Patent claims

1. A method for the production of protein-containing foamed food products, comprising the steps:

   a) metering raw materials into an extruder together with a liquid, wherein at least one raw material is a protein, preferably a vegetable protein, insect protein, cell protein, in particular of yeast, bacteria, microalgae, mould, or a mixture of different proteins, wherein the protein content in a dry raw material is greater than 50 % and is particularly preferably in the range from 60 % to 90 %, and the starch content in the dry raw materials is not more than 50 %, preferably in the range from 5 to 30 %, and the raw materials comprise at least one component which has a fiber content,

   b) mixing the raw materials in the extruder to produce a mixture,

   c) extruding the mixture to produce an extrudate, wherein a solids content of the extrudate is in the range from 20 % to 60 %, preferably in the range from 30 % to 50 %,

   d) leading the extrudate out of the extruder through a cooling die while cooling the extrudate to a temperature of less than 100 °C,

   characterized in that a controlled pore formation is performed in the extruder by providing a gas, so as to provide after step d) a foamed product having a protein content in the range from 15-30 wt.-%, preferably 19-23 wt.-% and a liquid content, preferably water content, of 45-70 wt.-%, preferably 55-65 wt.-%.

2. The method according to claim 1, characterized in that the gas is provided in the extruder by introducing this gas into the extruder.

3. The method according to any one of the preceding claims, characterized in that the gas is selected from the group consisting of CO_2, N_2, N_2O or SO_2.

4. The method according to claim 3, characterized in that the gas is introduced into the extruder in an amount from 0.01 to 5 % by weight, based on the total weight of the raw materials metered in step a).

5. The method according to any of claims 1 to 4, characterized in that the specific mechanical energy input introduced by the extruder is in the range from 10 Wh/kg to 120 Wh/kg, preferably in the range from 15 Wh/kg to 30 Wh/kg.

6. The method according to any one of the preceding claims, characterized in that a temperature in the extruder is set in the range from 80 °C to 180 °C, preferably in the range from 120 °C to 170 °C and particularly preferably 130 to 160 °C.

7. The method according to any one of the preceding claims, characterized in that oil is injected into a distribution body of the extruder and/or into the cooling die itself, preferably in a proportion in the range from 1 % to 10 %, based on the total weight of all raw materials metered into the extruder.

8. The method according to any one of the preceding claims, characterized in that the foamed product has distributed pores having a diameter of approximately 0.1-1 mm with a narrow size distribution, so that the diameter of at least 80%, preferably at least 90% the individual pores

only deviates by 0,1-10%, preferably 0,2-5%, from the value indicated above, and distributed closed cavities.

9. The method according to any one of the preceding claims, characterized in that the foamed product has a maximum force in the range from 10-50 N, preferably 15-40 N, more preferably 12-20 N, in longitudinal direction (F_L) and in the range from 10-90 N, preferably 15-70 N, and more preferably 15-50 N, in transversal direction (F_T).

10. A protein-containing foamed food product, obtainable according to the method according to any one of claims 1 to 9, characterized in that the foamed food product has a protein content in the range from 15-30 wt.-%, preferably 19-23 wt.-% and a liquid content, preferably water content, of 45-70 wt.-%, preferably 55-65 wt.-%.

11. The protein-containing foamed food product according to claim 10, characterized in that it is an alternative meat product.

12. The protein-containing foamed food product according to claim 11, characterized in that the L* value of the foamed food product deviates from the L* value of a meat product by no more than 20 %, preferably no more than 15 %.

13. The protein-containing foamed food product according to claim 12, characterized in that it has a fibrillar, porous, longitudinally oriented and cross-linked structure, and preferably exhibits a maximum force in the range from 10-50 N, preferably 15-40 N, more preferably 12-20 N, in longitudinal direction (F_L) and in the range from 10-90 N, preferably 15-70 N, and more preferably 15-50 N, in transversal direction (F_T).

14. The protein-containing foamed food product according to any of claims 10 to 13, characterized in that it has a porous structure, preferably with distributed pores having a diameter of approximately 0.1-1 mm with a narrow size distribution so that the diameter of at least 80%, preferably at least 90% the individual pores only deviates by 0,1-10%, preferably 0,2-5%, from the value indicated above, and with distributed closed and interconnected cavities, wherein the cavities preferably have a diameter of 100-300 µm with a normal deviation in the range of 50-70 %.

15. The protein-containing foamed food product according to any one of claims 10 to 14, characterized in that it is a food product which comprises at least one vegetable protein, insect protein, cell protein, such as of yeast, bacteria, microalgae, mould, or a mixture of different proteins.

16. Use of a protein-containing foamed food product according to any of claims 10 to 15 as a basis for cell cultivation.