Identification and prioritisation of risks to food safety and quality associated with the use of recycled waste-derived materials in agriculture and other aspects of food production

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Background

Due to the increased importance of resource efficiency and sustainability, there is greater interest in the re-use and recycling of waste and waste-derived materials, and an expanding range of routes via which food could be exposed to these materials. Developments in analytical techniques, together with horizon scanning exercises, mean that new agents that could be a concern for food safety are constantly being identified in materials that are considered to be well-understood (e.g. compost and biosolids), whilst new exposure routes (e.g. use of recycled materials in food packaging and animal bedding) continue to be developed. This results in many potentially hazardous agents and exposure routes that need to be identified and prioritised so that potential risks to food safety can be appropriately assessed and managed.

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Research Approach

The aim of this project was to allow us to identify the key risks (if any) to consumer safety from recycled waste and waste-derived materials and to enable future research projects to be targeted to investigate specific issues of concern to fill any data gaps.

The specific objectives were as follows.

- Identify the waste and waste-derived materials that are or could be associated with food production, whether in the UK or from food produced outside the UK and imported. Identify potentially hazardous agents within these materials, and routes through which food could be exposed to them.
- Rank the waste and waste-derived materials using qualitative methods (and for a selected subset using a semi-quantitative risk assessment technique), all underpinned by data from

published literature and outputs from a stakeholder workshop.
- Produce a report that prioritises the waste and waste-derived materials and recycling routes that require further investigation, highlighting significant data/knowledge gaps and detailing how these could be addressed in subsequent studies.

For each material and recycling mode combination, a literature review was conducted, which informed a qualitative risk assessment using experts' opinions. The qualitative risk assessment included the following.

- The number of different categories of potentially hazardous agents (microbiological, chemical, physical, radiological, nanoparticles, and anti-microbial resistance) that a material may contain and whether these are present at concentrations judged to be capable of causing harm in the human food chain.
- The number and effectiveness of the modifiers that may be present along an exposure pathway. These act to prevent the potentially hazardous agent(s) from entering the human food chain (e.g. dilution, washing), or conversely lead to accumulation or multiplication of potentially hazardous agents (e.g. growth of microbes).
- The degree of uncertainty regarding the potentially hazardous agents and exposure pathway due to deficiencies in the evidence base.

Different practices that occur within the UK, other EU countries, and non-EU countries were considered separately. Materials and practises that have recently been evaluated were not re-evaluated. Where multiple scenarios could be included within a term, the highest plausible hazard scenario was selected.

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Results

Fifty four waste and waste derived products linked to recycling modes were identified and qualitatively assessed. The materials were recycled by: applying to agricultural land (e.g. eggshells), used in animal bedding (e.g. recycled cardboard/shredded paper), used in livestock or fish feed, (e.g. sugar beet residues), and used in other ways (e.g. biopolymers in food contact packaging). These were grouped into high, medium, and low priorities for further investigation. The priority class boundaries do not have any specific meaning in terms of the risk of harm.

- A number of the wastes and waste derived products that we investigated have been shown to be potential sources of antimicrobial resistance (AMR); risks associated with the transfer of AMR were judged to be higher than other potentially hazardous agents present in waste materials. We therefore recommend that research is funded to better understand how AMR might be transferred from recycled waste materials into the food chain.
- The qualitative priority ranking outcomes indicated that future research should focus on certain recycled materials and practices used in food production outside the EU, because this assessment was largely driven by the uncertainty involved.
- Food safety risks in the context of waste recycling and food production are moderated by a wide range of policies, regulations and practices in waste management and processing, feed formulation, food production and in the retail supply chain, and involve multiple actors and very often multiple jurisdictions. A detailed review of this complex system would be invaluable to characterise it, identify its existing strengths as well as its weaknesses, and to establish the role that we could play in advocating the need for change, improving co-ordination between stakeholders and plugging gaps in the control of food safety risks.
- It would be timely to undertake a more in depth literature review of nanoparticles in the broad range of different waste derived materials used in food production.

- There is a need to better understand how mixtures and blends of recycled waste materials could affect issues such as potentially hazardous agent concentrations, bioavailability in soil and crop uptake.
- Whilst there has often been detailed research undertaken into how single potentially hazardous agents present in waste derived materials behave in the environment and the food chain, there is relatively little information on simultaneous exposure to combinations of potentially hazardous agents.

Some UK source term/recycling mode combinations that were scored as Priority 2 merit further investigation.

Research report

England, Northern Ireland and Wales

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