

mixer for approximately 2 minutes at a temperature of 100°F. The mixture was then extruded through a Brabender cooker/extruder Model 250. The extruder was heated to a temperature of 155°F and the extrusion orifice comprised a hollow truncated cone having a circular cross section. The cone was of a continually decreasing diameter and at its widest diameter was five-eighth inches, and at its narrowest diameter was 3/16 inches. Because of the construction of the extruder outlet tube, no back flowing or turbulence was noted and therefore the Reynolds number never exceeded 2000. Because of the construction of the extruder, the mixture was simultaneously subjected to stretching and heat-setting. The amount of linear expansion was not measured precisely but estimated at about 150%.

The resulting product was ground in a standard meat grinder to form a particulate protein material of a size especially suitable for forming meat patties.

A binder was formed in accordance with this invention by mixing together the following ingredients:

20 g. — 7S soybean protein isolate
50 g. — Water (pH 7.0)

The texturized protein particles and the binder were placed in a bowl and mixed together until the particles were coated with the binder. Fifty grams of this mixture were pressed into a mold and shaped into a circular patty having a diameter of 3 3/8 inches and a thickness of three-eighth.

The shaped patty was then placed in a microwave oven and microwaved for 3 minutes (providing a temperature of about 200°F) to heat-set the binder. The resulting product closely resembled a hamburger patty in appearance, handling characteristics and mouthfeel.

EXAMPLE VII

A particulate textured protein material was formed in a manner disclosed in U.S. patent application Ser. No. 248,581, now U.S. Pat. No. 3,840,679 as follows:

The following mixture was prepared by mixing for 5 minutes at 60 rpm in a Hobart A-200 mixer equipped with a dough hook:

Ingredient	Amount (% by Weight)
Soy protein isolate	41.0
Egg white solids	27.0
Liquid shortening	1.0
Coloring	0.5
Beef flavor	2.0
Water	28.5
TOTAL	100.0

This mixture was passed through a noodle extruder to provide intense mixing of the ingredients. The strands emerging from the die were homogeneous and had a circular cross section of approximately 5/16 inch diameter. The strands were cut into approximately 1/8-inch long pellets by means of a rotating knife cutting at the surface of the die.

The pellets were fed into a three-roll mill through a hopper positioned between rolls No. 1 and No. 2. The roll speed was adjusted so that roll No. 2 rotated about 4% faster (approximately 3 rpm) than roll No. 1, and roll No. 3 rotated about 4% faster than roll No. 2. Roll temperatures were 75°F. Sheeting of the protein pellets to form a coherent workable protein dough sheet resulted; the sheet was transferred in sequence to roll No. 2 and roll No. 3. The distances between the rolls were

adjusted to produce a sheet of 0.006 inch thickness. The sheet was removed from roll No. 3 by means of a doctor blade which is angularly disposed with respect to roll No. 3. The angle between the surface of the blade and an imaginary plane, tangent to roll No. 3 and passing through the blade edge-roll contact line, was 113°. A brown creped sheet resulted consisting of numerous tiny, parallel folds approximately 0.033 inch high and 0.040 inch apart, which resembled a single layer of parallel fibers fused together. The creped sheet was pulled away from the blade by means of a conveyor.

The creped protein sheet was conveyed to a rotary cutter equipped with six blades and operated at about 75 rpm. Cuts were made across the width of the creped sheet and parallel to the tiny folds in the crepe, producing strands 1/16 to 1/8 inch wide and about 12 inches long.

The following mixture was prepared for use as an edible binder:

Ingredient	Parts
7S soybean protein isolate	8.00
Liquid soybean oil	10.00
CaCl ₂	1.00
Coloring	.50
Beef flavor	4.00
Water	62.00
TOTAL	85.50

The binder was prepared for use by mixing ingredients in a commercial blender for 10 minutes. The pH was about 6.5. The mixture was homogeneous, brown in color, and had a tacky consistency.

The protein strands were aggregated in parallel alignment and coated with the binder.

The coating operation was performed in the following continuous sequence:

- a thin layer of binder was placed on a moving conveyor belt;
- a layer of substantially parallel protein strands was deposited on the layer of binder;
- a thin layer of binder was deposited on top of the strands. The binder to fiber ratio was 1:1.

The resulting layer consisting of protein strands and binder was transferred by the conveyor to the bottom belt of a continuous cooker-conveyor consisting of two moving, heated, converging stainless steel belts. The temperatures of the belts were 230°F for the top belt and 240°F for the bottom belt. The cooker conveyor was adjusted to compress and shape the material into a slab having a thickness of about one-half inch; residence time in the cooker-conveyor was 45 minutes. The product emerging from the cooker-conveyor had the appearance of a 1/2 inch thick slab of cooked beef. Examination of the product showed a fibrous, meat-like texture; eating quality was fibrous and similar to that of cooked beef.

All parts and percentages herein are on a weight basis, unless specified otherwise.

What is claimed is:

- A process for forming textured shaped protein food products comprising
 - coating particulate textured protein material with a binder consisting of from about 10 to 70%, by weight, of 7S soybean protein isolate, and from about 30 to 90%, by weight, water;