

Chapter 6

Revolutionizing Food: The Latest Frontiers in Food Science and Technology

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ABSTRACT

The food processing industry has witnessed a shift towards innovative non-thermal technologies to meet the growing demand for high-quality, safe, and minimally processed foods while preserving nutritional value and sensory attributes. This chapter explores recent advances in food science, including pulsed electric field (PEF) processing, sonication, high-pressure processing (HPP), nanotechnology, artificial intelligence (AI), and biodegradable packaging. These advances offer sustainable solutions to improve food processing, safety, and environmental impact, but challenges and potential risks need to be addressed for their effective implementation in the food industry. The purpose of the chapter is to provide some basic knowledge about new thinking in comprehensive food discipline and offer a summary of the latest developments in employing digital technologies in food production systems.

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1. INTRODUCTION

In the food processing sector, conventional heat treatment techniques like pasteurization and commercial sterilization are commonly used because they may successfully protect food by getting rid of dangerous bacteria, spoilage germs, and enzymes. However, the high temperatures generated by these methods frequently have negative effects on the food's composition, resulting in a degraded quality and diminished nutritional value (Fellows, 2017). A rapid rise has been observed in customer preference for wholesome, natural foods devoid of additives and preservatives. Because of this, customers' demands for high-quality, secure, nutritional, and minimally processed foods are being met through the development of novel, non-thermal technologies (Knorr et al., 2011). Cutting-edge non-thermal or minimal food processing techniques possess the capacity to safeguard food items without significant heat exposure, all the while preserving their nutritional advantages and sensory attributes intact. These innovative methods can prolong the shelf life of food products, maintaining their inherent flavors and colors, resulting in superior quality and heightened consumer appeal.

2. RECENT ADVANCES IN FOOD SCIENCE

Numerous food businesses looking for alternative ways to food processing have shown interest in cutting-edge non-thermal technology (Brennan & Grandison, 2012). The development of these cutting-edge technologies provides the perfect balance between security and minimum processing, thereby resolving financial restrictions while assuring top-notch quality (Tokusoglu, 2015). They also aid in lowering energy and water use, which reduces the carbon and water footprint related to food preparation. These revolutionary innovations are essential for advancing food security and environmental sustainability (Knoerzer, Juliano, Roupas, & Versteeg, 2011; Knoerzer, Buckow, Trujillo, & Juliano, 2015).

A few technologies are now in use, including waste valorization, sonication, HPP nanotechnology, artificial intelligence, and biodegradable packaging. Few, however, are still under development, such as mapping packaging, ohmic heating (thermal food processing technology), and e-beam.

3. PULSE ELECTRIC FIELD

Pulsed electric field (PEF) processing represents an innovative method for pasteurizing food, employing brief, high-voltage electric field bursts to achieve targeted microbial

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