Making our world more productive

MAP – Modified Atmosphere Packaging

Winning the race against time

Nowadays, good food has to be healthy, minimally processed and attractively packaged – as consumers' expectations from foodstuffs are continuously rising. Consequently, demands on food producers and producers of packaging machines and materials are increasing, too.

The consumer of today reacts sensitively when it comes to artificial additives and always wants to have the option of buying and preparing fresh foodstuffs and ready-made dishes that look and taste as if they have come directly from the farm or producer. Food safety and easy access to a rich variety of foodstuffs are very important. Therefore, it is becoming more and more difficult to meet consumers' high expectations. It is also becoming clear that the time factor is crucial.

The challenge: maintaining freshness

From the very moment fruit is picked, corn is harvested or fish is caught, the race against time begins. From now on, natural deterioration and spoilage endanger the quality and shelf-life of the foodstuff. However, external factors also pose a threat to the product's freshness. It is therefore of critical importance how the product is handled in the processing stage, on the filling line or during the chilling process prior to packaging. Particular emphasis must be placed on the packaging stage, because the way the foodstuff is packaged is decisive when it comes to prolonging shelf-life and guaranteeing food safety for the consumer.

The solution: modified atmosphere packaging (MAP)

In order to prevent this loss of natural freshness and quality, an effective and intelligent concept of food preservation has been developed – MAP. By combining food-grade gases with the right packaging materials and machines, MAP can maintain the quality of foodstuffs and extend their shelf-life.

Deterioration processes and the role of gases

Food is a biological, sensitive commodity. Original freshness and shelf-life are affected by the inherent properties of the product just as much as by external factors. Internal factors affecting quality are:

- The type and quantity of microorganisms
- Water activity a_w
- pH value
- Cell respiration
- Food composition

External factors affecting the inherent quality:

- Temperature
- Hygienic conditions
- Gas atmosphere
- Processing methods

Spoilage starts immediately

It is primarily microbial and chemical/biochemical deterioration that destroys food. Microbial deterioration starts immediately after harvesting or slaughtering. The presence of microorganisms can be traced back to the raw materials, the ingredients and the environment. Microorganisms are found everywhere in our surroundings, e.g. on our skin, on tools and in the air. For this reason, good hygienic conditions must be maintained throughout the processing chain. The ways in which microorganisms cause spoilage vary depending on the type of organism and the foodstuff itself. Basically, microorganisms can be divided into two categories: aerobic and anaerobic.

Aerobic organisms require the presence of oxygen (O_2) to survive and multiply. Anaerobic organisms, on the other hand, grow in the absence of oxygen. Aerobic microorganisms include Pseudomonas, Acinetobacter and Moraxella, which spoil food by decomposing and producing substances that give a bad taste and odour.

Anaerobic microorganisms include Clostridium and Lactobacillus. When foodstuffs are handled incorrectly, Clostridium can generate a toxin. Lactobacillus, on the other hand, is a harmless bacterium that turns the food sour by producing lactic acid.

Low temperature is a highly effective inhibitor

Temperature is one of the most important factors controlling microbiological activity. Most micro-organisms multiply optimally in the 20 to 30°C range and show reduced growth at lower temperatures. Careful temperature monitoring is therefore vital during all food handling and distribution stages. Chilling alone, however, will not solve all microbiological problems. There are some psychrophilic bacteria, e.g. Pseudomonas, that multiply at relatively low temperatures. For such organisms, other measures such as modified atmospheres are more effective.

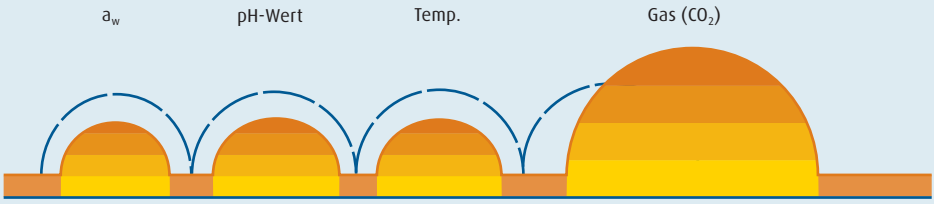
Solubility in water at Pgas = 100 KPa gram/kilogram at 15°C

Carbon dioxide, CO_2	1.97
Argon, Ar	0.06
Oxygen, O_2	0.04
Nitrogen, N_2	0.02

Oxygen causes chemical breakdown

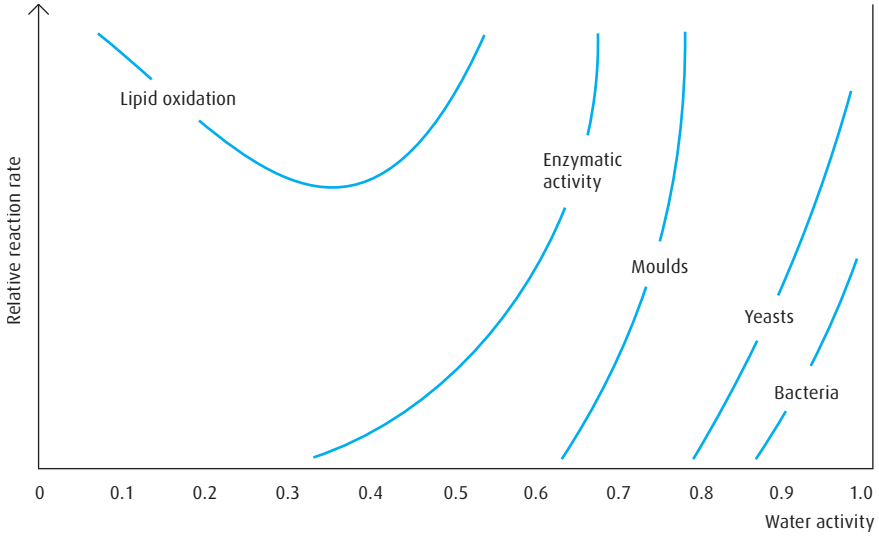
The chemical reactions may be caused by oxidation of vitamins or lipids or by enzymes. The chemical breakdown of lipids is the primary process in dry or dehydrated foodstuffs and in high-fat fish. This is due to the oxidation of unsaturated fats in the presence of atmospheric oxygen, causing the product to turn rancid. Enzymatic reactions caused by polyphenol oxidase, for example, result in brown discolouration of sliced fruits and vegetables. Oxygen, however, is important in maintaining the red colour of cut meat.

Hurdle concept

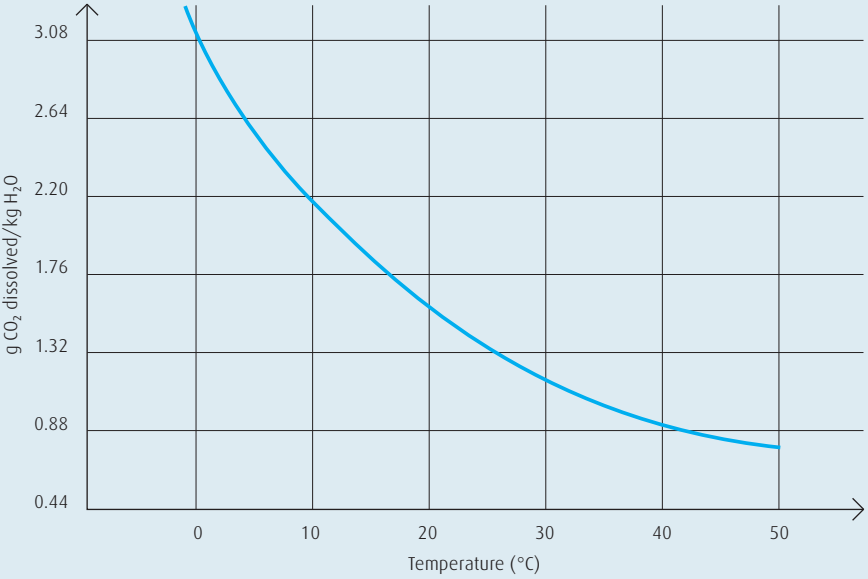


CO_2 contributes to food safety by providing an additional hurdle to the mechanisms that cause spoilage.

Chemical and biological reaction according to water activity



CO_2 solubility in water



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