

Polyvinyl Chloride (PVC, vinyl) is the world's most versatile plastic. Its versatility is due to the many additives available for use in PVC. These additives allow PVC to be rigid or flexible, opaque or transparent, and it is easy to color.

Unmodified PVC is very rigid and unusable in most applications, so plasticizers are used in order to make PVC more flexible. PVC has good dimensional stability due to the fact that it is mostly an amorphous structure. Because of the high polarity in PVC, it is the only resin that can withstand compounding with high amounts of plasticizers and still maintain an extremely high creep resistance. Depending on the plasticizer, the abrasion resistance can vary dramatically. With a small amount of plasticizer, flexible PVC will have more abrasion resistance than rigid PVC.

For adequate protection against UV rays, the addition of a UV stabilizer must be used. The use of a UV stabilizer is especially critical when working with transparent or translucent PVC.

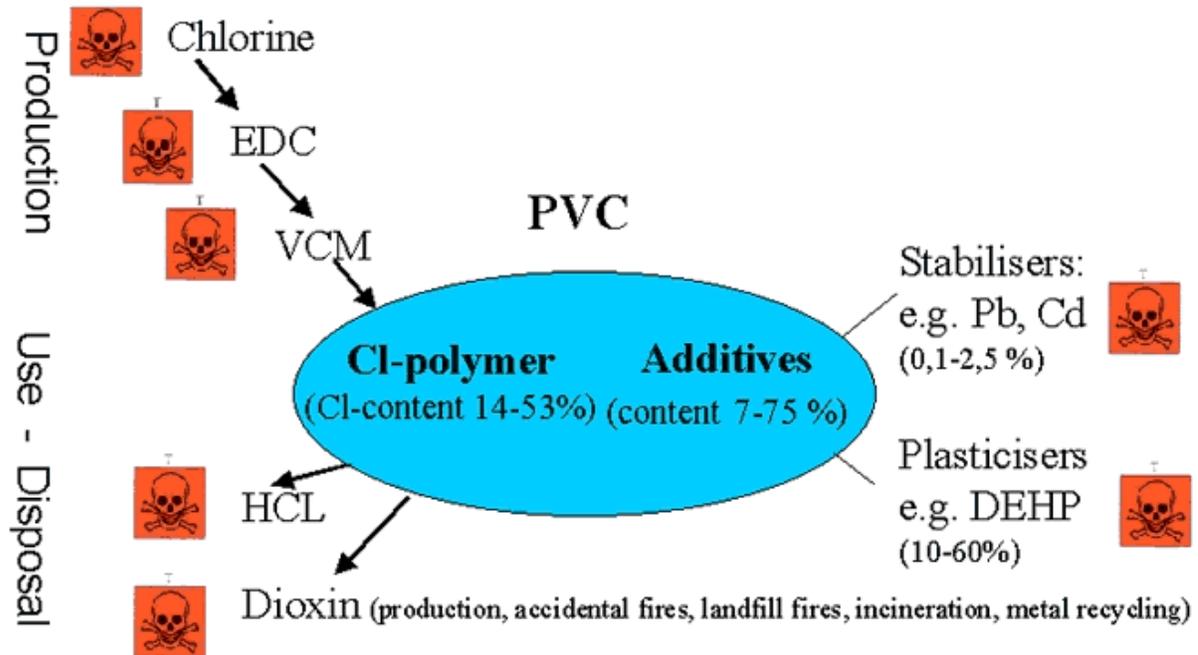
PVC is sometimes used in portable electronic wiring, solely because of its ability to resist flames. When a halogenated polymer (PVC contains chlorine, which is a halogen) begins to burn, the bonds are broken and the halogen is released. The halogen atoms have a strong affinity for hydrogen and will combine to form an acid (e.g. hydrochloric acid, HCl). This dense gas excludes oxygen from the area of combustion and smothers the flame.

Vinyl product can be recycled into new applications. Both post-industrial and post-consumer vinyl products are recycled and re-used in the production of carpet, roofing, siding, flooring, and pipe.

Historically, the biggest concern about processing PVC is the unhealthy byproducts that can be released during processing.

Chlorine is derived from common salt and ethylene is derived from natural gas. These two compounds are combined from the monomer vinyl chloride. The polymerization into PVC follows these steps (brief);

- Step 1: electrolysis of brine to create chlorine gas
Dioxins produced as a by-product.
- Step 2: production of ethylene dichloride (EDC).
Dioxins produced as a by-product.
- Step 3: creation of vinyl chloride monomer (VCM)
- Step 4: polymerize the VCM to create PVC.



Courtesy: PVCinformation.org

PVC is chemically attacked by hydrocarbons, ketones, esters and chlorinated solvents. Also, with a relatively high density of 1.38, PVC may be too dense for some applications. When exposed to heat, degraded PVC will produce HCl gas. High concentrations of HCl gas can be harmful to the environment as well as humans.

Tooling for use with PVC must resist oxidation from the hydrochloric acid. To prevent excessive oxidation (rusting) of the tool steel, one could consider stainless steel. This will add cost and weight to the tool. Machining time will increase as stainless steel take more effort and energy to machine than carbon steel.

Vinyl resins have poor heat resistance. Heat deflection temperatures (HDT) are typically around 165°F. During injection molding, PVC has a narrow processing window. This is due to the poor thermal stability and shear sensitivity of vinyl.

Rapid degradation can occur with PVC when exposed to acetel polymers. At processing temperatures, the two polymers are mutually destructive and rapidly degrade. Processers must take care to never mix these two polymers.

The advantages of PVC are notable; dimensionally stable, creep resistant, and inherent flame retardancy. This allows vinyl products to be used in many applications. These properties are balanced by the poor heat resistance and processing safety.

References

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The Vinyl Institute. www.vinylinfo.org