INACTIVATION OF ALPHA-AMYLASE USED AS AN INDICATION OF EFFECTIVE HEAT TREATMENT OF QUEENSLAND WHOLE EGG PULP

Investigations in the U.S.A. on thermal death times for Salmonella in liquid whole egg (Osborn, Straka, and Lineweaver 1954) and also on the narrow heat range in which pasteurization of whole-egg pulp can be carried out, showed that at temperatures below 135°F Salmonellae are not killed, whereas above 145°F the pulp tends to coagulate. Coagulation is almost instantaneous above 163°F (Payawal 1946; Brooks and Taylor 1955).

A laboratory method for the determination of the destruction of alpha-amylase and Salmonellae in whole egg pulp by heat pasteurization was published by Shrimpton *et al.* (1962), who correlated the inactivation of alpha-amylase with the Salmonellae "kill". It was established that no viable organisms of the more resistant Salmonella strain *S. seftenberg* N.C.T.T. 9959 were recovered after pasteurization at 64·4°C (148°F) for 2½ min, in a continuous flow plant. Complete inactivation of alpha-amylase was accomplished under these conditions.

The applicability of the method was investigated in regard to Queensland factory pasteurized whole-egg pulp as well as the suitability of the pulp following pasteurization at 148°F for commercial use.

Methods

Factory Pasteurization.—The liquid-egg pasteurization plant used by the South Queensland Egg Marketing Board is a continuous automatic system of high-temperature short-time pasteurization. It consists of the stainless-steel plate exchanger now universally used for the heating and cooling of all potable liquids.

A positive displacement pump feeds the egg pulp, at a constant rate, to the plate heat exchanger, where it is heated, firstly by regeneration and then by hot water, to the required pasteurizing temperature. It is held for 2½ min in the series of stainless-steel holding plates, and then rapidly cooled firstly by regeneration and then by chilled water to 38°F before being filled into cans for subsequent freezing. During the trials, the pump was set at 200 r.p.m. to deliver 600 gal of pulp per hr.

Alpha-amylase Test.—The alpha-amylase present in the whole egg, when incubated with standard starch solution, will degrade the starch and prevent the formation of a blue starch/iodine complex on the subsequent addition to iodine.

The intensity of the blue colour formed varies inversely as the residual alpha-amylase activity. It was measured with a Bausch and Lomb Spectronic 20 as percentage transmission at 585 mμ. A Lovibond comparator disc (4·26) has since been placed on the market by Tintometer Ltd., Salisbury, England.

Bacteriological Tests.—The tests for the presence of Salmonellae involved enrichment with double-strength tetrathionate broth and incubation at 37°C. However, McCoy (1962) showed no difference between single and double strengths of tetrathionate broths in the number of resulting positive Salmonellae isolations.

The selective medium was Brilliant Green MacConkey's agar. Harvey (1956) compared bile salt lactose media using bismuth sulphite agar and Brilliant Green MacConkey's agar and recommended the latter. However, as some strains of Proteus also produce red colonies on this medium, biochemical and serological tests were necessary. Polyvalent "O" and polyvalent "H" specific and non-specific Salmonella sera were used in the slide agglutination tests.

Experimental

Egg pulp was pasteurized at the factory at 148°F for 2½ min. Samples were collected and subjected to the alpha-amylase test.

Bacteriological tests were performed on the samples for possible detection of Salmonella strains.

The effect of freezing the pulp on the test was investigated. Pulps were examined after pasteurization and again after being frozen to 0°F.

The combination of freezing and storage of samples in relation to the results of the test was also examined. Samples were tested prior to storage and again after 4 months at 0°F.

Baking trials were conducted by the Central Technical College, Brisbane, to determine the influence of heat treatments on the baking quality of cake mixtures containing whole-egg pulp. Sponges were made from unpasteurized egg pulp and pulps pasteurized at 145°F and at 148°F for 2½ min. The pulps were originally frozen but were defrosted before commencement of the trials.

Results

All factory-pasteurized samples revealed effective heat treatment by the alpha-amylase test, which regards as effectively pasteurized all pulps with a final light transmission reading of not greater than 70 per cent.

Bacteriological tests detected no strains of surviving Salmonellae in the heat-treated pulps, and consistently plate counts of less than 10,000 bacteria per g with absence of coliforms were obtained.

Neither freezing nor storage at 0°F for a period of 4 months affected the negative results of the alpha-amylase test on samples after pasteurization. The number of samples tested was limited, but it would appear that the possibility of reactivation of the enzyme is remote.

The baking trials revealed that slightly longer beating times were required for the egg pulp pasteurized at 145°F and 148°F as compared with the unpasteurized pulp. Nevertheless, with slight modifications, sponges were produced comparable in volume, texture and quality (Figure 1).

All of the 336 pasteurized samples subjected to the test showed effective pasteurization.

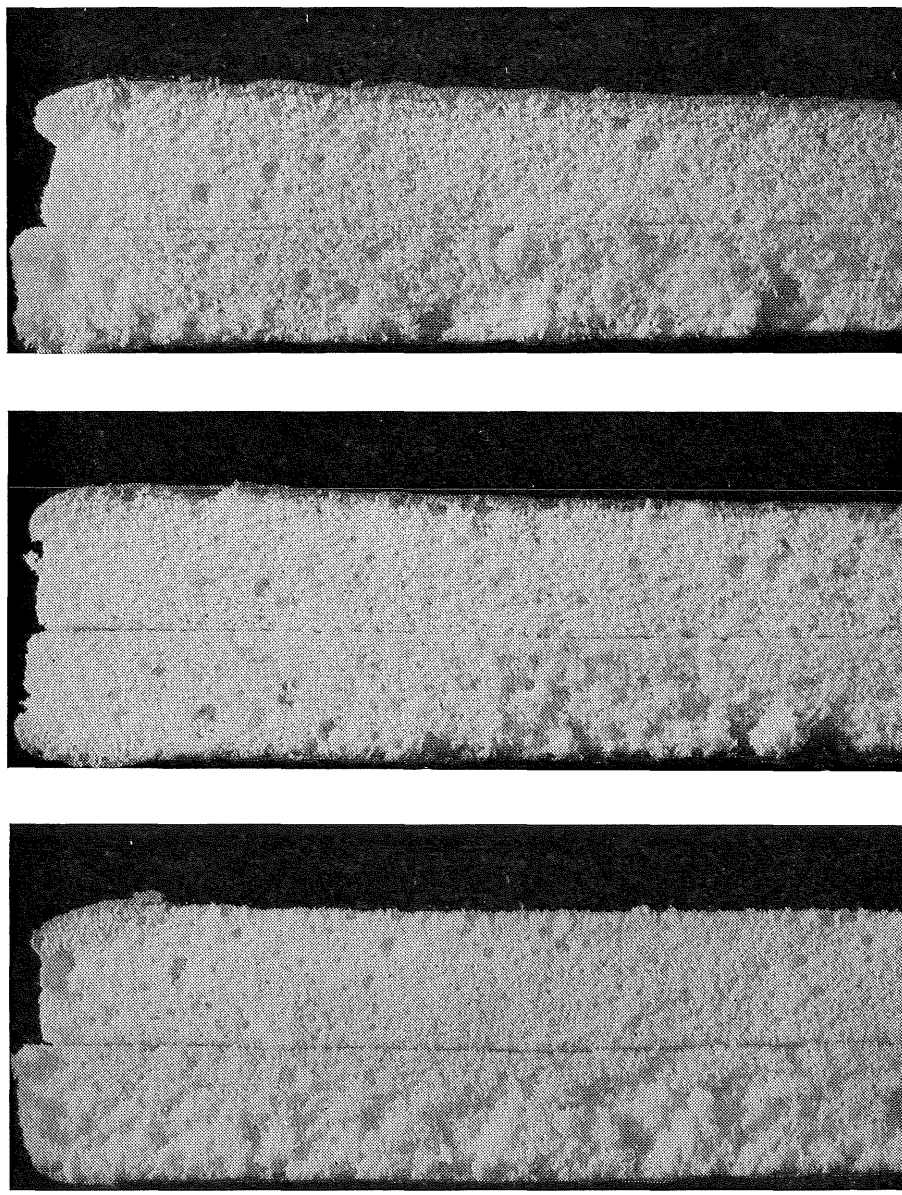

Fig. 1.—Sections of sponges baked with unpasteurized egg pulp (top), egg pulp pasteurized at 145°F (centre), and egg pulp pasteurized at 148°F (bottom).

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