World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:10, No:05, 2016

Edible Active Antimicrobial Coatings onto Plastic-Based Laminates and Its Performance Assessment on the Shelf Life of Vacuum Packaged Beef Steaks

Authors : Andrey A. Tyuftin, David Clarke, Malco C. Cruz-Romero, Declan Bolton, Seamus Fanning, Shashi K. Pankaj, Carmen Bueno-Ferrer, Patrick J. Cullen, Joe P. Kerry

Abstract : Prolonging of shelf-life is essential in order to address issues such as; supplier demands across continents, economical profit, customer satisfaction, and reduction of food wastage. Smart packaging solutions presented in the form of naturally occurred antimicrobially-active packaging may be a solution to these and other issues. Gelatin film forming solution with adding of natural sourced antimicrobials is a promising tool for the active smart packaging. The objective of this study was to coat conventional plastic hydrophobic packaging material with hydrophilic antimicrobial active beef gelatin coating and conduct shelf life trials on beef sub-primal cuts. Minimal inhibition concentration (MIC) of Caprylic acid sodium salt (SO) and commercially available Auranta FV (AFV) (bitter oranges extract with mixture of nutritive organic acids) were found of 1 and 1.5 % respectively against bacterial strains Bacillus cereus, Pseudomonas fluorescens, Escherichia coli, Staphylococcus aureus and aerobic and anaerobic beef microflora. Therefore SO or AFV were incorporated in beef gelatin film forming solution in concentration of two times of MIC which was coated on a conventional plastic LDPE/PA film on the inner cold plasma treated polyethylene surface. Beef samples were vacuum packed in this material and stored under chilling conditions, sampled at weekly intervals during 42 days shelf life study. No significant differences ($p < 0.05$) in the cook loss was observed among the different treatments compared to control samples until the day 29. Only for AFV coated beef sample it was 3% higher (37.3%) than the control (34.4 %) on the day 36. It was found antimicrobial films did not protect beef against discoloration. SO containing packages significantly ($p < 0.05$) reduced Total viable bacterial counts (TVC) compared to the control and AFV samples until the day 35. No significant reduction in TVC was observed between SO and AFV films on the day 42 but a significant difference was observed compared to control samples with a 1.40 log of bacteria reduction on the day 42. AFV films significantly ($p < 0.05$) reduced TVC compared to control samples from the day 14 until the day 42. Control samples reached the set value of 7 log CFU/g on day 27 of testing, AFV films did not reach this set limit until day 35 and SO films until day 42 of testing. The antimicrobial AFV and SO coated films significantly prolonged the shelf-life of beef steaks by 33 or 55% (on 7 and 14 days respectively) compared to control film samples. It is concluded antimicrobial coated films were successfully developed by coating the inner polyethylene layer of conventional LDPE/PA laminated films after plasma surface treatment. The results indicated that the use of antimicrobial active packaging coated with SO or AFV increased significantly ($p < 0.05$) the shelf life of the beef sub-primal. Overall, AFV or SO containing gelatin coatings have the potential of being used as effective antimicrobials for active packaging applications for muscle-based food products.

Keywords : active packaging, antimicrobials, edible coatings, food packaging, gelatin films, meat science
Conference Title : ICFPP 2016 : International Conference on Food Preservation and Packaging
Conference Location : Paris, France
Conference Dates : May 16-17, 2016