If you never buy packaged food, you can safely skip this article

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Food contact and packaging articles are made up of a very large number of different food contact materials (FCM), each of them consisting of numerous food contact chemicals (FCC). Inevitably, FCC migrate from any type of material into the food and consequently, they are absorbed along with the food. Muncke et al. [2020] emphasise their concern based on scientific evidence that FCM and articles are a relevant exposure pathway for known hazardous substances as well as for a plethora of toxicologically uncharacterised chemicals.

There are flaws in our packaged food safety control

It has been quite a long time since Grob et al. [2006] called for a more realistic perception and more coherent legal measures because of sufficient evidence to suggest that FCC can be transferred from food contact materials and articles into food. It is now very clear that a substantial majority of the human population is exposed to a number of these chemicals. Indeed, for many FCC there is evidence of human exposure from biomonitoring.

When FCM regulations were first developed, it was generally assumed that low-level chemical exposures – for example, the exposures below the toxicologically established no-effect level – pose negligible risks to consumers, except for carcinogens [Crump 2011]. Recent scientific information however demonstrates that this assumption is not generally valid: for example, exposure to low levels of endocrine disrupting chemicals can generate adverse health effects [Kortenkamp 2007; Vandenberg et al. 2012; Gore et al. 2015]. Additionally, chemical mixtures play a predominant role in the development of adverse effects. Very often, cumulative effects exceed the sum of individual effects [Kortenkamp & Faust 2018; Goeyens 2019; Trasande 2019]. This is of the utmost importance: human exposure to chemical mixtures is the norm, but this is currently not considered when assessing health impacts of FCC. And another critical aspect for understanding the development of chronic diseases is the timing of exposures during foetal and child development [Heindel & Vandenberg 2015].

These highly important insights are insufficiently considered in the risk assessment of chemicals in general and of FCC in particular [Muncke et al. 2020 and references herein]. What we must do is look beyond the presence of one particular molecule or other and focus on the biological activity –

carcinogenicity, hormonal disruption, immunotoxic properties, neurobehavioural disturbances, etc. – of the food and drinks we consume. Control agencies generally highlight the only molecule whose concentration exceeds the threshold value, but it is the mixture of highly different molecules that constitutes the threat.

In the European Union (EU), regulation EU 10/2011 on plastic materials and articles intended to come into contact with food includes a list of authorised substances for the manufacture of plastic materials and articles. It also sets acceptable maximum concentrations for some of the chemicals in the plastic FCM or in the packaged food (i.e. after migration). Many substances present in plastics, however, are non-intentionally added substances (NIAS). Even though regulations EU 10/2011 and EU 1935/2004 require a risk assessment of NIAS, this is a an almost impossible task. Identifying the NIAS is extremely demanding, if not impossible [Nerin et al. 2013; Pieke et al. 2018] as is studying the human health effects of NIAS. Most chemicals are currently unavailable as pure substances, and testing would prove too expensive.

So, what can we do?

People face an essentially un-quantified risk: food processing and packaging procedures have introduced high numbers of chemical contaminants into our diets, even though it is common knowledge that consumers will be serving as human sponges, soaking up and storing the contaminants in their bloodstreams. Is there anything we can do to defuse the ticking time bomb that has been inserted into our bodies without our consent? Muncke et al. [2020] highlight a number of points that will require the commitment of all the stakeholders concerned.

Our current risk assessment system is lagging behind and simply does not meet today's living standards. Regulatory agencies should update whatever hazard and exposure data are necessary to produce safety standards based on current scientific know-how and understanding [Muncke et al. 2017 & 2020]. The current approach to pre-market, prospective risk assessment of chemicals in FCM is insufficient to ensure public health protection since it relies on assumptions that do not reflect contemporary scientific knowledge and is sometimes based on inadequate industrial self-monitoring. Even the GLP (good laboratory practice) labs do not always deliver reliable data [Pesticide Action Network 2020]. Since food packaging is an essential link in the food supply chain, regulatory mechanisms and risk assessment approaches should be updated and strengthened.

Endocrine disruption, as a specific hazard, is not routinely assessed for FCC. Several chemical migrants are known to be endocrine disruptors, however [Nerin et al. 2018]. Screening assays for endocrine disruption should be developed and/or optimised. Deriving a safe threshold may not be easy, however, since endocrine disrupting chemicals with non-monotonic dose responses do not only have increasing effects with increasing doses, but may also have effects in the low-dose range [Gore et al. 2015]. Also, the mixture toxicity of the overall migrate, i.e. all chemicals migrating from FCM, should be determined for a relevant set of hazards such as genotoxicity, mutagenicity, reprotoxicity, and endocrine disruption. This means that finished food contact articles should also be tested for their biological activity. Hence, regulators and other stakeholders should invest in research and development for fast

or high-throughput approaches in order to screen the overall migrate (the complex contaminant mixture).

Finally, enforceable new regulations and sufficient resources for compliance control must be made available to authorities.

The current situation contradicts our dominant economic model based on unlimited growth and non-restrictive use of resources

Food packaging has become an important issue in discussions on circular economy [Ellen MacArthur Foundation 2017]. Priority projects include reuse, recycling or replacing plastic food packaging with alternative materials. Circular economy is a trilogy: (1) waste should become a starting material, (2) consumables should be non-toxic and possibly even beneficial, whereas durables should be reused, recycled or re-manufactered, and (3) energy sources should be sustainable, renewable by nature. Known hazardous chemicals should preferably not be used in the manufacture of food contact articles; moreover, if the use of known hazardous chemicals is essential and currently no suitable substitutes are available, research into developing safer alternatives should be a first priority. The development of safer alternatives could be based on current scientific principles, such as the Tiered Protocol for Endocrine Disruption [Shug et al. 2013].

For all of this, a multi-stakeholder dialogue should be established to identify solutions that are sustainable and focus on protecting humans and the environment while providing effective, efficient and affordable food packaging in a circular economy. Stakeholder needs are likely to vary between countries and cultural regions; diversity will not enable a “global” solution, but it must be respected.

Sustainable food packaging in the circular economy

It may only be achieved by combining efforts. All conflicting goals must be considered, and all stakeholders, including food and packaging manufacturers, recyclers, decision makers, civil society, and consumers must be involved [Geueke et al. 2018]. Why? Because food packaging is an issue that concerns us all.

It would be utterly wrong to claim that food packaging serves no useful purpose. Imagine taking home a litre of wine and a kilo of peanuts without being able to rely on any form of packaging.

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LIFE AND CHEMISTRY OFFICE

April, 2020