Briefing/Opinion - Why PVC and PTFE should not be placed on OECD Green list of waste shipment

About Health Care Without Harm

Health Care without Harm (HCWH) has long campaigned for a phase-out of PVC in the healthcare due to the health hazards posed by products made of this polymer. Already in 2007, HCWH Europe documented hospitals across Europe[1] that had already begun phasing out PVC medical devices to protect patients from DEHP and other alternative plasticisers.

Polyvinyl chloride (PVC)

PVC is a high-volume, synthetic material with many different formulations and configurations. Approximately 75 percent of all PVC is used in construction and building materials including flooring, pipes, carpet backing, and wall coverings as well as office furniture, supplies, and packaging. PVC is currently used in healthcare-specific applications including IV bags, blood bags, urine bags, tubing, oxygen masks, catheters, and disposable gloves.

Why is PVC problematic?

The concerns about PVC focus on chemical hazards associated with its entire life cycle - from production to disposal - including additives used for performance characteristics and applications.

End of life; PVC product recycling

In general, plastics can be recycled by mechanical technologies, including separation of polymer types, decontamination, re-melting, and re-use into similar or different products. The public and environmental health impacts of these technologies can vary considerably, and in practice only a few of the many plastics we use every day are widely recycled. Burning plastics in waste-to-energy plants designed to produce heat, steam, or electricity is sometimes labeled "recycling" but this is a misuse of the term; EU legislation classifies these processes as incineration and these technologies carry risks similar to waste incineration.

[1] (Austria, Denmark, Sweden, Czech Republic, Slovakia, France, Italy, The Netherlands)

Very small amounts of post-consumer PVC is recycled and it is challenging for several reasons:

- When waste streams of various plastics are mixed without sorting and separation, PVC content of more than 10-15% can make those wastes much less useful and sometimes destroy their value completely. Recycling facilities must therefore rigorously separate PVC from mixed plastic through hand sorting or automated systems (Hopewell, 2009; Association of Plastics Recyclers; LeBlanc, 2016; Ragaert, 2017)
- PVC can be difficult to recycle in part because of additives; PVC can contain many different types of additives, so a consistent post-consumer waste stream is almost impossible. (Hopewell, 2009; VinyLoop; Association of Plastics Recyclers) For successful recycling, PVC products need to be "super-separated" by product type to keep them from going to an incinerator or landfill.
- The costs of PVC recycling can be particularly high (Technology Quarterly, 2007; VinyLoop; Michael, 2015; Sadat-Shojai, 2011). In 2018, a PVC industry recycling facility in Italy closed after 15 years of losses and collapsing demand for their product.

PVC product disposal

With the challenges of recycling, PVC disposal options include waste incineration or landfilling. In landfill, PVC can leach toxic additives into soils and groundwater; in incinerators, the burning of PVC releases toxic chemicals into the air and produce massive amounts of highly toxic dioxin laden ash. When PVC is burned, highly hazardous dioxins and furans are formed and released directly into the environment or sequestered in ash that must then also be disposed (a new waste disposal problem in itself) (Römbke et al. 2009).

The synthesis of dioxins, furans, and/or related organochlorines requires chlorine and organic compounds, often in association with metal catalysts, heated within a range of temperatures that fosters the formation of these molecules from precursors or *de novo.* The extent to which *combustion in waste incinerators produces dioxins*, furans, and related compounds depends on incinerator design, operating conditions, and fuel composition. Under certain combustion conditions, higher PVC concentrations in the fuel mix result in higher dioxin formation. PVC is a particularly important chlorine contributor to the fuel mix that results in dioxin/furan formation in poorly controlled incineration and building or landfill fires. The chlorine in PVC also results in the creation of hydrogen chloride gas during burning or pyrolysis; highly corrosive, it can damage the incineration/pyrolysis plant. Filtering this gas out, and the corrosion it causes, both increase the costs of waste handling.

Waste industries claim that incineration using highly advanced emission control technologies provides clean energy that reduces climate impacts and toxicity. The evidence, however, clearly demonstrates the harmful short- and long-term effects of waste incineration's emissions and byproducts. Below are two examples from EU Members States, highlighting poor waste management:

1. Incinerators have mismanaged highly toxic ash in several cases; in 2015, Sweden was found to have sent 500,000 tonnes of highly toxic fly ash from waste incinerators to a small island in Norway for five years, creating risks of heavy metal leakage into the Oslo fjord and explosions on the island.
2. The most recently installed incinerator in The Netherlands was recently shown to be far from clean; long-term tests reveal that emissions of dioxin, furan, and persistent organic pollutants are far beyond the limits. From the uncontrolled combustion of 19 tons of undefined waste*: "An official conservative estimate of dioxin emissions is 33 mg, but this figure is probably much higher, since the waste was wet and likely to have a Polyvinyl Chloride, PVC, content above 2% because of an impossibility of pre-separation of PVC."*

Furthermore, fluorinated compounds such as very persistent, bioaccumulative and toxic perfluorooctanoic acid (PFOA) were detected in all (six) samples (433 – 794 hours, total 3,929 hours). PFOA should not be detectable at all in modern waste incineration processes. The presence of PFOA in the stack can be an indicator of incomplete combustion, i.e. not complying with a minimum 2 seconds residence time at 850°C.

Polytetrafluorethylene (PTFE)

A synthetic fluorinated polymer, PTFE is more commonly known by its commercial name *Teflon* and is used as a non-stick coating for pans and other cookware. It is nonreactive, partly because of the strength of carbon–fluorine bonds, and so it is often used in containers and pipework for reactive and corrosive chemicals. In the medical field, PTFE is commonly used to coat surgical instruments as well as medical components such as catheters, guidewires, and implantables. It is commonly used as a graft material in surgical interventions and frequently employed as coating on catheters.

PTFE: end-of-life phase

Combustion of plastics containing halogens such as polytetrafluorethylene, teflon, can cause emissions of hazardous substances such as dioxins (Weber & Kuch, 2003). Also pyrolysis of fluorinated polymers or fluoropolymer dispersion can result in the unintentional formation and release of fluorinated POPs (e.g. PFOA), other PFAS, other toxic substances, ozone depleting substances and greenhouse gases

(Sinclair, 2007; Ochi, 2008).

Halogens emitted from the combustion of plastic waste can also cause corrosion in incinerators and other thermal facilities. Furthermore, since most plastics are fossil fuel based, incineration may also contribute to global warming and depletion of petrochemical resources. It is also important to recognise that in many countries the informal recycling economy is a fundamental element of plastic waste management. But little is known of the fate of plastic additives within these informal 'recycling' practices.

PTFE scrap should not be incinerated because highly corrosive vapours are released which damage the incineration plant.

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