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REVIEW

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Sonoprocessing: mechanisms and recent applications of power ultrasound in food

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ABSTRACT

There is a growing interest in using green technologies in the food industry. As a green processing technique, ultrasound has a great potential to be applied in many food applications. In this review, the basic mechanism of ultrasound processing technology has been discussed. Then, ultrasound technology was reviewed from the application of assisted food processing methods, such as assisted gelation, assisted freezing and thawing, assisted crystallization, and other assisted applications. Moreover, ultrasound was reviewed from the aspect of structure and property modification technology, such as modification of polysaccharides and fats. Furthermore, ultrasound was reviewed to facilitate beneficial food reactions, such as glycosylation, enzymatic cross-linking, protein hydrolyzation, fermentation, and marination. After that, ultrasound applications in the food safety sector were reviewed from the aspect of the inactivation of microbes, degradation of pesticides, and toxins, as well inactivation of some enzymes. Finally, the applications of ultrasound technology in food waste disposal and environmental protection were reviewed. Thus, some sonoprocessing technologies can be recommended for the use in the food industry on a large scale. However, there is still a need for funding research and development projects to develop more efficient ultrasound devices.

KEYWORDS

Acoustic cavitation; food processing; sonoprocessing; sonochemistry; ultrasound; ultrasonic

Introduction

Innovative thermal and non-thermal technologies have displayed immense potential owing to their wide-scale application in food processing. Among these technologies, ultrasound is widely used for various purposes in food science, including dispersion, catalysis, extraction, nanoparticle synthesis, and graphene generation (Muthoosamy and Manickam 2017). Ultrasound is gaining popularity due to its capacity to preserve natural freshness, taste, and nutritional elements in food while consuming less energy (Wang et al. 2019). Sonoprocessing utilizes ultrasound for transmitting energy to produce chemical and/or physical effects in both laboratories and in an industrial medium stream. Ultrasound is divided into two types based on the frequency range: low-intensity ultrasound (0–1 W. cm^2, >100 kHz) and high-intensity ultrasound (>1 W cm^2, 20–100 kHz) (Nowacka and Wedzik 2016). Both types of ultrasound treatments have practical applications in various disciplines, most notably in food processing and food safety-related sectors. As a nondestructive method, low-intensity ultrasound is utilized to monitor the changes in physicochemical properties during food preparation. In comparison, high-intensity ultrasound is used for many applications, including emulsification, and inactivation of enzymes and bacteria that leads to the extension of the shelf life of food products (Aadil et al. 2015; Wang et al. 2019).

The main ultrasound effects resulted from acoustic cavitation, including the formation and collapse of air bubbles

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.