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PROCESS FOR MAKING SOY PROTEIN MORE HEAT COAGULABLE IN COMBINATION WITH EGG WHITE AND COMPOSITIONS CONTAINING SAME

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ABSTRACT OF THE DISCLOSURE

Aqueous dispersions of soy protein material are modified by raising the pH to over about 9.0 and then reducing the pH to about 5.5 to 8.0. The modified products are used to replace a portion of the egg white in foods whose structures depend at least in part on the heat coagulation properties of egg white.

The present invention relates to a process of treating soy protein to render the same more heat coagulable when used in combination with egg white. It also relates to compositions comprising the modified soy protein and egg white and to the preparation of food products utilizing such compositions.

Egg white is a valuable constituent of many foods due primarily to its nutritional qualities and to the fact that it can be whipped or aerated to produce foams and/or heat coagulated to yield relatively rigid matrixes which serve as the supporting structures for a variety of foods. In some cases, such as in the production of angel food cakes using conventional or traditional mixing procedures, the egg white is used for both of these properties—aeration and heat coagulation. In other cases, the egg white is used mainly or solely for only one of its functions. In this respect, it is used in the production of layer cakes, meat loaves, vegetable protein meat analogs, and the like primarily for its heat coagulable properties wherein it serves to bind the other constituents of such foods into a matrix which is capable of holding its shape under normal conditions.

While egg white is commonly used for the purposes set forth and others and is normally readily available to housewives and food manufacturers, it is subject to seasonal variations in cost and availability and is often the most, or one of the most, expensive ingredients of the food being prepared. Thus it would be highly desirable to find a replacement in whole or part for egg white.

Soy protein is also a readily available commodity and extensive research has been carried out in an effort to make use of same in foods because of the high nutritional value thereof. Much of this research has been directed at the production of isolates or other concentrates which are bland. In this respect soy protein is often characterized by a flavor and/or odor which a certain portion of the populace finds objectionable. It has also been proposed to modify soy protein to improve its functional properties when used in various foods. One example of this is the use of acid or acid with enzyme hydrolysis to reduce the molecular weight of the soy proteins. The resulting products are current articles of commerce and find use as aerating agents for confections and related foods as described on page 978 of Markley's book "Soybeans and Soybean Products," vol. II, 1951, Academic Press, Inc. This modification renders the soy proteins non-heat coagulable or does not improve the gel forming ability of the same. Thus such modified soy protein products or soy albumins find utility in food applications as egg white substitutes where aeration, but not heat coagulation, is the key property needed.

In recent years, a considerable research effort has been directed at the production of products which resemble natural meats. One of the main avenues for producing these meat analogs is to first prepare fibers from edible proteins and then add suitable flavoring agents, colorants, binders and the like to the fibers and heat set the resulting products. To date, and to the best of our knowledge, the only really suitable binder has been egg white. As such, it performs a variety of functions when heat coagulated. Thus it tends to bind the multiplicity of fibers together perhaps through some type of coaction with the fibers, aids in binding water in the product, and contributes elasticity to the meat analog. It is bland and also works well in the impregnating fluid or serum containing the other ingredients added to the fibers. It is not perfect, however, since the quality varies from batch to batch, often gives the analog a mottled appearance, sometimes causes toughness and is also subject to bacteriological deterioration.

It is an object of our invention to provide a process of treating soy protein to render the same more heat coagulable when used in combination with egg white. A further object of the invention is to provide heat coagulable compositions comprising egg white and the modified soy protein product. Another object of the invention is to provide a process of preparing foods wherein the egg white content is reduced by the use of the modified soy protein product. Still another object of the invention is to provide foods wherein a composition comprising egg white and the modified soy protein product is utilized. These and other objects will become apparent from the following detailed description.

We have now discovered that soy protein can be rendered more heat coagulable when used in combination with egg white by raising the pH of an aqueous dispersion thereof to above about 9.0 with an alkaline material and then reducing the pH to between 5.5 and 8.0. The resulting modified soy protein product finds use as a replacement for up to about ¾ of the egg white needed to provide the structures or matrixes of a variety of foods wherein the egg white functions primarily through its property of being heat coagulable.

The starting material can be a soy isolate or concentrate containing at least about 70% by weight protein. Such materials can be obtained by removing at least a part of the non-protein constituents of defatted soy flour, meal or flakes by various means. Isolates normally contain over 90% by weight protein and are preferred materials in our process. Such isolates can preferably be obtained by alkaline extraction and acid precipitation using conventional techniques. For example, they can be prepared by the extraction of defatted soybean flakes or similar sources material with dilute aqueous solutions of sodium hydroxide with subsequent precipitation of the extracted protein with an acid at the isoelectric region (pH 4.1 to 4.6). Representative acids are hydrochloric acid, sulfuric acid and sulfurous acids. It is to be noted that the improvement achieved by the use of our process varies somewhat depending on the precise method used in preparing the starting soy isolate or concentrate and especially as to the acid used in the precipitation step. Thus, for example, sulfurous acid precipitated soy protein can be treated in accordance with our invention with less alkali than is required to treat hydrochloric acid precipitated soy protein to obtain optimum heat coagulation properties or gel strengths.

Any of a variety of water soluble alkaline materials can be used to raise the pH of the soy protein material to the indicated degree. Preferred materials are the inorganic bases and salts such as trisodium phosphate