certain limit values that are being respected. In this context, EPPA monitors lead and cadmium values in the recyclate and in new profiles as part of a voluntary product surveillance initiative. The taking of samples and their analysis is completed by external institutes.

Despite the presence of these substances, it has been scientifically proven that recycling is the best end-of-life treatment for PVC windows, compared to landfilling and incineration. The European Chemical Agency (ECHA) has therefore recommended to restrict the placing on the market of new lead, however including a derogation for lead stabilizers embedded into the matrix of rigid PVC applications such as windows. The up to 2% of lead stabilizers contained in these applications are best controlled if recycled. A comparison with incineration has shown that the latter would cause an immediate release of most of the contained substance into the air. Landfilling would also result in incineration in the long run.

Furthermore, landfilling and incineration destroy a valuable resource that can be used as a replacement for new sourced virgin material. Accordingly, recycling is beneficial for the environment in two ways: by controlling the risk of legacy additives and by saving valuable resources.

Conclusion: Mechanical recycling of PVC products is a useful and sustainable contribution to climate protection. One ton of PVC recyclate saves 2,027 tons of CO₂ compared to the use of virgin material. This is an important contribution to a resource efficient product and production policy.

5. Declarations and Labelling

5.1. Environmental Product Declarations (EPD) for UPVC windows

EPDs have been generated for UPVC windows according to EN15804. System houses and window manufacturers collected the necessary data. The resulting association-EPD⁵ for double and triple glazed UPVC windows represents at least 60% of the European UPVC window profile production. It is valid for all profile reinforcement and surface variations as well as for traditionally wedged or bonded window designs. They can be found here:

<https://epd-online.com/PublishedEpd/Detail/9838>

<https://epd-online.com/PublishedEpd/Detail/9185>

The life cycle assessment takes into consideration environmental impacts, use of resources, output streams and waste categories of UPVC windows. Furthermore, it contains several sensitivity analyses of reinforcements, recyclate content and an overview of disposal quotas.

5.2. Labelling of dangerous substances

Also our EPDs point towards the declaration of Substances of Very High Concern (SVHC). This refers to a duty by system houses to inform downstream users according to Art. 33a REACH if the lead content in the UPVC recyclate exceeds 0,1% w/w.

Moreover, chapter 2.8 of the REACH Regulation lines out that Ca-Zn stabilizer compounds may need to be labelled according H302, H317 and H318. This obligation only applies to the compound but not to the UPVC window profile.

The table below gives an overview of currently applicable threshold values of formerly used lead and cadmium stabilizers as prescribed by REACH, RoHS II and waste legislation.

Threshold values	REACH	Waste Framework Directive	RoHS II
Cadmium	0,1% (1.000 ppm)	N.A.	0,01% (100 ppm)
Lead stabilizers	N.A.	0,3% (3.000 ppm)	0,1 % (1.000 ppm)

Table 2: Threshold values for lead and cadmium according to European chemical and waste legislation

Conclusion: **UPVC window profile systems comply with all legal obligations.**

Brussels, December 2019

6. Literature

Environmental Product Declaration for PVC-U window (1,23 x 1,48 m) with insulated double-glazing (2016), retrieved March 7th, from: <https://epd-online.com/PublishedEpd/Detail/9185>

Environmental Product Declaration for PVC-U window (1,23 x 1,48 m) with insulated triple-glazing (2017), retrieved March 7th, from: <https://epd-online.com/PublishedEpd/Detail/9838>

Joint Research Centre (2012), Green Public Procurement Windows and external doors Technical Background Report, draft, retrieved March 7th, from: <http://susproc.jrc.ec.europa.eu/windows/docs/Technical%20background.pdf>

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Mercea, P. V., Losher, C., Petrasch, M. and Toşa, V. (2017), Migration of Stabilizers and Plasticizers from Recycled Polyvinylchloride. J Vinyl Addit Technol. [doi:10.1002/vnl.21609](https://doi.org/10.1002/vnl.21609)

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