What is Modified Atmosphere Packaging (MAP) and Should You Consider It?

FRESH NATURAL PRESERVATIVE-FREE

These buzzwords used to describe food and beverage products are no longer just a passing trend but are becoming the standard. Consumers demand fresh products that involve minimal processing, yet also desire them to have extended shelf lives. Because of this, modified atmosphere packaging (MAP) has become increasingly popular for extending the shelf life of fresh items. So what is MAP and how do you know if it's right for your product?

What is MAP?

According to the FDA, modified atmosphere packaging "involves either actively or passively controlling or modifying the atmosphere surrounding the product within a package made of various types and/or combinations of films." One of the first applications of this technology was introduced by McDonald's, which used modified atmosphere packaging of lettuce in bulk-sized packages to be distributed to their retail outlets. This enabled them to package perishable products in bulk that would be shelf-stable for longer periods of time.

A modified atmosphere can be defined as one that is specially created by altering the natural distribution and makeup of gases in the air. When applied to packaging, this involves modifying the makeup of gases contained within each package to provide optimal conditions for increasing the shelf life and reducing oxidation and spoilage of perishable food and beverage products.

There are two different kinds of modified atmosphere packaging: Passive and Active. The FDA defines **Active MAP** as "the displacement of gases in the package, which is then replaced by a desired mixture of gases" and **Passive MAP** as "when the product is packaged using a selected film type, and the desired atmosphere develops naturally as a consequence of the products' respiration and the diffusion of gases through the film."

What are some examples of MAP?

Gas Flushing

For food and beverage products, nitrogen is most often used to decrease the amount of ambient oxygen within that package, as this gas can increase the rate of product spoilage. Nitrogen gas flush is a MAP option that many of manufacturers or packers use. This can occur inside the package itself as well as in the steps leading up to packaging, like inside the filling apparatus. During this process, nitrogen gas is actively pumped in to displace oxygen. The FDA reports that this accomplishes three things:

- Displacement of oxygen to delay oxidation
- Decreasing the growth of aerobic spoilage organisms
- Acting as a filler to maintain package conformity

Barrier Packaging Films

Choosing specific packaging films that provide increased protection is another example of modified atmosphere packaging. This is accomplished by using barrier packaging films that provide decreased permeability to moisture and oxygen, such as low-density polyethylene (LDPE), polyvinylchloride (PVC) or polypropylene (PP), according to FDA. New on the market are 'smart' packaging films that can contain indicators of temperature, leakage, food quality, and more.

Scavenger or Desiccant Packs

Another example of MAP is the addition of an oxygen scavenger or desiccant pack to your packaging. These small sachet type packages often contain a mixture of iron powder and ascorbic acid, and sometimes activated carbon. These ingredients act as catalysts or activators, absorbing ambient moisture and oxygen, thereby removing it from the interior of the packaging that houses the perishable product.

On-package Valves

One-way valves added to the exterior of packaging are another example of MAP. These special valves can be added to roll film during the packaging process. One-way valves allow certain gases to escape from the package without allowing any outside gases in. This is often done to release pressure created from gases the products release, but can also be done to allow air to escape from packages for better stacking and palletization.

Who should use MAP?

Modified atmosphere packaging has long been used in many industries, including fresh produce, coffee, nuts, and pharmaceuticals.

After coffee beans are roasted, they release carbon dioxide. Without MAP, roasters must allow the beans to cool and degas before packaging because the build-up of CO2 can cause the package to burst. However, these results in beans reaching the consumer that are not at the utmost level of freshness. Staling can occur quickly if beans are exposed to the elements for too long. As a result, many specialty coffee roasters are turning to MAP in the

form of one-way valves that allow for the release of carbon dioxide, without letting any ambient environmental gases in. This allows for packaging coffee beans at the height of their freshness, preserving the flavours and quality that consumer's desire.

Fresh produce will often use many forms of modified atmosphere packaging, including nitrogen gas flush and choosing specific barrier packaging films. Fresh fruits and vegetables are especially sensitive to environmental conditions, and thus often must utilize more than one tactic to preserve their freshness and stall perishing. Nitrogen gas flush will displace oxygen within the package, thereby decreasing oxidation which leads to discoloration, off-flavours, and spoilage. Barrier packaging films double down on preservation efforts by keeping excess moisture, ambient gases, and contaminants out of the package.

The **pharmaceutical and dietary supplement** industries will often employ oxygen scavenger or desiccant packs to decrease the amount of moisture or oxygen in the interior of product packaging. You have probably seen these small packs inside packages of pain relievers or vitamins, labelled 'do not ingest'. These small packs extend the shelf life of these important products, allowing for consumers to store them in their medicine cabinets for longer periods of time.

What are benefits of MAP?

Longer shelf life / higher quality

Food packaged under a protective atmosphere spoils much slower. Combined with continuous cooling, MAP can significantly extend the freshness and shelf life. This effect varies depending on the product type. However, a doubling of the shelf life is usually possible. Normally, MAP products keep a high quality over a longer period of time and arrive at the consumer in the best possible condition.

Less waste

Longer durability is often associated with fewer problems during long distance shipment, and longer shelf life. As a result, waste disposal due to spoiled food can often be reduced.

More Sales Opportunities

Because of the longer shelf life, MAP typically opens up new geographic markets to manufacturers. Particularly with perishable goods, longer shipment distances can be achieved. A global market can become a reality.

Fewer Preservatives

Packaging under a protective atmosphere extends the shelf life of food, meaning in many cases that the use of preservatives can be reduced or even completely eliminated. Consumers get products that do not contain artificial additives.

Appealing Package Design

Next to functional aspects, the design of the packaging plays a significant role in the competition for consumers. The look-and-feel and the quality impression influence the purchasing behaviour. MAP is very well suited for the most appealing packaging design and presentation of the food product.

Factors influencing the shelf life of food, and the influence of modified atmospheres

From the time that fruits and vegetables are harvested or animals are slaughtered, the spoilage process begins. This process is often accelerated the more the products are processed, such as cut fruit or minced meat. How long foods are durable, which means suitable for consumption, is very different and depends on various factors, e.g. the content of water and salt, pH value, hygiene conditions during production, storage conditions such as temperature or humidity, packaging. Depending on the characteristics and combinations of these factors, food products are differently sensitive to microbial or chemical / biochemical spoilage.

Chemical and biochemical spoilage

Directly after harvesting of plant or slaughter of animal material, chemical processes begin to change the structure or quality. Sometimes this is useful, e.g. dry-aging of meat, which can be seen as a maturation to improve quality. In principle, however, the quality of organic material decreases. For example, the oxidation of fats quickly leads to a rancidity of the product.

Microbial spoilage

Microorganisms are a major threat to the shelf life and quality of food. On the one hand, they influence colour and smell, but they can also lead to health hazards and make the products uneatable. The source of the microorganisms is either the food itself or an impurity that cannot be completely excluded in the production and packaging process.

The changes due to chemical / biochemical and microbial spoilage can be significantly slowed by MAP techniques together with cooling. Various gases and mixtures with different properties are used to slow the process of spoilage as much as possible.