



## White Paper

### Coatings on Fresh Produce and the 2023 Apeel Controversy Edible Films: Extending Shelf-Life and Preserving an Appealing Appearance

Fresh fruits and vegetables have a natural covering in the form of a skin, covered by a cuticle (a natural shell of higher plants that covers and protects the flowers, leaves, fruits, and vegetables from adverse external influences) or a shell in the case of nuts. These natural barriers regulate the exchange of oxygen, carbon dioxide, and water and reduce the loss of volatile flavor and aroma substances.<sup>1</sup>

Because fruits and vegetables contain a large quantity of water, they are highly perishable. Immediately after harvest transpiration begins and leads to loss of quality, shriveling, and discoloration.<sup>2</sup>

For example, apples are 85% water, and long transportation times from tree to retail shelf provide an opportunity for water loss. Freshly harvested apples have their own waxy coating that protects them from shriveling and weight loss. For today's industrial-scale growers, long storage of apples from one season to the next or for transit from one hemisphere to another make it necessary that apple packers add a thin coat of natural wax to improve their "life expectancy."<sup>3</sup>

The FDA has created groups of specific related foods for the purpose of establishing acceptable tolerances and/or to set limitations for the use of direct human food ingredients. Waxes and coatings fall under the category of *surface-finishing agents*. These are "...substances used to increase palatability, preserve gloss, and inhibit discoloration of foods, including glazes, polishes, waxes, and protective coatings."<sup>4</sup>

Today coatings applied to produce to extend the quality and shelf life are considerably more sophisticated than the application of a traditional coating of beeswax (a material approved for use in organic production).

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<sup>1</sup> <https://www.mdpi.com/2079-6412/13/5/911>

<sup>2</sup> <https://www.ijcmas.com/abstractview.php?ID=20301&vol=9-11-2020&SNo=359>

<sup>3</sup> <https://www.esc1.net/cms/lib/TX21000366/Centricity/Domain/97/Apples%20Waxing%20Statement.pdf>

<sup>4</sup> <https://www.ecfr.gov/current/title-21/chapter-I/subchapter-B/part-170>

## How to Know if Produce is Treated with Edible Films

Almost all apples, for example, shipped from large packing houses will be treated with some kind of coating to maintain the quality and extend shelf-life. And as our supply chains continue to reach around the world, most fruit and vegetables are being treated with some kind of post-harvest coating or edible film to extend their shelf-life by days, weeks, or even months. All to the benefit of the food wholesaler and retailer, of course, since extended shelf-life is rarely equated to superior nutrient quality.

In most cases, the consumer will not be able to tell if any coating has been applied just by looking at a vegetable or piece of fruit because coatings, in general, are less than 0.3 mm thick. It would be necessary to look for the branded seal or label required by the US Food and Drug Administration (FDA) on packages of produce or the cartons in which bulk produce is shipped.<sup>5</sup>

### **Apeel™ Branded Edible Films – Legitimate Safety Concerns or Overblown Misinformation (or Both)**

**“Apeel gives the entire supply chain more time. That's better for your business, your customers, and our planet.” (Apeel.com)**

Apeel Sciences, manufacturer of coatings to extend the shelf life of fruits and vegetables, has equated an extended timeframe for the produce supply chain with protecting the planet and solving climate change *one avocado at a time*. And that means more business for retailers – likely at a premium price – and good karma for consumers.

Combining marketing finesse and careful wording, Apeel Sciences has created the view that Apeel is an edible film applied to fruits and vegetables to keep them looking fresh and appealing for days or weeks longer than nature alone would support.

The company has slowly moved away from using individual product names in their marketing and promotional materials to concentrating on using just the word “Apeel,” which means the names Edipeel™ and Organipeel™ are being subsumed. Edipeel is a product for conventional producers and Organipeel is approved for organic produce.

What’s the difference? The products are made of two distinctly different sets of ingredients.

**Edipeel** is Generally Recognized as Safe (GRAS) with the FDA as a surface finishing agent for fresh fruits and vegetables comprised “entirely of a mixture of food grade, highly processed glycerolipids derived from edible plant oils, specifically the food additive mono- and diglycerides of fatty acids,” sourced from recycled plant materials.<sup>6</sup>

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<sup>5</sup> <https://nwhort.org/wp-content/uploads/2014/10/FreshFruitLabelingManual-rev-0721141.pdf>

<sup>6</sup> [United States Edipeel Product Information Sheet.pptx \(storyblok.com\)](#)

**Organipeel** is registered with the EPA as a fungicide with a very short – and not very informative – ingredient list. The product is described to the EPA as “Provides reduction of spoilage and decay caused by non-public health microorganisms on the surface of unprocessed fruits and vegetables” with this accompanying ingredient list:

ACTIVE INGREDIENT: Citric Acid - 0.66 % BY WT  
OTHER INGREDIENTS: 99.34 % BY WT.  
TOTAL: 100%

Note that 99.34% of the ingredients used in Organipeel are not identified.

There is an additional OMRI Listed® product called Fruit A-Peel Pro, manufactured by Fruit Growers Supply Company, which is categorized under **Processing Products: Fruit Coatings – Allowed With Restrictions, Shellac, Orange, Unbleached**.

On Apeel’s website, listed on the FAQ page, the company says, “Yes! We have formulations that are OMRI Listed® for the growers and distributors of USDA Certified Organic produce. Apeel’s products help reduce post-harvest food waste, overpackaging, and costly controlled-atmosphere storage.”<sup>7</sup> This verbiage does not recognize that the OMRI Listed® products are neither identified as a fruit coating or an edible film. Organipeel is listed under **Crop Products: Fungicides**, while an additional product is described as a wetting agent for use in crop pesticides - presumably Organipeel.

It seems that the company has slowly moved away from using their product names in their marketing and promotional materials to concentrating on using just the word “Apeel.” An unintended consequence of that decision is that the simplification has led to more confusion. And a somewhat over-aggressive marketing program by Apeel implies all their products reduce waste by preserving fruits and vegetables with a protective coating and are approved for use on organic produce.

### **Confusion abounds**

In early April of 2023, it appears a conspiracy theorist discovered the product safety data sheet published online for a cleaning product with a similar name sold in the UK and combined that with a reference to a CNBC video from Dec. 2018 about a Bill Gates-backed startup manufacturing an edible coating named Apeel.

Apeel (the produce coating product) and Apeel (the cleaning product) became completely conflated, and comments, videos, and links on social media platforms like Twitter, Facebook, and Reddit skyrocketed, and have continued to reappear.

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<sup>7</sup> <https://www.apeel.com/faq>

The confusion and response could be almost considered normal *social media insanity* except that it began to affect the businesses of Apeel Sciences' customers. Risking consumer trust and loyalty, some of Apeel's customers have stopped using their products and publicly distanced themselves.

**Starr Ranch Growers**, Wenatchee WA, removed any mention of Apeel from their website, though their announcement of partnership with Apeel, published April 1, 2021, can be found on the Internet Archive [here](#).

And **Stemlit Growers**, also Wenatchee WA, once described by Apeel as one of their users, is no longer mentioned anywhere on the Apeel site. Stemlit announced their partnership with Apeel, [published](#) in trade media on September 24, 2020, and also has since removed all mention of Apeel on their site.

Unfortunately, the kerfuffle is spilling over into the consumer market of organic produce, possibly decreasing consumption of organic food and support for the production of organics.

Consumers need to be aware that marketing is not reality. Are Apeel's products approved for use on certified organic produce or not? Are they or are they not protective coatings? Is Edipeel being used on fruits and vegetables sold as certified organic because of the confusion about the products/names?

What can consumers do to protect themselves? While the choices may be fewer when buying tree fruit, there are many when buying vegetables.

**Grow your own at home.** If you live in an apartment or condo, grow something on your porch or patio. Tomatoes in patio pots, herbs in window boxes – there are lots of ways to take the first step.

**Grow your own in a community garden plot.** Nearly every community of any size offers plots that include water, shared tools, and are generally fenced against intruders. And a community garden plot comes with built-in advisors in neighboring plots.

**Shop at one or more farmers markets.** Almost every city, town, or village has a farmers market, some have more than one. At a farmers market you get produce that is almost always fresher than anything you'll find on a grocery shelf, where it takes days—or even weeks—to arrive. Encourage more local and regional production by encouraging others to visit the market.

**Shop at a member-owned food co-op or independently owned natural food store.** Food co-ops reflect the values and principles of their owners and members and fit comfortably into small towns and unique neighborhoods. The independence of today's

food co-ops makes each one different and contributes to the diversity of the business landscape and the success of a wide network of local suppliers.

**Join a CSA (Community Supported Agriculture).** With a CSA subscription you are partnering with a farmer for the growing season and you're helping prepay for seed, labor, and materials that are needed for the upcoming season. Being a member of a CSA is being a part of a community that supports a very hardworking farmer and his family.

## **Edible Waxes and Coatings – A Primer**

**Beeswax** is a natural wax produced by honeybees (genus apis) and widely used after purification. Beeswax can also be mixed with either chitosan (a polysaccharide that comes from the outer skeleton of shellfish, including crab, lobster, shrimp, and crayfish<sup>8</sup>) or cellulose-based coatings.<sup>9</sup>

**Carnauba wax** comes from the leaves of a palm native to and grown only in northeastern Brazil. It is a hard, brittle natural wax often combined with another type of wax like beeswax.<sup>10</sup>

Food grade **paraffin wax** is composed of vegetable oils, palm oil derivatives, synthetic resins and other materials and is nearly colorless and odorless.<sup>11</sup>

**Shellac**, a resin secreted by the female lac bug on trees in the forests of India and Thailand, is commonly used to provide a glossy sheen and effective preservative seal.<sup>12</sup>

Shellac is approved for use as a surface treatment for certain whole fruits, such as citrus fruit, melons, apples, pears, peaches, pineapples, pomegranates, mangoes, avocados, and papayas and as a glazing on nuts.<sup>13</sup>

**Protein-derived edible coatings** include casein, collagen, gelatin, whey protein, egg white protein, keratin, soy protein, wheat gluten, peanut protein, and corn-zein and cotton seed protein. Most often these ingredients are combined with a fat or wax of some kind to improve water retention.<sup>14</sup>

**A monoglyceride/diglyceride-based coating** consisting of fatty acids found in plants and animals is marketed as Edipeel™, manufactured by Apeel Sciences. Edipeel is described in

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<sup>8</sup> <https://www.webmd.com/vitamins/ai/ingredientmono-625/chitosan>

<sup>9</sup> <https://www.ijcmas.com/abstractview.php?ID=20301&vol=9-11-2020&SNo=359>

<sup>10</sup> <https://blendedwaxes.com/blog/5-facts-carnauba-wax/>

<sup>11</sup> <https://blendedwaxes.com/blog/3-facts-about-food-waxes/>

<sup>12</sup> <https://en.wikipedia.org/wiki/Shellac>

<sup>13</sup> <https://www.afsuter.com/product-category/industry/food-agriculture/>

<sup>14</sup> <https://www.ijcmas.com/abstractview.php?ID=20301&vol=9-11-2020&SNo=359>

documentation presented to the FDA as “Glycerolipids derived from recycled plant materials.” Glycerolipids are one type of lipid (fat) consisting of fatty acids or fatty alcohol.<sup>15</sup>

**Polysaccharide-based coatings** are widely used edible coatings. These polysaccharides are prepared from various plant species. The most commonly used polysaccharide coatings include cellulose, chitosan, and various plant gums.<sup>16</sup>

**Alginate** is a polysaccharide which is naturally derived from brown algae. Carrageenan, an alginate, is an extract from a red seaweed commonly known as Irish or Carrageenan Moss.<sup>17</sup> Alginate controls respiration by acting as a barrier to moisture, water vapor, and oxygen.<sup>18</sup> OrganicEye is pressuring the USDA to remove the approval for carrageenan’s use in organic food due to independently produced, published research that indicates it is a potent inflammatory agent and carcinogen.

**Chitosan biocontrol agents and essential oil vapors** have been used to coat avocados, mangoes, and papayas. Chitosan is produced from chitin found in the shells of shrimp, crabs, lobsters, and crayfish and is biodegradable.<sup>19</sup>

**Nanomaterials and nano-chitosan coating** combined with natural antimicrobials, such as essential oils, are nontoxic, biodegradable, and cost-effective, and have a wide spectrum of antifungal activities.<sup>20</sup>

### **How are edible waxes and coatings applied?**

Whether coatings are heated to liquid or combined with a solvent, they can be applied by spraying, brushing, or dipping, and then allowed to dry and form a seal, an edible coating that is so thin as to be invisible. Edible films and coatings are not intended to replace traditional packaging materials but to provide an additional means to improve preservation of the products.<sup>21</sup>

### **Considerations about consuming post-harvest coatings applied to fruit and vegetables**

According to the McGill University Office for Science and Society, the wax itself presents no health issue since it is not absorbed and passes through the digestive system. Wax coatings can also be used on organic produce if they are made from a natural source like beeswax or

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<sup>15</sup> <https://www.lipotype.com/lipidomics-services/glycerolipid-analysis/>

<sup>16</sup> <https://www.mdpi.com/2673-4176/4/2/8>

<sup>17</sup> [https://web.archive.org/web/20140407080507/http://www.seaweed.ie/uses\\_general/carrageenans.php](https://web.archive.org/web/20140407080507/http://www.seaweed.ie/uses_general/carrageenans.php)

<sup>18</sup> <https://www.ijcmas.com/abstractview.php?ID=20301&vol=9-11-2020&SNo=359>

<sup>19</sup> <https://www.frontiersin.org/articles/10.3389/fmicb.2021.711092/full>

<sup>20</sup> <https://www.frontiersin.org/articles/10.3389/fmicb.2021.711092/full>

<sup>21</sup> <https://www.ijcmas.com/abstractview.php?ID=20301&vol=9-11-2020&SNo=359>

Carnauba wax. While consumers can eat the very thin layer of wax on fruits, all coated produce should be well washed to remove bacteria that may be on the surface.<sup>22</sup>

### **Eat organic: Choose carefully for your health and lifestyle**

*Caution should be exercised if you have special dietary needs or observant religious/spiritual restrictions.*

Buying organic ensures that produce will be coated with simple waxes such as carnauba wax or beeswax or a coating of unbleached shellac. Some of the newer and more sophisticated coatings are made from a wide range of ingredients that include allergens or may conflict with Kosher or vegan lifestyle choices.

Consumers with food allergies should be aware that protein-based edible coatings may contain allergens such as milk, whey, wheat gluten, corn gluten, soy protein, surimi (fish protein), and collagen/gelatin (animal protein); chitin/chitosan is derived from shells of crustacean such as crab, shrimp, lobster, and crawfish.

For those who keep Kosher, note that coatings made from or including chitin/chitosan are derived from shellfish. And for consumers who are practicing vegans, some coatings contain chitin/chitosan from shellfish, collagen and/or gelatin, which are animal proteins, or surimi, a fish protein.

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<sup>22</sup> <https://www.mcgill.ca/oss/article/you-asked/why-do-they-spray-wax-apples-0>