

Assessment of Commercial Antimicrobials Incorporated into Gelatin Coatings and Applied to Conventional Heat-Shrinking Material for the Prevention of Blown Pack Spoilage in Vacuum Packaged Beef Cuts

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Abstract : One of the primary spoilage issues associated with vacuum-packed beef products is blown pack spoilage (BPS) caused by the psychrophilic spore-forming strain of *Clostridium* spp. Spores derived from this organism can be activated after heat-shrinking (eg. 90°C for 3 seconds). To date, research into the control of *Clostridium* spp in beef packaging is limited. Active packaging in the form of antimicrobially-active coatings may be one approach to its control. Antimicrobial compounds may be incorporated into packaging films or coated onto the internal surfaces of packaging films using a carrier matrix. Three naturally-sourced, commercially-available antimicrobials, namely; Auranta FV (AFV) (bitter oranges extract) from Envirotech Innovative Products Ltd, Ireland; Inbac-MDA (IMDA) from Chemital LLC, Spain, mixture of different organic acids and sodium octanoate (SO) from Sigma-Aldrich, UK, were added into gelatin solutions at 2 concentrations: 2.5 and 3.5 times their minimum inhibition concentration (MIC) against *Clostridium estertheticum* (DSMZ 8809). These gelatin solutions were coated onto the internal polyethylene layer of cold plasma treated, heat-shrinkable laminates conventionally used for meat packaging applications. Atmospheric plasma was used in order to enhance adhesion between packaging films and gelatin coatings. Pouches were formed from these coated packaging materials, and beef cuts which had been inoculated with *C. estertheticum* were vacuum packaged. Inoculated beef was vacuum packaged without employing active films and this treatment served as the control. All pouches were heat-sealed and then heat-shrunk at 90°C for 3 seconds and incubated at 2°C for 100 days. During this storage period, packs were monitored for the indicators of blown pack spoilage as follows; gas bubbles in drip, loss of vacuum (onset of BPS), blown, the presence of sufficient gas inside the packs to produce pack distension and tightly stretched, "overblown" packs/ packs leaking. Following storage and assessment of indicator date, it was concluded that AFV- and SO-containing packaging inhibited the growth of *C. estertheticum*, significantly delaying the blown pack spoilage of beef primals. IMDA did not inhibit the growth of *C. estertheticum*. This may be attributed to differences in release rates and possible reactions with gelatin. Overall, active films were successfully produced following plasma surface treatment, and experimental data demonstrated clearly that the use of antimicrobially-active films could significantly prolong the storage stability of beef primals through the effective control of BPS.

Keywords : active packaging, blown pack spoilage, *Clostridium*, antimicrobials, edible coatings, food packaging, gelatin films, meat science

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