

COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Position paper on the alternatives to conventional plastics for food & drinks packaging

Background and Introduction

1. In conjunction with pressure from environmentally aware consumers and the strategy to reach net zero to mitigate the effects of climate change as well as the “*blue planet effect*” (Dunn *et al.*, 2020)¹, recent years have seen a major global increase in the development and use of alternative biobased materials to conventional plastics² for food & drinks packaging.
2. These alternatives are a diverse, complex set of materials and blends. The materials are usually derived from living matter (animal, plant or fungal biomass) and are partially or wholly made of substances that are naturally available or are synthesised from biomass, such as sugarcane, corn, and algae. Some examples include, but are not limited to, wheat straws; beeswax wraps to replace clingfilm; and bamboo/rice husk for paper coffee cups.
3. The alternative materials are usually classified into three main groups:
 - Bio-based plastics: ‘made using polymers derived from plant-based sources such as starch, cellulose, or lignin. Bio-based plastics can be engineered to be biodegradable, but can also be made to have the same durability as conventional fossil-based plastic’³.
 - Biodegradable plastics: ‘can be broken down into water, biomass, and gasses such as carbon dioxide and methane. The extent of biodegradability depends on environmental conditions such as temperature, humidity, microorganisms present, and oxygen’⁴.

¹ Dunn, M.E., Mills, M. and Verissimo, D., 2020. Evaluating the impact of the documentary series Blue Planet II on viewers’ plastic consumption behaviors. *Conservation Science and Practice*, 2(10), p.e280.

² Plastics are a wide range of synthetic or semi-synthetic materials that use polymers as a main ingredient.

³ Department for Business, Energy & Industrial Strategy and Department for Environment Food & Rural Affairs, [Standards for Bio-Based, Biodegradable, and Compostable Plastics: Call for Evidence](#) (Department for Business, Energy & Industrial Strategy, Department for Environment Food & Rural Affairs, 2019)

⁴ Ibid

- Compostable materials: ‘a sub-set of biodegradable plastics that break down into water, biomass and gasses under composting conditions. Industrial composting conditions are the most optimal’⁵.

4. Advice on biobased food contact materials (BBFCMs) has been increasingly requested from the Food Standards Agency (FSA) so it was therefore considered timely for the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) to review the available toxicological information on BBFCMs. The following position paper summarises preliminary discussions at COT and their future work, including reasons for prioritisation, as well as identifying the individual BBFCMs recommended for further review.

COT discussions and papers

5. Several papers have been presented to the COT, which included discussion of the following topics: the limited research that has been undertaken into the development of BBFCMs and the associated potential risks to the consumer (TOX/2020/24⁶); relevant market data⁷ and reports⁸ (TOX/2020/50⁹); a table of enquiries received from the FSA Food Contact Material (FCM) Policy Team (TOX/2020/50¹⁰) - these included Non-intentionally added substances (NIAS¹¹) such as the presence of formaldehyde in bamboo cups and the allergic potential of material such as chitin and wheat; as well as a detailed discussion paper focussing on the immunogenicity and allergenicity of chitin and chitosan-based BBFCMs (TOX/2020/42¹²).

COT conclusions

6. The COT acknowledged the challenges and complexities associated with BBFCMs as well as highlighting several limitations and knowledge gaps on BBFCMs research and regulation. These included labelling¹³, composition (including biodegradability), contaminants and standardisation. Members noted that quantitative information was needed on contamination, degradation, migration of chemicals and allergens during the manufacture and use of commercial BBFCMs, as well as environmental impacts after disposal, such as the formation of micro/nano-particles upon entering landfill or from energy-from-waste processes. It was noted that only limited evidence exists to demonstrate BBFCMs in direct food-contact applications meet similar standards of safety as conventional plastics.

7. Members agreed that there was a general lack of information on the presence of nanomaterials in BBFCMs. Therefore, overall, information on specific migration of all the possible migrating substances (nanofillers, plasticizers, antimicrobial additives, micron and nano sized plastic particles *etc.*) under different testing

⁵ Ibid

⁶ https://cot.food.gov.uk/sites/default/files/2020-08/tox202024plasticpackagingalternatives_accessibleinadobeopro_0.pdf

⁷ https://docs.european-bioplastics.org/publications/market_data/Report_Bioplastics_Market_Data_2019.pdf

⁸ Market and safety analysis of alternatives to plastic food packaging (Renton, 2020).

⁹ <https://www.food.gov.uk/research/research-projects/market-and-safety-analysis-of-alternatives-to-plastic-food-packaging>

¹⁰ https://cot.food.gov.uk/sites/default/files/2020-10/TOX_2020_50%20BBFCM%20paper%20update.pdf

¹¹ https://cot.food.gov.uk/sites/default/files/2020-10/TOX_2020_50%20BBFCM%20paper%20update.pdf

¹² Non-intentionally added substances are chemicals that are present in a FCM but have not been added for a technical reason during the production process

¹³ <https://cot.food.gov.uk/sites/default/files/2020-09/TOX-20-42%20Chitosan%20%26%20chitin%20BBFCMs.pdf>

¹⁴ The COT was informed that that there was currently no legal requirement to have labelling on packaging to state if it was biobased, or whether it contained allergens.

conditions would improve identification of potential hazards and enable an estimation of possible exposure. This would allow better demonstration that these novel biodegradable packaging materials meet comparable requirements. Additional toxicity studies or approaches to enable assessment of long term risk may be needed for a more comprehensive risk assessment.

Priority BBFCMs to review for health risk assessment and next steps

8. The COT agreed a priority list of BBFCMs for health risk assessment based on their potential health hazards, extent of usage, and UK policy interest (TOX/2021/01¹⁴). The prioritised materials to be reviewed are: polylactic acid (PLA), starches, bamboo biocomposites and polyhydroxyalkanoates (PHA)¹⁵. This was not a closed list, other priority BBFCMs could be added as necessary based on the same criteria.

9. Health risk assessments of the prioritised BBFCMs should be considered within the context of life cycle assessment studies, which include environmental hazards to address indirect impacts on human health. However, this was not all within the remit of the COT. It was noted that the Department for Environment, Food and Rural Affairs (DEFRA) (and its expert scientific committee, the Hazardous Substances Advisory Committee, HSAC), the Organisation for Economic Co-operation and Development (OECD), and the Environment Agency were assessing the wider environmental impacts. These impacts should be monitored to identify additional potential hazards to human health.

10. Further assessments of intelligent packaging¹⁶ (also known as smart packaging) and nanomaterials used within food packaging will be undertaken as policy priorities and resources permit as part of the Committee's work¹⁷ and would include bio sensors as well as nano coatings.

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¹⁴ <https://cot.food.gov.uk/sites/default/files/2021-01/TOX-2021-01%20Matters%20Arising%20Final.pdf>

¹⁵ <https://cot.food.gov.uk/sites/default/files/2021-01/TOX-2021-01%20Matters%20Arising%20Final.pdf>

¹⁶ Intelligent packaging: packaging system that is capable of carrying out intelligent functions (such as sensing, detecting, tracing, recording and communicating) to facilitate decision making to extend shelf life, improve quality and enhance safety.

¹⁷ <https://cot.food.gov.uk/sites/default/files/2021-05/COT%20Draft%20Minutes%20Feb%20Final.pdf>