

House of Lords Presentation

Background:

Dr George Kellie is chairman of KellieSolutions™, a leading UK marketing and technology company. Dr Kellie's businesses have been in existence for nearly 20 years and have a strong reputation and expertise in plastics, packaging, and sustainability strategies. KellieSolutions™ has been focused on the detailed analysis and evaluation of advanced new technologies in packaging, paper and plastics films on a world-wide basis. This has included shelf life extension solutions.

In the field of sustainable materials, KellieSolutions™ has also been particularly active, working on advanced materials in packaging, film, sheet and fibre form. Dr Kellie is actively involved in generating new sustainable solutions across a broad range of applications for major international clients.

In recent months George Kellie has published a series of articles on practical business actions in the recession and as a contribution to the recovery is offering a free consultancy service to struggling UK businesses.

Nanotechnology and its Place in the Packaging Market

From a KellieSolutions perspective, nanotechnology fits in to a group of processes and techniques designed to meet a complex range of requirements. These range from extended shelf life through to easy to recycle, etc. In general, we view nanotechnology in a much broader category of micromaterial addition. Whether these are actually in nanometres or just in very low addition levels largely does not matter. What does matter is the ability to create products which can meet a complex series of challenges.

Trends and Opportunities in Advanced Packaging Materials

Summary. Packaging developments in the coming years need to focus on an interlocking series of objectives. These include aspirations such as lightweight, easy to recycle, low CO2/greenhouse gas impact and, of course, low cost. Overriding all of this is product safety.

At the heart of this work is the need to extend packed food shelf life and dramatically reduce food waste. These are beneficial outcomes that apply to society in general and not just to the commercial enterprises involved in the industry. However in order to gain mass market acceptance these new packaging formats have to be cost effective and safe. Three of the major trends are in techniques for extending shelf life, time/temperature Indicators, and nanotechnology. These threads are interdependent.

Shelf Life Extenders. In the area of advanced technology for extending shelf life, we can already see the development of materials which offer shelf life improvement through atmospheric modification. These can be modified atmosphere (MAP) packs (these are very well known) and more recently the use of moisture, oxygen, ethylene, and CO2 sachet-type absorbers. All of those play a part in extending shelf life depending on the food degradation/barrier requirements.

Time Temperature Indicators (TTIs) and related devices are also interesting. KellieSolutions have done a considerable amount of work with a number of these products. While they attract consumer interest, at this time their costs are often prohibitively high and at times it is difficult to easily verify whether they really provide more information than the simple “use-by” date. A much more important area where TTIs can have impact is to look at monitoring and management of the Chill Chain. The Chill Chain process is one of the key controllers of the quality of food that arrives in the store. The more we know about the Chill Chain, the more we know the history of how packs have been stored and distributed. By measuring and monitoring pack history we reduce food degradation risks and improve process efficiency. This is the area where we believe there are greatest gains to be made. In addition, the cost of TTIs becomes insignificant when they are monitoring a transit pack or pallet with multiple packs compared to the cost when they are applied to individual packs.

Nanotechnology

Nanotechnology involves advanced materials dimensioned at or near atomic scale. A nanometer is one billionth of a meter. At this nano level the characteristics and performance of materials can radically change often providing unique properties and benefits previously impossible to achieve. In our work we talk more about “micro” and “miniature” rather than nano. These micro additives are still materials used at low levels but not strictly nano. For example this allows us to create new generation vacuum micro-deposited materials for clear barrier films. The opportunities are exciting. In the future nanocomposites may be able to modify packaging films to increase gas barrier, enhance strength, and improve temperature resistance. Not surprisingly nanotechnology has not yet achieved its much-hyped potential which has run well ahead of reality. Also before nanotechnology can be fully adapted to direct food-contact packaging applications, the technology must be evaluated in safety regulatory systems.

Some examples of nanopackaging materials include ..

- **Nano composites.** These can create high barrier layer in films and bottles with minimal extra weight. These can help to create barrier packs with long shelf life under ambient storage conditions.
- **Electrically conductive inks.** Potentially these can be used to print radio-frequency identification (RFID) tags and other on-pack electronics.
- **Nanoclays.** These are being incorporated into plastic nanocomposites. Once again gas/moisture barrier is the main focus.
- **Zinc oxide nanoparticles.** Such materials are aimed at providing antimicrobial performance.

By using a nano level or just micro level deposition, we can open up a whole new set of markets and opportunities.

Ultra Clean Materials. A related area is the micro evaluation of surface properties. This is not about deposition, rather the reverse. The aim of these techniques is to produce ultra pure and ultra clean films. Measuring “clean” and “pure” is difficult and requires using different techniques including liquid particle scanning and Time-of-

Flight Secondary Ion Mass Spectrometry (TOF-SIMS). This work opens up new opportunities by focussing on packs that have a minimal impact on the products contained within them. In simple terms.. "less is more".

One of the most promising innovations in smart packaging is the use of nanotechnology to develop antimicrobial packaging. KellieSolutions has recently patented advanced processes to micro-deposit anti-bacterial additives.

Safety:

This is a live issue which is being followed by several bodies. The Food and Agriculture Organisation of the United Nations (FAO) and the World Health Organization (WHO) are starting to look at the issues. In June 2009 they will hold a joint meeting to examine potential food safety risks from nanoparticles.

KellieSolutions™ Ltd