

# Post-Packaging Irradiation Combined with Modified Atmosphere Packaging for Control of Bacterial Pathogens on Meat Products

## A.S. Leaflet R2180

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### Summary and Implication

Post-packaging irradiation combined with modified atmosphere packaging can effectively reduce *E. coli O157:H7* in ground beef patties, and *Listeria monocytogenes* on cooked pork chops and frankfurters. The irradiation sensitivity of these two food-borne pathogens was found to be similar in both vacuum and low oxygen MAP packaging. However, *E. coli O157:H7* can survive irradiation in both vacuum and low-oxygen MAP packaging during storage, therefore, temperature-abused or undercooked irradiated vacuum or MAP packaged ground beef may not be safe. MAP with 100% CO<sub>2</sub> was effective for extending the lag phase of *Listeria monocytogenes* survivors on irradiated ready-to-eat meat products up to 10 to 11 weeks. MAP packaging with low oxygen and 0.4% CO can be used for stabilizing fresh meat color when the product is treated with irradiation, which often results in discoloration.

### Introduction

The outbreaks of foodborne illnesses and frequent recalls of meat products indicate that additional control measures are needed to control bacterial pathogens on meat products more effectively. Irradiation and modified atmosphere packaging are two well established technologies used to control spoilage and pathogenic bacterial in foods. Combining these two technologies may improve bacterial control while maintaining meat quality.

### Material and Methods

Fresh ground beef patties were inoculated with *E. coli O157:H7*, and cooked pork chops and frankfurters were inoculated with *Listeria monocytogenes*. The concentration of inoculation was 5 log/gram (cm<sup>2</sup>). Samples were packaged with vacuum or MAP with 99.6% CO<sub>2</sub> + 0.4% CO (for beef patties) or 100% CO<sub>2</sub> (for pork chops and frankfurters). Irradiation sensitivity (radiation D<sub>10</sub>- value) and the growth of survivors under temperature abuse or during refrigeration storage were determined. Meat qualities, such as meat color (L\* a\* b\*), lipid oxidation (TBA value), pH, package purge and sensory attributes are also evaluated with non-inoculated products.

### Results and Discussion

An irradiation dose of 1.5 kGy eliminated 3 logs/gram of *E. coli O157:H7* on beef patties, and 2.0 kGy inactivated 3 logs/gram (or cm<sup>2</sup>) of *Listeria monocytogenes* on pork chops and frankfurters, when products were packaged with either vacuum or MAP packaging. Temperature abuse showed no significant growth of these bacteria. After irradiation, *E. coli O157:H7* survived (but did not grow) on beef patties during 6 weeks of refrigeration storage. *Listeria monocytogene* grew on pork chops and frankfurters in vacuum packages after 4-9 weeks of refrigeration storage, however, this organism did not grow in MAP packaged product for at least 10-11 weeks (Figure 1 and 2). MAP packaged irradiated beef patties had bright cherry red color while vacuum packaged patties were brown (picture 1). TBA value, pH and purge of irradiated meat product were similar in both vacuum and MAP. No rancidity was observed. Sensory evaluation showed more irradiation aroma in MAP packaged beef patties. MAP packaged pork chops were less firm and more juicy, and MAP packaged frankfurters were less dense and more sour-like aroma.

Figure 1.

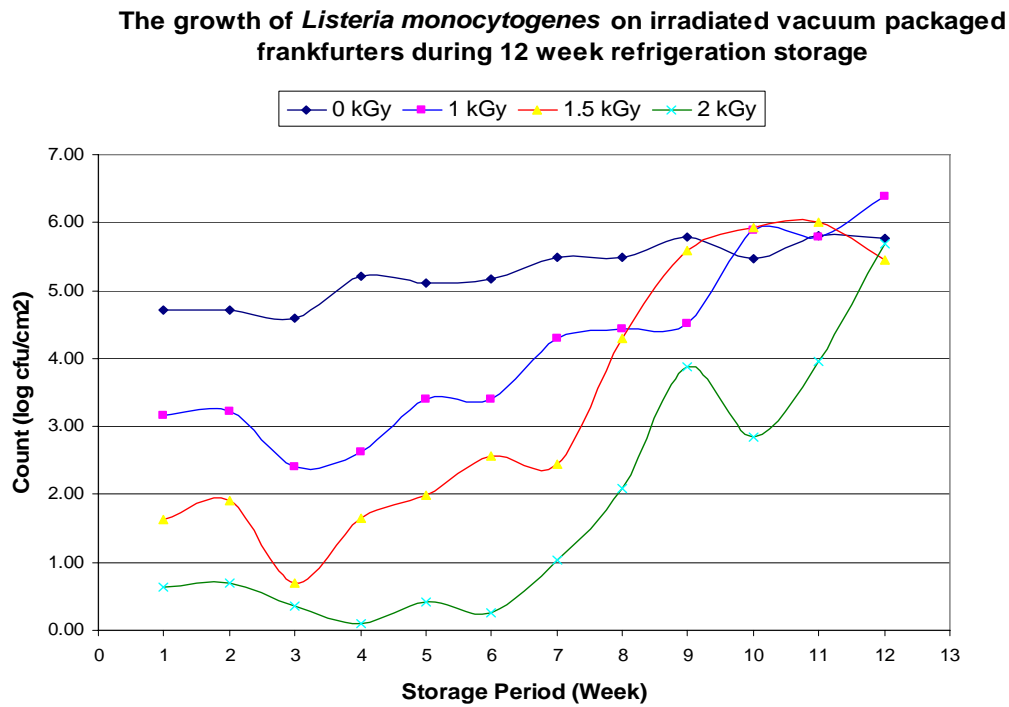
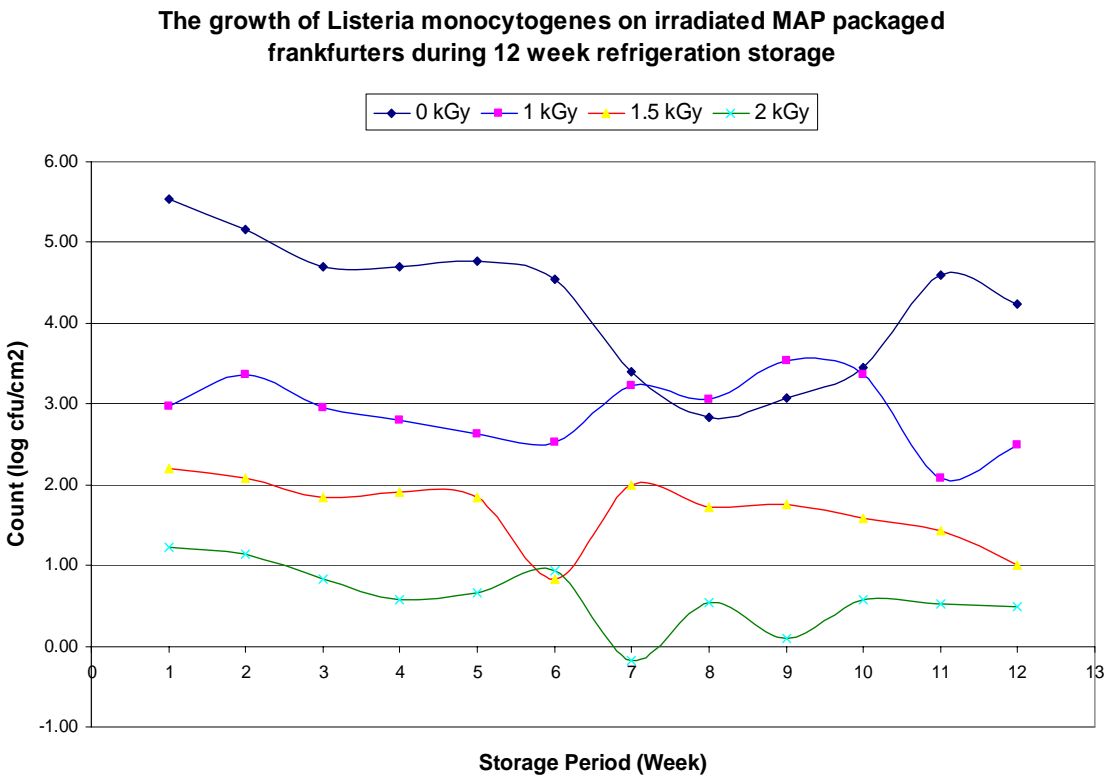


Figure 2.



**Picture 1.**

**The color of irradiated beef patties in vacuum and modified atmosphere packaging.**



**Packaged with MAP with 0.4% CO**

**Packaged with vacuum**