Spray-on application of food cultures for safety and quality improvement of cooked, cured meat products

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I. INTRODUCTION

Application of lactic acid bacteria on cooked meat products after a final heat treatment aiming to improve shelf-life quality and/or safety is an emerging and promising technique for utilizing beneficial features of live cultures. Herein, it is demonstrated how spraying a defined level of *Latilactobacillus cuvartus* (SafePro® B-LC-48) cells as a post-pasteurization step contribute to inhibit growth of *Listeria monocytogenes* during shelf-life of hot-dog sausages with full level of nitrite or without nitrite added.
Another example of stabilization of product quality for cooked meat product is illustrated by spraying a *Lactococcus lactis* strain (Bactoferm® Rubis) during slicing/packaging. This prevents light-induced color fading because residual oxygen in packs efficiently is reduced below critical limit due to metabolic active bacteria. In general, such applications of lactic acid bacteria, represent clean label bio-solutions capable of replacing costly and energy requiring processing steps for a range of Ready-To-Eat products like cooked meat products, but also a technique to consider for plant-based meat alternatives and vegetable products.

II. MATERIALS AND METHODS

Part I: Hot-dog sausages (24% fat and 2.4% salt) were produced with two recipes: i) no nitrite added or ii) 108 ppm sodium nitrite added. A challenge test was conducted following ISO 20976-1 protocol with 3 batches included: control with 108 ppm nitrite; SafePro® B-LC-48 and 108 ppm nitrite and SafePro® B-LC-48 without nitrite.
A two strain *Listeria monocytogenes* cocktail was used. Inoculation level of *L. monocytogenes* targeted 10^2 cfu/g (SD 0.07 cfu/g), while the culture SafePro® B-LC-48 was applied by spraying an aqueous suspension with an inoculation level of 10^7 cfu/g to obtain a homogenous distribution on the meat product. Storage of samples was 20 days at 4°C followed by 40 days at 8°C.

Part II: A standard cooked, cured ham (2% salt and 120 ppm nitrite) was produced and sliced followed by packaging in modified atmosphere (60% CO_2 and 40% N_2). Samples were either control or sprayed with aqueous suspension of Bactoferm® Rubis on product surface during slicing targeting an inoculation level of 10^7 cfu/g. Initial storage period was at 4°C for 12 days, where packages were kept in the dark for initial 7 days before exposure to light (1200 lux) simulating retail display. After day 12 samples were kept at 8°C exposed to light. During storage level of residual oxygen and surface color parameters were measured.

III. RESULTS AND DISCUSSION

The challenge test with SafePro® B-LC-48 sprayed-on hot-dog sausages in vacuum packages show efficient inhibition of *L. monocytogenes*. Fig.1 shows evolution of the concentrations of lactic acid bacteria and *L. monocytogenes* during shelf-life at varying storage temperature. Fig. 2 shows residual oxygen levels in headspace of control and samples with Bactoferm® Rubis added over storage time. The insert plot shows differences in color parameters for the two samples observed after samples are exposed to light.

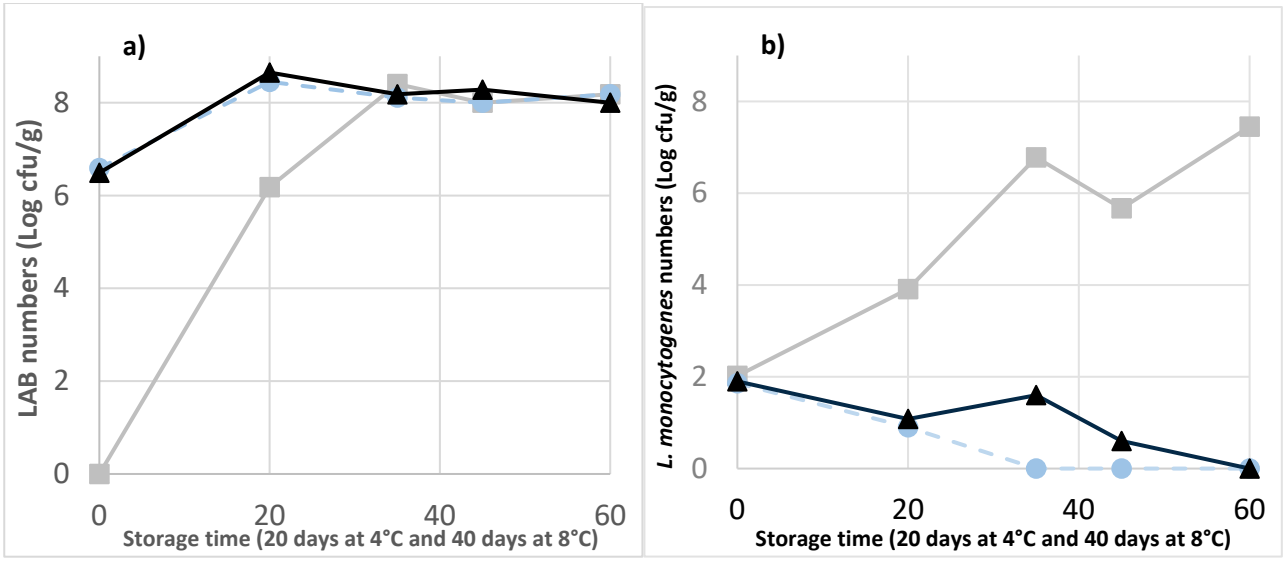

Figure 1. Challenge test in hot-dog sausages, evolution in lactic acid bacteria (LAB) concentration (a) or *L. monocytogenes* concentration (b) during the shelf-life. Symbols are: Control with 108 ppm nitrite ( ); B-LC-48 and 108 ppm nitrite (▲); and B-LC-48 without nitrite (●).

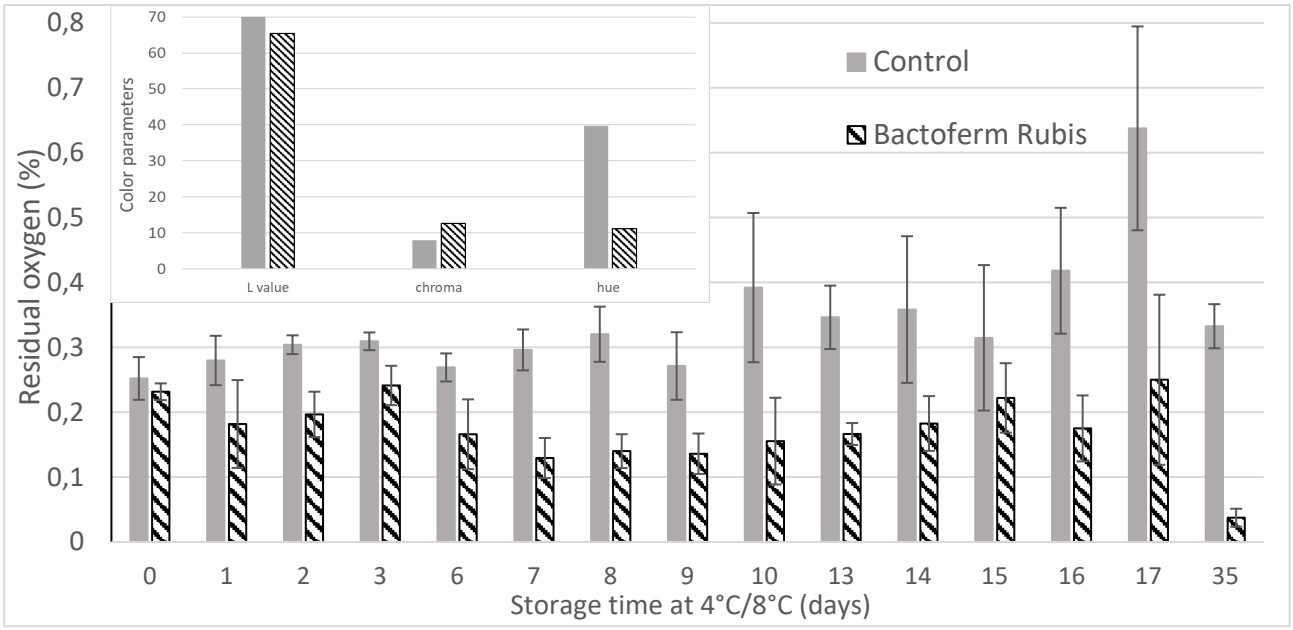

Figure 1. Part II trial with MAP cured cooked ham showing residual oxygen levels in headspace of samples with and without Rubis added. Insert plot shows color parameters for lightness, chroma and hue angel analyzed on day 7 after exposure of samples to light.

IV. CONCLUSION

Challenge test on emulsified sausages shows that SafePro® B-LC-48 culture helps protect against growth of *L. monocytogenes.* Samples sprayed with SafePro® B-LC-48 both with and without added 108 ppm nitrite have a growth potential $\delta = 0$, and concentrations of pathogen *L. monocytogenes* is in fact decreasing at all sampling times during the 60 days shelf-life. These findings hold good perspectives for food cultures in low or no nitrite meat products.

The test of Bactoferm® Rubis as a mean of protecting against photooxidation in cured meat products shows inoculated samples to have lower residual oxygen compared to control. This factor is preventing light-induced color fading when product is exposed to light as seen from higher chroma value and much lower hue angel indicating a more intense and redder color shade of product with Rubis added.