

Introduction to Modified Atmosphere Packaging

Presentation Prepared for The Food Club

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Introduction

Modified Atmosphere Packaging

- Is packaging where the contained atmosphere has been substantially changed to a different combination of gases to that found in air
- Was pioneered by Marks & Spencer in the late 1970's
- Was in use in every major UK supermarket by the late 1980's
- Is a market that is still growing at around 5-7% per annum.
- Since 1997 must be declared on the pack by the phrase "packed in a protective atmosphere"

Reasons for the growth in MAP

- Changing eating habits
- Changing lifestyles
- The need to ensure product safety
- To extend shelf life
- Extend geographic markets
- Development of other packaging technologies
- Use of centralised production and distribution facilities

Advantages of MAP

- Potential shelf-life increase of 50-400%
- Reduces economic loss
- Products distributed over larger area
- Provides higher quality product
- Easier separation of slices
- Improved presentation
- Little or no need for preservatives

Disadvantages of MAP

- Visible additional costs
- Temperature control necessary
- Different gas formulations required
- Special equipment and training
- Food safety concerns
- Increased pack volume
- Benefits lost when pack opened or leaks

Products

- Raw meats
- Poultry
- Cooked and cured meats
- Fish and shellfish
- Dairy Products particularly cheeses
- Ready meals
- Fresh Pasta
- Bakery products
- Fruit and vegetables
- Snacks
- Dried Foods

Gases

- Air is :-
 - 21% Oxygen
 - 78% Nitrogen
 - 1% Argon
 - 0.03% Carbon dioxide
- MAP gases are normally:-
 - Carbon dioxide – to inhibit microbial growth
 - Oxygen – to maintain the colour of red meat and prevent anaerobic conditions (white fish)
 - Nitrogen – as an inert filler gas
- Other tried include:-
 - SO_2 , N_2O , NO , O_3 , He, H_2 , Ne, Ar etc, but none have caught on!

Typical Modified Atmospheres

Product	O ₂	CO ₂	N ₂
Red Meat	80	20	
White Meat & Pasta		30	70
Low fat white fish & shellfish	30	40	30
Produce	5	5	90
Hard Cheeses		100	
Baked goods		60	40

Gas Composition within the pack

- This is unlikely to remain constant through the shelf life of the product because:
 - Physical interaction between gas and product
 - Effects of microbial and product metabolism
 - Gas permeation through the packaging material

Interaction between gas and product

- Dissolving of the gases into the food
 - Mainly CO₂ into the aqueous and fat phases of the food
- Trapped gases (e.g between slices) can be released into pack
- Gases dissolved in the food may be released into pack atmosphere

Gas permeation through the packaging

- No pack is a perfect barrier!
- All films are permeable to a greater or lesser extent
- Permeability depends on:
 - Nature of gas
 - Structure and thickness of material
 - Temperature
 - Relative humidity for some materials
 - Partial pressures

Machinery types

There are 4 distinct methods of producing modified atmosphere packs

1. Flow wrapping
2. Vertical form-fill-seal

Both with atmosphere change by displacement

3. Thermoform-fill-seal
4. Rigid pack fill and seal

Both with atmosphere replacement by evacuation

Choice of pack style/machine depends largely on the product to be packed

Horizontal Flow Wrap



Horizontal Form-Fill-Seal Packaging System
Source: www.hayssen.com and www.waitrose.co.uk, 18.March.2003

- Gas replacement by continuous flow of gas from a tube situated close to the seal area
- Typical products: hard cheese, baked products, produce.
- Speeds: typically 50- 90 packs per min
- Manufacturers: Hayssen, Ilapak, Rose Forgrove, PFM
- Variations: bottom film feed, tear tape, reseal facility

Vertical form-fill-seal.



Vertical Form-Fill-Seal Packaging System

Source: www.hayssen.com and www.waitrose.co.uk, 18.March.2003

- Gas displacement from tube adjacent to the seal
- Typical products: snacks, salads, grated cheese,
- Speeds; up to 85/min
- Manufacturers: Sandiacre, Woodman, Rovema, Blueprint
- Machines include integral weigher
- Variations: tube diam. to suit product, reseal facility

Thermoform-fill-seal



Thermoformed Fill-Seal Packaging System

Source: www.zedindustries.com and www.waitrose.co.uk, 18.March.2003

- Gas replacement by evacuation within the vacuum chamber
- Typical products: meat, bacon, fish, cooked meats, pizza
- Speeds: from 5/min semi-auto to 80/min fully automatic
- Manufacturers: Multivac, Mecaplastic, etc
- Variations: several methods of reseal and special application packs

Rigid and bulk pack fill and seal



- Gas replacement by evacuation
- System used widely for “mother packs”
- Typical products: powders, meat cuts, and products packed in rigid packs
- Speeds dependant on application
- Variations: packing of still drinks

MAP is not a cure-all!

- It is not the answer to all food packaging problems
- MAP will generally benefit food and it's acceptable shelf-life but this is also influenced by
 - the original quality of the food being packed
 - conditions under which the food is stored
- It does not mean temperature controls can be relaxed
- It must be used in conjunction with other preservation techniques

Active Packaging

- Oxygen scavengers
 - Iron powder oxidation
 - Sachets or labels
 - Ageless (Mitsubishi GC)
 - Freshilizer (Toppan)
- Extends shelf-life
- Reduces need for extremely low O₂ in MAP
 - Increased line speed



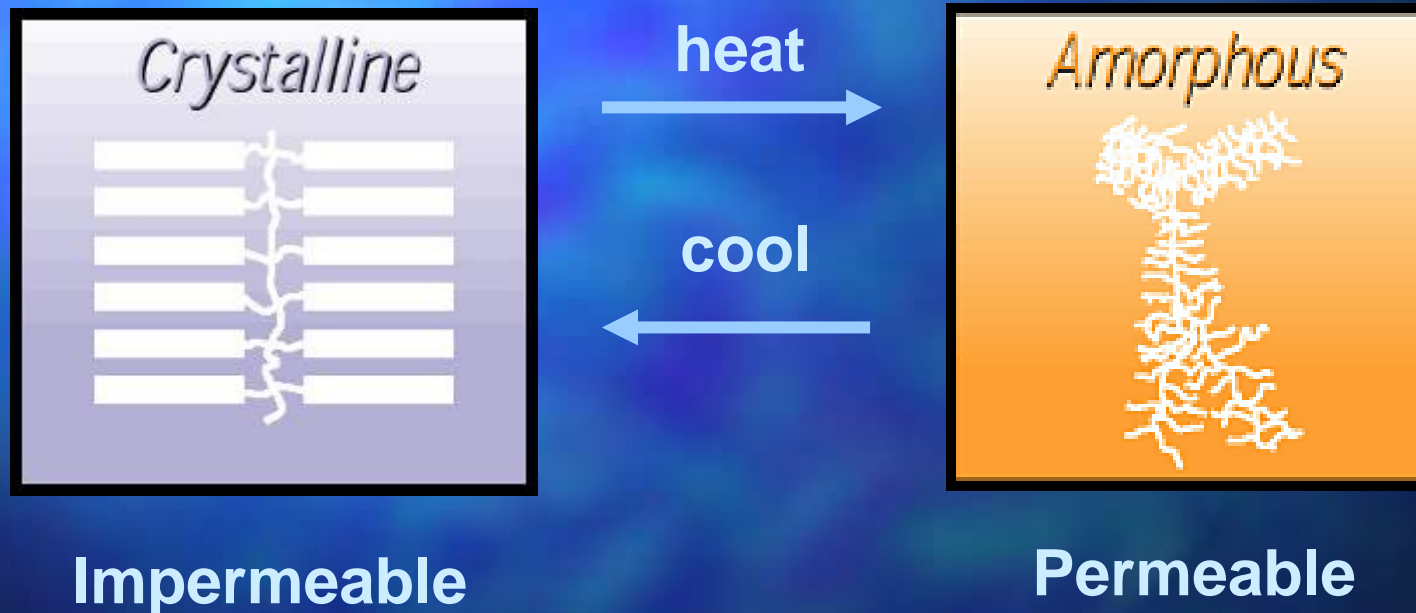
Active Packaging

- Oxygen scavenging film
 - OS1000 from Cryovac
 - Activated by UV close to fill point

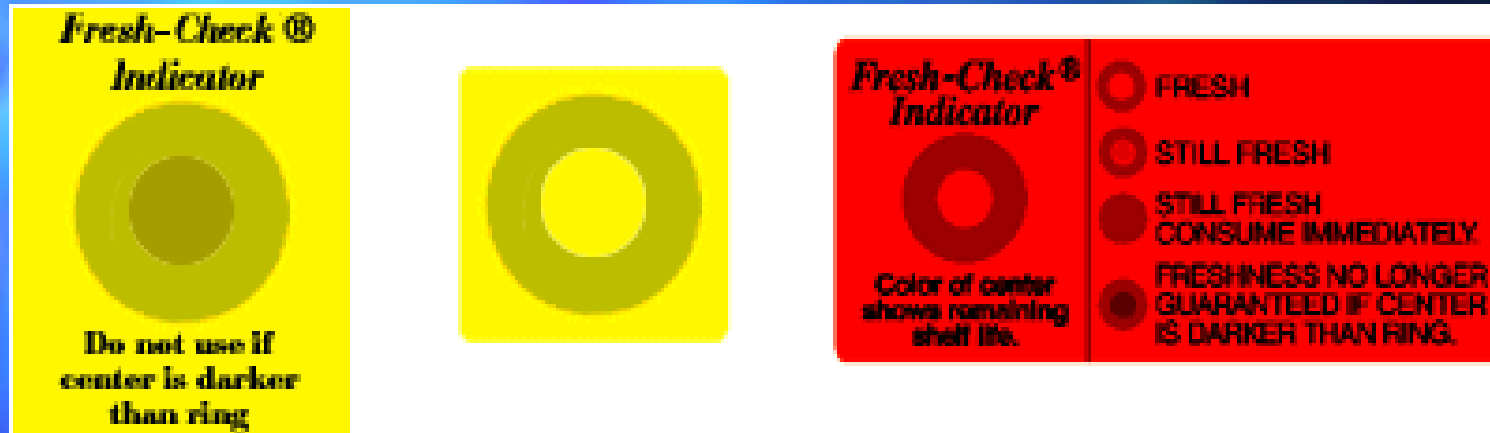


Smart Films

- Landec's Intelimer Polymers



Time Temperature Indicators



- Function
 - provides information on exceeding a temperature threshold or a cumulative time temp history
 - informs that correct storage conditions have or have not been adhered to
- Benefits
 - Reassurance
 - Real information rather than implied fitness (use by)
 - Highlights problems
 - Reduces shrinkage