

blend, and maintain the oil blend at a temperature of about 43°–49° C. (110°–120° F.) under constant agitation until the oil blend is combined with other ingredients. The product has been manufactured using fish oil made from tuna and sardine meal, distributed by Mochida International of Shibuya-ku, Tokyo, Japan, but is produced and packaged by the Sambu-gun, Chiba plant of the Kyowa Technos Co., Ltd.

A whey protein-in-water slurry is prepared by the following procedure. About 66.30 kg (146.03 pounds) of water is placed in a vessel and heated to a temperature in the range of about 54°–60° C. (130°–140° F.). It is believed to be critical that the temperature of the water does not exceed 60° C. (40° F.) during this procedure. Add the whey protein concentrate to the water, and maintain the resultant protein-in-water slurry under agitation at a temperature of about 54° C. (130° F.) until this slurry is combined with other ingredients. The resultant slurry is about 15% total solids.

A carbohydrate slurry is prepared by the following procedure. About 141.309 kg (311.253 pounds) of water is placed in a vessel and heated to a temperature in the range of about 68°–74° C. (155°–165° F.). Dissolve the sodium citrate, magnesium phosphate, calcium carbonate, and micronized tri-calcium-phosphate (TCP) in the water. Preferably the micronized TCP has a maximum median particle size of about 2.2 microns as determined using a Cilas 715 granulometer or 1.0 micron as determined using a Sedigraph 500 ET particle size analyzer. To the resultant solution add the Maltfin® 040 (distributed by Grain Processing Company of Muscatine, Iowa, U.S.A.) and agitate the solution until the Maltfin® 040 is dissolved therein. Maltrin® 040 is a maltodextrin, or corn syrup solid. The number 40 refers to the dextrose equivalent of the ingredient (4 to 7) and was selected to minimize the effect of this ingredient on the osmolality of the nutritional product. To the resultant solution add to the sucrose and the soy protein hydrolysate. The resultant slurry should have a pH of about 4.3. Add 2.19 kg (4.814 lbs) of 45% potassium hydroxide to the slurry in an amount sufficient to adjust the pH of the slurry to be in the range of about 6.1–6.3. (If necessary the amount of 45% potassium hydroxide may exceed the amount specified). The slurry is maintained at a temperature in the range of about 54°–60° C. (130°–140° F.) under agitation until the slurry is combined with other ingredients. The resultant slurry is about 43% of total solids prior to the addition of the potassium hydroxide.

Just prior to combining the above described slurries/blends together, a pea protein-in-water slurry is prepared by the following process. About 29.46 kg (64.89 pounds) of water are placed in a vessel and heated to a temperature in the range of about 60°–65° C. (140°–150° F.). The pea protein is added to the water under agitation. The resultant slurry is maintained at a temperature of about 54° C. (130° F.) under agitation until this slurry is combined with other ingredients. The resultant slurry is about 10% total solids.

The oil blend, carbohydrate slurry, and first and second protein-in-water slurries are all combined together. The resultant final blend is then heat processed by the following procedure:

- (a) The final blend is preheated to a temperature in the range of about 68°–74° C. (155°–165° F.).
- (b) The final blend is de-aerated at 13–15 psi.
- (c) The final blend is emulsified at 900–1100 psig.
- (d) The final blend is heated to a temperature in the range of about 98°–106° C. (208°–222° F.) using a plate heater.
- (e) The final blend is then heated to a ultra-high temperature in the range of about 146°–147° C. (294°–297° F.), and is held at this temperature for 5 seconds.

- (f) The final blend is then flash cooled to a temperature in the range of about 98°–106° C. (208°–222° F.), then plate cooled to a temperature in the 71°–79° C. (160°–175° F.).
- (g) The final blend is homogenized at 3900–4100/400–600 psig.
- (h) The final blend is held at a temperature in the range of about 74°–85° C. (165°–185° F.) for 16 seconds.
- (i) The final blend is then cooled to a temperature in the range of about 1°–70° C. (34°–45° F.), and held at this temperature until the product is sealed in containers (preferably within 48 hours).

An ultra trace mineral solution is prepared by the following procedure. About 0.42 kg (0.92 pounds) of water are placed in a vessel and heated to a temperature in the range of about 66°–71° C. (150°–160° F.). The zinc sulfate, copper sulfate and sodium selenate are then added to the water and the solution is agitated until these ingredients dissolve in the water. The resultant solution is about 20% total solids. The resultant solution is then added to the final blend.

A water soluble vitamin solution is then prepared by the following procedure. About 3.32 kg (7.303 pounds) of room temperature water is placed in a vessel. The ascorbic acid, 45% potassium hydroxide (0.23 kg (0.5 lbs)), choline chloride, carnitine, and taurine are added to the water with agitation. To the resultant solution the following vitamins are added: niacinamide, d-calcium pantothenate, folic acid, thiamine HCl, riboflavin, pyridoxine HCl, cyanocobalamin, and biotin. The resultant solution is about 20% total solids. The resultant solution is then added to the final blend. It is understood that in large scale production it would be preferable to have the water soluble vitamins provided in a premix.

A flavor solution is then prepared by the following procedure. About 72.14 kg (158.906 pounds) of room temperature water is placed in a vessel. The vanilla and MAG 110 (Monoammoniated Glycerrhizinate) are dissolved in the water. The resultant solution is about 5.4% of total solids. The flavor solution is then added to the final blend. The resultant final blend is about 29.3% total solids.

The final blend is then placed in suitable containers, such as 8 ounce cans, sealed with a suitable closure, and subjected to terminal sterilization.

It is recommended that if the enteral nutritional product of this second preferred embodiment is manufactured on a large scale that rather than adding the fish oil to the oil blend, the fish oil should be metered into the product blend at a constant rate just prior to emulsification to improve dispersion of the fish oil throughout the final blend.

We claim:

1. A liquid enteral nutritional product comprising: (a) protein system comprising, by weight, (i) at least 50% of a soy protein hydrolysate having a molecular weight partition as determined by size exclusion chromatography wherein 30–60% of the particles have a molecular weight profile in the range of 1,500–5,000 Daltons and the amino acid profile of the soy protein hydrolysate has about 0.4 to about 0.7% by weight free amino acids, and (ii) at least 10% intact protein; and
 - (b) an emulsifier selected from the group consisting of diacetyl tartaric acid esters of mono-diglycerides and sodium stearoyl lactylate; the nutritional product having a pH in the range of 6.4 to 6.6 and being a stable emulsion after being subjected to terminal sterilization.
2. A liquid enteral nutritional product according to claim 1 wherein the intact protein comprises at least one intact protein selected from the group consisting of sodium caseinate, pea protein and whey protein concentrate.