

# Ultrasound; a Novel and Innovative Processing Method for Egg and Egg Products Preservation

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## Abstract

Fresh eggs are natural and inexpensive source of high quality micronutrients. Egg products are used widely by the foodservice industry in a variety of forms with white, yolk and whole liquid. Thermal processing remains the most commonly used method for achieving safe and convenient these food products including eggs. However, the high temperatures cause detrimental effects on nutritional components such as coagulation and also changes in taste and texture. It is necessary for fresh eggs products to reach the final consumer with high quality. Ultrasonication is a one of the fast, versatile, emerging, and promising green technology used in the food industry from last few years with extended the shelf life including egg processing.

**Keywords:** Egg; Egg products; Egg quality; Egg processing; Ultrasound/Sonication; Cavitation; Microbial inactivation; Quality characterization; Protein functionality

## Introduction

Eggs are natural and inexpensive source of high quality protein and micronutrients and also the most consumed food due to their multifunctional properties such as foaming in cakes and meringues; gelation in cakes and quiches; adding nutritional value (nutritional bars or powdered mixes-protein fortification); and improved texture of baked goods [1]. The egg has a long history of being recognized as an important food ingredient and nutrient source for humans. However, shell eggs are highly perishable foodstuff and undergo considerable quality changes (chemical, physical and microbiological) during long term storage. Thus, it is necessary for fresh eggs to reach the final consumer with high quality [2] with extended the shelf life using effective novel treatment techniques. Food scientists today are focused on the development of not only microbiologically safe products with along storage life, but also, products that have fresh-like characteristics with a high quality in taste, flavor, and texture. Thermal treatments are the most common used

method to obtain safe and shelf-stable foods; however, the high temperatures achieved during processing usually cause detrimental effects on the desirable nutritional components and health related compounds. High temperature is responsible for protein coagulation and changes in flavor, taste, and texture, often creating the need for additives to improve the product. Due to a clear consumer demand for high quality food, new safe and emerging non-thermal effective technologies of food processing and preservation are being developed [3].

Egg are used as raw materials or auxiliary components in the production of many different food products (bakery and pastry industry, mayonnaise, sauces, sports products, ice cream, biscuits, soups, nougat, waffles, chocolate and cream varieties) with freeze, dried (powder) or pasteurized form [4]. Egg is used extensively in the food production for the purpose of gelation, foaming, crystallization retardants, binders, colorants, flavor-giving volume receive, blistering or emulsifier function. Nowadays purpose of the preservation of eggs and egg products to increase the shelf life and stability, pasteurization technique is utilized. However, because of heat treatment can damage the functional properties, flavor and structure of egg; there is increasing demand for alternative pasteurization methods that ensure safety while decreasing product degradation. Novel thermal and non-thermal technologies have been designed to meet these requirements, especially in the processing of egg albumin. At present, several non-thermal processing technologies such as high hydrostatic pressure (HHP) [5-7], ultrasound (US) [8,9], ultraviolet light (UV), pulsed electric fields [10-13], ozonation [14,15], among others, are being used or explored to process foods at low temperatures, avoiding the negative changes induced by heat for perishable food [16-18].

US treatment is one of the sustainable, green, and nonconventional technologies that has gained increasing popularity in food processing, particularly in tissue homogenization, extraction of bioactive compounds, drying, enzyme inactivation, and filtration [19].

It has been observed a limited number of publications concerning the effect of ultrasounds on the processing eggs the use of ultrasound, especially upon improving the quality of

liquid egg. Therefore, with using non-thermal technologies such as ultrasound to improved retention of quality and functional properties with shorter processing times of liquid egg in commercial liquid egg industry will be important. Ultrasonic treatment is one of non-thermal technologies that could be the alternative to existing thermal processing techniques. It is based on the transmission of ultrasonic sound waves (20 kHz to 100 kHz frequency) through a media. Ultrasound with a frequency range oscillating between 16-100 kHz and 10-10000 W/cm<sup>2</sup> of power has immense potential for a wide range of applications in the food processing. The effect of ultrasound is related to cavitation, heating, dynamic agitation, shear stress and turbulence. The rapid bubble collapse produces shear forces in the surrounding liquid. It enhances convective heat transfer as well as generates bubble explosions, which produce local hot spots that could cause microorganism inactivation and enzyme destruction by cavitation [20,21]. The cleaning/disinfecting of factory surfaces, but many of its uses are still being researched. Recently, numerous ultrasound studies were published in using ultrasonic waves may improve the overall characteristics of shell eggs that will result in significant savings for the egg industry. Considerable amount of published work on ultrasonic treatment were dealt with microbiological effect on perishable food rather than functional and chemical properties even it has a broad range of use in food industry [20,22-30]. Thus, it is necessary to investigate the use ultrasound in protection of the internal qualities based on physicochemical and functional properties of egg and egg product. Ultrasound is gaining importance because this non-thermal processing technique is mild, and avoids the formation of off-flavours and the deterioration of food components and nutrients.

## Conclusions

The fresh eggs could be considered as excellent sources of nutrients and functional compounds to provide wellness. Food manufacturers must seek to identify the optimal preservation methods in order to offer products with a high quality and sensorial attributes to alternatives to conventional methods such as sterilization and pasteurization. At the same time, food safety has to be achieved through the preservation methods, making shelf life stable. US technologies have been developed with great success.

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