Retorted Meat and Vegetable Protein Combinations

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ABSTRACT

Soy proteins are the most versatile, widely used and accepted of the vegetable proteins. Flours and grits are not often used in retorted products because of their flavor. Textured flours are limited in their applications because of the intensification of their beany flavor and their loss of structure on retorting. Concentrates have an improved flavor profile, but relatively low functional properties, and are used as protein supplements and water and fat absorbers in some retorted products. Structured concentrates have a bland flavor profile and retain their good flavor and texture on sterilization and are well suited to a variety of retorted products. When high levels of extension with structured concentrates are used, adjustments may be necessary to increase the binding properties of the mass. The binding, gelling and emulsifying properties of soy protein isolates are particularly useful in retorted products since these properties are maintained at sterilizing temperatures. Novel methods of augmenting or dilating meat products using isolate-salt-polyphosphate brines are outlined, including the preparation of restructured meats. The use of textured proteins and isolates in the preparation of reformed or restructured meats is also described.

INTRODUCTION

This paper is confined to soy proteins, since they are produced in the largest variety of forms and are the most widely used and accepted of the vegetable proteins. I will only outline the established uses of soy proteins in retorted products, and elaborate on the more novel applications. Uses of soy proteins in the meat industry can be classified broadly as functional and extension, although in practice both these properties of an ingredient are important and have to be allowed for in a well balanced formulation.

SOY PROTEINS AND THEIR USES IN RETORTED PRODUCTS

Defatted Flours and Grits (50% Protein)

These are rarely used in retorted products because of the beany flavors produced on heating under sterilizing conditions.

Textured Soy Flours

Textured flours (TSF, TSP, etc.) are widely used as meat extenders. Their structure and texture can be modified by varying extrusion parameters and by the addition of salts to the mix before extrusion. Textured flours absorb water, and to some extent fat, so they can be regarded as having a physical function in addition to their main role as extenders. They are also used in retorted products to absorb juices liberated during canning, resulting in a less sloppy or firmer final product. Examples of this type of application are canned minced meat, pie fillings, and especially pet foods.

The main disadvantages in using TSF in retorted products are loss of integrity and texture and intensification of undesirable flavors. Both are aggravated by high temperatures and enclosed conditions encountered in retorted products, although some improvement in retaining structural integrity is shown by the retort stable types of TSF.

Concentrates (70% Protein)

Soy protein concentrates are usually made by extracting water soluble oligosaccharides from defatted flakes using either alcohol or aqueous alcohol, or water at the isoelectric pH of the protein. The first method produces a concentrate with low protein solubility and very bland flavor, while the second method produces a concentrate with a high protein solubility and a less bland flavor. Concentrates are used to absorb and bind water and fat, and to emulsify fat particularly when the amount of free water in the system is low. Concentrates are used in retorted products such as canned frankfurters, luncheon meats, burgers, meat balls, patés etc.

Structured Concentrates (70% Protein)

Structured concentrates are extruded products but can be made to have a fibrous or laminar rather than a sponge structure. Being concentrates, they do not contain the flatus-producing soluble oligosaccharides present in flours. Most of the color and flavor precursors are also removed during processing, resulting in a very bland product.

The difference in flavor between textured flours and structured concentrates is particularly evident after retorting. In general, structured concentrates have a higher water absorption than textured flours, and their structure and texture stands up to retorting much better.

Structured concentrates are usually more compact than textured flours and take longer to hydrate. However, the times and temperatures employed in canning are ample to fully hydrate these products. Thus, structured concentrates are ideally suited for retorted products because their bland flavor and good structure, maintained after high temperature processing, allow their use in appreciable amounts without impairing the organoleptic properties of the final product. Structured concentrates can be used in any retorted product, including goulashes, stews, minced meats, chopped hams, corned beef type products, meat loaves, meat balls, etc. Since they can be used at fairly high levels, their use may necessitate rebalancing the formulation by increasing the fat content in the meat component to maintain succulence and flavor of the final product, and also by increasing the amount of binder present, e.g., meat or fat emulsion or isolate dispersion.

Isolates (90% Protein)

The traditional uses of soy protein isolates in meat products utilize their properties of binding, emulsifying and gelation. Isolates are used as emulsions, dispersions, or additions in dry form to comminuted or emulsified meat

TABLE I

Uses of Soy Proteins in Retorted Products

Retorted products	Primarily extension			Primarily functional		
	Grits and flours	TSF	Concentrate	Structured concentrate	Isolate (binding)	Isolate (dilation)
Burgers	X	X	X	X	X	X
Frankfurters, etc.			X	X	X	X
Hams, shoulders, etc.						X
Luncheon			X	X	X	X
Meat balls	X	X	X	X	X	X
Meat loaves		X	X	X	X	X
Minced meats		X	X	X		X
Patés			X		X	
Pet foods	X	X	X	X	X	
Poultry rolls				X		X
Reformed meats		X		X	X	X
Stews, goulashes, ragouts		X		X		X

products. Soy protein isolates are particularly useful in retorted products, e.g., meat balls, frankfurters, luncheon meats, meat loaves, etc., because their capacity to emulsify fat is maintained at temperatures at which other emulsifiers break down.

More recent applications, originally developed for hams, have been extended for use in almost any meat application. This technique has resulted in the development of a new raw material, meat in which extra water is firmly bound by the use of soy protein isolates, polyphosphates and salt. This meat, called "augumented" or "dilated," can be used as is (hams, roast beef, poultry rolls, roast pork), in a coarsely comminuted state (corned beef, chopped ham, luncheon meat), or as individual pieces (stews, ragouts, goulash), or as a component or reformed or restructured meats.

If properly prepared, this raw material containing up to 35% added water has processing losses no greater and often lower than that of the original meat. For larger pieces of meat (whole hams, etc.), the processing can be fairly complex involving the standard operations used in the manufacture of hams, i.e., multineedle injection using an isolate-salt-polyphosphate brine, followed by massaging. However, for smaller pieces of meat (around 100 g or less) or for comminuted meats, the preparation consists simply of mixing the meat pieces with the isolate-salt-polyphosphate brine in a tumbler or a standard meat mixer for between 10 and 60 min (until the brine is absorbed). The resultant meat behaves very much like regular meat, except that the mixing and absorption process tenderizes the meat, so that tougher grades of meat than normal can be used to provide an acceptable final product.

REFORMED OR RESTRUCTURED MEATS

Reformed meats utilize secondary cuts of meat which are restructured to a more acceptable form free from pieces of fat and connective tissue. They usually consist of a fibrous phase bound together by a matrix. The fibrous phase can be either meat or textured protein, and the matrix can be a meat emulsion, or a meat-fat emulsion. Soy proteins (textured) can be used to form the fibrous phase and isolates to augment or dilate the course meat component, and also in the matrix phase either as a dispersion or as a fat emulsion acting as a heat stable binder. Reformed meats are usually heat set, diced and then used in various cooked meat applications including goulashes, stews, pie fillings, etc.

A novel approach to reformed meats is to mix ground meats with an isolate-salt-polyphosphate brine, freeze the resultant mass, and then dice the product before canning. No heat setting is necessary. The product retains its integrity on canning, and has a good chew and mouthfeel. Since the binder is diffused uniformly throughout the meat, there are no visible discontinuities between fibrous and matrix phases as in some reformed meats. The bound water also gives the product succulence rather than the hard, dry, fibrous structure of some other reformed meats.

This type of product has been used mainly in products of the stew and goulash type, but no doubt other applications will be found as the potential benefits of the techniques become better known.

I have used the term "isolates" as a class, but it should be stressed that there are many different types of isolates on the market, many of them designed to perform in a specific type of application, so that care must be taken when testing these products to ensure that the correct product is used in the correct way.

Table I summarizes the various ways in which soy proteins are used in retorted products.