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Produce Protection Peel: Wax vs. Plant Material

Objective

The objective of this paper is to understand the current produce wax coating practices and compare them to sustainable alternatives, such as Apeel Sciences' plant-derived coatings. The purpose of edible coatings is to provide customers with the satisfaction of a clean, healthy, and appetizing source of nutrition. While wax coatings don't have significant health effects on humans, the process of the current, commercialized agricultural system contributes to a larger amount of microbial contamination, moisture loss, and food decay and waste than alternative protection layers. Based on Apeel Sciences, their coatings prevent two to three times less food waste than traditional produce coatings and decrease greenhouse gas emissions from refrigeration (Anonymous, 2018). As edible coatings are necessary for slowing down the respiration rate of produce spoilage, the food industry needs to adjust to sustainable practices that extend shelf life while eliminating the application of pesticides and retaining the produce's high nutritional value.

Purpose of Edible Coating Application

Edible coatings are thin layers applied to fresh produce to enhance their naturally present waxy cuticle or replace the natural barriers where the produce cuticle has been removed. Apples, for instance, naturally have an extracellular cuticle layer that protects the fruit before and after harvest from wind, temperature, chemicals, and drought. A study with figs found that after harvesting, figs' epicuticular wax reduces its ability to protect against physiological decay and weight loss because the fruit is no longer able to restore and produce new wax (Chessa, et al., 1992). The reason why corporations apply a wax layer is to decrease fruit proneness to microorganism infections, physical damage, and moisture loss (Veraverbeke, et al., 2001). Additional purposes include slowing down respiration to extend shelf life, retain nutritional value, and restrict foreign odors. Minimizing food loss is important because wasting fruits and vegetables imply wasting the essential nutrients and calories for human health. Because extending the shelf life, maintaining nutritional value, and preventing contamination of a fruit is crucial for commercialization, a protectant layer is necessary for customer satisfaction.

While wax coatings are U.S. Food and Drug Administration (USFDA) certified, some unsatisfactory results of the wax layer are that it can contribute a bloom and stickiness in the product. The wax layer does not have significant health effects, but it is an industry that needs an updated and sustainable practices to minimize food waste and retain nutritional density. In the following sections, I will discuss the application process of wax layers and alternatives that would increase shelf life and decrease food waste.

Postharvest Treatments of Fresh Produce: Highly Commercialized

Processes that lead to delivering fruit to markets include: both physical (heat, edible coating, and irradiation), chemical (antimicrobial & anti-browning agents, nitric oxide, and sulfur dioxide), and gaseous treatments (ozone, ethylene, and controlled atmosphere storage) (Mahajan, et al., 2017). According to the same article, edible coatings are composed of hydrophobic and hydrocolloid/hydrophilic groups, such as lipid-based waxes and protein-based materials. Coatings may also contain aloe vera, polyvinyl acetate, mineral oils, and cellulose. The produce will also undergo lots of refrigeration and controlled atmospheric storage to maintain freshness. If refrigeration practices on these fruit decline slightly, it would help to minimize greenhouse gases. Furthermore, most produce covered in wax are grown with pesticides and other chemicals to maximize crop cultivation. While pesticides and other chemicals will be prevalent in these fruit and vegetables, sustainable practices ensure that crops are grown organically to prevent detrimental health effects to those eating the produce.

Postharvest Treatments of Fresh Produce: Apeel Sciences

Apeel Sciences is a young corporation that provides a sustainable practice of applying protection coatings on fruits and vegetables with parts of other produce that go unused after harvesting. Like wax coatings, it is also compliant of the USFDA regulations but extends the shelf life of produce by two to three times longer than wax layered products (Anonymous, 2018). Apeel produces are coated with plant-derived materials – lipids and glycerol lipids – that exist in peels, seeds, and pulp of harvested fruits left over. Apeel emphasizes its product's ability to reduce food waste, reliance on refrigeration and controlled atmospheres, and improve nutrition density content. The company aims to eliminate the usage of wax, gas, and pesticides to keep fruits and vegetables fresh over time. Layers are applied by spraying, dipping, or brushing a powdered mixture of water onto the produce, creating a microclimate inside every piece of produce, extending its ability to combat physical stressors. Apeel coatings keep moisture inside the produce and oxygen out, reducing the rate of respiration that leads to spoilage. The company supports the plant's natural abilities to protect against environmental stressors and retain a higher density of nutrients by giving the opportunity for growers to harvest the produce when ripe and fully developed before their journey to the grocery store. Whereas protein-based layers can trigger allergic responses, Apeel's lipids are not a source of regulated allergens and is USDA Certified Organic. The Apeel layer cannot be washed off without damaging the produce itself, but because it is made of other food ingredients, consumers are safe to eat the layer as well.

Limitations

Limitations for edible coating applications include the costs of investing in research and implementation of advanced coating equipment, finding edible materials that have the desired properties for coatings, and challenging regulations for different coating materials. Because there are tradeoffs with all materials, industries must prioritize coating purposes and implement the

best option for extending produce life and human health in terms of preventing contamination. Since Apeel Sciences is a new corporation, there is little to no articles supporting their lipid-based coatings. Because of the lack of published material, we could only rely on what the company presents on their website and assume that they are speaking transparently and truthfully. Moreover, implementing plant-based coatings will be difficult on a commercialized and large scale because Apeel Sciences needs to diverge consumer interests from traditional produce to their sustainable produce. Another limitation is the reduction of greenhouse gases emitted from refrigeration and transportation of these crops. To combat these issues, companies must create relationships with local farmers to receive food from close by and also minimize refrigeration needed to keep the produce cool.

Conclusion

To provide customers with exceptional fruits and vegetables that appear impressive, production companies must pick their crops prematurely, ship the products under heavy refrigeration, and get them in the market seemingly fresh to sell at the store (Strom, 2016, p. 1). Although refrigeration aims to prevent food waste, leaking refrigerants and the power necessary to generate storage damages the ozone layer. About 15% of refrigerants in commercial refrigerated warehouses leak into the atmosphere, contributing to the deterioration of the stratospheric ozone layer (Twilley, 2014). To reduce refrigeration, food waste, and the amount of produce picked before fully developed, Apeel Sciences' technology applies a thin layer of unused fruits and vegetables to preserve the produces' natural ability to combat microbial contamination and physical damage while retaining high nutritional densities. As Americans waste about 40% of their food purchased, Apeel provides a sustainable practice that reduces the produces' spoilage rate and gives it a longer chance at being eaten before tossed away into landfill or composting (Twilley, 2014).

The highly commercialized food system has many flaws including having a higher input of pesticides, greenhouse gas emissions, and food waste. Although Apeel's technology is relatively young with a lack of clear data supporting the success of their product in all aspects, Apeel can guarantee that the plant detritus coating can deliver produce that have longer life expectancies with minimal waste, compared to wax layers. By increasing yields by reducing losses at the harvest level, translating into lower prices for consumers, commercializing Apeel Sciences at a larger scale would benefit the Earth and humans through minimizing its current greenhouse gas outputs, decreasing food thrown away, and increasing the nutritional densities that are essential for human health (Strom, 2016, p. 4). As Apeel Sciences invest in larger scale commercialization and adjusting human attitudes towards their practices, the company will need government support to mass implement their processes to replace the unsustainable food system and help curtail global climate change.

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