



**OREGON
DEPARTMENT OF
AGRICULTURE**



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Expert Article PACKAGING

In this expert article, we're going to explore a trend in packaging - sustainability. We'll discuss some issues surrounding traditional plastic packaging materials and advances in sustainable packaging that could help you to consider as you think through packaging for your food or beverage product.

THE PROBLEM OF FOOD WASTE

Over half a billion tons of food are wasted globally each year, comprising nearly one third of the agricultural food supply chain. This remarkable volume of waste leads to adverse environmental impacts, spanning from climate change to the pollution of water resources. Coupled with the fact that we will need to feed several billion new people over the coming decades, the amount of food that is wasted will grow rapidly if newer technologies and practices are not adopted.

There are many reasons for food waste, spanning from preharvest losses due to pests and weather to consumer behaviors in restaurants and kitchens.



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While it may not be obvious, packaging performance and shelf-life extension play a key role to address this problem.

Proper packaging is critical to the preservation of food quality and the prevention of spoilage. This is achieved primarily through: 1) controlling gas and vapor exchanges between the internal food and external atmosphere; 2) extending shelf-life by reducing spoilage from chemical reactions and microorganisms; and 3) preventing food safety issues from occurring.

THE PROBLEM OF TRADITIONAL PLASTICS

When food is thrown away or consumed, the packaging is discarded, often outside of the recycling loop. We produce millions of tons of plastic each year in the food industry, much of it as single-use items. Nearly 40% of plastic ends up in landfills, and an alarming amount is found in the oceans. It has been estimated that there will soon be more plastic mass in the oceans than seafood.

Microplastics, or pieces of plastic less than 5 mm long, are a particularly challenging problem. These tiny particles can be ingested in vast quantities by marine animals with significant effects. We still do not know the impact on human health.

One new area of sustainable packaging research is using raw ingredients and agricultural by-products as new sources of sustainable packaging.

Traditional plastics are oil-based, which contributes to emissions responsible for climate change. Further complicating matters, fossil-fuel derived plastics are formulated into many different types, several of which are not able to be recycled at municipal facilities.

Plastics also persist in the environment for extremely long times. Reducing or eliminating single-use plastics in the food industry would benefit the environment in many ways.

When thinking about commercial sustainability, it is highly likely that consumers will continue to demand that companies reduce their use of plastics as well.

ADVANCES IN SUSTAINABLE PACKAGING SOURCES

A great deal of interest has been focused on using raw ingredients and agricultural by-products as new sources of sustainable packaging, particularly as alternatives to plastic.

Researchers and companies have examined fruit pomace, or byproducts, as an alternative source of fiber and cellulose to reinforce and mold pulp-based packaging. Different types of pomace including apple, blueberry and cranberry, have been successfully incorporated into pulp boards.

Some companies have developed edible films derived from agricultural by-products that can be sprayed onto fruits and vegetables to prolong their shelf-life. Researchers have even begun to identify functional compounds in edible packaging that may confer health and wellness benefits to consumers.



New biopolymers have been created to replace traditional fossil-fuel based plastics. Biopolymers are typically created from starch and cellulose. Examples include polylactic acid (PLA), polyvinyl alcohol (PVOH), and polyhydroxyalkanoates (PHAs). Some of these polymers are still new to the marketplace but will likely become more prominent over time.

Sustainable alternatives to plastic should all have the ability to biodegrade in the environment at much faster rates compared to fossil-fuel based plastics. However, it is important to note that when considering an alternative source of material, it is important to consider food safety. Traditional plastics perform well and a transition to new source materials should not compromise safety.

ADVANCES IN PACKAGING TECHNOLOGY

Advances in new technologies in food packaging are occurring rapidly. Gas permeation across a package is a major cause for food spoilage. With the exception of glass, other packaging materials allow for some gas exchange.

Often, however, these materials either let in too little or too much of a particular gas, compromising

shelf-life. A recent technology that is gaining popularity is Modified Atmospheric Packaging (MAP). MAP relies on controlling the internal atmosphere in the packaging. This can be done passively by using properties of the product itself, or actively through gas flushing with gases such as nitrogen, and use of gas scavengers or emitters. Depending on the product, MAP packaging can be complex, requiring consultation with experts in the field.

Another major leap in technology over the past decade is the incorporation of intelligent sensors into packaging. Currently, several categories of sensors exist, which can alert people to: 1) the freshness of food; 2) the integrity of the food packaging; 3) time and temperature indicators (TTI); and 4) the identity and tracking of the product, such as an RFID tag.

While all of these sensors play an important role in controlling food waste, the TTI trackers are particularly useful to detect temperature abuse resulting from many scenarios, such as a failed refrigeration system or a lengthy holding time in a humid warehouse. The freshness sensors are often based on detection of certain gases, such as ammonia, pH levels and certain metabolites that form when spoilage starts to happen. RFID, which allows tracking of a product throughout the supply chain, could assist with determining the causes of food waste as a product moves through the supply chain, and even after it's discarded.



Smart Sensor





LABEL DATING AND SIZING

Consumers are often confused by the date labeling of food products. The terms “best by,” “expires on,” “sell by,” and “use by” have different meaning to different people.

The “best by” label is an indicator of food quality only and assume that the consumer stores the product according to the label instructions. However, there is a misperception among many people that when this date is exceeded, the product is now inherently unsafe to consume and it is discarded. In reality, this date is just a general reference to food quality, such as changes in texture or flavor over time.

The confusion is especially problematic when “best by” is equated to “use by.” The “use by” dates are set by the manufacturer as a guarantee against food safety issues that might occur (even if highly unlikely) if the product is consumed past this date.

The U.S. Food and Drug Administration is actively looking at label language issues that may reduce confusion among consumers and help reduce food waste. As part of this approach, they are standardizing language to indicate one descriptor for optimal quality, such as “Best If Used By.” A government app called FoodKeeper may be a helpful resource to check dates for different food types:

www.foodsafety.gov/keep-foosafe/foodkeeper-app

Another way to reduce packaging waste is to have a proper fit and size of packaging to the food item. Using less packaging, if possible, will help reduce waste.

Examples include form-fit molding and vacuum-sealing around a product and avoidance of unnecessary interior dead space of bulky form. The durability of the final packaged product when stacked, stored and transported throughout the supply chain is an important determinant as well, as stronger packaging should result in less compromised containers and corresponding waste.

SUMMARY

There are many approaches to making food packaging more sustainable. These include adopting technologies to extend shelf-life, sourcing sustainable materials beyond traditional plastics, using intelligent sensors and labeling products with standardized language in form-fit containers.

As consumers are paying close attention to environmental issues, it is more important than ever to learn about different options and advances in food packaging.

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