

The Problem of Toxic Pollutants in the Circular Economy

Ethel Eljarrat

Institute of Environmental Assessment and Water Research (IDAEA) – Spanish National Research Council (CSIC)
C/ Jordi Girona 18-26, 08034 Barcelona, Spain
ethel.eljarrat@idaea.csic.es

Extended Abstract

Recycling is a key element in the Circular Economy. However, one aspect that is not usually taken into consideration is the presence of hazardous chemicals in different materials. These materials (textiles, plastics, electronics, tyres, ...) contain a large number of chemical compounds. For example, in the case of plastic materials, these are made up of polymers to which various chemical compounds (plasticizers, stabilisers, flame retardants, sunscreens, anti-bacterials, ...) are added, which can constitute up to more than 50% of the final weight. In the case of textile materials, thousands of chemicals are also used in the different manufacturing processes and finishing activities such as bleaching, printing, dyeing, impregnation, coating or plasticising, both in natural and synthetic textiles.

There are more than 12.000 different chemicals in common use, of which the scientific community is focusing its attention on more than 2.000 of them. At present, there is already scientific evidence characterising more than 60 as substances of high risk to human health. Their toxicity is not acute toxicity, i.e. they do not have immediate effects, but chronic toxicity: the toxic effects appear in the medium to long term due to continuous daily exposure to very low concentrations (10^{-6} - 10^{-9} g). Some of these toxicants are endocrine disruptors, and even such small concentrations can produce serious mutations at the cellular level. Some of the diseases associated with toxic chemical additives include various types of cancer, infertility, hyperactivity and attention deficit disorder, neurodegenerative diseases, autism, cardiovascular diseases, obesity, diabetes, ...

As most of these chemicals are not covalently bound to the materials, they can be released at all stages of the life cycle of products by migration into liquids or solids or by volatilisation. In this way, they contaminate all environmental compartments, air, water or soil. And humans are exposed to these toxic chemicals through three main routes of exposure: ingestion of beverages and food, inhalation of both indoor and outdoor air, and dermal contact.

These toxic chemicals can also be released during the various recycling and waste recovery processes, and may also be present in products produced from recycled materials. If we are looking for a sustainable production model, we must be able to monitor what happens to the toxic compounds present in wastes during the different recycling processes, as well as in the final product. We must also ensure that recycled materials are no more contaminated than new materials. And, of course, we must prevent already legislated toxic compounds from being reintroduced back into the market through recycled products. Scientific studies show the presence of chemical compounds whose use has been banned for more than 10-15 years in materials produced from recycled waste.

The problem is exacerbated when waste is recycled for a subsequent use other than the original one, which is the most common practice today. For example, we recycle plastic bottles to make textiles, or we recycle tyres to make playgrounds or athletics tracks, ... In this case, we must ensure that those compounds that are suitable for the manufacture of one type of material are not reintroduced into a different type of more sensitive product for whose use the chemical compound in question is not allowed. Several scientific studies have shown examples of such critical situations, having found, for example, substances banned for the manufacture of children's toys in toys made from recycled plastics. Recent studies have also shown the presence of various toxic compounds in rubbers from recycled tyres. These rubbers are used for the manufacture of playgrounds without previous studies being able to demonstrate that there is no risk of exposure for children playing on such playgrounds.

For all of these reasons, chemical additives are currently a barrier to moving towards a 'clean' Circular Economy. The Circular Economy must be a 'clean' circle, and dirty recycling undermines countries' efforts to develop a safe Circular Economy, achieve a clean environment and improve people's health.