Life on the shelf – can antibacterial packaging help?

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One of the great successes of human ingenuity is the treatment of foods in order to preserve their usability. It is believed man migrated into colder climates tens of thousands of years ago because whilst food tended to be scarcer it also survived longer because of the lower temperatures.

Chilling food in order to extend its shelf life is one method in a range of preservation methods that are used today. Food preservation methods, from the historic to the modern, are based on the need to inhibit the metabolic activity of food-contaminating micro-organisms.

When the micro-organisms' activity overruns whatever inhibitory techniques have been applied to them, the food they are contaminating is spoiled and no longer fit for human consumption. Food spoilage adds to the issue of food wastage.

Some studies suggest that up to 50% of the world's food production is wasted. Food wastage is caused by inefficient use of land, insufficient production and processing practices and by more trivial issues like consumer taste and product aesthetics.

The UK WRAP report describes that in 2012 an estimated 22% of food was wasted in the UK; equivalent to 4.2 million tonnes.

The value of avoidable wastage in 2012 alone was estimated at £12.5 billion. This level of food wastage combined with rising food prices and extensive media coverage fuels public feeling that these issues should, somehow, be addressed.

Poor storage, transportation and stock management processes allow micro-organisms to thrive in foodstuffs and therefore spoil food beyond use.

Obviously, improvements in these areas could lead to substantial savings for the food industry and for consumers.

What is clear is the need for a multifaceted approach by the application of interventions at all vulnerable points in the farm to fork process.

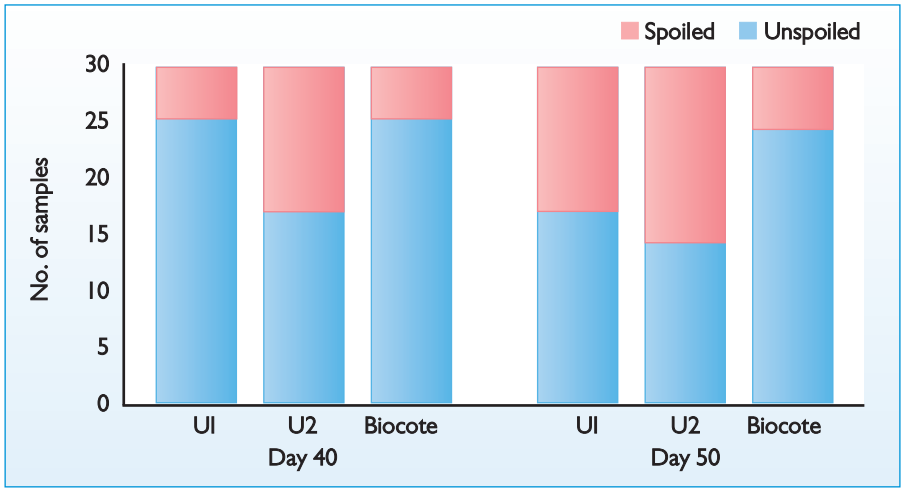

Fig. 1. Microbial spoilage in different packaging types.

Table 1. Microbial analysis to determine numbers of unspoilt red meat samples per microbial group of interest over study period.

	Day 30			Day 40			Day 50		
	U1	U2	BC	U1	U2	BC	U1	U2	BC
Total bacterial count	10	10	10	10	9	9	7	5	8
Enterobacteriaceae	10	10	10	10	4	6	4	5	6
Yeasts	10	10	10	5	4	10	6	4	10
No. unspoiled samples (out of 30)	30	30	30	25	17	25	17	14	24

U1 = Untreated packaging 1 U2 = Untreated packaging 2
BC = BioCote treated antimicrobial packaging

Antimicrobials

Recent technological developments have the potential of contributing to reducing the amount of food going to waste. Notably, advances in the storage and packaging of foods demonstrate promise in delaying the onset of microbial degradation and spoilage.

Various substances possess the ability to inhibit the growth of food-spoiling micro-organisms. Some of these active substances have been successfully added to polymers used to make food packaging.

The concept is simple: if the growth of these micro-organisms can be inhibited by the activity of the antimicrobials incorporated into packaging materials the spoilage point of food will be deferred compared to the same foodstuffs packaged with no antimicrobial protection.

There are myriad natural and man-made substances that are candidates for incorporating into food packaging for the specific intention of extending food shelf-life.

Some antimicrobials are better than others because they are safe for food contact, more acceptable in terms of cost implications and demonstrate highest antimicrobial activity from the packaging material.

This last factor of a packaging material with the ability to inhibit microbial growth is one that needs to be based on evidence produced from meaningful studies.

Studies and research

BioCote Ltd (UK) are leaders in antimicrobial technology and have undertaken extensive studies into the efficacy of antimicrobial technologies in real-world environments as well as in the laboratory.

To do this, BioCote collaborated with commercial organisations involved in the food industry for the objective of measuring any difference antimicrobial food packaging made to shelf-life of the food studied.

This article presents data generated from a number of those studies and seeks to make conclusions about the potential benefits of antimicrobial technology in food packaging.

The basic approach to the studies was to package foodstuffs identically in BioCote-treated and untreated packaging and store as normal. Periodically samples in both types of packaging were retrieved from storage and examined in the laboratory to quantify levels of micro-organisms present on the surface of the foods.

The number of samples processed in the studies was such that the results produced from the analyses were considered acceptable representations of what was occurring microbiologically on the surface of the food being tested.

The results

All meat samples obtained from primals stored in each packaging type were unspoilt by microbial contamination after 30 days in cold storage (Table 1). This 30 day period of storage was composed to 20 days at 1˚C and a subsequent 10 days at 6˚C. The samples were also tested for E. coli, Sulphite Reducing Clostridia (SRC) and Pseudomonads. Results are not included in the table as these organisms were not detected.

Conclusions

After 30 days of chilled storage none of the samples packaged in either BioCote-treated or untreated materials exhibited microbial growth to the point of food spoilage.

By storage day 40 samples of all three packaging types were exhibiting microbial spoilage.

Specifically, type 2 untreated packaging demonstrated the most spoiled samples (13 spoiled samples from 30), whereas the untreated packaging type 1 and the BioCote-treated packaging performed identically (five spoiled samples from 30). At the end of the study period (day 50) the BioCote-treated samples were collectively less spoiled than both types of untreated package samples.

Specifically, type 2 untreated packaging continued to exhibit the most spoiled samples (16/30), followed by type 1 untreated packaging (13/30). The BioCote-treated package samples produced the fewest number of spoiled samples (6/30).

In contrast to both untreated packaging types, the BioCote-treated packaging did not produce any samples spoiled by the growth of yeasts throughout the course of the study.

These data suggest that adding a BioCote antimicrobial additive to food packaging material can produce a beneficial outcome with respect to the shelf-life of food. The main finding of this study has been reproduced in other similar studies examining the effect of antimicrobial packaging on the longevity of various stored meat types. So, will adding antimicrobials single-handedly solve the world's food waste problems? The short answer, of course, is no. But, by extending the shelf-life of certain food products it could be a contributing factor. ■

References are available from the author on request