

Introduction

Custards are used in bakeries as filling for cakes, donuts and puffs, for example. It is commonly known that this type of filling is an excellent medium for growth of many different kinds of microbes, even when stored under refrigerated conditions. Products made using custard filling are extremely perishable, with a shelf life of just two or three days after production. At odds with this tendency to deteriorate, is a growing demand for perishable products with extended shelf life that are also free of preservatives.

According to European guidelines, ready-to-eat products like custards with a shelf life of more than four days need to be tested on outgrowth of *Listeria monocytogenes*. *Listeria monocytogenes* is a pathogenic microorganism that is capable of growing under refrigerated conditions.

Combination of ingredients inhibits *Listeria monocytogenes* outgrowth

Custard fillings have proven to be a good medium for the growth of *Listeria*. The number of possibilities for improving shelf life of these kinds of fillings using conventional methods (f.e. lowering pH or Aw value) are limited, due to alterations in taste or properties of custard fillings.

Smartfood research results indicate that using combinations of ingredients that by themselves have no or even an adverse effect on the custard's shelf life, provide shelf life improvement and even inhibit *Listeria monocytogenes* growth.



Listeria monocytogenes outgrowth on a laboratory medium

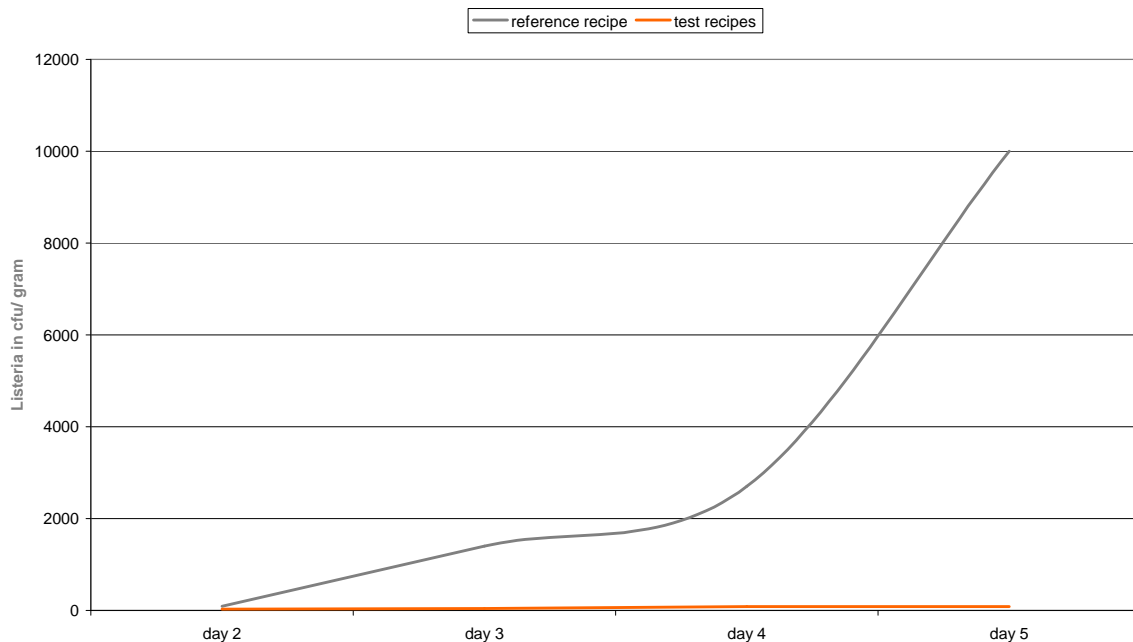
Challenge testing

During research tests, reference products purchased at the local market were compared to test recipes. The test recipes contained several combinations of raw materials that proved effective in extending shelf life. All recipes were challenged using 55 cfu *Listeria monocytogenes* per gram of product. Both test recipes and reference recipes were prepared using instant custard powders, without any processing steps after the preparation of fillings.

Perishable custard fillings

In the reference recipes growth of *Listeria monocytogenes* was found after two days shelf life. In the test recipes *Listeria monocytogenes* did not grow for at least five days (see graph below). All recipes tested were free of preservatives.

Development *Listeria monocytogenes* in perishable custard



During this test, an additional interesting observation was made. In order to measure any possible growth of present spoilage microbes; total aerobic plate count was measured during the challenge

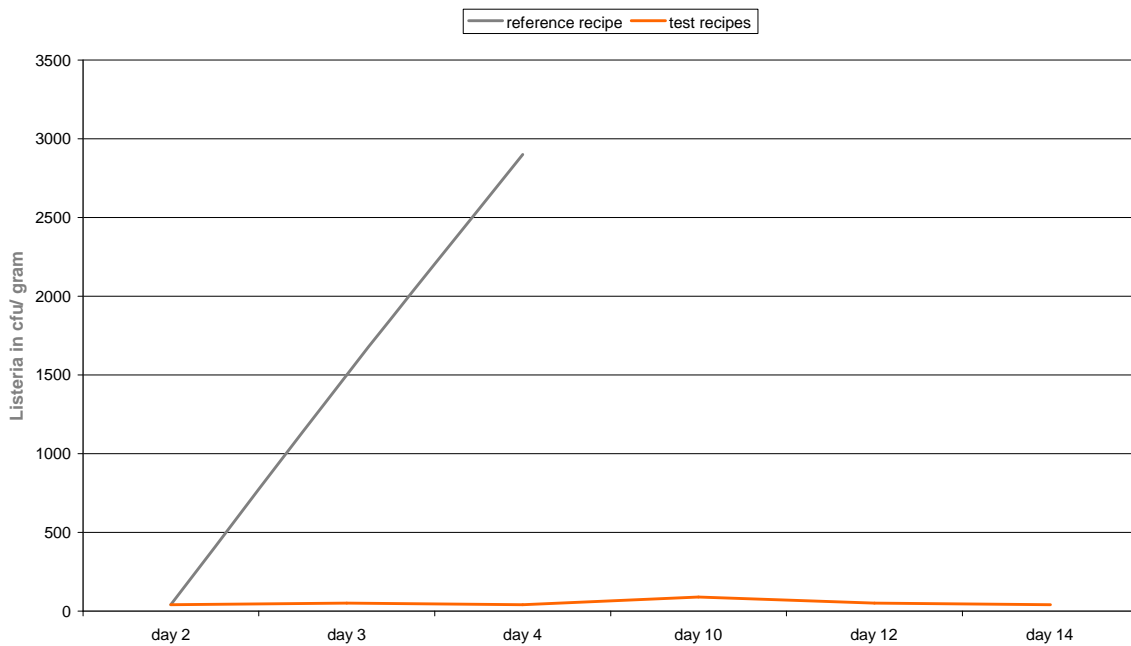
tests. Up until the end of the fifth day of the test, aerobic plate count results were acceptable; even in the reference recipes. This implies that total aerobic plate counts are an unreliable indication for *Listeria* outgrowth. In the reference recipes, accelerated growth of *Listeria* was found between the second and third day of the shelf life test. This indicates a maximum shelf life of two days for the reference custard filling. The test recipes showed a shelf life of at least five days.

Custard filling extended shelf life

Custard fillings with extended shelf life were also tested. Once again in these tests, growth of *Listeria* monocytogenes was found in the reference recipe within two days, even though a preservative was used. Again this indicates a maximum shelf life of two days for the reference custard filling. Apparently the applied preservative does not inhibit the growth of *Listeria*. In the test recipes *Listeria* monocytogenes did not grow until the end of the test after 14 days. For these test recipes, a shelf life of 14 days seems feasible. Both test and reference recipes contained the same preservative.

During these tests, once again low aerobic plate counts, in combination with outgrowth of *Listeria* monocytogenes, were found in the reference recipes. Although total aerobic plate counts elevated slightly by the end of the test, *Listeria* did not grow in the test recipes.

Development *Listeria* monocytogenes in custard with extended shelf life



Storage temperatures challenge tests

When European guidelines are followed during *Listeria* monocytogenes challenge testing, products need to be stored at elevated temperatures. If products are to be stored at temperatures between 5-7°C, these guidelines require first storage at 8°C during 1/3 of the shelf life and then storage at 12°C during 2/3 of the shelf life.

Since the goal of the challenge tests described was to determine an approximate shelf life of the custards, it was not possible to use this formula at the time of testing. As a compromise it was decided to carry out all tests at 10°C.

Smartfood

Smartfood researches clean label preservation for food. The tests described are part of a programme to investigate interactions between (natural) raw materials and microbes.

Written by Frank Cleophas; owner of Smartfood and expert in clean label preservation. Contact: www.smart-food.nl



Preparation of microbes for challenge testing