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Process Bulletin

Pasteurized Liquid Egg

Description

Despite the decline in the consumption of shell eggs in recent years, the demand for liquid egg products in the food industry has been increasing[1,2]. Several hundred million pounds of frozen, pasteurized egg products are produced by the U. S. egg industry every year. Increases in the number of manufactured food items using egg products has resulted in a 30% growth factor in the use of liquid, frozen and dried egg[1]. Some of the applications for pasteurized egg products include whole eggs used for custards and cakes, salted yolks for salad dressings and mayonnaise and other egg products for the manufacture of pet foods, culture media for growth of microorganisms, vaccine production, cosmetics and hair shampoos[1].

Since 1966, U. S. food laws require that all commercial eggs broken out of the shell for manufacturing must be pasteurized[3]. Liquid eggs are pasteurized to destroy salmonella microorganisms that cause an infectious type of gastrointestinal illness[4,5,6]. In general, the pasteurization conditions for egg whites or whole eggs in the U. S. involve heating the liquid egg to 140 - 143°F and holding for 3.5 - 4.0 minutes[3]. Variations of these conditions are made for different egg products such as whole egg, plain yolk, salted yolk, sugared yolk, sugared whole egg or egg whites. Recently, new processes have been proposed for ultrapasteurizing egg products on continuous flow, high temperature, short-time pasteurization equipment "to provide liquid whole egg products for refrigerated distribution which have greatly reduced levels of spoilage microorganisms, while still having good functional properties"[2,7,8]

Objective

Homogenization is used as part of the pasteurization processing of liquid whole egg. The homogenizer is usually located after the hold tube but before the cooler[2,7,8]. However, the homogenizer may also be placed between the heater and the hold tube[5,9]. A detailed description of the pasteurization method will not be covered here, but more information can be obtained from the references given in this report.

The effect of homogenization on pasteurized, liquid, whole egg can be summarized as follows.

1. Homogenization decreases the viscosity of pasteurized and unpasteurized, frozen egg products.
2. Homogenization eliminates separation in frozen egg products during storage.
3. Homogenization improves the foaming power and cake volume for baking products made with pasteurized (or unpasteurized), frozen, liquid egg.
4. However, homogenization can be detrimental to the foaming power and cake volume for baking products made with pasteurized (or unpasteurized), fresh egg products (i.e., product not frozen).

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The details of some of these homogenization effects are described in reference 5. Despite the investigations done on the characteristics of homogenized egg products, there is no explanation given of the physical changes that occur to the liquid egg causing these particular results. One reference suggests that homogenization damages the whipping properties of egg white, because it disrupts the physical structure of proteins. "On the other hand, pressure, per se, under 5000 psi causes no change in the viscosity and functional properties of egg white. Pressure by itself above 5000 psi can cause coagulation of egg white"[10]. Studies on the effects of high pressure on food products have revealed this phenomenon. "In 1914, it was demonstrated that high hydrostatic pressure could coagulate egg albumin with complete coagulation occurring above 6000 kg/cm^2 (85,338 psi). Pressure-induced coagulation was due to protein denaturation"[11].

Equipment

The homogenizer selected for this application should be able to handle the viscosities of liquid, whole egg. In most cases the homogenizing pressure will be 3000 psi or less.

Manufacturers of pasteurization equipment should be able to develop the appropriate systems to handle liquid egg products. Because some of these pasteurization schemes are patented, the inventors should be contacted for any licensing requirements, if these patented configurations are used.

Notes

1. _____, "Ready Eggs", Technical Bulletin (Wisconsin: APV Crepaco, 1990)
2. K. R. Swartzel, H. R. Ball, Jr. and M-H. Hamid-Samimi, U. S. Patent 4,994,291; 1991
3. N. N. Potter, Food Science, Second Ed. (Connecticut: AVI Publishing, 1973), 414-421
4. L. Kline and T. F. Sugihara, "Effects of Pasteurization on Egg Products," The Bakers Digest (August 1966): 40-50.
5. T. F. Sugihara, K. Ijichi and L. Kline, "Heat Pasteurization of Liquid Whole Egg," Food Technology (August 1966): 100-107
6. G. H. McWhinney, "Pasteurized Eggs," The Bakers Digest (February 1966): 53-56 7.
7. K. R. Swartzel and H. R. Ball, Jr., U. S. Patent 5,019,407; 1991
8. K. R. Swartzel, H. R. Ball, Jr. and M-H Hamid-Samimi, U. S. Patent 5,019,408; 1991
9. S.T. Papetti, U. S. Patent 5,465,655: 1995
10. W. J. Stadelman and O. J. Cotterill, Egg Science and Technology (Connecticut: AVI Publishing, 1977), 204
11. David Farr, "High Pressure Technology in the Food Industry," Trends in Food Science and Technology (July 1990): 14-16

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