PVC Alternatives Database

Building the Future

Why PVC is bad news

Globally, over 50% of PVC manufactured is used in construction, in products such as pipelines, wiring, siding, flooring and wallpaper. As a building material PVC is cheap, easy to install and easy to replace. PVC is replacing ‘traditional’ building materials such as wood, concrete and clay in many areas. Although it appears to be the ideal building material, PVC has high environmental and human health costs that its manufacturers fail to tell consumers.

From its manufacture to its disposal, PVC emits toxic compounds. During the manufacture of the building block ingredients of PVC (such as vinyl chloride monomer) dioxin and other persistent pollutants are emitted into the air, water and land, which present both acute and chronic health hazards. During use, PVC products can leach toxic
additives, for example flooring can release softeners called phthalates. When PVC reaches the end of its useful life, it can be either landfilled, where it leaches toxic additives or incinerated, again emitting dioxin and heavy metals. When PVC burns in accidental fires, hydrogen chloride gas and dioxin are formed.

Greenpeace Pyramid of Plastics

For virtually all PVC applications, safer alternatives exist, using more sustainable, traditional materials - such as paper, wood or local materials. PVC can also be replaced by a variety of other, less environmentally damaging plastics, although most plastics pose some risk to the environment and contribute to the global waste crisis.

Greenpeace has developed a pyramid of plastics to assist those making material selection, to avoid PVC use. The guidance focuses on the toxic characteristics of the potential alternative materials. It provides a qualitative ranking based on environmental and health problems of PVC, addressing the production, additives, product emissions during use, disposal and recycling.

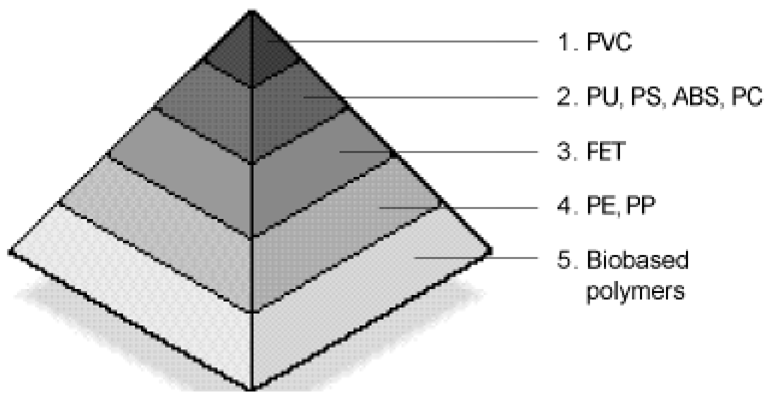
It does not include raw materials and energy inputs and therefore does not address all criteria of a life cycle analysis. It provides guidance for interim steps on the route to clean production. Ultimately we should ask why we are using these materials and whether or not they are necessary.

The pyramid of plastics is a ranking of plastics according to their hazardous characteristics. PVC, the most problematic plastic, is at the top of the pyramid, and biobased plastics, the least polluting of the plastics, are at the pyramid's base. It represents an ongoing process to qualify the main plastics in the economy. More plastics can be added as necessary and qualifications may change depending new information on the material, such as in production processes or the use of toxic additives.

Additives

The addition of toxic additives can significantly change the environmental impacts of a plastic. For example, chloroparaffins or brominated flame retardants in polyolefins or biobased plastic products with heavy metal stabilizers would significantly increase the hazard level of the plastic and therefore change its position on the pyramid of plastics. Furthermore, many additives are persistent organic pollutants (POPs) and can cause serious environmental damage.

It is essential that the production of biobased plastics does not involve the use of genetically modified organisms (GMO's) or allow the patenting of life.



1) Polyvinyl chloride (PVC) and other halogenated plastics

2) Polyurethane (PU), Polystyrene (PS), Acrylonitrile-butadiene-styrene (ABS), Polycarbonate (PC)

3) Polyethylene-terephthalate (PET), Polyolefins (PE, PP, etc.)

4) Biobased plastics

Notes:
· Metallocene technology is a new way to widen the range of properties and applications of polyolefins. This will in turn help replace many rigid and soft PVC applications.
· TPE's are thermoplastic elastomers that can be made from many different mixes of different plastic monomers/short polymer chains. Currently most of the building blocks are polyolefins, but can also contain other polymers such as polyurethane. Therefore, TPE's can not be generally ranked in the pyramid of plastics.

Polyvinyl chloride (PVC) is unique in its high chlorine and additives content, which makes it an environmental poison throughout its life cycle. Vinyl chloride is a known human carcinogen. PVC releases dioxin and other persistent organic pollutants during its manufacture and disposal and cannot be readily recycled due to it chlorine and additive content. Furthermore, additives are not bound to the plastic and leach out.

Polyurethane (PU) is mainly used in insulation and soft/foamed products like carpet underlay. It uses several hazardous intermediates and creates numerous hazardous by-products. These include phosgene, isocyanates, toluene, diamines, and the ozone-depleting gases methylene chloride and CFCs, as well as halogenated flame retardants and pigments. The burning of PU releases numerous hazardous chemicals such as isocyanates, carbon dioxide, hydrogen cyanide, PAHs and dioxins.

Polystyrene (PS) is widely used for foam insulation and also for hard applications like cups and toys. Its production involves the use of known (benzene) and suspected human carcinogenic substances (styrene and 1,3-butadiene). Styrene is also known to be toxic to the reproductive system. PS can be technically recycled, but recycling rates are low, although still higher than for PVC.

Acrylonitrile-Butadiene-Styrene (ABS) is used as a hard plastic in many applications like pipes, car bumpers and toys (hard building blocks). ABS uses a number of hazardous chemicals. These include butadiene and styrene (see above) and acrylonitrile. Acrylonitrile is highly toxic and readily absorbed by humans by inhalation and directly through the skin. Both the liquid and its vapor are highly toxic. Acrylonitrile is classified as a probable human carcinogen as are styrene and butadiene.

Polycarbonate (PC) is used for products like CDs and refillable milk bottles and is usually made with the highly toxic phosgene -derived from chlorine gas. PC does not need additives but does need solvents for its production, such as methylene chloride, a carcinogen. Other solvents used may include chloroform, 1,2-dichloroethylene, tetrachloroethane and chlorobenzene. A number of processes have been developed to reclaim polycarbonate from compact discs and PC milk and water bottles, for downcycling into lower quality products such as crates or building applications, or for mixing in small quantities with virgin material for higher grade products such as bottles.

Polyethylene-Terephthalate (PET) is made from ethylene glycol and dimethyl terephthalate. PET is generally used in packaging (e.g. bottles) and often contains additives such as UV stabilisers and flame retardants. PET recycling rates are high compared to other plastics.

Polyolefins such as Polyethylene (PE) and Polypropylene (PP) are simpler polymer structures that do not need plasticizers, although they do use additives such as UV and heat stabilizers, antioxidants and in some applications flame retardants. The polyolefins pose fewer risks and have the highest potential for mechanical recycling. Both PE and PP are versatile and cheap, and can be designed to replace almost all PVC applications. PE can be made either hard, or very flexible, without the use of plasticizers. PP is easy to mold and can also be used in a wide range of applications.

In comparison with PVC, PE and PP use fewer problematic additives, have reduced leaching potential in landfills, reduced potential for dioxin formation during burning (provided that brominated/chlorinated flame retardants are not used), and reduced technical problems and costs during recycling.

Bio-based Polymers Biodegradable plastics from renewable sources (bio-based) are seen as a promising alternative for plastic products which have a short life cycle or are impractical to recycle, such as food packaging, agricultural plastics and other disposables.

Bio-based plastics can be made out of products obtained from raw materials produced by a natural living or growing systems, such as starch and cellulose. The advantage of bio-polymers is that they readily degrade and can be composted. Natural polymers include cellulose (from wood, cotton), horn (hardened protein) and raw rubber. Converted natural polymers include vulcanized rubber, vulcanized fibre, celluloid and casein protein.

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