The Royal Academy of Engineering

Nanotechnologies and Food

Response from the Royal Academy of Engineering to the House of Lords Science and Technology Committee call for evidence

March 2009

Introduction

The Royal Academy of Engineering is pleased to submit evidence to the House of Lords Science and Technology Committee call for evidence on 'Nanotechnologies and Food'.

In 2004, the Royal Academy of Engineering and Royal Society were commissioned by Government jointly to produce a study on 'Nanoscience and nanotechnologies: opportunities and uncertainties'[1]. The study did not focus particularly on the food industry; however most of the recommendations are relevant.

This response is based on contributions from Fellows of the Academy. The Academy is content for its input into this call for evidence to be made public and would be pleased to provide supplementary evidence if required. We have chosen to respond to the broad subject areas outlined in the call for evidence rather than the specific questions

1. State of the science and its current use in the food sector

1.1 Nanoparticles occur naturally and have always been created as the products of combustion and food cooking. Naturally occurring nanotechnology is present in many foods. For example, milk contains casein micelles which consist of nanostructures and deliver calcium phosphate to the body.

1.2 New nanotechnologies for food tend to be based on existing systems rather than being completely novel. Producing processing food can involve the creation of micro or nano structures, and understanding how those created structures can be broken down in the digestive system. For example, understanding of how butter emulsions are structured and broken down can be used to build new structures, producing butter with lower fat content yet similar taste and 'mouth-feel'.

1.3 <u>Nutrition and pharmaceuticals</u>

1.4 Nanoemulsions and particles in food can be used to deliver flavours and nutrients. Examples include bio-nanomaterials that allow metabolic inclusion and controlled release systems that help regulate diet and nutrition. Coupled with a stronger understanding of how foods and nutrients are digested, these applications could result in strong health benefits. It is likely that bio-nanomaterials will increasingly be used for food therapeutics (nutriceuticals).

1.5 Pharmaceutical drug products could also be delivered to the body using similar methods. 'Smarter' bio-molecules can be synthesised with tailored release and absorbency characteristics. Nanotechnology will contribute to the low cost manufacture of these bio molecules.

[1] www.raeng.org.uk/policy/reports/nanoscience.htm

1.6 Some nutritional and pharmaceutical applications (including those mentioned above) could be made commercially available fairly easily, but the food industry tend to be more risk averse than most. The risks of consumer rejection and reputation damage may outweigh any potential benefits of a new food technology.

1.7 Food packaging

1.8 In developed countries, nanotechnology tends bo used to create sophisticated food products and packaging to attract consumers. There is significant research effort in areas such as antimicrobial surfaces and in reactive packaging (e.g. indicators that change colour when food is unsafe to eat). These packaging technologies have obvious crossover with medicinal applications such as 'smart' bandages and anti-microbial hospital surfaces.

1.9 Improving manufacturing

1.10 The food industry is keen to increase manufacturing efficiency and reduce waste. Nonstick surfaces that enable a production plant to be cleaned and re-used more rapidly would reduce water usage and therefore cost. It currently requires several litres of water to produce one litre of mineral water, because of cleaning requirements. A range of products is now being tested in the market, using either nano patterning or structuring methods. However, they are currently too expensive to be widely used, or need further development.

2. Public engagement and consumer information

2.1 One of the most important issues to address is the requirement for continued dialogue with the public on nanotechnology. Good public engagement is a two-way process that increases understanding of public attitudes and why barriers in consumer acceptance of new technologies may exist.

2.2 In the US the widespread cultivation of genetically modified (GM) corn is generally accepted, whereas in the UK there has been a backlash against all use of GM materials, including food. UK public attitudes to GM and the reasons for the initial backlash are multi-faceted. The GM example illustrates the need for genuine public dialogue around emerging technologies at an early enough stage to understand people's expectations and concerns, and the reasons underlying these. This indicates the need for public engagement to include those who are not involved in the commercial aspects of the food supply chain.

3. Health and safety and regulations

3.1 Regulatory frameworks are currently adequate although there remains uncertainty over the relative toxicity and therapeutic/nutritional benefits of many nanomaterials. Research is occurring that will produce data on the benefits and risks; this should help inform regulation.

3.2 There are no specific provisions for nanomaterials within the Registration, Evaluation and Authorisation of Chemicals (REACH) regulations.

4. Other comments

4.1 Food production is a complex system involving many inputs such as water and energy. It is worth noting that nanotechnologies can make an indirect contribution to improving food production by helping produce clean water and energy more efficiently.

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