

A big future for the science of the small

01 December 2006

Nanotechnology is the development of new products and processes using matter with dimensions in the range of approximately 0.1 to 100 nanometres. A nanometre is one-billionth of a metre (or one-millionth of a millimetre), making this truly the 'science of the small'. To put this in perspective, the width of one atom is approximately one-tenth of a nanometre, a DNA molecule is about 2.5 nanometres wide and the thickness of a human hair is approximately 80,000 nanometres.

At a recent conference in Amsterdam: 'Nano and Microtechnologies in the Food and Healthfood Industries' (25th-26th October 2006), participants learned that nanotechnology exploits the fact that at the nanoscale, the properties of a material can differ substantially, and in potentially useful ways, from those of the same material at a larger scale. This pioneering technology, which has actually been around for decades, has the potential to revolutionise everyday life in areas as diverse as Information Technologies, communications, energy, cosmetics, textiles, healthcare and food.

Nanotechnology and food

Many food companies are now investing in nanotechnology research that could provide us with safer, healthier, more nutritious and tastier food. Food production costs will be lowered as techniques become more efficient, using less energy, water and chemicals, and producing less waste.

Although there are currently only a handful of food-related products on the market that incorporate nanotechnology, many more exciting new applications are in various stages of development. Some of the key areas in which this emerging science will play a valuable role include food packaging and food safety, and 'interactive foods'. Imagine ice-cream that has the taste and texture of ice-cream without the use of fat!

Food packaging and food safety

'Smart packaging' systems are being developed that will result in better protection of food and improved monitoring techniques that allow food to be traced from 'farm to fork'. Lighter, more flexible packaging materials that are more resistant to heat, light, mechanical and other damage, and materials that can absorb oxygen and moisture, will help to keep foods fresher for longer. Nanoparticles with antimicrobial properties, and dirt-repellent surfaces, are also expected to have widespread application for packaging materials and in machines used in food production processes.

Further down the pipeline are materials that can adjust their properties according to external or internal conditions, such as temperature, and those that can repair themselves when torn or punctured. Another innovative idea is the use of embedded 'nanosensors' in packaging, which can detect minute quantities of chemicals such as those released when a food starts to spoil. The consumer is alerted to the spoilage or

contamination by a colour change in the packaging.

Functional / interactive foods

New food systems are being developed with enhanced functional properties. Visions for the future include low sodium foods that still taste salty due to interactions with the tongue, and nutrient delivery systems that use nanocapsules to deliver micronutrients, antioxidants or even drugs to specific target areas of the body at designated times. Ultimately, 'nanosensors' could be developed that detect an individual's personal profile and trigger the release of appropriate molecules from the product. In this way, foods could be customised according to the specific taste and smell preferences of the consumer, along with their needs related to health status, nutrient deficiencies or allergies. Potential applications include foods that can release an appropriate amount of calcium in consumers with early osteoporosis, or those with 'smart filters' that are shaped to trap molecules that might cause an allergic reaction.

Consumer concerns

Although nanotechnology holds great promise for the future, as with any new technology, consumers naturally have concerns about the possible risks to human health and the environment. Although current EU regulations are considered broad enough to cover existing nanotechnologies, this is currently under review. Thorough pre-market testing of products, focussing on particle size as well as composition, is one way in which consumers want governments to act. Research Institutes and government organisations in the UK and Germany are currently leading in this area. A consultation process, involving both experts and consumers, is being undertaken by the German Federal Institute for Risk Assessment (BfR), and should be completed by the end of 2006.

Further information:

1. [Nanotechnology: Innovation for tomorrow's world.](#)
2. [International Food Information Council.](#)
3. [The National Nanotechnology Initiative.](#)
4. [European Commission](#)
5. [The A to Z of Nanotechnology.](#)
6. [European Nanotechnology Gateway \(nanoforum.org\). Report on Nanotechnology in Agriculture and food](#)
7. [The Royal Society/Royal Academy of Engineering Report: Nonoscience and nanotechnologies: opportunities and uncertainties](#)
8. [Federal Institute for Risk Assessment](#)
9. <http://www.foodtech-international.com/papers/nanotechnology.htm>
10. <http://www.foodtech-international.com/papers/application-nano.htm>