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3,694,221

ENZYME MODIFIED PROTEIN PROCESS

Ralph A. Hoer, Ballwin, Christopher W. Frederiksen, St. Louis, and Robert L. Hawley, Webster Groves, Mo., assignors to Ralston Purina Company, St. Louis, Mo. No Drawing. Continuation-in-part of application Ser. No. 625,980, Mar. 27, 1967. This application Jan. 30, 1970, Ser. No. 7,224

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44 Claims

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ABSTRACT OF THE DISCLOSURE

A method of preparing a vegetable protein product having excellent wettability in aqueous solutions and improved drop in and stir in characteristics is disclosed. The product exhibits a greatly improved texture, mouthfeel, and wettability over known materials and can be incorporated in a wide variety of food materials to form superior protein fortified foods. The process involves subjecting aqueous protein material to a rapid heating and physical working step, such as by steam injection, reacting the protein in the presence of a proteolytic enzyme for a short time to hydrolyze and modify the protein, and heating the protein to inactivate the enzyme and stop the reaction. The aqueous protein can be dried and a dry, powdered protein product is recovered which is highly dispersible in water, has high drop in and stir in characteristics, and which has excellent smooth texture and mouthfeel.

This application is a continuation-in-part of application Ser. No. 625,980 filed Mar. 27, 1967, now U.S. Pat. 3,642,490.

This invention relates to food, to the preparation of vegetable protein food products of controlled, high dispersibility and, more particularly, to a method of preparing a vegetable protein food and a soy protein food of high dispersibility, and food products made therefrom. The food products prepared by the process of this invention have improved drop in and stir in characteristics and exhibit an improved smooth texture and mouthfeel over previously known materials.

This invention was conceived and developed largely for soy materials because of the special problems encountered with such materials. Therefore, it will be explained largely with respect to soy materials and has special application to such materials, although it can be used for other protein materials in the broader aspects of the invention, for example, other oilseed materials, fish protein materials, or microbial protein products may be used.

The preparation of vegetable protein products by a variety of processes is known, including obtaining protein products from soy protein. Enzymatic processes for obtaining food materials from vegetable protein materials are also well-known; a typical process is disclosed in U.S. Pat. 2,232,052 granted to E. H. Cummins. The usual process employed in enzymatic processes requires a lengthy reaction time, typically several hours, and is conducted as a batch type operation. The process of this invention is a continuous type of operation which uses an enzymatic reaction to hydrolyze and modify the protein reactant within a short time, usually in seconds, or, at most, a few minutes, and which produces a product of unexpectedly superior functional properties.

SUMMARY OF THE INVENTION

The major object of this invention is to provide an enzymatic method of processing vegetable protein and particularly soybean protein materials to form a desirable

edible protein product that has the high dispersibility necessary to be functional and has excellent smooth texture and mouthfeel. Another object is to obtain such a product which is also highly functional due to a controlled high dispersibility that enables excellent grade aqueous suspensions to be formed which exhibit excellent texture and mouthfeel. Hence, a resulting milk type product is smooth, not chalky, lumpy or granular. The method proceeds very rapidly and is substantially complete in a matter of minutes or even seconds. The resulting product can be used directly as a food and also will blend smoothly with products containing other flavorings without altering the character of the other flavorings.

Moreover, the novel soy treating process can be operated on an automated continuous flow basis, with a minimum of operating personnel and with a high production output rate.

The basic unique product obtained is one of excellent functionality. It is highly dispersible from a dry state and has exceptional drop in and stir in characteristics. It is treated with a process involving heat and enzymatic hydrolysis which proceeds substantially to completion in a matter of a few minutes. The product uniquely has an optimum combination of properties not obtainable heretofore in having a high dispersibility, e.g., of above about 80%, preferably above about 90% for a product formed from an isolated protein, a drop in rating of at least about 2 and a stir in above about 60%. Hence, it can be used as a food product in various forms, with high protein content. It also can be selectively added to a wide variety of other food products to effect special results, such as protein fortifiers which are added to aqueous solutions by the consumer. When added to cold milk the material of the invention exhibits excellent drop in and stir in characteristics and has extremely high total dispersibility. The mouthfeel of the milk mixture is excellent and it can provide a refreshing and nutritious drink, for example, of the instant breakfast type.

The novel process preferably treats the soy material as an aqueous slurry with controlled, rapid, dynamic heating to an elevated temperature range and with momentary physical working under dynamic conditions and under controlled positive pressure and elevated temperature conditions to expose and alter or modify the complex protein molecules. The so treated slurry may be retained for a brief controlled retention period at elevated temperature and under positive pressure. Then the undesirable substances may be removed by causing subsequent instant pressure release to cause flash off, with vaporizing of some moisture that is laden with the entrained substances, followed by separation of the vaporized materials from the slurry. The treated slurry is then subjected to a short enzymatic hydrolysis to hydrolyze and modify the protein material. The enzymatic treatment proceeds for from a few seconds to a few minutes and then the slurry is heated to inactivate the enzyme and stop the reaction. The slurry is then dried to an attractive light colored redispersible powder. The full nature and significance of the process and product will be understood upon studying the detailed description to follow.

DESCRIPTION OF PREFERRED EMBODIMENTS

As is well known, the interrelated chemical and physical characteristics of natural food substances are so extremely complex that very little is truly known or understood about them. Research into the behavior and nature of these characteristics and the changes caused in them under differing conditions and treatments is dependent almost entirely upon an empirical approach. Further, the acceptance of such materials by humans or animals, and the