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TREATMENT OF PROTEINACEOUS MATERIALS

Julius Brody, Dorchester, Mass.

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This invention relates to the treatment of certain proteinaceous materials, and in particular to a process of liquefying proteinaceous materials to prepare or recover nutritional food supplements or concentrates from them.

The process of this invention may be used to liquefy or solubilize a number of proteinaceous materials, particularly animal tissues of a soft texture. Specifically it has been found effective on the entire protein of fish, including meat, entrails, skin, scales and fins, but not the skeleton and eyeballs, and on the major proportion of the protein found in the entrails of poultry and mammals, with the exception of the stomachs. It is contemplated that the greatest field of utility of this invention lies in the utilization of fish by-products, and it is with specific reference to the solubilization of fish proteins that this invention is described in detail.

Fish by-products present an important source of supplemental food values including vitamins, hormones, minerals and a variety of proteins. Many of these products, such as the entrails from commercial food fish, are generally thrown overboard to conserve valuable storage space on shipboard and also because of their susceptibility to rapid decomposition which would necessitate for their preservation either mechanical refrigeration or the use of chemical preservatives. When food supplements are recovered from such waste materials, the waste materials are generally ground mechanically and further treated to remove their nutritional elements or dried and used in fertilizers. Because stones and pebbles, which are frequently found in many fish stomachs become lodged in the grinding apparatus to damage it or require its shutdown, mechanical grinding has not proved entirely satisfactory.

Other fish by-products are considered of sufficient value to justify their utilization. For instance fish livers are pressed to recover their high vitamin oil. Press water, that is aqueous body fluids pressed from fish generally after cooking, is often concentrated as much as is possible without gel formation also to be utilized as a source of vitamins.

This invention provides a novel process of both liquefying and preserving proteinaceous products, including fish entrails, livers, and scraps which may be practiced inexpensively without mechanical grinding to produce a product rich in supplemental food values. This process may be conveniently practiced aboard ship and the liquefied product produced may be stored for several weeks without refrigeration in parts of the ship not adapted to fish storage. One feature of this invention is that the liquefied product may be concentrated in its solids content, thereby becoming so well preserved that it may be kept unrefrigerated for months. A further aspect of the solubilization process of this invention is that it requires no heat and only a slight amount of mechanical energy in the form of occasional stirring. The concentrated or unconcentrated liquid produced by this invention may be handled with ease, and pebbles and other foreign solids may be strained from it.

This invention also has utility in the processing of press water which, if used at all, is concentrated to a

solids content of generally about fifty percent. At this concentration there is a tendency for the press water to solidify when cooled, forming a gelatinous material which cannot be easily handled. The process of this invention may be utilized to effect liquidization and preservation of gelled press water, or to prevent gellation, resulting in a fluid concentrate having far higher solids content than has heretofore been considered practical.

This invention is based chiefly on the discovery that solubilization of such proteinaceous materials may be effected by adding urea to them. After about four or six days, depending in part on the temperature of the mixture and degree of agitation, the protein is completely liquefied. Moreover, during this solubilization period no discernible biological decomposition, such as fermentation or putrefaction, occurs, provided the urea concentration is satisfactorily high. This solubilization process is carried out without heating, preferably at a temperature below 30° C. At higher temperatures there is some tendency towards gellation, probably the result of a partial polymerization of the urea and protein.

Solubilized fish entrails which result from this process may be strained to remove pebbles, and further processed to recover the vitamins and other food values. It may be used either directly or after concentration to a solids content of from about thirty percent or more by weight as a plant food, by spraying it on the soil and turning it in. As a supplement to poultry feed it is desirable to concentrate it to between fifty to sixty-five percent solids to form a thick liquid which may be added directly to the feed, from two to three percent based on the weight of the feed being sufficient. In its concentrated form the product is physically stable so that stratification does not occur to any appreciable extent. Moreover concentration does not markedly affect the pH of the material; the concentrated product is substantially neutral in its hydrogen ion concentration. It has been found that sixty-seven percent by weight of solids is the practical maximum attainable without the material becoming too viscous to handle easily.

The amount of urea that should be added to effect solubilization and preservation has been found to be in the range of ten to twenty percent by weight. Solubilization may be effected with lower concentrations, but the mixture is not well preserved, and at concentrations in the neighborhood of five percent the urea tends to promote rather than impede the biological decomposition processes. Concentrations above twenty percent are entirely usable, but unnecessary.

Accordingly, to process fish entrails according to this invention, urea in an amount of from about ten to twenty percent of the weight of the entrails is added and mixed with them in any suitable container. The mixture is maintained at the ambient temperature, but not above 30° C., and stirred occasionally to prevent stratification or sedimentation and to accelerate solubilization. A daily stirring of three-fourths of an hour has been found sufficient. After a period of four to six days the entrails are completely solubilized and may be strained and further processed to utilize their food values. During the solubilization process no noticeable biological decomposition takes place. It is suspected that the urea causes solubilization of all biological species present.

Immediately after solubilization it is advantageous to concentrate the solubilized protein, in order to reduce its volume, improve its preservation and to render it more suitable to add to animal feed or to use for agricultural purposes. Concentration may be conveniently done in vacuum evaporators under a vacuum of at least twenty-eight inches of mercury to maintain an evaporation temperature below 45° C. Evaporation at higher temperatures has been found to tend to result in gellation of the