

# Eliminating Oxygen: Sorbent Technologies are Ensuring Deli Meat Quality

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Processed meat companies are relying on new packaging technologies to appeal to time-pressed consumers. Product appearance is key to appeal to time-pressed consumers. Product appearance is a primary factor influencing consumer purchasing decisions of premium meat products and researchers have identified oxidative degradation as a factor affecting meat color, flavor and product shelf life. Meat companies are now using oxygen absorbing active packaging components to offset the effects of aging and oxidation.

In fact, oxygen sorbents are becoming so essential to meat appearance and quality that they are being referred to as "outredients" due to their impact on taste, color and texture. They are components that actively contribute to the appearance and taste of food by continually removing oxygen from inside packaging atmospheres.

Oxygen exposure results in the degradation and spoilage of food. The four main paths in which oxygen affects meat are color oxidation, flavor oxidation, lipid/fat oxidation and microbiological spoilage.

Color change is the main reason for regulating the oxygen content of food packaging. Oxygen causes a color change in meats, primarily a loss of redness in beef, signifying the age or possible mishandling of the product. This initial color change gives the meat an aged and undesirable appearance to consumers.

While factors like temperature and packaging integrity play a role in the rate at which food degrades, oxygen is necessary for the growth of most organisms responsible for meat spoilage. Although processed meats are formulated to combat the growth of anaerobic pathogens, the removal of oxygen is necessary to inhibit the growth of aerobic pathogens.

## SPOILING TRIGGERS

Spoilage is defined as any tactile, visual, olfactory or flavor change that the consumer considers unacceptable. Microbiological spoilage can still occur and go undetected in packaging, and in extreme cases pathogenic organisms can multiply to levels that cause food poisoning.

Various microorganisms can also produce color changes in food products. Pseudomonas turn food yellow, green or red and bacillus causes food to blacken. Yeast typically forms white colonies on meat and fungi can exhibit a range of water-soluble colors. A slimy texture can also form on meats as bacteria grow, giving it an unattractive iridescent "shine."

Putrefaction occurs as bacteria break down the proteins in food, giving off foul odors. This process can also taint the flavor of the food products. Pseudomonas, bacillus and fungi cause the hydrolysis of proteins, resulting in a

bitter, offensive taste and nutritional loss. The biochemical oxidation of fatty acids can affect both color and flavor. Food will also become rancid through the hydrolysis of triglycerides.

Much of the research for extending the shelf life, safety and quality of foods has shifted from manipulating the product to controlling the packaging system. The emphasis remains on controlling the atmosphere, particularly the presence of oxygen. The meat industry has embraced the development of modified atmosphere packaging. The technology inherently leaves some oxygen behind in the packaging and additional oxygen ingress will occur through the plastic film. Modified atmosphere packaging, partnered with outgredients can effectively eliminate the oxygen within the package over the expected shelf life of the product.

In the absence of oxygen, meat's natural color can be retained for several weeks. The largest single category of products currently employing sorbent technology is sliced deli meats, including smoked and cured meats. Most are pork products; varieties of ham, smoked chops, bacon bits and pepperoni are the most popular.

Color retention has been the driving force for manufacturers to use a sorbent inside packaging. The red color of some cured meat is faint and easily oxidized by a light-initiated, free radical reaction. It is important to remove oxygen before the product is exposed to daylight or retail display lighting, in order to maintain an appealing, healthy appearance. If not, color is visibly reduced within a few hours following packaging and the product will turn brown or gray within a few days.

A benefit to oxygen removal inside packaging is the inhibition of aerobic microbiologic spoilage. Growth of yeast, bacteria and mold are effectively retarded by the removal of oxygen. As mentioned, aerobic pathogens in food products will shorten the shelf life of products as a result of the inclusion of outgredients in product packaging. Existing MAP packaged goods realize even greater longevity and color retention by incorporating sorbents into packaging to remove residual oxygen.

However, sorbents are not an alternative to MAP. In fact, the two processes complement each other. Modified atmosphere packaging lines incorporating a sorbent have been found to operate at higher speeds without sacrificing the oxygen percentage inside packaging.

The objective is to pull the oxygen level down to 100 p.p.m. within a few hours and to zero within 24 hours to avoid product discoloration. As a secondary benefit, the shelf life of meat is substantially extended when held in an atmosphere where the oxygen content is too low to permit growth of aerobic pseudomonads that can cause food spoilage.

A study performed at Cornell Univ., Ithaca, N.Y., concluded that ham packaged in a MAP environment benefited from the inclusion of an oxygen sorbent. The ham packages containing outgredients had lower psychrotrophic bacteria, yeast and mold counts, and better color retention compared to those without absorbers over a 79-day test period.

The study also showed oxygen sorbents did retard the development of "grayness", resulting in a more visually appealing product. In the middle and late stages of the experiment the higher redness values were readily observable to the naked eye.

## **MANAGING OXYGEN TRANSMISSION**

All plastics are permeable to gases. The nominal oxygen transmission rates of lidding films used in vacuum packaging are low. Over time the quantity of oxygen entering the plastic pack will eventually be sufficient to cause discoloration of meat products.

To ensure product stability the packaging film should be gas impermeable. That is most readily achieved by using foil laminate, as the metal layer is impervious to gas.

However, foil laminated film is considered undesirable for sliced deli meat applications because consumers prefer to see the actual meat products before purchasing. Therefore the use of clear film becomes necessary and oxygen ingress is unavoidable. Sorbent technology actively removes oxygen over extended periods of time, effectively negating any ingress that occurs.

Outgredients might be the edge meat processors are seeking. However, North American consumers are not accustomed to the idea of loose components inside packaging. Alternative solutions are available. Self-adhesive oxygen sorbents can be discreetly applied to the underside of lidding stocks and concealed by product labels.

Such sorbents are formulated only with food-safe ingredients and are resin bonded. They will not leak or spill, even if sliced open with a knife. They typically go undetected by consumers. This has proved to be the preferred insertion method for North America and Europe.

Contrarily, Asian consumers look for the sorbent inside the package and will not buy food where a sorbent can not be easily seen. For these applications, sachets can be dropped into the package.

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