Bio-Based Materials for Use in Food Contact Applications

Area of research interest: Chemical hazards in food and feed
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Conducted by: Fera Science Ltd (UK National Reference Laboratory for FCMs)

Background

Food packaging provides a wide range of functions that extend beyond ensuring food safety and supply chain integrity. However, exposure to contaminants or the components of food contact materials due to migration into food, poses a potential risk to human health. Depending on the nature of the migrating chemicals, and the overall exposure, the risk can be either negligible, acute or chronic.

BBFCMs are derived from renewable biological resources (both animal or plant sourced; mostly by-products of agricultural and food production). They consist of polymers directly extracted or removed from biomass, by a range of different processes. For example, produced by chemical synthesis using renewable bio-based monomers or produced by microorganisms or genetically modified bacteria. They are attractive alternatives to oil-based polymers because they are derived from sustainable sources and are generally biodegradable or compostable. Substantial increases in the volume and range of BBFCMs available to food manufacturers are anticipated, driven by regulatory and consumer pressures, and hence greater use of these materials by the food industry is predicted. As a result, it was agreed to carry out a comprehensive literature review of BBFCMs, in order to understand any potential impact this may have related to FCM risks.

Research Approach

The review focused on those materials already marketed for food contact use, as well as any scientific literature which reports on the development of new materials. It covered the presence of chemical contaminants (whether intentionally or non-intentionally added substances), microorganisms, allergens, nanomaterials and their transfer through contact to food. The effect on shelf-life performance and evaluation of the toxicity of the BBFCMs was also examined. The chemical contaminants investigated included naturally occurring organic toxins (e.g. mycotoxins, plant toxins), industrial organic pollutants (e.g. dioxins, PCBs), inorganic heavy metals (e.g. lead, arsenic, mercury), and process contaminants (e.g. furan and acrylamide).

The work of UK academic institutions actively involved in this area was identified and their research programmes were summarised. As well as identifying any materials used and the stage of development, any additional work required to take the products to market and any work carried out to assess their suitability for contact with food was considered.

Results

The report highlighted that BBFCMs can exhibit barrier properties similar to traditional oil-based plastics, enabling comparable shelf life performance and consumer protection. However, it also identified that to date, limited research has been undertaken into the development of BBFCMs

derived from agri-food by-products and understanding the associated risks to the consumer. To be used in the food sector, information on the presence of inorganic contaminants such as heavy metals, persistent organic contaminants and natural toxins in BBFCMs, and their capacity to transfer into food, is required.

Current analytical methods and risk assessment processes, used for establishing contaminant chemical transfer from oil-based plastics to food, are expected to be appropriate for or adaptable to BBFCMs. However, in addition to developing and standardising new analytical procedures for BBFCMs, surveillance of the materials in use within the supply chain should be considered, as this would enable the evaluation of any potential risks posed to consumer safety by BBFCMs.

The properties of BBFCMs, such as biodegradability, combined with their manufacture from diverse biomass resources, may lead to additional sources of risk that are not observed with traditional plastics. For example, very limited information is available on the potential allergenicity of BBFCMs or the potential for the transfer of allergens to food. Other potential barriers to the adoption of BBFCMs, especially if derived from agri-food by-products, include variability in the availability and characteristics of the source materials.

Further issues might include consumer acceptance, where animal-derived materials are used. The traceability and authenticity of the source materials used and the BBFCMs derived from them may also need to be considered, to ensure supply chain integrity.

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