PLASTICS RECYCLERS EUROPE

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Feedback on:
Chlorinated paraffins with carbon chain lengths in the range C14-17

Plastics Recyclers Europe (PRE) represents the interest of the plastics recycling industry. Several of PRE members are specialized in treating flexible PVC from either pre-consumer and post-consumer origin.

It is with great interest that we read the Proposal to list “Chlorinated paraffins with carbon chain lengths in the range C14-17 and chlorination levels ≥45% chlorine by weight” in Annex A, B or C to the Stockholm Convention on Persistent Organic Pollutants.

Disclaimer

To the best of our knowledge this proposal is a first step to identify MCCPs as persistent organic pollutants within the Stockholm Convention. As such, a decision shall be based on the intrinsic properties of the substance, **we feel ill equipped to judge whether this is appropriate or not and shall refrain from making any comments in this submission in that direction. Our position, at present, is that we are neither for nor against inclusion of MCCPs within the Stockholm Convention**.

What we can comment on, is the use of MCCPs in our industry and potential implications for the plastics recycling industry. We realize that this is somewhat early in the process for such comments, but nevertheless would like to share some initial findings.

Chlorinated paraffins, usage phase

Chlorinated paraffins can function as a plasticizer in flexible PVC, however they are somewhat harder to incorporate into the formulation compared to more conventional plasticizers such as DINP or DOTP. Such conventional plasticizers are non-chlorinated and therefore decrease the chlorine concentration of the material. In most cases this is not an issue, however when PVC is selected for its natural flame retardancy in a particular application, this can be problematic as this flame retardancy is due to the chlorine content of the material. The addition of such non-chlorinated plasticizers thus decreases this natural flame retardancy of the PVC based material.

The above is relevant knowledge as it enables one to predict which PVC applications may contain chlorinated paraffins. Typically, one would only find them there where flame retardancy is required. For example, one should not expect to find chlorinated

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paraffins in geomembranes used to contain water (e.g. garden ponds), but should expect to find them in electric cable sheeting. To the best of our current knowledge the only flexible PVC waste stream that 1) may contain MCCPs, 2) that is being recycled, and 3) from post-consumer origin is electric cable sheeting.[1]

The use phase of the plastics cables sent for recycling is, contrary to what one may expect based on definitions alone, more akin to that of Building and Construction, as the cable waste is normally derived from such applications. This does not mean that electric cables are not present in electrical & electronic or automotive applications, however due to the specificities of the collection and treatment steps these shorter cables are not recycled at the scale of the cables that are taken from building and construction. Thus, the material that arrives to the recycler was first placed on the market more than a decade ago.

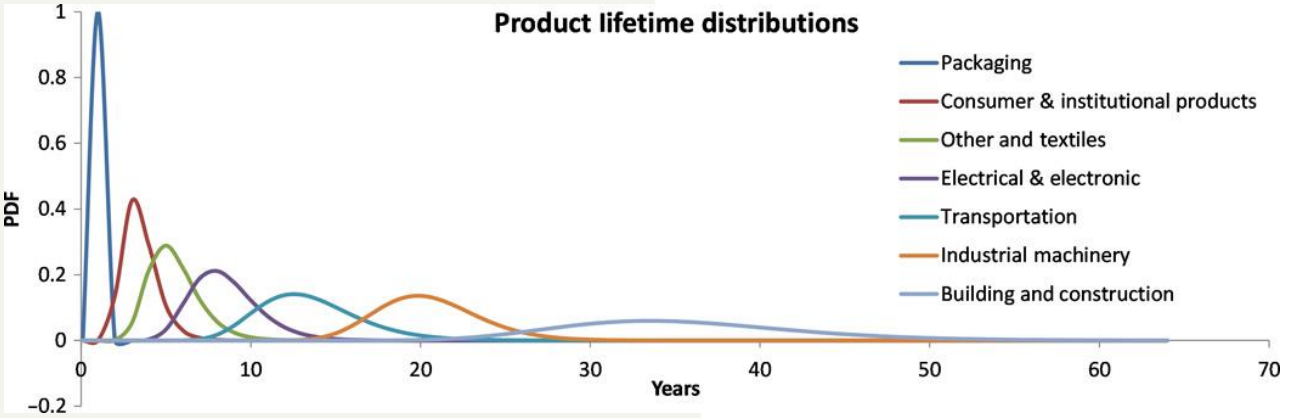

Figure 1 Product lifetime distributions for the eight industrial use sectors plotted as log-normal probability distribution functions (PDF). Source: [1]

Chlorinated paraffins, end-of-life phase

Electrical cables are normally sent for copper (and aluminum) recycling where cable choppers or cable strippers recover metals and produce a residual waste fraction consisting of predominantly flexible PVC. Such waste will also contain a fraction of polyethylene, polyurethane, and other polymers, as well as minor impurities of metals, textiles, minerals, and composite material.

A fraction of such residual waste is directed to landfills and to a lesser extend to incineration with energy recovery/co-incineration.[2] However, a recycling sector has emerged that specializes in this particular waste stream over the past decades. The key competence of

[1] Pre-consumer material may also exist, but any restriction on use of MCCPs would have less of an impact on recycling. This does not mean that the restriction of MCCPs would not have an adverse impact on this virgin supply chain.
[2] (Co-)Incineration facilities tend to set specifications on the amount of PVC (or chlorine) they will accept in input material that cannot be met by this residuals fraction, hence the grater volumes flowing to landfill than to incineration.

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the companies in this sector is to separate the flexible PVC from the other polymers and other materials. Technology employed by these recyclers can be a combination of the following:

- Electrostatic sorting
- Magnetic and eddy current separation technology
- Micronization under specific conditions resulting in different materials achieving a different particle size distribution, followed by sieving

Chlorinated paraffins, recycling phase

Depending on to some extend the input material and to a greater extend the **required[3] output quality level**, different levels of purity can be achieved.

Following the purification step, some recyclers perform compounding activities whereby they can add substances to improve the physical/mechanical properties of the material. For example, while the material does have some flexibility due to some plasticizer content, many end applications require greater flexibility, thus the addition of plasticizer (e.g. DINP or DOTP) can be appropriate.

Contrary to the polybrominated diphenyl ethers there are no ways to effectively separate MCCP containing flexible PVC from not MCCP containing flexible PVC[4]. Should MCCPs be present in the input of a plastics recycler the MCCPs will thus be present in the output of the recycler. In fact, because other materials and other polymers are removed the concentration of MCCPs will be greater in the output than in the input.

If and when the MCCPs are included in the Stockholm Convention this may result in a situation where the flexible PVC from cable sheeting would no longer be allowed to be used in new products if limits are set too low. Whether or not this would be the most advantageous outcome for human health and the environment is a relevant question. In order to evaluate this one would need to determine what would happen in such a scenario with and without higher tolerances for the recycling of flexible PVC containing MCCPs.

Should however limits be set that would allow for the continuation of recycling, the material obtained would displace virgin material production and result in savings on GHS emissions. This may lead to a continuation of the existence of MCCPs for a longer period of time, as a smaller fraction that would be destroyed. However, the environmental release from such

[3] The creation of order is always associated with energy expenditure (thermodynamic laws). Should a particular lower end application not require high quality material one would not need to perform the most effective separation and thus can save on processing costs/energy expenditure (and have lower CO2 emissions).

[4] Addition of brominated flame retardants in general increases the density of the material, a property that is used by WEEE/ELV plastics recyclers to separate the non-brominated plastics from the brominated plastics waste by density separation.

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recycled articles is what counts and should be assessed through environmental release modeling.

Chlorinated paraffins, alternative waste management routes

Typically, when recycling would no longer be an option, the material as a whole would be directed to landfill or incineration. Specialized incinerators may be able to accept such high chlorine containing waste, though these are likely not omnipresent and ready to take the full volume of material. These plants are likely running close to full capacity. Therefore, a fraction would likely be diverted to landfill.

The fraction directed to incineration would present the benefit that MCCPs would be destroyed in line with the objective of the Stockholm Convention. However, the bulk of the material is not MCCPs, it is PVC, and this valuable material would be destroyed along with the MCCPs. The process itself will have a CO2 footprint and the fact that material is destroyed means that new material needs to be generated to fulfill the societal demand for this material with associated greenhouse gas emissions.

The fraction directed to landfill would mean that MCCPs are not destroyed. Rather they are more contained from the environment. However, unless this material is directed to the most extreme of hazardous waste landfills, there will be some leaching to the environment. Greenhouse gas emissions from landfilling this material should not be expected. However, the lack of displacement of virgin material will mean that new virgin flexible PVC will be produced with associated GHS emissions.

Conclusions

The pure environmental impact assessment would still not be an easy one. The benefits of recycling are primarily the savings in GHS emissions while the adverse effect is an additional release of MCCPs to the environment resulting from an additional life cycle. Two very different scales.

Plastics Recyclers Europe is, with kind support of Euro Chlor, conducting a study to quantify the level of various chlorinated paraffins in post-consumer cable derived flexible PVC recyclate. The results of this study will not be available before the deadline of the current public consultation. The results should enable the environmental impact assessment and the consideration of the policy option to set limits that would enable recycling.

References

[1] R. Geyer, J. R. Jambeck, and K. L. Law, "Production, use, and fate of all plastics ever made," (in eng), *Science advances*, vol. 3, no. 7, pp. e1700782-e1700782, 2017, doi: 10.1126/sciadv.1700782.