# Chapter 8
# Nanotechnology in the Food Industry

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## ABSTRACT

*This chapter addresses the potential application of nanotechnology in various areas of the food industry. Nanotechnology is having an impact on several aspects of the food industry, from product development to packaging processes. Nanotechnology is capable of solving the very complex set of engineering and scientific challenges in the food processing industries. This chapter focuses on exploring the role of nanotechnology in enhancing food stability at the various stages of processing. Research has highlighted the prospective role of nanotechnology use in the food sector, including nanoencapsulation, nanopackaging, nanoemulsions, nanonutraceuticals, and nanoadditives. Industries are developing nanomaterials that will make a difference not only in the taste of food but also in food safety and the health benefits that food delivers. While proposed applications of nanotechnologies are wide and varied, developments are met with some caution as progress may be stifled by lack of governance and potential risks.*

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## INTRODUCTION

Nanotechnology offers much promise to food science. Food nanotechnology includes a range of potential applications, including alterations to the properties of foods (e.g., nano-additives and nano-ingredients), improvements to the delivery, quality, and safety of food; and the development of enhanced food packaging (i.e., food contact materials). For example, scientists are creating food packages that contain nano-sized particles devised to warn consumers that a food product is unsafe to eat, and are inventing nanoencapsulated materials that can distribute nutrients to human cells. The food industry has been researching how nanoscience can be used to improve food since 1999, and there are signs that the research and development of food nanotechnologies is likely to grow quickly in the coming years. Nanotechnology is expected to influence numerous areas of food science in ways that will benefit both the food industry and consumers. For example, nanotechnology is being used to improve the quality and safety of food. Nano sensors are being developed that can detect and signal the presence of spoilage microorganisms, and potentially even differentiate the presence of pathogenic from benign microorganisms. Nanotechnology is also being used to create healthier foods that can deliver nutrients and medications to different parts of the human body and can alleviate allergenic.

The food and beverage sector is a global multi trillion dollar industry. The major food industries and companies are consistently looking for ways to improve production efficiency, food safety and food characteristics. Extensive research and development projects are ongoing with the ultimate goal of gaining competitive advantage and market share. For an industry where competition is intense and innovation is vital, nanotechnologies have emerged as a potential aid to advances in the production of improved quality food with functionalised properties. Advances in areas such as electronics, computing, data storage, communication and the growing use of integrated devices are likely to indirectly impact the food industry in the areas of food safety, authenticity and waste reduction.

Nanotechnologies involve the manipulation of matter at a very small scale generally between 1 and 100 nanometres. They exploit novel properties and functions that occur in matter at this scale. Nanomaterials and nanoparticles may include any of the following nano forms: nanoparticles, nanotubes, fullerenes, nanofibres, nanowhiskers, nanosheets. A nanoparticle is defined as a discrete entity that has three dimensions of the order of 100 nm or less. A nanomaterial is defined as an "insoluble or biopersistent and intentionally manufactured material with one or more external dimensions, or an internal structure, on the scale from 1 to 100 nanometres. Nanotubes have a cylindrical lattice arrangement of material; fullerenes have a spherical molecular arrangement; and nanofibres have a length to diameter ratio of