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Abstract

The Environmental Safety Aspects of Technologically Powerful Materials Are Often Overlooked †

Anne Kahru [1,2,*], Margit Heinlaan [1], Irina Blinova [1], Villem Aruoja [1], Kaja Kasemets [1], Asya Drenkova-Tuhtan [1], Mariliis Sihtmäe [1] and Monika Mortimer [1]

[1] Laboratory of Environmental Toxicology, National Institute of Chemical Physics and Biophysics, 23 Akadeemia Tee, 12618 Tallinn, Estonia; margit.heinlaan@kbfi.ee (M.H.); irina.blinova@kbfi.ee (I.B.); villem.aruoja@kbfi.ee (V.A.); kaja.kasemets@kbfi.ee (K.K.); asya.drenkova-tuhtan@kbfi.ee (A.D.-T.); mariliis.sihtmae@kbfi.ee (M.S.); monika.mortimer@kbfi.ee (M.M.)
[2] Estonian Academy of Sciences, 6 Kohtu, 10130 Tallinn, Estonia
* Correspondence: anne.kahru@kbfi.ee
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Novel materials and their combinations are the basis of societal progress: stone—Stone Age; bronze—Bronze Age; iron—Iron Age. For the current stage of the development of mankind, there is not yet a commonly agreed strategic key material (silicon, polymers, graphene, nano*) but it is generally agreed that novel materials and their combinations are creating the basis of the technological progress. Not all technologically powerful materials are intrinsically safe and may harm humans and our surrounding ecosystems already at relatively low concentrations (copper, silver, zinc, cadmium, lead, mercury, nickel, chromium, platinum, lithium, and cobalt). That does not mean that intrinsically harmful materials cannot be harnessed to offer mankind new developments (incl. for the generation of green energy and the destruction of environmental pollutants). Indeed, some of the intrinsically harmful materials highly conduct electricity (copper), have magnetic properties (cobalt, nickel, and neodymium), or possess multiple technologically beneficial properties (graphene). However, progress cannot be built upon threatening the health of people and the environment. To find a balance between venture and precaution, the environmental fate and safety aspects of technologically powerful materials can no longer be overlooked to be in line with the UN Sustainable Development Goals, The Green Deal, and One Health programs. In addition, environmental toxicity data are imperatively needed for all materials sold or marketed in Europe in large quantities, as regulated by REACH legislation. Moreover, the data on the toxicity of almost all elements in the periodic table as well as on plenty of organic compounds to conduct the initial risk assessment are available in various databases and scientific resources. Unfortunately, the communities of material scientists and engineers who create novel materials and devices and environmental scientists who have knowledge on harmful effects of materials are educated separately and do not share the same information space in their professional life. Due to that, there is a big risk that the novel technologies will be introduced on a large scale before their environmental aspects (but also human health aspects) have been deeply evaluated. To avoid that, a holistic approach, covering also safety aspects [1], is needed while novel technologies are planned and designed, analogous to that applied in nanomaterials safety research about 20 years ago when physicists, biologists, chemists, material scientists, environmental scientists, and medical doctors joined forces for the analysis of potential harmful effects of nanomaterials—cornerstones for nanotechnologies [2,3].

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