

Improving the Safety of Ready-to-Eat Egg Products

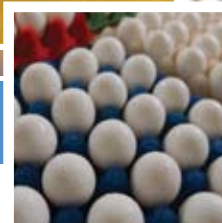
Sheryl Barringer, Food Science and Technology

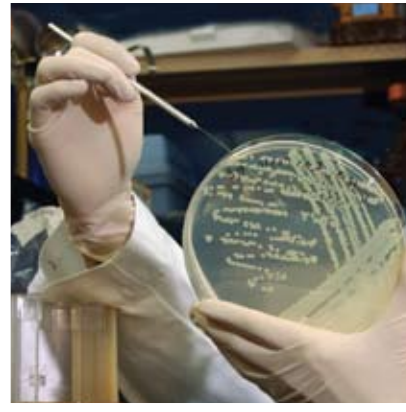
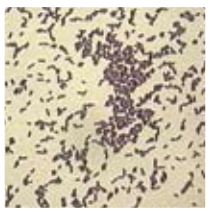
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Listeria monocytogenes, a bacteria, is a major problem in the ready-to-eat food market because it is a pathogen that is found everywhere. *L. monocytogenes* has been responsible for many food-related illnesses and deaths. Because of this bacteria, the USDA has set a zero-tolerance limit for *L. monocytogenes* in foods that will be eaten without cooking or will only be warmed. The objective of this project was to develop a method to produce ready-to-eat cooked egg products that are both safe and tasty.

The first approach was to lower the pH of raw eggs to below the minimum pH needed for growth of *L. monocytogenes*. The food-grade organic acids—citric, sodium acid sulfate, malic, tartaric, and lactic acid—were tested. Citric acid produced a good texture with a pleasant orange flavor. Sodium acid sulfate produced a good texture with a sour off flavor. Malic acid produced a strong off flavor. Tartaric acid produced a slight off flavor with a mushy texture. Lactic acid produced the best results but still had a slight off flavor. Various combinations and masking agents were tested, but ultimately all were unsuccessful at covering the off flavors produced at the pH needed to inhibit growth of *L. monocytogenes*.

The next approach was to develop a cooked, ready-to-eat product that could be distributed frozen and then microwaved without having to be thawed. Various freezing conditions were tested to prevent the formation of package ice from cooling steam. The best combination was to freeze before packaging in a still-air freezer until the center temperature reached 70°C. This resulted in no package ice formation during storage. The process could be shortened by freezing in a blast freezer to an internal temperature of -1°C.





Microwave thawing initially produced uneven temperatures within the food. This was solved by heating the sample for 1 minute 40 seconds while sealed in a bag. To eliminate variations in the food product's texture throughout the product's shelf-life and during the freezing and re-heating process, a cross-linked modified food starch was added to the formulation. This approach produces an acceptable product but is limited to frozen distribution.

Future work will look at the addition of antimicrobials. Antimicrobials can be mixed in with the other ingredients, or applied as a powder to the surface of the product. Surface application has the advantage that less needs to be added, because it is added directly where it is needed. The disadvantage is that the covering must be uniform across the entire surface since microorganisms will grow anywhere the antimicrobial missed.

Future work supported by an industry partner for \$14,745 will study the use of electrostatic coating to apply antimicrobials. Electrostatic coating has been shown to produce more even coating than regular coating, If electrostatic coating can produce even, uniform application of antimicrobials, a minimal amount can be added while still producing a safe product.



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