Effectiveness of Oxygen or Moisture Scavengers to Extend Shelf Life

Introduction

Maintaining product quality and extending shelf life are challenges for food businesses of all sizes. Exposure to oxygen and moisture are two of the most common threats to food stability, leading to rancidity, microbial growth, nutrient loss, and undesirable changes in product attributes. To combat these issues, some food brands use oxygen and/or moisture scavenger packs in the primary food package, typically in direct contact with the food. These scavenger packs are specialized solutions designed to absorb excess oxygen or humidity inside sealed food packaging. Deciding whether to use these technologies depends on the type of product, its ingredients, and the desired shelf life, but food businesses also need to consider the added costs and challenges associated with them.[1,2,3,4]

Benefits and Challenges

The main reason a food business would use a moisture scavenger pack is to prolong the shelf life of a food product. You can learn more about the factors affecting a food product's shelf life by reviewing AURI's Food Product Shelf Life Guide for Scaling Food Businesses, available at **auri.org/guides/food-product-shelf-life-guide-for-scaling-businesses/**.

As a tool to extend a food product's shelf life, the benefits of oxygen and/or moisture scavenger packs may include:

- Less expired product waste, resulting in potential cost savings[5]
- Allows a business to extend its distribution range
- Maintains product quality, thus reducing the potential of a negative consumer experience

However, oxygen or moisture scavenger packs are not a panacea solution to extending a food product's shelf life. Challenges associated with using these packaging solutions include:

- Scavenger packs have a high unit cost and are typically added manually to each individual package, making them expensive additions to the overall cost structure of the product
- Scavenger packs may not address the primary mode of failure for the product's shelf life (refer to AURI's *Food Product Shelf Life Guide for Scaling Food Businesses* to learn more about failure modes)[7]
- Scavenger packs are not a substitute for low moisture/oxygen barrier packaging or poor package seals. Once the active ingredient inside is "used up" by removing the excess moisture or oxygen in the package microenvironment, scavenger packs are no longer effective. If the packaging is poorly sealed or has a low moisture/oxygen barrier, new oxygen or moisture from outside the package will quickly replace that which was removed by the scavenger[4,5,6,7]

Alternative Solutions

Alternatively, a food business should prioritize the following to ensure they are maximizing the shelf life of their product prior to investing in scavenger packs:

- *Optimize the barrier properties of the primary food package.* Both the water vapor transmission rate (WVTR, also known as a water barrier) and the oxygen transmission rate (OTR, also known as an oxygen or aroma barrier) should be optimized according to the product failure mode. For example, if a product typically fails due to oxygen ingress, resulting in rancidity, the OTR of the

primary package should be less than 0.1 g/100 in^3/24 hr, preferably around 0.06. Note that an overengineered package barrier will result in a higher packaging cost; thus, it is important to optimize the package barrier according to the properties of the product.

- *Improve the seal integrity of the packaging.* Investing in a high-quality sealer and adding seal quality control checks into your production process are the two primary ways to impact seal integrity.
    - o For a small food business, a constant heat sealer is crucial to maximizing both seal integrity and finished product output (examples: **coffeetec.com/collections/constant-heat-sealers**). These sealers allow the use of thicker packaging material while increasing the width of the seal area, at a higher rate of production.[8]
    - o Regular maintenance on seal jaws is important to ensure consistent sealing performance.
    - o Regular checks of package seal integrity is an important part of a comprehensive quality control plan. The most widely used tool for checking seal integrity is a leak detector (example: **flexpakinc.com/product/package-leak-detector/**). This type of precision device is expensive, however, so a cheaper, alternative method is to fill a clear plastic container with water and squeeze a pouch while it is submerged. If any bubbles are visible, then the package seal is compromised.
- *Product design.* Some food products are designed to minimize the impact of moisture or oxygen on product quality. For example, dipping a cookie in a fat-based coating (i.e., chocolate) acts as a natural barrier, since a fat-based coating seals the cookie inside an oxygen and moisture-resistant barrier.

In summary, oxygen and moisture scavenger packs can be valuable tools for extending shelf life and protecting product quality, but they are not a panacea solution. Their effectiveness depends on the barrier properties of the packaging and the consistency of the sealing process. Therefore, a food business should first look to evaluate and optimize packaging structures, sealing methods, and quality control systems before investing in scavenger technology. By approaching the shelf life of their products strategically, balancing costs, product characteristics, and packaging performance, food businesses can determine whether moisture scavenger packs are the right fit for their business.

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