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The Need for Chemical Simplification as a Logical Consequence of Ever-Increasing Chemical Pollution

Today, we know that chemicals can be found pretty much anywhere. An article titled "The Need for Chemical Simplification as a Logical consequence of Ever-Increasing Chemical Pollution" was released in October of this year to discuss this. Studies show that mixtures of hundreds, if not thousands of chemicals, are present in the environment today. However, little information exists on the effects of most of these chemicals on plants, animals, and humans. It was reported by the European Chemicals Agency that for the 24000 chemicals (more or less) registered under REACH, 88% of the records reviewed were incomplete. Most notably, they lacked information on the long-term impacts of these chemicals. However, the important chemical compounds that have been extensively studied have proved to affect multiple life functions, including reproduction. Today, "the chemical pollution problem is being considered as one of nine planetary boundary threats, yet the least well understood."

Usually, once we accept that there is a problem, the next step is to understand just how big of a problem it is. In this case, the magnitude of the problem remains largely unknown. However, this doesn't stop scientists from being able to observe trends. For one, hazardous substances like persistent organic pollutants or mercury have been regulated by international conventions, and yet, studies are showing that the concentrations of these substances in Arctic top predators are still high and don't seem to be decreasing. In the agrochemistry industry, the development of new ingredients is still driven by a desire to use highly effective substances and replace pesticides that are toxic for mammals. This proved to be successful in avoiding impacts on mammals, fish and birds, but is still having drastic and growing effects on pollinators, aquatic invertebrates, and terrestrial plants. It is unfortunately quite common for attempts to replace problematic substances to be ineffective, and in some cases, even lead to increased risk.

Legislations requiring chemical risk assessments are in place in many countries, so how come this keeps happening? How come harmful chemicals still end up being produced and sold? There are two main reasons. First of all, the number of chemicals that exist in commerce is estimated to be anywhere between 100,000 to 350,000. This is a rather overwhelming amount, not to mention the rate at which these numbers are increasing. The fact that many of these chemicals are later transformed into other products makes it even more difficult for chemical risk assessments to be up to date. It has been argued that better chemical risk models need to be developed, however, here lies the second problem. Predicting interactions between these thousands of chemicals and thousands of biological targets, not to mention predicting impacts on each potential component (cells, organisms, populations, ecosystems), is an incredibly overwhelming task.

If that's the case, what does a solution look like? "What is the consequence of the above outlined state of the environment, regulation and science in our field and how can we achieve a more positive future trajectory?" The article proposes chemical simplification as a solution. They argue that it should not be seen as a "political position", but rather the "logical" outcome at this point in time where decades of research into risk assessment and regulations haven't been successful in solving the problem of chemical pollution.

Chemical simplification involves two important components, the first is to reduce the number of chemicals. Reducing the number of chemicals is not only vital in limiting our exposures to them, but also plays a key role in the transition to circular economies given that recycling requires a certain level of chemical simplicity. The second important

component is to make grouping a common practice. Grouping is key to being able to estimate the potential risk of chemicals where data is missing. Once grouped, chemicals lacking data are compared to other chemicals in the same class that do have sufficient data. This would allow hazardous profiles to be identified and ruled out without having to conduct a detailed risk assessment each time. It would also play an important role in transitioning towards simplified and reduced chemical portfolios.

For some, chemical simplification appears to be a step backwards and not forwards. Is it? The article brings to light the fact that chemicals simplification will require plenty of innovation in science and engineering. For example, products and materials that are less chemically intense but still functional will have to be developed, a process which will require lots of work. With growing environmental awareness, products and materials that are chemically simple are also growing in demand by brands of consumer products and the consumers themselves. Keeping this in mind, the authors of this article hope to see more discussions happening on how to "innovate chemicals, chemical products, and chemical assessment towards simplicity, efficiency, and environmental safety."

References:

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