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Science for Environment Policy

Product design screening method helps reduce toxic materials in consumer goods

A recent study has described a simple method to screen the toxicity of materials used in consumer products. Using utility meter products as examples, the study found, for example, that stainless steel and polyvinyl chloride (PVC) had high toxicity potentials and suggests less toxic, but equally effective and priced, alternatives that could be used instead.

Product manufacturers and designers increasingly consider not only the performance and cost of the materials used in a product, as has traditionally been the case, but also whether the materials are potentially hazardous to human health and the environment. Hazard-based toxicity screening of materials is a simple method which can be used to reduce the toxic content of manufactured products. Such screening is especially suitable for complex products made up of many components and materials, for example, electronics and other high-tech goods.

This study highlighted the use of the Fraunhofer Toxic Potential Indicator (TPI) to score the toxicity potential of different materials used in consumer products. For each material, the method provides a single number (referred to as TPI per milligram of substance) between 0 and 100. The higher the number, the greater is the potential toxicity of the material.

Each TPI number combines the environmental, health and safety information for a particular material. Environmental toxicity is represented by a water hazard classification; human toxicity by occupational exposure limits; and various physical hazards, such as the flammability of the material, are also captured. In addition, TPI scores can be combined to provide an overall score for a component made up of a variety of materials. As an example, the study assessed the toxicity potential of materials, including metals, polymers, ceramics, glass, liquid crystals, magnets and plasticisers, used in utility meter products.

Materials in utility meters with some of the highest toxicity scores were identified as polymers: acrylonitrile-based materials, such as acrylonitrile butadiene styrene (ABS) and buna-N nitrile rubber, and PVC. Stainless steel was also identified as having a high toxic potential, due to the nickel and cadmium content, which workers are potentially exposed to during the production process.

In addition, components that contained significant amounts of stainless steel and the potentially carcinogenic acrylonitrile- and PVC-based polymers were considered to have the highest toxicity potential. Possible alternative materials with lower TPI scores were identified to replace those with high toxicity potentials. For example, aluminium materials were considered suitable alternatives to stainless steel, and high density polyethylene (HDPE) and polypropylene were suggested as viable replacements for PVC and ABS. As well as toxicity, the selection of alternative materials also depended on technical specifications, e.g. corrosion resistance and machinability, performance and cost.

The researchers highlight the need for standardised toxicity information, as well as reliable materials data to be supplied by manufacturers of products. In the EU, for example, this is happening as the REACH[1] regulations require companies to register substances being manufactured or used that may be potentially hazardous to human health and the environment. The researchers stress the importance of considering any uncertainty in the toxicity and materials composition information available that is used to determine toxicity by this method.

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1. See: www.ec.europa.eu/environment/chemicals/reach/reach_intro.htm