CALIFORNIA DRIED PLUM BOARD

Industrial Ingredients

Technical Bulletin

February 2011

Dried Plums--Natural Replacement For Phosphates In Meat Products

Abstract

Recent research sponsored by the California Dried Plum Board conducted at the University of Arkansas-Fayetteville Food Science Department demonstrated that the addition of dried plum mixtures can be a good substitute for the phosphates currently being used in poultry processing. These conclusions come at a time when meat and poultry processors are seeking to raise the value of underutilized animal protein cuts as well as to add value to processed meats to increase profitability. At the same time consumers and foodservice operators are demanding more use of natural food ingredients and shorter, cleaner food labels along with increased flavor and other meat and poultry sensory characteristics.

The Use of Phosphates in Animal Proteins

Processors add phosphates to meat, poultry and fish for many reasons, but especially to achieve moisture retention —along with a higher yield—and flavor protection in processed meats. Phosphates can reduce oxidation, help retain marinade and cook juices, preserve color, and lend freeze/thaw stability.

Grinding or chopping meat can form a “meat emulsion” that needs to hold up during cooking and processing, such as smoking. Adding phosphates enhances stability in finely chopped meat systems, such as bologna or hot dogs, by influencing the pH, ionic strength, protein extraction, binding and viscosity.

Meat emulsions extract and solubilize the proteins into a solution; this is enhanced by high ionic strength and pH. Additional chopping or mixing disperses the proteins around muscle cells and fat particles so that, when cooked, the protein coagulates to form a gel that stabilizes the matrix. Phosphates help extract proteins from meat, whether chopped or whole muscle.[1]

Preparation of products such as wings involves vacuum tumbling. Alone, tumbling is useful when it is desirable to coat the pieces, such as Buffalo wings, with a viscous, flavored marinade. The injection technique is useful when the solution needs to penetrate throughout the meat, such as in the preparation of poultry-based delicatessen rolls. Tumbling after injection is indicated when the goal is to promote uniform penetration through the poultry meat and to avoid development of “pickle pockets.”

Uncooked, frozen poultry products also benefit from the presence of phosphates that have a cryoprotective effect on the protein and lipids, and thus assist the protein in binding water and minimizing the moisture loss during thawing, and also protect against the development of rancid flavors.

In the production of comminuted poultry, such as chicken nuggets and turkey franks, dry phosphate, sodium chloride and ice are added to the ground meat and physically mixed for dispersion. The hydrated protein forms a matrix that entraps the fat. The presence of phosphate stabilizes the emulsion during the cooking process and results in decreased cook-cool loss.

Labeling And Sensory Impact of Phosphates

Long-distance distribution networks and convenience-craving consumers have meat processors exploring methods to extend the shelf life of all types of proteins—from marinated, raw, prepackaged chicken breasts to fully cooked slabs of ribs to simple ground beef. Factor in that an increasing number of consumers seek out labels with terms such as “natural" and “minimally processed," and take a pass on “chemical-sounding" names in the ingredient list, and this dramatically reduces the available options for ensuring product longevity.

Artificial preservatives such as BHA, BHT and TBHQ have long been the standard to ensure an economically sensible shelf life for fully cooked and packaged meat products. But today’s consumers want products that have clean labels with ingredients they can recognize.

Consumer demand for quick and tasty value-added meat products often goes head-to-head with a desire to eliminate perceived harmful food additives. A segment of the population is wary of added phosphates, alginates, erythorbates or salts. Yet, these consumers also want the convenience of prepared meat products.

In addition to “label shock” the use of some phosphates and other moister binding ingredients can alter the flavor of the meat product. For example in some full-fat products, alkaline phosphates result in a "soapy" flavor when used at too high a level. A more neutral phosphate blend might reduce the soapy flavor. Acid phosphates have much the same function as alkaline phosphates, but yield will be sacrificed.

Dried Plums

The d’Agen plum variety is considered to be a Superfruit. Many fruits labeled Superfruits owe their reputation to their antioxidant content and composition. Dried Plums are no exception posting an ORAC value of 8557 per 100 grams. Fresh plum juice concentrate is even higher with an ORAC value of 12220. Dried Plums’ antioxidants are mostly chlorogenic and neochlorogenic acids.

Dried Plums also contain naturally occurring sorbitol (15%, 25% in Dried Plum powder) that serves as an effective humectant to bind and hold moisture. There is also 7.5% fiber that contributes to moisture binding and holding. And, there is 1.5-2.0% malic acid, a natural flavor potentiator that rounds out flavors making them even more savory and appealing.
These dried plum nutritional components are possible due to the uniqueness of the d’Agen plum variety that is one of only a few that are allowed to naturally ripen on the tree without fermenting.

Fresh plum juice concentrate is the ideal dried plum ingredient for replacing phosphates in poultry as well as other animal proteins. As a liquid plum juice concentrate easily incorporates into marinade solutions that can be injected, needled, and vacuum tumbled. The following is a guide when considering fresh plum juice concentrate to replace phosphates in various animal proteins.

Protein	Plum Concentrate As % of Meat Block	Plum Concentrate As % of Marinade	Vacuum Pressure	Tumble Time
Beef	8% - 22%	1.5% - 3.0%	23 lbs	22 minutes
Lamb	6% - 28%	1.5% - 3.0%	20 lbs	18 minutes
Pork	10% - 28%	1.5% - 2.5%	18 lbs	23 minutes
Chicken	10% - 30%	1.5% - 2.5%	15 lbs	18 minutes
Turkey	5% - 20%	1.5% - 2.5%	18 lbs	23 minutes

University Of Arkansas Research Abstract

California Dried Plum Board sponsored research conducted at the University of Arkansas-Fayetteville Food Science Department, demonstrated that the addition of dried plum mixtures can be a good substitute for the phosphates currently being used in poultry processing.

Boneless/skinless chicken breasts were obtained from the University of Arkansas poultry processing facility. Breast fillets were marinated in a 15% marinade solution in a vacuum tumbler (20inHg) at 20rpm for 30 min. After tumbling, fillets were allowed to marinate for 12 hours at 4°C. Breast fillets were then removed from excess marinade, weighed, vacuum-packed, frozen and stored at -20°C until further analysis.

Treatment Code	Ingredient	Amount
A	**dried plum fiber** NaCl deionized water	4.5 grams 10 grams 1 liter
B	**dried plum powder** NaCl deionized water	4.5 grams 10 grams 1 liter
C	**plum concentrate** NaCl deionized water	0.40 liters 10 grams 0.86 liters
D	**dried plum fiber** **dried plum powder** NaCl deionized water	2.25 grams 2.25 grams 10 grams 1 liter
E	**sodium tripolyphosphate** NaCl deionized water	4.5 grams 10 grams 1 liter
F	no marinade used	

All plum products (dried plum fiber, dried plum powder, plum juice concentrate, or a 1:1 mix plum fiber and plum powder) produced a more-tender chicken breast fillet than did the traditional phosphate mixture.

Consumers found no difference in the treatments when compared to the phosphate control. While the consumers found the juiciness attribute less favorable for plum fiber or plum powder on the likeness scale (like extremely to dislike extremely), the plum fiber and plum powder "just about right" values were closer to 2 (just about right).

Water holding capacity analysis showed that plum fiber marinade retained moisture as well as the phosphate control and had a lower amount of thaw loss but a slightly higher amount of cook loss. Color was comparable to the phosphate control. Plum powder had slightly lower marinade retention and thaw loss and slightly more cook loss compared to the phosphate control.

Conclusion

Dried plums do not impart a flavor to animal proteins but rather, enhance and round out other food flavors in a recipe or formulation. This makes dried plums the perfect ingredient for complete flavor systems whether sweet or savory and is particularly important when developing ethnic flavor systems with complex formulas and ingredients. All of these dried plum natural components contribute to extending the shelf life, safety and value of beef, pork, poultry, lamb and many other animal proteins.

Important for meat processors is the natural water-binding abilities of dried plum ingredients that when used in a vacuum tumbling process can add 12% or more weight, much of which is retained throughout the final cooking process. The ability to control purge is improved. And dried plums' natural antioxidants help to extend shelf life in fresh and frozen meat formats.

Also important is the ability of dried and fresh plum ingredients to replace or reduce many unwanted ingredients such as phosphates, salt, gums, starches, flavor enhancers, synthetic antioxidants and other ingredients to shorten and improve label content and perception.