PVC, URETHANE AND LEATHER
A COMPARISON

POLYVINYL CHLORIDE (PVC)

It's produced from natural gas and common table salt (sodium chloride), which is separated into chlorine and sodium. Chlorine is used to make disinfectants, pharmaceuticals, various chemicals, and plastics, including polyvinyl chloride. (The sodium is used to make soaps, detergents, and a wide range of beneficial products.) The intermediate chemical used to make PVC, vinyl chloride monomer (VCM), was found in the 1970s to cause a rare form of cancer. However, today's improved methods of producing both chlorine and VCM are tightly monitored by Federal regulations essentially minimizing risk.

PVC is produced in a closed vessel by adding a catalyst to the VCM in water. The finished plastic particles are removed and cleaned of all but a trace quantity of the VCM, which is then recycled. When processed into finished products, no detectable level of residual VCM should remain. PVC does not degrade back to VCM, but under extreme exposure to heat and light, can produce hydrogen chloride. However, scavengers are added to PVC compounds to capture any HCL that might form.

In a fire, PVC will also produce hydrogen chloride, which quickly reacts with surrounding materials. (Hydrogen chloride is the principal component of the human digestive system that converts food into a form that can be absorbed into the body.) The major causes of death in a fire, however, are suffocation and carbon monoxide poisoning. PVC-coated fabrics are commonly engineered to retard, or restrict flame spread—and are widely used for commercial applications (i.e., public seating, automotive, and aircraft interiors, etc.). PVC products also have a major safety advantage versus common plastics such as polyethylene and polypropylene, which can melt, dripping as a hot waxy substance, which will stick to the skin, causing severe burns.

The most common PVC-coated fabric manufacturing facilities can be compared to "non-edible bakeries", where PVC, with the consistency of flour, is mixed with oils, preservatives, leavening agents, colorants, and various additives to produce a 'batter' that is spread on a continuous "cookie sheet", which travels through an oven to produce a leather-like material. Proper selection of these ingredients can produce a wide range of environmentally friendly products.

POLYURETHANES

Recognized for many desirable attributes, they may be or may not be more environmentally friendly. While chlorine is not present in the finished product, it is used in preparation of some of the intermediate chemicals, which consist mainly of reactive isocyanates, polyols (alcohols, glycols, etc.), and amines. It is not uncommon for workers to develop severe sensitivity to certain isocyanides and amines.

Most urethanes are subject to degradation by moisture (hydrolysis) or by oxidation. Polyurethane fabrics can be treated for flame retardance, but in a fire it has been

demonstrated that they can decompose first into the initial raw materials, including isocyanides, and then into a wide range of low molecular weight reactive chemicals.

Urethanes can be made in water, from 100% solids, or in solvent systems depending on the desired properties for the intended use. In general, water-based systems are used for top coatings, 100% solids for films, and solvent systems for breathable (coagulated) coated fabrics. Because of health issues associated with coagulation solvents, most manufacturing has moved to those parts of Asia with lower environmental standards.

On a per pound basis, urethane fabrics are significantly more expensive than vinyl coated fabrics. Those based on polycarbonates (higher cost polyurethane resin system) have the best overall physical properties (and the highest cost).

LEATHER

Hides continue to be produced by processes developed as early as the 17th century, where the individual hide is removed from the animal, de-haired in vats, de-fleshed, tanned with Chromium Salts, or with tannins from tree bark (so called vegetable tanning) and saturated with oils (fat liquors), in a process taking many weeks. They are then finished with dyes, pigments, top coatings, and texturizing. Historically, automotive seating leathers have been coated with a vinyl skin to improve wear properties.

END OF LIFE

This term does not necessarily mean landfill for PVC and polyurethane fabrics. Industry-wide estimates indicate that 98% of post-industrial scrap is recycled, and that the recovery of post-consumer material, while small, is growing. Techniques are available to separate vinyl from fabric and reprocess it on conventional plastics equipment. The current lack of a viable way to accumulate post consumer upholstery has limited recycle efforts in this category, however. While laboratory tests indicate biodegradable polymers, such as PLA degrade within months, in a real life landfill, the estimate is in excess of a hundred years. It should be noted that such products are not considered replacements for flexible vinyl coated fabrics at this time.

ADVANTAGES

There are potential advantages and disadvantages for PVC, polyurethane, and leather, based on performance, fashion, perception, cost, and environmental issues. The choice of base ingredients in each affects their safety, tailorability, processability (cutting, forming, tailoring), flame resistance, sustainability, performance, and useful life.

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