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Listeria and Spoilage Inhibition Using Neutralized and Sodium Free Vinegar Powder

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Abstract : The trend for sodium reduction in food products is clear. Following the World Health Organization (WHO) publication on sodium usage and intake, several countries have introduced initiatives to reduce food-related sodium intake. As salt is a common food preservative, this trend motivates the formulation of a suitable additive with comparable benefits of shelf life extension and microbial safety. Organic acid derivatives like acetates are known as generic microbial growth inhibitors and are commonly applied as additives to meet food safety demands. However, modern consumers have negative perceptions towards -synthetic-derived additives and increasingly prefer natural alternatives. Vinegar, for example, is a well-known natural fermentation product used in food preservation. However, the high acidity of vinegar often makes it impractical for direct use in meat products and a neutralized form would be desirable. This research demonstrates the efficacy of powdered vinegar (Provian DV) in inhibiting Listeria and spoilage organisms (LAB) to increase safety and shelf life of meat products. For this, the efficacy of Provian DV was compared to the efficacy of Provian K, a commonly used sodium free acetate-based preservative, which is known for its inhibition against Listeria. Materials & methods— Cured pork hams: Ingredients: Pork ham muscle, water, salt, dextrose, sodium tripolyphosphate, carrageenan, sodium nitrite, sodium erythorbate, and starch. Targets: 73-74% moisture, 1.75+0.1% salt, and pH 6.4+0.1. Treatments: Control (no antimicrobials), Provian®K 0.5% and 0.75%, Provian®DV 0.5%, 0.65%, 0.8% and 1.0%. Meat formulations in casings were cooked reaching an internal temperature of 73.9oC, cooled overnight and stored for 4 days at 4oC until inoculation. Inoculation: Sliced products were inoculated with approximately 3-log per gram of a cocktail of L. monocytogenes (including serotypes 4b, 1/2a and 1/2b) or LAB-cocktail (C. divergens and L. mesenteroides). Inoculated slices were vacuum packaged and stored at 4oC and 7°C. Samples were incubated 28 days (LAB) or 12 weeks (L. monocytogenes) Microbial analysis: Microbial populations were enumerated in rinsate obtained after adding 100ml of sterile Butterfield's phosphate buffer to each package and massaging the contents externally by hand. L. monocytogenes populations were determined on triplicate samples by surface plating on Modified Oxford agar whereas LAB plate counts were determined on triplicate samples by surface plating on All Purpose Tween agar with 0.4% bromocresol purple. Proximate analysis: Triplicate non-inoculated ground samples were analyzed for the moisture content, pH, aw, salt, and residual nitrite. Results—The results confirmed the no growth of Listeria on cured ham with 0.5% Provian K stored at 4°C and 7°C for 12 weeks, whereas the no-antimicrobial control showed a 1-log increase within two weeks. 0.5% Provian DV demonstrated similar efficacy towards Listeria inhibition at 4°C while 0.65% Provian DV was required to match the Listeria control at 7°C. 0.75% Provian K and 1% Provian DV were needed to show inhibition of the LAB for 4 weeks at both temperatures. Conclusions—This research demonstrated that it is possible to increase safety and shelf life of cured ready-to-eat ham using preservatives that meet current food trends, like sodium reduction and natural origin.

Keywords : food safety, natural preservation, listeria control, shelf life extension
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