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A Supplement to Food Product Design

Designing Moist Meats

A Plum Assignment





Designing Moister Meats: A Plum Assignment

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A revolution has taken place in the foodservice industry over the past few years. Increased labor costs and concern over food-safety issues are leading foodservice providers in both institutional settings and consumer sectors to turn away from on-site preparation of meat products in favor of purchasing these items precooked and frozen, then reheating them at the point of purchase or consumption. While this practice cuts costs and maintains tighter control over sanitation, it can unfortunately lead to less-flavorful and dry, mealy finished products, due to multiple heating steps depleting meats of their flavorful juices. Combine the pre-cooking-freezing-reheating protocol with an increased use of lower-fat meats and long holding times (recall that Seinfeld episode in which that

lone movie-theater hot dog spun into eternity on its carousel under the heating lamps?), and you've got a recipe for an unpalatable product.

Secrets for moister meats

Processors have had some success using humectant, moisture-boosting adjuncts such as soy protein, modified food starches, carrageenan and other gums to hold on to the succulence that is sometimes lost or escaped after meat products spend as long as a few hours in holding ovens. But these additives don't always hold the moisture effectively, and don't do much to help flavor either.

Enter dried plum puree. This versatile ingredient shot into the spotlight almost a decade ago when bakers used it as a stand-in for fat, and noticed that products retained a moist texture reminiscent of that of their full-fat cousins. Dried plum puree's healthful, natural image and its ability to reduce the number of ingredients in a formula gave it a

solid spot among baked-goods processors' cast of fat-sparing ingredients.

The same fiber and sorbitol in plum puree that hold in baked goods' moisture achieve similar results in meats. The fiber (around 7.5% by weight) absorbs moisture much as a sponge would, while sorbitol (about 15%) holds it in the meat. In this respect, the ingredient moves beyond functioning as a fat replacer and toward working as a moisture binder in meat.

Doing flavor a favor, naturally

Dried plum puree also contains malic acid, a naturally occurring organic acid that potentiates flavor. Fat carries much of a food's flavor, making lower-fat products less flavorful. However, malic acid coats the mouth much as fat does, rounding out the flavor and letting it linger on the palate. This effectively draws out the bell-shaped curve that flavor takes in the mouth over time, and explains why a little malic acid appears as an additive in many fat-reduced products.

Custom compositions

Other than fiber, sorbitol, malic acid and, of course, dried plums, just what does dried plum puree contain? According to Jim Degen, consultant to the California Prune Board (CPB), Pleasanton, CA, it generally consists of dried plums blended with dried plum juice concentrate. It can be tailored as required for a specific application or production method with blends of dried plums, apples and pears or other fruits. Puree manufac-

moisture of 30%, but increasing the moisture with additional water, juice and/or juice concentrates leads to a pourable consistency with a moisture content that can go up to about 60%. Adding apple and pear can lighten the ingredient color and bring down the flavor level. And for those looking to incorporate a dry powder, some manufacturers offer puree powders combining plums and other fruits for a low-moisture (3.5%) ingredient with a light tan color.

USDA has earmarked for the school lunch program to date.

Dallas-based Quik-To-Fix Foods was among the first to test the waters. David Magill, a consultant to the CPB, worked with the company to formulate hamburgers made with USDA commodity bonus dried plum puree. "Commodity bonus" products are often excess-supply items that the USDA removes from the marketplace and distributes free-of-charge to the school and other foodservice markets. The experimenters presented students with precooked, frozen hamburger patties made from 80:20 lean:fat ground beef with 3% dried plum puree and isolated soy protein. The students first evaluated the burgers without condiments, and then with whichever condiments they preferred.

Since students base their expectations for burger taste and texture on fast-food all-beef burgers, they often turn up their noses at the beef/soy patties served in school lunches. But in two evaluations of test burgers, the students consistently rated them as equal to or better than those of the major chains. Over 50% of respondents also rated them as better than their normal school fare, and said they'd like to eat them again, even on a regular basis. In addition, analytical tests showed that the beef/plum/soy hamburgers initially had 17.8% more moisture than all-beef burgers and lost 15.8% less moisture after being reheated to a temperature of 102°C and held for up to four hours.

Decreased cost, increased appeal

Tests show that for optimum moisture-binding, puree usage level in hamburgers, as well as other meat applications, lies at around 3% to 5%. As an added advantage, patties

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turers can also add starches, spices and seasonings if required for a particular application; this can cut labor and warehousing required for separate ingredients, as well as improve consistency and dispersability in the finished product. "The basic product we have, which we call Plum Juicy™, is a blend of dried plums and dried plum concentrate," notes Degen. "But this can be customized to include other ingredients to alter color and flavor notes." These multi-fruit combinations open the door to using dried plum purees in applications where a dark color would be a drawback — chicken patties, for example.

The actual composition determines the ingredient's color, moisture, viscosity and texture. The standard Plum Juicy product is a thick, smooth, dark-brown puree with a

Clean-label appeal

Dried plum puree can bump a number of less attractive ingredients from a cluttered label. Currently, many of the water-binding and flavor-enhancing ingredients used in meat products turn an ingredient citation into something long and intimidating. Using dried plum puree cleans up such a list and makes it appealing to consumers.

"Meating" foodservice challenges

How do dried plum puree ingredients perform in the "real" world? Since the school foodservice market is about as real as you can get, a number of commodity ground-beef processors have begun marketing puree-containing school-lunch hamburgers using some of the nearly 2,000 tons of plum puree that the

containing this level of puree aren't any stickier or less workable than all-beef ones. To boot, the resulting meat and juice colors aren't significantly different than those found in the all-beef burgers.

Burgers containing these puree levels have a post-cooking cost-per-pound below that of all-beef burgers, due in part to puree's ability to hold moisture, forestall drip loss and increase cooked-product yields. This means that even without using bonus-commodity puree, the cost impact would still work out to only a fraction of a cent per pound.

Beyond burgers

The use of prune puree is not just limited to foodservice hamburgers. "Even at trade shows, we've tested to great positive response on everything from the burgers to the pizza toppings, to the hot dogs, to the meatballs," says Magill. Like hamburgers, pizza consistently ranks among children's favorites. Considering the frequency with which students eat pizza at school (with most consuming it weekly) and their high expectations for its taste and texture, the positive reviews they gave pizzas that used precooked and frozen beef/pork sausage containing 5% dried plum puree, as well as a sauce containing 10% dried plum puree, are encouraging. More than 90% of the students involved said that they'd like to eat the test pizzas again.

"The bottom line for manufacturers to realize, at least when we're talking about dried plum puree as a USDA bonus commodity, is that it lowers manufacturer cost because the product is replacing other ingredients," Magill notes. And you can't ignore the nutritional bonuses, especially for schools.



The USDA requires that healthful school meals have a relatively high caloric content, while keeping fat down. Dried plum puree has the advantage of being extremely low in fat and high in carbohydrate-based calories. According to Magill, versus an all-meat hamburger, "by adding the USDA commodity bonus puree, we can lower the fat content by up to 40% while keeping the calories up."

Moving beyond school foodservice, a test in the Chicago and San Francisco areas had consumers evaluate hotdogs containing 5% dried plum puree. In addition to rating them the same as or better than conventional hotdogs in 79% of the cases, they noted that the superior taste and juiciness made them desirable choices. Lab tests comparing 5% dried plum puree hotdogs with all-beef controls showed that the plum version had 8.4% more moisture

after being held at 102°C for four hours than did the controls.

A mix of applications

Ever Changing Times, a Florida-based product development firm that worked with the CPB in developing dozens of products using dried plum puree, and Adam Mickenberg, a chef with the company, have had success with a number of applications. Their first products used dried plum puree at about 25% to 35% as a tomato replacer or adjunct in tomato-based sauces. These sauces led to the use of puree in pizza toppings, beef-and-pork sausages, turkey sausages and pepperoni. Mickenberg has also seen dried plums increase the moisture-holding capacity of patty-style and link sausages, turkey burgers, turkey meatballs, turkey breakfast sausages, meatloaf and other products, and says that we've only scratched the application surface.



Customizing plum-puree ingredients allows their use in a wide range of products. Mickenberg favors using standard plum puree in coarsely ground items such as hamburgers and pizza toppings since their larger particle size and darker color blend well with these products. The slight color imparted by typical usage levels can give a regular hotdog the look of an old-world frank. And light-colored, finely emulsified applications, such as cooked bratwurst, provide additional opportunities for puree blends and dried plum puree powder, with its lighter color and finer particle size.

Since plums mixed with meat is not a typical culinary pairing, some product developers might worry about imparting a lingering fruit taste. But there's nothing to fear. The standard 3% to 5% levels used to improve texture and moisture aren't high

enough to give meat a fruit flavor, least of all in a robustly seasoned sausage paired with a hearty tomato sauce, or a burger topped with all the fixings. For any application with more stringent requirements, adding mild pear and apple concentrates can bring down the ingredients' flavor level even further.

Easy does it

The 3% to 5% recommended usage levels for plum puree don't make meat products any more difficult to work with or handle. When incorporating it into a hamburger patty or a meatloaf, for example, "as long as you don't over-mix it — over-mixing is going to make anything more sticky — and as long as you're able to get it distributed evenly, the workability will still be fine," says Mickenberg. For those who opt for the powdered version, no pre-hydration is required prior to mixing.

At low use levels, significant darkening also doesn't present an issue. For beef or pork products, especially meatballs that go into red sauces, the color consideration is moot. But what about pale-colored applications? "We did some light-colored turkey products with the plum puree at 3% and it actually gave us a more desirable result since it took some of the pinkish color out of the poultry," says Mickenberg.

For puree-containing precooked meats, the initial cooking method influences the final result. Using the right method ensures that the product retains a crispy, charred flavor typical of grilled burgers and avoids excessive fruit-sugar caramelization. This may occur if the meat-product manufacturer uses direct-heat cooking methods such as grilling and griddle-cooking. Instead of promoting desirable Maillard reactions between sugars and proteins in meat, using direct heat could result in an entirely different, sweeter browned flavor.

In practice, this problem is easy to avoid. Mickenberg says that casings on sausages and other processed meats serve as a barrier that prevents caramelization even during direct-heat cooking methods. But burgers, pizza toppings, meatballs and other applications that are fully exposed are not candidates for these methods. Instead, processing via flash-grilling and then finishing in a hot-air or infrared oven — or processing in an oven for meatloaf, or simmering in a sauce for meatballs or taco meat — will thoroughly cook the item without direct surface heat. Mickenberg has even had success deep-frying some puree-containing meats, such as breaded turkey patties.

On-site foodservice preparation of precooked meats containing dried plum puree is relatively foolproof, a necessary requirement given the preponderance of unskilled labor in this segment. It just requires reheating on a sheet pan in an oven or microwaving. Still, during product testing, some school districts, unsure how to prepare them, thermally "abused" frozen patties on flat grills and even steamed the burgers, says Magill. "You wouldn't ever know the difference. These can be rethermalized in almost any way possible," he says. The fully cooked burgers only need a couple minutes of heating, which doesn't promote an undesirable level of caramelization, even during flat-grilling.

Muscling in on whole-muscles

In conjunction with Texas A&M University, College Station, the CPB has begun research on introducing purees into whole muscle meats, both raw and precooked, to see if these too would benefit from sorbitol and fiber's ability to retain moisture. If successful, it could end a phenomenon that plagues many manufacturers of vacuum-packed whole-muscle meats — purge. "When you vacuum pack meat products, especially whole-muscle products, there is the tendency to draw the moisture out of the meat. So, if you look in the meat case at a supermarket, you'll see the effects of purge — liquid accumulating in the vacuum packaging as it's coming out of the meat," says Degen. To compensate for lost moisture, processors inject liquids ranging from water and broths to brines of salts, sugars, soy proteins and hydrocolloids. If research shows that dried plum puree also maintains moisture

in raw, whole-muscle meats, it could cause a revolution in whole-muscle meats.

Currently, standard plum puree might not easily flow through existing injection systems. However, looking at formulation and processing changes for the puree might make the process commercially viable. Steven Young, Ph.D., product development consultant, participant in CPB projects and principal at Steven Young Worldwide, Sugar Land, TX, notes that

operators face severe labor problems that have resulted in hundreds of thousands of unfilled jobs. Even worse, foodservice operators are often forced to hire kitchen help with little education or skill in food preparation. This has given rise to food safety issues and a spate of incidences of foodborne illness."

Enter precooked meats. Precooking directly addresses the foodservice problems of labor availability and skill, as well as food safety, regardless of the

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by simply increasing the proportion of dried plum juice and concentrate to that of puree, the product becomes more amenable to injection. All parties involved foresee dried plum puree opening the door to less purge, higher yields, lower costs, and a moister-textured whole-muscle product.

Precooked trends and solutions

Consumer food expenditures have forever shifted to eating away from home, notes Degen. "In spite of paying higher prices for the same foods that could be prepared at home, the convenience and the consumer's lack of ability or even willingness to do the cooking are worth the added expense," he says. "But this growing demand for food away from home comes at a time when foodservice

many away-from-home eating venues. But precooking, freezing and reheating meats can stress important sensory characteristics such as moisture, flavor and texture. Designing meat products that live up to consumer as well as processor expectations can be a challenge, but formulating with plum puree has the potential to address many of these challenges with an all-natural, cost-effective ingredient. As Magill says, "I think that the future with this product is as bright as we can make it." ■

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