

New Culinary Ready Meal Era

Advances in packaging, freezing technologies, and “specialty industrial ingredients” now allow chefs and scientists to authentically translate recipes to a microwavable container or skillet-friendly bag.

by Rachel B Zemser, MS, CCS

When you think about the canned and frozen foods of the 1950s, the phrase “culinary innovation” doesn’t leap to mind. Those products were appreciated simply for their functionality and shelf stability. Research on frozen products, in particular, focused merely on ensuring that all of the food components finished cooking at the same time. Indeed, cooking “synchronization” was pretty much all that mattered; culinary aspirations remained on the back burner. But all that has changed.

Advances in packaging, freezing technologies, and “specialty industrial ingredients” that help create sauces with improved freeze-thaw stability now allow chefs and scientists to authentically translate recipes from white tablecloth to a microwavable container or skillet-friendly bag. On the other end of the

spectrum, thermally processed low-acid canned foods no longer have to be in a can, per se, as flexible retorted containers and aseptic processing have been introduced. Both of these processes allow for shorter sterility cook times. That, in turn, improves the flavor and texture of the finished frozen or shelf-stable product.

Flash Frozen in Time

In the early 1920s, Clarence Birdseye invented the Quick Freeze Machine, which used flash-freeze principles to limit formation of ice crystals and improve the quality of frozen foods. The meals’ quick preparation time brought some consumer acceptance, but people still complained about cardboard texture, bland flavor, lackluster color, and curdled sauces. Companies had little incentive to aim for delicious flavor

because even minimum consumer standards had not yet been met. Luckily, these challenges prompted the USDA Agricultural Research Service (ARS) to conduct time-temperature tolerance studies. The ARS scientists experimented with every step of the process: vegetable selection, harvesting, handling, blanching, freezing, packing, storing, and transporting products to market. They eventually developed nine principles for freezing vegetables that producers still follow today (see box).

Modern Foundation

These principles may seem basic, but they are the foundation of modern freezing technology and allow us to continually improve the finished product. Scientists know which application methods work best on specific fruits and vegetables and, for instance, how to determine when cryo-

genic freezing is worth the cost or when mechanical IQF (individually quick frozen) processes will suffice.

Indeed, cryogenic freezing and IQF allowed ingredient suppliers to develop high-quality specialty ingredient components such as IQF roasted vegetables, pre-cooked IQF brown rice, and frozen sauce “pucks.” Even delicate vegetables such as asparagus can be produced at restaurant-level quality by chefs who want to experiment in the R&D test kitchen. Frozen-ingredient suppliers can now cater to R&D chefs’ whims to create, for example, home-style meat nuggets and vegetable shapes that have a “from scratch” look, not a cookie-cutter appearance. Flash freezing not only improves overall quality, but also ensures a safer finished product. Meat lasagna that can be frozen in 10 minutes

Nine Principles for Freezing Vegetables

1. The product must be freezable. Peas freeze; cucumbers do not.
2. The variety must be suitable. Garden peas, for example, freeze better than peas grown for canning.
3. The raw product must be first class. Freezing preserves defects as well as superior quality.
4. Handling between field and plant must be as prompt as possible.
5. Natural enzymes must be inactivated by blanching.
6. Freezing must be fast enough to preserve quality yet economical enough to be competitive.
7. The plant must be kept sanitary and the line clean, to prevent contamination by molds, yeast, and bacteria.
8. Packaging must ensure that no moisture is lost during a year’s storage.
9. Storage temperatures must be uniform, and never exceed 0 degrees Fahrenheit.

**Source: USDA Agricultural Research Service*



Green Giant Valley Selections Vegetable Rice Primavera (Canada).

Source: Innova Market Insights

will spend very little time in the temperature danger zone (40°F to 140°F). Therefore, pathogenic bacteria such as *E. coli* will have no chance to be frozen, thawed, and eaten by uninformed consumers, who may think that the precooked item is safe to eat without reheating.

Farm to Freezer

Improvements in frozen meals and ingredients start in agriculture. Industrial-scale fruit and vegetable production is controlled in many parts of the world to ensure year-round availability; consistency in size, shape, and texture; and better selling-point values. In many cases, manufacturers will have exclusive contracts with the growers to ensure quality compliance in the field, finished product and transporting practices. Processors may also locate their process-

ing facility right on a farm site to ensure that the products are truly frozen at the peak of their freshness. Consumer demand for more specialty items has also prompted growers to harvest sophisticated foods that were previously too expensive to include in frozen meals. You can now find baby artichokes, edamame, diced mango, ginger, and IQF lemongrass in mainstream, affordable lines of frozen dishes. Ingredient trends will always start in the big cities and fine dining establishments but once they hit the media wire, the demand for those specialty components increases and produce formerly found only by the bushel, now turns into bins, truckloads and tankers.

Packaging Pleasers

“Technology in packaging material and innovation continues to improve,” observes

Eric Koyama, frozen foods R&D consultant at Culinary Revelations [San Francisco]. “Consumers are now demanding restaurant-quality frozen meals, which has forced the packaging companies to accelerate their timelines in developing packaging that offers a restaurant-type meal experience.”

Early frozen meals were first served in lacquered cardboard containers or compartmentalized aluminum foil trays, then in plastic crystallized polyethylene trays for microwave cooking. These early frozen-meal trays would result in uneven cooking of the product. Koyama cites big improvements in microwave technology, such as trays whose compartments vary in thickness to equalize cooking times and “susceptor” trays that allow bread to get crispy in “grilled” microwavable panini

sandwiches. Other innovative packaging, such as “meals in a bag,” lets consumers feel like they are actually cooking. Koyama says, “Just dump the ingredients in a pan, add some liquid, and cook. It’s the egg in the Betty Crocker mix philosophy.” These skillet meals have a mixture of high-quality IQF roasted vegetables, frozen sauce “pucks”, frozen mozzarella cheese cubes, and grill-lined meat. A typical bag of frozen “skillet” components flows easily into a heated pan. The solid pucks of tomato sauce slowly begin to melt, and the frozen cheese cubes dissolve in the sauce without being burned because the sauce pucks provide moisture. The ingredient statement on a typical skillet meal reads like a food science ingredient handbook, but the end result is a tasty, well-balanced home-style meal prepared in

just 10 minutes! Other types of frozen-meal packaging are designed to control moisture migration, one of the major quality issues in frozen-meal development. Consider, for instance, Lean Cuisine Market Creations, which have a release valve on the back of the bag to vent excess steam during microwaving. Café Steamers, a US line of healthy frozen meals, features a dual-tray steam cooker. The sauce is on the bottom of a microwave bowl, and the pasta and vegetables are on top in a plastic grid tray. As the product heats, the steam from the sauce cooks the pasta.

Helpful Hydrocolloids

Hydrocolloids provide lots of entertainment for the modern chef in the Fat Duck Restaurant kitchen, but when it comes to R&D they play a much more important role as controllers of moisture. Today's elaborate frozen meals include many sophisticated ingredients and sauces in the same container or bag, and they undergo constant freeze-thaw cycles as they move from manufacturer to truck to supermarket to home freezer.

Hydrocolloids help maintain stability and prevent moisture migration in the meal components. Cellulose, for example, enhances cling in

sauces and minimizes stickiness in pre-cooked frozen pasta. Tomato sauce can “weep out” water during repeated thawing, but adding a blend of xanthan gum, gum arabic, and carrageenan can prevent separation and maintain the tomato sauce emulsion. Ground beef meatballs or meat analogs can easily fall apart when going through the freeze-cook cycle, but konjac gum can help hold the meatball together and improve its finished texture.

Chefs have endless ways to meet their culinary goals in a finished frozen item. However, the technology can be complicated, and not all creative R&D chefs are trained in hydrocolloid technology. Companies such as TIC Gums recognize that food manufacturers have little time for R&D trial-and-error and make it easy for chefs: Just call a “Gum Guru” at their 1-800 number.

Sterile Sensations

Frozen meals work well at home, but what about great savory meals on the go for work, camping, or long-distance travel? Canned or “commercially sterile” foods are ideal because they are shelf-stable until opened. In the 1950s, corned beef hash, brined peas, soup, and other canned foods were popular because their convenience and long shelf

life appealed to Americans who thought they should hoard food in case of war. No culinary innovation was pursued because the high-heat sterilization process was so damaging to the flavor, color, and texture of canned foods that creativity seemed like a waste of time.

Years of heat-processing research have confirmed that the only way a high-pH product can be shelf-stable is to cook it hot enough to kill *Clostridium botulinum* and inactivate its toxin-producing spores. The “kill-step” rules have not changed, but lately a slew of interesting and delicious shelf-stable low-acid foods have appeared on the market.

Rocking the Retort

Truitt Brothers, Inc. [Salem, Oregon] is a retort facility that manufactures not only canned foods but also shelf-stable trays, flexible pouches, and double-seamed bowls. The new packaging has redefined retorted high-pH products, which are now sought after by campers, 24-hour gas station kiosks, and people who are just always on the go. Ryan Booth, a food scientist at Truitt Brothers, explains: “With a pouch you can vacuum out all the air to eliminate head space, a process that’s not possible in a can, where water or brine must be added to reduce headspace.

Sterile-pouch products have a clean flavor and are not mushy or salty like their canned counterparts.” Booth also points out that flexible pouches have thinner profiles, and heat can transfer to the center point faster than they could in a can. Thus, the basic retorting rule of heating the coldest spot to minimum lethality is still being followed, but the smaller pouch allows the heat to reach the core quickly without overcooking the food stored in the perimeter of the package. Flexible, retortable pouches and double-seam bowls allow chefs and food scientists to create tasty ready-to-serve side dishes such as rice and beans. The products are shelf-stable, microwavable, and portable. Proteins like hot dogs and chicken slices are now retorted without being made to taste like water-logged or brined mush.

Premium Products Prevail

Improved flash-freezing technology, unique packaging, innovative functional ingredients, and some molecular gastronomy-style science all contribute to improvements in the quality of savory meals in the frozen and retorted shelf-stable categories. Formerly discouraged by rudimentary freezing and heating technology, R&D chefs are now inspired to pull authentic concepts and trends from the restaurant world into their kitchens and recreate classics from all over the globe.

Consumers also love the portability of shelf-stable savory products. It’s now easier than ever for people to get the number of recommended daily servings of fruits and vegetables. That’s because, thanks to technological advances, these foods can be produced in travel-friendly, fresh-tasting varieties, all at an affordable price point. ♦

Source: Innova Market Insights



Café Steamers, a US line of healthy frozen meals, features a dual-tray steam cooker.