LITERATURE REVIEW, NEW PROTEINS
1 July 1974 – 30 June 1975

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LITERATURE REVIEW, NOVEL PROTEINS

1 July 1974 – 30 June 1975


Swedish Institute for Food Preservation Research (SIK), P.O. Box 220 Gothenburg 16, Sweden

ABSTRACT

This literature review on novel proteins in conventional and unconventional foods was carried out at the Swedish Institute for Food Preservation Research (SIK) with grants from the Swedish Board for Technical Development (STU). This review is a continuation of five earlier reports.

This report covers the period July 1974 – June 1975.

The review is a result of a continuous literature survey at SIK’s library as well as computer literature search.

The information is primarily categorized as to the source of protein (fish protein, other animal proteins, oil seed proteins, other vegetable proteins, and microbial proteins) and then evaluated in subheadings such as processing, functional properties, nutritional value etc. The reference, often with short comments or abstracts, are given in a bibliography.
A. MISCELLANEOUS PROTEINS

Anon.
Amino-acid content of foods and biological data on proteins.
Food Policy and Food Science Service, Nutrition Division, FAO.

Anon.

Anon.
Novel proteins.
(In Swedish).
Seminar at SIK, October 17-18, 1974.

Comments
Data on vegetable proteins and fish protein concentrate.

Novel proteins are mainly considered in the following topics:

Microbial processing for producing foods. (Topic 4a)

By-products from food plant wastes. (Topic 5c)

New food sources of key nutrients. (Topic 8a)

Exploiting local food raw materials. (Topic 8b)

Today's unconventional proteins and selection criteria of their application.

Experience from the use of rape-seed proteins.

Experience from the use of fish protein concentrate.

Legal aspects on the use of novel proteins in foods.

Analytical methods to establish the presence of non-meat protein in meat products.

The influence on meat systems of the functional properties of added proteins.

The influence on meat systems on the texture of meat products.

The aroma of novel proteins and their flavour effect when added to meat products.

Enzymatic hydrolysis of fish protein.

Technical ways of producing a decoloured, tasteless leaf protein concentrate.

Microorganisms as a protein source.
Abrahamsson, L., Hambræus, L. & Vahlquist, B.
Swedish emergency food (SEF): An ongoing applied nutrition research program.

Achaya, K.T.
The Protein Foods Association of India: present work and future goals.

Asimov, Isaac.
Protein 1984.

Attwood, E.M.

Bonadonna, T.
World production of meat. (In French)

Cantarelli, C.
A preliminary discussion of the problems associated with the production and utilization of non-conventional proteins for human consumption. (In Italian)

Comments
Formulating of a Swedish emergency food mixture suitable for use in relief operations in developing countries. Tests were performed with wheat as the main component and also containing fish protein concentrate, dried buttermilk, whey protein concentrate, dried peas, oatmeal flour, rapeseed protein concentrate or defatted soy flour.

A report from the Protein Foods Association of India. Some of its activities are test marketing studies of innovative product concepts, and formulations of standard national specifications for various nutritive products.

The article presents one man's possible solution to the food shortage problems of the future. Since animal protein production is inefficient, the author suggests the use of plant proteins or ultimately a synthetic amino acid mixture fortified with vitamins and minerals.

The booklet deals briefly with the literature on unconventional protein sources, published since 1965. Some centres for further information are listed.

The world supply of meat is briefly discussed as well as the substitution of vegetable proteins or microbial proteins for meat.

A survey of the present experimental and production trends in the utilization of potentially available vegetable protein sources by resorting to non-conventional processing methods.
Caster, W.O.  
The promises and problems of the new foods.  
The Inter-Institutional committee on nutrition.  
University of Georgia, October, 1970.  

Cremiers, P. de  
New protein sources and their use in human nutrition.  (In French)  

Hermansson, A.-M.  

Jones, A.  

Ledden, J.J.  

Litchfield, J.H.  

Comments

Improving the protein content of foods using soybean and fish protein concentrates was discussed in most of the eight papers presented at the meeting.

Production of protein concentrates from soy, rapeseed, sunflower seed, green vegetables, fish, algae, yeasts, moulds and bacteria and of textured vegetable proteins from soy is described and a survey given of the use of these protein sources in infant foods, dietetic and vegetarian foods, animal foods and as substitutes for dried fruits, condiments, dairy products and meats.

A systematic investigation of functional properties, such as solubility, swelling, viscosity, gel strength and water-binding, dependent on water-protein interactions.

This book discusses the technology and economics of protein on the world scale, describing the quality and availability of protein sources such as fish meat and vegetables. New methods of synthesising protein with micro-organisms are covered.

Technical, economic and marketing facts on single cell proteins and proteins from plant and animal sources. 73 references.
Novel protein intelligence unit.
Ministry of Agriculture, Fisheries and Food.
London.

Novel protein intelligence unit.
Ministry of Agriculture, Fisheries and Food.
London.

Kárpáti, G. & Zachariev, G.
Production of foods rich in proteins.
(In Hungarian)
Élelmészeti Ipar

McLaren, D.S.
The great protein fiasco

Neto, J.S.A.
Food staples as vehicles for protein concentrates.

PAG
Preclinical testing of novel sources of protein. (PAG Guideline No. 16).

Comments

Novel proteins in the United States.

Notes on two international symposia concerned with novel protein developments.

An information is given about the change of food composition and nutritional-biological value of foods traditional and enriched with soy-, milk- and biomass-proteins. Analytical methods used in these investigations are specified.

The claims that there is a protein gap and protein crisis are discussed from a critical point of view.

The enrichment of corn and cassava meals was studied by using dried skimmed milk, soy protein isolate, food yeast and DL-methionine. Corn meal had its crude protein content increased from 8-21% and cassava meal reached a crude protein content of 12,2%.

The guideline includes toxicological safety, nutritional value, sanitation, acceptability and technological properties. Detailed recommendations for chemical analysis, biochemical and microbiological evaluation, and protein quality and safety tests.
PAG
The PAG Compendium.

Porter, J.W.G. & Rolls, B.A. (eds.)
Proteins in human nutrition.

Potparic, M.
Economic and nutritive aspects of the use of animal and vegetable proteins in meat products.

Rakowska, M.
Prospects for the use of proteins from unconventional sources in the feeding of man.
(In Polish)

Schmandske, H.
Herstellungsmöglichkeiten neuartiger Lebensmittel.

Sepp, R.
Vegetable proteins.
(In Swedish)

Stanley, D.W.
Protein prospects for dairy products and meat.

Comments

Approximately 7000 pages of comprehensive documents issued by PAG from the inception of PAG to December 31, 1973.

Contents:

Protein supplies and requirements.
The evaluation of protein quality.
The role of food science and technology.
Some factors affecting the utilization of proteins.

The article deals with the technological, nutritive and economic aspects of the use of animal and vegetable proteins as additives in the meat industry in Yugoslavia.

A review of the chemical composition and biological value of proteins produced by single cell organisms and obtained as by-products from oilseeds. Suggestions on how to improve the utilization of different protein resources in Poland are emphasized.

Based on the literature, the international knowledge is represented about the possibilities of the production of textured proteins.

Production of protein concentrates from rapeseed, wheat and green vegetables. The concentrate is mixed into meat products. Also used for animal feeding.
Sterner, M.N.
Low cost protein foods: Increasing their supply and acceptance in developing countries.

Tolstogusow, W.B.
Physikochemische Aspekte der Herstellung künstlicher Nahrungsmittel.

The author outlines the general approach to the problem of protein architecture and the development of synthetic foods from proteins. He presents the main results of relevant studies on the compatibility and the interactions of proteins and polysaccharides in aqueous media and deals with possibilities of influencing the structure and the physical properties of gels of given composition.

Trauberman, L.
Planning ahead for low cost protein.

A table on properties, applications and suppliers of soy and cottonseed proteins is presented. Other vegetable protein sources and single cell proteins are also reviewed.

van Veen, A.G. & van Veen, S.M.L.
Pioneer work on protein foods.

The establishment of the Protein Advisory Group (PAG) and the scope of the group in the 1950s and 1960s is reviewed.

Wu, Y.V. and Inglett, G.E.
Denaturation of plant proteins related to functionality and food applications. A review.
B. FISH PROTEIN CONCENTRATE

1. Reviews

Hallgren, B. et al.
New uses for fish proteines.
Nato Advan. Study Inst.
(1973), p. 369-381

Lopez-Benito, M. & Gil, M.
Obtainment of fish protein concentrate from low-price species.
IV Int. Congr. Food Sci.
& Technol. 8b (1974),
Source: Food Sci. &
Techn. Abstr. 7 (1975):6,
R318.

Noble, J.
New protein sources from the sea.
Food Ind. South Africa

Noble, J.
Making the best use of protein from the sea.
Fishing News Int.
13 (1974):10, p. 69, 71
Source: Food Sci. &
Techn. Abstr. (1975):2,
R59.

Comments

Fish protein concentrates were obtained from horse mackerel,
mackerel and blue whiting by extraction with isopropyl alcohol,
ethanol, NaOH or H2SO4. The concentrate from horse mackerel con-
tained 96-98% protein with 0.01-
0.1% fat and was of better quality
than Type A on the FAO grade
scheme. The concentrate was con-
sidered suitable for protein en-
richment of foods.

The use of drum-type automatic
meat/bone separators from recovery
of fish meat from fish frames and/
or under-utilized fish species is
briefly discussed, with reference
to: manufacture of various pro-
ducts from deboned comminuted
flesh of the African bonga fish;
manufacture of fish-based sausage
products; production of fish
spreads; and production of a
paste-type product from lobster
bodies. A new air-cooled meat/
bone, separator, the Paoli
'Kool-Kap' is briefly described.
Olley, J.
Unconventional sources of fish protein.

Regier, L.W.

Roels, O.A.
Fish protein concentrate. History and trends in production.
In "Production of fish protein concentrate".

Comments
Utilization of waste products (namely fish viscera) is discussed.
Unconventional sources of fish protein considered are: fish sausage, fish protein concentrate, smoked press-cake, and fish sauces and pastes.
2. Toxicity


Comments
Samples of fish protein concentrates from a total of 124 production lots prepared in pilot plant by 3 different methods have been tested for the presence of viable *Clostridium botulinum* spores. No spores could be demonstrated with certainty in any of the FPC tested.
3. Nutritional value and properties

Baldwin, R.E. & Sinthavalai, S.
Fish protein concentrate foam.

Comments

10% fish protein concentrate (FPC) foams had greater specific vol. than foams from lower or higher concentration. Regardless of concn., 20 or 24 min of whipping resulted in more stable foams with greater specific vol. than those whipped 16 min. Adjusting pH to 8 or 10 before whipping favoured stability in foams. Solubilization (adjusting to pH 12 and heating) of 10% FPC followed by adjusting to pH 6 before whipping improved both vol. and stability of foams and reduced the optimum whipping time to 4 min, but none of the foams was stable to heat.

Chen, L.-F.
Fish protein concentrate and enzyme derivatives containing reactive groups.
Source: Food Sci. & Techn. Abstr. 7(1975):6, R297

Fish protein concentrate (FPC) from hake was (i) extracted with hot isopropanol and partially solubilized by succinylation with succinic anhydride followed by heating at pH 9 for 30 min, or (ii) extracted at pH 11.5. Yield of (i) was 73% and degree of succinylation was 90%. Yield of (ii) was about 50%. Pancreatin digestion of protein isolates released 4.1 and 4.5% of the total lysine, and isoelectric point was 4 and 5 for (i) and (ii) respectively. (i) had a strong cheese-like curd upon quiescent acidification, while (ii) had a very fragile curd.

Fujimaki, M., Arai, S., Yamashita, M. & Noguchi, M.
Acidic oligopeptides as flavor-potentiating factors of enzymatic hydrolysates of a fish protein concentrate and a glutamic acid-enriched plastein.

A pronase hydrolysate of fish protein concentrate (FPC) was fractionated and a low mol. wt. acid fraction with flavour-potentiating activity obtained. Oligopeptides isolated from this fraction contained high molar ratios of glutamic acid residues.
A glutamic acid-enriched plastein synthesised from a 2:1 mixture of peptic FPC hydrolysate with L-glutamic acid-a,p-di-ethyl ester, when treated again with pronase, produced a more effective flavour-potentiator without concomitant bitterness.
Fujimaki, M., Arai, S., Yamashita, M., Kato, H. & Noguchi, M.
Taste peptide fractionation from a fish protein hydrolysate.

Groninger, H.S. Jr. & Miller, R.
Preparation and aeration properties of an enzyme-modified, succinylated fish protein.

Comments
Various proteases were compared with each other for their ability of generating tastes from a fish protein concentrate (FPC), and pronase was selected as an enzyme producing a large amount of brothy taste peptides. From the FPC hydrolysate obtained by treatment with this enzyme, an acidic fraction MW < 1000 was prepared by ultrafiltration and subsequently by column treatments with activated charcoal and 2 different ion-exchangers. The acidic fraction was rechromatographed on Amber-like CG-120 to obtain a fraction containing neither free aspartic acid nor free glutamic acid. The resultant acidic, oligopeptide fraction was found to taste considerably brothy and have a favourable aftertaste effect.

Fish myofibrillar protein was succinylated, partially hydrolyzed with bromelain, defatted and dried. The dry, modified protein had an off-white to white color and was readily dispersible in water and buffers. Dispersions of the protein were opaque in appearance, stable to heat, had little odor and a bland flavor and showed good aeration or whipping properties. The hydrolyzed succinylated protein was capable of being whipped over the pH range of 5.0-10.0; the foams were relatively stable; and the whipped protein was compatible with salt, sugar and flavoring materials. The foams had a low tolerance to added oil; however the tolerance of the protein foam could be increased through the incorporation of certain monoglycerides into the system. The functioned utility of the protein in food systems was demonstrated by incorporation of the protein into a dessert topping, a soufflé and both a chilled and a frozen dessert.
Fish protein concentrate (FPC) has been studied primarily for its value as a source of protein. However, other nutrients, namely minerals, may also be present in FPC in considerable quantities. This study indicates that FPC products prepared from 1 fresh water (bluegill) and 3 marine (thread fin shad, spade fish, croaker) species of fish are exceptional dietary sources of Ca, P, Fe and Mg.

It was confirmed that there is a clear relationship between the amount of actomyosin in surimi and the quality of kamaboko. It was observed that the actomyosin content of the surimi and the quality of the resulting kamaboko decreased with increasing storage period of the raw materials.
Korschgen, B.M. & Baldwin, R.E.
Fish protein concentrate as an emulsifier.

Koury, B.J. & Spinelli, J.
Effect of moisture, carbohydrate and atmosphere on the functionality of fish protein isolates.

Lee, C.M., Toledo, R.T., Nakayama, T.O.M. & Chichester, C.O.
Process requirements and properties of spray-dried squid protein.

Comments

The emulsifying property of solubilized 10% fish protein concentrate (FPC) adjusted to pH 4, 6 or 8 was tested by substituting it for 10g liquid whole egg in a mayonnaise-type formula. Adjusting the pH to either 6 or 8 favoured firmness and fineness and stability of emulsions. Regardless of pH the emulsions made with 20 g of solubilized 10% FPC were significantly (P < 0.05) more stable than those made with 10 or 30 g.

Studies were conducted on factors affecting the functional storage stability of fish protein isolates prepared by complexing partially hydrolysed myofibrillar fish proteins with sodium hexametaphosphate, the stability of the isolates as reflected by a change in emulsifying capacity was related to their moisture content and reached a max. at about 2.5% moisture. The stability of the isolates was enhanced by co-drying with non-reducing sugars, such as sucrose and lactose, storage in N₂ and vacuum atm. did not affect the stability of the isolates.

The process requirements and properties of dehydrated squid protein prepared by a water extraction and spray dehydration process were studied. After removal of skin and viscera, a water soluble fraction was obtained by filtering the comminuted slurry which, when diluted and spray-dried, was converted into a powder having a very light colour. A low yield of 29.4% on the semi-pilot scale appeared to be due to material loss during washing. In a well designed laboratory study however, yield averaged 74% indicating that loss during washing could be minimized. The product averaged 81% protein, had excellent water solubility and a good oil binding capacity as well as
Leshchenko, P.D., Gensitskii, I.P. & Nozdrachev, S.I.
Hygiene evaluation of a new sea product-krill paste.

Loustauanau, J.
Characteristics of a low fluoride fish protein concentrate from whole croaker (Micropogon undulatus)

Comments

Emulsion stability. Animal feeding studies showed that nutritionally the quality of the dehydrated squid protein is comparable with that of casein.

Paste made from the Antarctic krill, had a tворог consistency, a carrot-red colour and a pleasant taste reminiscent of crab meat. It contained 71% moisture, 38% protein, 25.7% fat, 26.4% aminopolysaccharides, 1.5% water-soluble N compounds, 1.8% carbohydrate and 6.3% ash in DM. The amino acid composition of the protein is tabulated. Tests on rats and dogs showed that the paste alone was equal as protein source to beef + casein (1:1) or to casein + paste (1:1).

Fish protein concentrate (FPC) made from whole fish usually exceeds the max. concentration of 100 ppm fluoride permitted in standards, but would enable the use of small industrial and trash fish without need for deboning and eviscerating. In this study FPC was made by several modifications to existing methods from whole croaker, a trash fish from the Gulf of Mexico, and evaluated chemically. Assuming that bones and scales are not soluble in isopropyl alcohol, a screening device was adapted for refining the defatted final product of 3 extractions by separating the fine particle fraction (82% protein, 10% ash, < 50 ppm fluoride) from the coarse fraction retained in the screen. Dry solids in the coarse fraction were best separated by air classification. From results and observations of this study an alternative method for FPC production from whole fish is proposed.
Makdani, D.D., Huber, J.T., Mickelsen, O. & Bergen, W.G.
The influence of water fraction on the nutritional value of fish protein concentrate.

Rasekh, J.
Effect of freeze drying, spray drying, and stabilizers on functional characteristics of fish protein concentrate.

The nutritional values of water-soluble and water-insoluble fractions of commercial fish protein concentrate (FPC) extracted with (i) hexan (ii) isopropanol and (iii) 1,2-dichloroethane were evaluated in a series of feeding trials with rats; the FPC fractions were the sole protein source in the diet. The amino acid composition of the FPC fractions was also determined; no data for amino acid composition are, however, given. The results showed that rats fed the water-insoluble fraction grew faster than those fed the original FPC; rats fed the water-soluble fraction grow more slowly than those fed the original FPC; and those fed the water-soluble fraction from (ii) or (iii) FPC lost weight. Amino acid analysis showed that water extraction resulted in an increased % essential amino acids in the water insoluble fraction, and a low % essential amino acids in the soluble fraction. The higher nutritional value of the insoluble fraction is attributed to this difference in amino acid composition. FPC extracted with (iii) was of lower nutritional value than FPC extracted with (i) or (ii). This is attributed to function of toxic substances during processing. These toxic substances were not fully separated by subsequent aqueous extraction.

A study was conducted to define some of the functional properties of IPA extracted hake FPC. Also investigated were possible methods of improving functional properties of FPC by foaming a water slurry and adding stabilizers and then spray-drying or freeze-drying. Certain functional properties such as bulk density, pH, wettability, % overrun, emulsion stability, emulsion capacity, water swelling index and water binding index, and suspended solids were measured.
Rasekh, J. & Metz, A.
Acid precipitated fish protein isolate exhibits good functional properties.

Shenouda, S.Y.K. & Pigott, G.M.
Lipid-protein interaction during aqueous extraction of fish protein: myosin-lipid interaction.

Shenouda, S.Y.K. & Pigott, G.M.
Lipid-protein interaction during aqueous extraction of fish protein: fish actin preparation and purification.

Preparation of an isolate from red hake (Urophycis chuss) by deboning, microcutting, hydrolyzing, sieving, bleaching, protein precipitation, centrifuging, extraction, centrifuging washing and drying, is described and a flow sheet included. Proximate analyses of fish protein isolate are compared to raw fish, fish protein concentrate and soy isolate. Colour, solubility, wettability, dispersibility, emulsion capacity and foam viscosity of the isolate are determined. Amino acid composition of the raw fish, fish isolate from whole fish and from headed/gutted fish, fish protein concentrate and soy isolate is tabulated. Sensory evaluation showed the isolate made from headed/gutted fish to have considerably better organoleptic characteristics than that from whole fish. The isolate could be used as a binder in meat emulsion products similar to frankfurters, bolognas or luncheon meats.

Present results are reported of model system experiments to determine whether or not the fish lipid interacts with myosin and which groups of lipids are responsible for this interaction. Studies of the effects of ageing, heating and air denaturation (foam formation) on the formation of these lipid-protein complexes are also reported.

A method was developed to produce a pure actin from fish. The procedure consists of four steps: (i) preparation of aceton powder, (ii) extraction of G-actin from the aceton powder, (iii) purification of G-actin by repeated polymerization (to F-actin) and depolymerization to G-actin, (iv) and final purification by using Sephadex G-200 column and lyophilization.
Shimizu, Y. & Nishioka, F.
Species variations in heat coagulation properties of fish actomyosin-sarcoplasmic proteins systems.

Sidwell, V.D., Lagally, H.R. & Ambrose, M.E.
Nutritional and chemical evaluation of various fish and shellfish proteins.

Smith, V.J., Linn, J.S. & Olcott, H.S.
The residual lipids of fish protein concentrates.

Comments
Heat coagulation in mixed solutions of actomyosin (AM) and sarcoplasmic extract at various mixing ratios was investigated in 6 fish species, and the contents of sarcoplasmic proteins (SP), coagulable SP (C-SP) and AM in muscle were determined in 8 species of fish.

This study on the protein characteristics of fish and shellfish is based upon the findings of 17 species that can be harvested in large quantities, but are not commonly sold in the market place. The protein content varies within species as well as between species. Some of this variability is associated with the season during which it is caught, with the physiological status of the animal, and with the availability of food. The amino acid profile of fish flesh is very much like that of whole egg, except it is a little lower in the S-containing components and in tryptophan. PER value of the fish flesh is equal to or better than the value for casein.

Data is presented on the composition of lipids extracted from samples of fish protein concentrates (FPC) made from Pacific hake, Northern anchovy, Atlantic menhaden and Atlantic herring and also on the effects of storage at several temperatures and humidities on the composition of the residual lipids in hake FPC. Gas chromatographic analyses of the methyl esters of the fatty acids from the Pacific hake FPC stored at different temperatures and humidities confirmed the relative stability of FPC during storage even under adverse conditions of temperature and humidity.
Sonu, S.C.
Isolation of squid protein concentrates and their physical and chemical properties.

Methods for preparing functional protein concentrate from squid were investigated. Deodorization of aqueous squid protein isolates with a combination of acid-activated clay or 5% H2O2, and 95% ethanol gave high quality products with good solubility, emulsion stability and water uptake ability, high lipid values (1-3%), essentially odourless, and stable on storage for 6 months at room temperature. All concentrates prepared contained 89-95% protein, 2-3% ash and 2-7% moisture, had excellent pepsin digestibility (98,75-99,99%) and contained essential amino acids (except tryptophan) in excess of FAO recommended standards.

Takagi, I.
On rheological properties and structure of kamaboko. VIII. Influence of Modori upon viscoelastic properties and structure of fish muscle paste.

When brayed fish meat containing about 3% of sodium chloride is incubated at room temperature for a very long time or heated at about 60°C, a decrease in kamaboko forming ability is observed. This phenomenon is usually called modori of the brayed fish meat. The shearing creep behavior of the modori-brayed-meat was determined and the mechanism of modori was discussed.

Takagi, I.
On rheological properties and structure of Kamaboko. XII. The dependence of the stress relaxation moduli on myofibrillar protein concentration in Kamaboko.

The dependence of the tensile stress relaxation moduli on the concentration of myofibrillar proteins in kamaboko was investigated. Studies were conducted using kamaboko prepared from croaker muscle and jack mackerel muscle.
4. Processing and production

Anon
(Nestle, SA)
Fish protein isolate.
British Patent
1348241 (1974)
Source: Food Sci. &
Techn. Abstr.

Blake, J.H.
Production of fish
protein concentrate
from Moroccan sardines.
Prod. Fish-Protein Conc.
Exp. Group Meet.

Bosund, S.I.W.
Bengtsson, E.L. &
Östman, K.B.L.
Fish protein isolate.
Brit. Patent
1348241 (1974)
Source: Chemical Abstr.

Chu, C.-L. &
Piggott, G.M.
Acidified brine extraction
of fish.
Transactions of the ASAE
16(1973):5, p. 949-952
Source: Food Sci. &
Techn. Abstr. 6(1974):6,
R349.

Comments
Fish material is treated with
aqueous alkali at pH 10-12 and
80-100°C, after which the in-
soluble materials are separated
from the alkaline solution, de-
salted and deodorized.

Production of fish protein concen-
trate (FPC) suitable for human con-
sumption was investigated. Extrac-
tion of homogenized whole fish
with acidified brine gave high-
quality product that could be ex-
tracted with isopropyl alcohol to
produce an essentially tasteless,
odourless FPC. Max yield from
hake was obtained with 1:1 (w/w)
6% brine in sea water (approx. 8%
NaCl total) acidified at a level
of 1:50 (w/w) HCl to fish (91,9%
protein recovery). Acid content
had no apparent effect on avail-
able lysine content as indicated
by chemical analysis and protein
efficiency ratio tests. The
brine-extracted residue requires
further extraction of the lipid
residue (4-5%) for a food grade
product.
Crawford, D.L.
Preparation of fish protein hydrolysates.
Com-74-10173/4.
Oregon State Univ.
Corvallis U 7405 Jul. 73.
55 pp.

Dingle, J.R., Kennedy, D.J. & Dyer, W.J.
Fish protein concentrate.

Gasser, R.J. & Huster, L.B.
(Soc. d'Ass. Tech. pour Produits, Nestle SA)
Fish protein isolate.

Hale, M.B.
Using enzymes to make fish protein concentrates.

(Astra Nutrition AB)
Method and device for the manufacture of protein from fish.

Fish or seafood muscle is dispersed in an aqueous alkaline NaCl solution, which is then acidified to precipitate the protein. Lipids and water are removed by treatment with isopropanol, after which protein is separated from the remaining mixture.

Protein is isolated from fish material by solubilization with alkali, after which lipids present are removed by liquid-liquid solvent extraction.

Development of an enzymic process for manufacture of fish protein concentrate is described. Comminuted fish are enzymatically digested under controlled pH and temp. conditions; the resulting hydrolysate is then screened to separate bones and scales, centrifuged to separate oil and indigested solids, evaporated, filtered and spray dried. The resulting product is fully water soluble; by omission of the centrifugation stage of the process, a partially-soluble easily dispersible product may be manufactured. Economics of the process and applications of the product are briefly discussed.

Fish protein is obtained by subjecting whole fish to a combination of processing steps including cutting, washing, heat-coagulating, separating processes and solvent extraction. The fish are cut transversely to their longitudinal axis and washed with water. Heat-coagulation is then carried out...

Kahn, L.N., Berk, Z., Pariser, E.R., Goldblith, S.A. & Flink, J.M.
Squid protein isolate: effect of processing conditions on recovery yields.

Comments

by direct application of steam in a parallel flow. Separation of the bones is followed by homogenizing before separation of the skin and encapsulated fat from the protein fraction. Draining, solvent extraction and drying of the protein fraction produces a fish protein of neutral taste and free from odour and having a low fat content and high degree of whiteness.

Squid were investigated as a potential source of protein isolate. The various process parameters which influence extraction of protein (particle size, time, extraction pH, salt concentration, relative amount of solvent to squid tissue, and temperature) were investigated. From this study the following parameters were chosen to optimize extraction: pH 11 (NaOH) or 4% salt concentration (NaCl, sodium hexametaphosphate); temp. 22°C, time 45 min, particle diam. 2-3 mm solvent-to-squid ratio 10:1. Under these conditions about 85% of squid protein can be extracted. 65% of extracted N is recovered as protein isolate by isoelectric precipitation at pH 5.

Ke, P.J., Ackman, R.G. & Eaton, C.A.
Ternary equilibrium data of isopropanol extractions process for production of wax ester oil and FPC from barracudina.

Ternary equilibrium data for the system of isopropanol-water-oil have been determined at 60°C, using spermaceti and lard as model wax esters and triglycerides, respectively. It was predicted that the 'Halifax' IPA extraction process for the production of fish protein concentrate could be satisfactorily used for barracudina without further modification.
Kirpichnikov, V.P.
Nekrutman, S.V. &
Sumenkov, B.I.
Method of obtaining
an edible protein sub-
stance from small marine
crustaceans.
USSR Patent 426 648
(1974).
Source: Food Sci. &
Techn. Abstr. 6(1974):11,
R576.

Knutsen, T.L. &
Österman, S.
Fish protein.
Source: Food Sci. &
Techn. Abstr. 7(1975):6,
R339.

Mackie, I.M.
Proteolytic enzymes in
recovery of proteins
from fish waste.
Process Biochem.
Source: Food Sci. &
Techn. Abstr. 7(1975):4,
R195.

Comments

Crustaceans, e.g. krill are com-
minuted and pressed, then the
resultant liquid is heated to
coagulate the protein, which is
separated off. In order to pro-
vide more complete extraction of
the liquid to reduce ditin con-
ten and to accelerate the pro-
cess, the comminuted mass is
treated with an electromagnetic
field of high or super-high
frequency e.g. 2375-2450 MHz,
preferably at ≤ 36-40°C.

In a process for the prepara-
tion of tasteless and odour-
less fresh fish protein the
watered fish meal is extracted
with propanol or butanol.

Developments in the use of
proteolytic enzymes for recovery
of proteins from fish wastes
(e.g. from filleting) or fish
spp. not normally used for
human consumption are reviewed.
Processing waste is approx.
64% of the wt. of cod and con-
tains 10% protein. Existing
recovery procedures as fish
meal of fish protein concen-
trates (by solvent extraction)
produce valuable animal feed-
stuffs, but new processes of
enzyme digestion yield superior
products which are almost
equivalent to casein and have
good solubility and emulsifying
properties. Slow digestion,
using the natural fish enzymes,
yields a useful slurry for
animal feeds, but great improve-
ments have been obtained by
accelerated digestion. In this
a waste suspension is hydrolyzed
by added proteolytic enzymes
(papain, bromelaig, microbial
enzymes) at 50-60°C for 30 min
and neutral pH. The suspension
is filtered to remove bones,
stereized by boiling at 1 kg/cm²,
and spray or freeze-dried. Diges-
tion for 30 min is sufficient
Comments

to remove flesh from bones, without complete hydrolysis. Present use of the product is mainly as a casein substitute. Further research is needed to remove the tendency to bitter flavours and improve the colour, which is affected by blood and pigments from the raw fish.

Molyneux, F.
Shark fishery by product technology.

Onoue, Y. & Riddle, V.M.
Use of plastein reaction in recovery protein from fish waste.

Pelroy, G., Spinelli, J., Miller, R., Wieg, D. & Lehman, L.
Stabilized press cake for FPC manufacture.
Food Technol. 28(1974):3, p. 64, 66, 68, 70, 72, 74, 82.

Roels, O.A.
Fish protein recovery.

A high quality proteinaceous product is recoverable in 35% yield from fish waste by a process of peptic hydrolysis followed by a pepsin-catalysed recombination of soluble peptides to form plastein. Hydrolysis is at pH 2.0 and 37°C for 6 h. Soluble peptides are then separated from insoluble residue, adjusted to pH 4.5 concentrated at 45°C to 30% protein solids, and incubated for 24 h at 37°C with additional pepsin. The insoluble plastein formed during incubation is filtered, washed and dried.

A process is described for the preparation of press cake that is stable at ambient temperature to microbiological and oxidative deterioration. The press cake was stabilized with antioxidants and sodium metabisulphite or isopropanol. Fish protein concentrate (FPC) made from the stored press cake had the same organoleptic and nutritional properties (PER) as FPC made by conventional processing.

A homogenized slurry of fish or fish product is digested at elevated temperature and a pH of about 1. The resultant aqueous phase is separated to yield a protein hydrolysate of low oil content.
Schulman, M. Pitchon, E. & Anderson, C.D.
Production of fish protein.

Spinelli, J. & Koury, B.J.
Fish protein concentrate.

Toledo, R.T.
Functional protein concentrates from plant and animal sources by low temperature solvent extraction.

Tsypenovitch, A.S. & Kolesnik, L.A.
Streptomyces griseus protease in the manufacture of fish products.

Comments

A slurry of comminuted fish is partially hydrolyzed with a proteolytic enzyme, and the modified proteins are recovered as a protein-phosphate complex. This complex is extracted first with a polar solvent to remove lipids and then with water to remove the solvent. The extracted complex is neutralized with an alkali and dried.

A low-temp. solvent extraction process was developed for extracting proteins from wet fatty materials. Isopropyl alcohol (IPA)-hexane mixture extraction in the first stage followed by hexane in the succeeding stages to remove residual IPA and fat produced excellent protein and purified fat. Desolventization and solvent recovery procedures are described. Proteins produced from poultry and beef by-products had excellent binding properties and salt soluble protein contents.

A new method of manufacture of frozen comminuted fish is described, based on separation of the soluble N (by washing for 20-30 min, with intensive mixing) and pressing the residue in a cloth at a pressure of 2 kg/cm². With this pressure, the minced fish tissue does not penetrate through the cloth. This process permits reduction of water consumption by a factor of 1.6.
5. Applications

Atkinson, W.T.  
(Archer Daniel Midland Co.)  
Meat substitute.  
Source: Food Sci. &  
Techn. Abstr. 6(1974):10,  
S1331.

Auerman, L.J.  
Ways of improving the  
quality and nutritive  
value of bread.  
Zagadnienia Piekarkstwa  
Source: Food Sci. &  
Techn. Abstr. 7(1975):3, M399

Marinou, A., Co, D.Y.C.L. &  
Livingston, G.E.  
Evaluation of fish protein  
concentrate as a replace-  
ment for dry skim milk in  
weaning food mixtures.  
J. Food Sci. 39(1974):5,  
p. 883-886.  
Source: Food Sci. &  
Techn. Abstr. 7(1975):1,  
659

Comments

Meat substitute food products  
comprise extruded protein  
materials containing a mixture  
of solvent-extracted oilseed  
material and fish protein concentrate.

A general description of methods  
of improving bread quality and nutritive value covers: development of new grain var. improvements in dough production methods and incorporation of unconventional additives, eg. fish protein or soy bean concentrates.

Fish protein concentrate (FPC)  
was evaluated nutritionally  
and organoleptically as a re-  
placement for dry skim milk in  
Laubina mixtures which are  
blended foods containing parboiled wheat and chick-peas  
(Laubina 104) or lentils  
(Laubina 106). On the basis of  
amino acid analysis, the limit-  
ing essential amino acid in  
milk-free Laubina was methionine.  
Amounts of FPC required to be  
added to milk-free Laubina mix-  
tures to raise methionine levels  
to that of eggs were 14,05% for  
Laubina 106, and 2,91% for  
Laubina 104. PER for Laubina  
104 with fish protein was 2,27  
and 2,42 for Laubina 104 with  
milk.

Organoleptically Laubina mix-  
tures containing fish protein  
or milk protein showed no  
statistically significant  
differences when used in preparing soups or cookies; but when mixtures were made up into semi-solid infant food, difference was detected at the 5% level of significance only in Laubina 106.
Okada, M., Miyauchi, D. & Kudo, G.
"Kamaboko" - the grant among Japanese processed fishery products.
Source: Food Sci. & Techn. Abstr. 6(1974):6, R304

Comments
Kamaboko, a Japanese-style rubbery fish cake, is made by mixing ground fish muscle with starch, sugar, salt and mono-
sodium glutamate and heat pasteurizing it by steaming,
broiling, immersing in boiling water, or deep fat frying. The
distinctive organoleptic characteristic of kamaboko is
its elasticity, which depends on the species of fish used,
freshness of the fish and processing techniques. Keeping
quality depends mainly on ingredients used, processing
temperature and packaging. It is suggested that kamaboko-
type products could easily be modified to suit the pre-
ferences of the US consumer.

Sidwell, V.D.
Analysis, testing and uses of fish-protein con-
centrate.
Expert Group Meet. 2(1972) p. 127-149.
UN Publ. Geneva.

Yanez, E.
Supplementation of cereal protein with fish enzymatic
hydrolysate and Candida utilis yeast.

Zuchowicz, S.
Use of fish protein preparation in canned meat
manufacture.

A protein preparation made from fresh or frozen, fat or other fish,
was used. It consists of a white tasteless fine-fibered hydrated
protein isolate containing approx. 70% moisture and 30% protein with
< 0.5% fat and < 0.5% ash. 30% of the protein is undenatured;
the preparation has marked blending and emulsifying pro-
erties and retains the nutritive value of fish protein; the total
bacterial count is < 10^4/g. The
Comments

cost is assessed at £1.45/kg.
Recipes for canned minced beef, 'Tourist preserve', 'English goulash' and frankfurters including 5-10% of the preparation are tabulated. Panel tests showed that the addition had no significant effect on the organoleptic quality of the canned foods tested. The economic advantages of the addition are pointed out.
C. ANIMAL PROTEIN OTHER THAN FISH PROTEIN

1. Whey, caseins coprecipitates and milk protein

1.1. Reviews

Anon.
More protein from whey.

Anon.
Whey - are important potential protein source.

Anon.
Whey recovery; new way to profits.

Comments

The articles includes data on whey output and dried whey production in many countries and areas during 1966 and 1970-1973, international trade in dried whey, wholesale prices of dried whey and their relationship to dried skim-milk prices, and utilization of whey in various foods, specifying the quantities used and effects on the quality of the products.

This commodity note, based on a paper presented to the Working Group on Dairy Industry Development of the FAO/Industry Cooperative Programme in April 1974, discusses the growth in world whey output. The recent increase in whey processing (especially drying), the use of whey in beverages, the economics of whey during, the 1974 increase in dried whey prices, the use of dried whey in foods such as bakery goods, ice cream and processed cheese, international trade in dried whey, and the future outlook.

Properties of whey are discussed briefly and whey uses in foods and functional properties imparted are given the range includes baked goods, dry mixes, dry whey flow agent, confectionery, sherbet, ice cream, jam, water ice, batter mix for frying, various whey-soys beverages, processed cheese and whey-soya blends.
Anon.
Pollution abatement, rising disposal costs spur research into new uses for whey.

Bollerup, H.
The quantitative importance of milk protein.

Bourdonnaye, A. dela
Utilization of whey - its nutritional value and future.

Guerin, J. & Alais, C.
Caseinates in the food industry. Uses and analysis.

Holsinger, V.H., Posati, L.P. & Devibiss, E.D.
Whey beverages: a review.

Comments
A summary of the papers presented at a 2-day Whey Utilization Symposium, held in Ottawa in 1974, is given, the subjects including feeding whey to pigs and ruminants, condensing and drying whey, yeast fermentation of whey, membrane processing, food uses for whey and whey protein concentrates.

The high quality of whey proteins and their exceptionally high contents of lysine and tryptophan are emphasized.

Casein and its derivatives used in the food industry are briefly described, including acid casein, lactic casein, rennet casein, caseinate and casein-whey protein co-precipitate. Food uses include coffee whiteners (coffee creamer), whipped toppings, instant breakfasts, imitation milk, dips, Cottage cheese, bakery, confectionery and meat products. Analytical standards and methods are briefly discussed.

The use of cheese whey as a base for manufacture of a variety of beverages, both alcoholic and nonalcoholic, is reviewed.
Jensen, G.K.
The use of milk protein in food production.

Klostermeyer, H.
The world protein situation, a challenge to milk research.

Mann, E.J.
Whey utilization.

Muller, L.
Milk protein in food.

Smith, G.M.
The production and utilization of milk proteins.

Southward, C.R.
Rennet casein- industrial chemical or food ingredient.
Food Technol. in New Zealand 9(1974):8, p. 11, 12, 15.

Comments

This paper presented at the 1974 Marschall Int. Dairy Symp. in London is concerned mainly with the production of casein and caseinates, coprecipitates and whey protein and their uses in foods.

Consideration is first given to rennet casein as a food ingredient. Its flavour, method of manufacture, properties and uses are then reviewed.
1.2. Nutritional value and properties

Anon. (NIZO)  
Milk protein coprecipitates.  
Neth. Appl. 71 15, 702 (1973)  

Comments  
A milk protein coprecipitate is obtained by heating a mixture of 2-10 parts by wt of whey, or an equivalent amount of concentrated whey or 0.2-1 part by wt. of the mother liquor resulting from the preparation of lactose and containing 30-35% dry substance, with 1 part by wt of butter milk or skimmed milk, the pH of the mixture being adjusted to 6,5-7.1 prior, during or after the addition of 0,1-1,0% CaCl₂. The formed coprecipitate is suspended in water and enough of an aqueous polyphosphate solution added, so that the dry product has a NSI 4-11. The observed product is a baking adjuvant with enhanced baking properties and of high nutritive value and low lactose content.

Asan, T.  
Fibrous protein from cottage cheese whey.  

The possibility of making protein fibers from whey protein concentrate (NPC) prepared from cottage cheese whey by a polyphosphate complexing process was investigated. A wet-spinning process for fiber formation from WPC was studied.

Clegg, K.M. & McMillan, A.D.  
Dietary enzymic hydrolysates of protein with reduced bitterness.  

A pre-digested dietary protein could have applications for patients with digestive disorders and especially for the condition of cystic fibrosis. Egg white and casein have been investigated as protein substrates and treated with endopeptidases and pig's kidney tissue as a source of exopeptidases; hydrolysates relatively free of bitterness and containing small peptides and over 50% free amino acids have been obtained.
DeVilbiss, E.D.,
Holsinger, V.H., Posati, L.P. & Pallansch, M.J.
Properties of whey protein concentrate foams.

Forsum, E.
Nutritional evaluation of whey protein concentrates and their fractions.

Hidalgo, J., Kruseman, J. & Bohren, H.U.
Recovery of whey proteins with sodium hexametaphosphate.

Comments

The ability of whipped 14, 20 and 25% TS whey protein concentrates (WPC) to replace beaten egg whites (14% TS) in angel-food cake formulations was tested. After 10 min baking (total baking time 30 min). The 20% WPC cake had risen rapidly to its max. height and then collapsed. The 25% WPC cake did not collapse during baking but was very dry and crumbly with large holes. Effects of whipping time, solids concn., added sucrose, pH, bubble size, fat content and protein denaturation on foam stability of angelfood cake batter and serum leakage were investigated.

Whey protein concentrates were industrially produced by gel filtration and ultrafiltration and were fractionated further by large-scale gel filtration. Nutritional values of the 2 concentrates were similar and high. Whey protein fractions containing α-lactalbumin had high PER and NPU values while fractions containing β-lactoglobulin had high NPU values but only moderate PER values. According to the calculated chemical scores, amino acid contents of the concentrates and of all the fractions were almost adequate to recover the needs of the human infant and more than adequate to cover those of young children. Utilization of the α-lactalbumin-rich fraction III in humanized infant feeding formulae is discussed.

Under optimum conditions (pH 3), > 90% of the protein of whey was precipitated by Na-hexametaphosphate, provided the whey was decationized previously. On a dry wt. basis the precipitate contained 70-85% protein, 10-20% Na-hexametaphosphate, and 10-15% lactose. Only a negligible amount of the precipitant remained in the supernatant.
Hill, R.D. & Leeuwen, H. van
Bitter peptides from hydrolyzed casein coprecipitate.

Josephson, R.V.,
Rizvi, S.S.H. & Harper, W.J.
Compositional difference in whey systems.

Kehrberg, N.L. & Johnson, J.M.
Storage stability of dried sweet cheese whey.

Keuhler, C.A. & Stine, C.M.
Effect of enzymatic hydrolysis on some functional properties of whey protein.

Comments
3 bitter peptides were isolated from casein coprecipitate hydrolysed with a commercial trypsin preparation. No other bitter peptides were detected. All originated from $\alpha_{\text{s1}}$-casein and comprised residues 23-34, 91-100 and 145-151 of that protein. The second peptide was the most bitter, and had not previously been reported as a bitter peptide.

The composition of different whey systems (i) Cheddar whey (ii) cottage whey (iii) whole milk whey (pH 4.6) and (iv) skimmilk whey (pH 4.6) is discussed. Alkaline gel electrophoretic and Sephadex G-100 patterns were normal for fresh wheys but showed significant whey protein denaturation/aggregation in UF powders.

Dried whey was stored in sealed plastic bags, in glass jars and open under room conditions and refrigeration for 30, 60 and 90 days. Samples were analyzed for moisture, pH, color and protein solubility. Greatest changes occurred in open, room temperature, stored whey. Cakes were prepared from all whey stored under room conditions using 100% substitution for non-fat dry milk (ndm). Initially, a taste panel found no significant differences between ndm cakes and whey cakes. After 30 days ndm cakes were preferred to cakes made from open-stored whey, and at 90 days panel members preferred ndm cakes over all whey cakes.

The effect of hydrolysis by the enzymes Pronase, pepsin and Prolase on the whipping and emulsifying properties of whey protein were investigated. Extent and type of hydrolysis were determined by formaldehyde titration and filtration on Sephadex G-50 respectively, emulsifying capacity in terms of the max. oil/protein ratio compatible with emulsion

Comments

stability. With increasing hydrolysis, rapid and considerable with Pronase, slower and much slighter with pepsin and Prolase, slower and much slighter with pepsin and Prolase, progressive reduction of approx. corresponding magnitude occurred in the vol. and stability of the whip and in the emulsifying capacity of the protein. Whey protein proved definitely inferior to fresh egg white for the preparation of meringues.

Five whey products were examined: i) spray-dried rennet whey, ii) spray-dried whey protein concentrate obtained by ultrafiltration, iii) as ii) but ultrafiltration being combined with repeated (5x) washing, iv) spray-dried heat-precipitated whey proteins, v) as iv) but roller-dried. Protein and N fraction contents of i)-v) were respectively (4%: protein 11,1, 19,0, 52,0, 31,4 and 53,3; soluble N 1,77, 2,91, 7,74, 0,62 and 0,18; protein N, 1,25, 2,33, 7,00, 4,23 and 8,03. Amino acid compositions of the proteins were determined. NPU values determined on rats, were 96, 91, 94, 91 and 78 respectively.


The nutritive value of Cheddar cheese whey protein mixed with soybean protein isolate at different levels was investigated by ad lib. feeding trials on 190 albino rats.


Comments

Samples of casein, coprecipitate, soluble whey protein and traditional lactalbumin have been analyzed for amino acid composition and PER. The results are tabulated and discussed. Nutritive value of whey protein was unaffected by processing, the cystine content being higher than in lactalbumin. Coprecipitates were nutritionally superior to casein.

This specification covers various mixtures of whey concentrate and collagen hydrolysate (obtained as a waste product from the tank water) following the steam rendering of fat. In one example, an imitation milk product is obtained by mixing 9 parts of lactose-reduced whey concentrate (40% solids) with 1 part of collagen hydrolysate (40% solids). The product contains 33.6% protein, 42.0% lactose, 19.1% minerals and 4.2% moisture.

Model samples containing fish, casein, or soy protein were analysed by GC and MS. Over 150 compounds were identified representing aliphatic hydrocarbons, alcohols, aldehydes, ketones and furan derivatives, and S-containing compounds. Of particular importance for the aroma of all heated samples is the presence of branched chain aldehydes and S compounds. H2S is important in the fish protein sample.
Richert, S.H.
Whey protein isolate preparation and functional properties evaluation.
Order no. 72-23332.

Comments
Protein, precipitated from commercial cheese whey by addition of 0.5% sodium hexametaphosphate (HMP) and acidification to pH 2.5 with H₂SO₄ on a pilot scale, was collected with an automatic desludging centrifuge and recovered in soluble form by neutralization with Ca(OH)₂. CaHMP precipitate was separated without physical difficulty. Functional properties and composition of whey protein isolate (WPI) compared favourably with commercial dried egg albumin (DAB), sodium caseinate and soy protein isolate. WPI contained approx. 2.5% Ca and high ash content was soluble between pH 4 and 8 and had lowest viscosity. Compared to DAB, the WPI on heating, gave a more crumbly fibrous gel withstanding higher temperature formed more stable emulsions and resulted in similar cake volume and profiles but of a more tender, moist and crumbly consistency.

Richert, S.H., Morr, C.V. & Cooney, C.M.
Effect of heat and other factors upon foaming properties of whey protein concentrates.

The effects of heating whey protein concentrate (WPC) dispersions at 50-85°C for 30 min at different pH, Ca concentration, Eh, and sodium lauryl sulphate concentration upon whey protein denaturation/aggregation and foaming properties were studied. In general, the more severe heat treatments at 80-85°C impaired the foaming properties of WPC dispersions. Heating WPC dispersions at 50-70°C greatly improved their foaming properties; however, this beneficial effect was only temporary. Data are given for comparison of protein composition and denaturation and foaming properties of selected WPC sources.
Rostroza, N.K. & Izbash, E.A.  
Composition and properties of decalcinated coprecipitate.  
XTX Int. Dairy Congr.  
7(1975)4, P774.

Comments
Coprecipitate released minerals for up to 30-40 min when it was mixed with 10X its weight of 0.2M HCl, or 5X its weight of 0.5M HCl. Ca was reduced from 2.64% to 0.36% and P from 1.55 to 0.76%. Soluble proteins equivalent to caseinates could be produced by adding sodium or potassium salts to dispersions of demineralized coprecipitate.

Rusch, D.T.  
(ICI America Inc.)  
Emulsified proteinaceous compositions.  

High protein concentrates from casein and fish protein and the like are made more palatable by encapsulation with fats having mp above 70°C.

Stegink, L.D., Shepherd, J.A., Brummel, M.C. & Murray, L.M.  
Toxicity of protein hydrolysate: correlation of glutamate dose and neuronal necrosis to plasma amino acid levels in young mice.  

Possible adverse effects of parenteral administration of casein or fibrin hydrolysates to infants was assessed in the light of the finding that when administered in large quantities to neonatal mice, these hydrolysates caused raised blood glutamate and aspartate concentration resulting in neurotoxicity. It was concluded that under the usual conditions of administration, these hydrolysates had no adverse effect on infants.

Thomas, M.A.  
Baumgartner, P.A. & Hyde, K.A.  
A study on some of the functional properties of 3 types of calcium coprecipitate, important in the manufacture of comminuted meat products, was carried out in a model system.  

A study on some of the functional properties of 3 types of calcium coprecipitate, important in the manufacture of comminuted meat products, was carried out in a model system. It was found that the 3 types, High Calcium coprecipitate No. 2 (High Cal 2), High Calcium coprecipitate No. 6 (High Cal 6) and Low Calcium coprecipitate (Low Cal) improved the emulsifying and water binding capacity of the meat at the 20% replacement level. It was also found that the performance of the 3 types of co-
Towler, C.  
Functional properties of milk protein for use in foods.  
XIX Int. Dairy Congr.  
7(1975):4, P690.

Zbikowski, Z. & Kisza, J.  
Production of demineralized whey proteins.  
XIX Int. Dairy Congr.  
7(1975):4, P591.

Comments

precipitates studied was equal to that of the conventional non-meat proteins e.g. sodium caseinate, used in sausage manufacture.

Emulsifying capacity, emulsion stability, foaming, power and foam stability, gel properties and rheological properties of caseinates and whey protein products were examined. Substantially undenatured whey proteins obtained by ultrafiltration of whey are soluble at low pH and are, therefore, suitable for fortifying acid beverages. Whipping and foaming properties of whey protein solutions were particularly dependent on the type of whey used and on the processing history.

In studies comparing protein precipitation by heating at pH 3.9 or with ethanol, the former method, which gave a precipitate with 8.7-12.7 TS (77-91% protein and 2.2-2.8% ash in DM) is considered the better and more easily applicable under industrial conditions.
1.3. Processing and production

Anon.
A new method for the manufacture of protein concentrates.

Comments
A new method developed at the German Democratic Republic Dairy Research Institute for the production of bland, heat stable, casein-based protein concentrates is briefly described. The method involves precipitation of casein and whey proteins, separation of the precipitate and drying. The concentrate contains \( \geq 90\% \) TS, \( \geq 60\% \) protein in DM, \( \leq 24\% \) lactose in DM, \( \leq 5\% \) in fat in DM and \( \leq 15\% \) ash in DM. Main uses are in the meat industry, e.g. in boiling and cooking sausages, and in fish and baked products.

Anon.
(Melk Unie Gouda NV)
Method for obtaining whey proteins.
7(1975):1, P55.

Coagulated whey protein is separated from the whey or whey liquor, washed with water and finely dispersed in an aqueous medium. The temperature of the dispersion is increased to preferably 55-60°C, the pH is subsequently increased to preferably 10,5-11,5 and immediately after gelling and melting of the protein it is lowered (citric acid) to preferably 7,0-9,0. Alkaline earth metal ions (Ca or Mg) are preferably added to the obtained protein solution which may then be concentrated or processed to obtain a dry product. The protein product, which is fully digestible and has a favourable amino acid pattern similar to non-processed whey protein, is suitable as an egg white substitute in baker's products and as a component of baby foods.

Anon.
(Union Laitiere Vaudoise)
Process for the preparation of a hydrolysate of proteins for use as foodstuff

The process as detailed in 1 of 2 examples given comprises mixing 70 kg casein with 62 kg water and 92 kg purified arsenic-free HCl (sp. gr 1,17 and concentration about 34%) boiling

Borgwardt, J., Conrad, P., Härtling, H., Kabur, M., Krüger, W., Quensel, E., Sielaft, H. & Wunderlich, W.-D.
Method for production of protein.

Comments

with stirring for approx. 18-20 h until the casein is fully broken down, cooling to 28-32°C, gradual addition of 105-115 kg pure sodium hydroxide (as a 30% aqueous solution) to the mixture to bring the pH to 6.6-6.7, cooling the neutralized mixture to 15-25°C and purification by centrifugation or filtration the clear liquid is preferably spray-dried at 95-100°C, obtaining a powder readily soluble in water. The dried product contains 53.5-53.7% amino acids, 41-41.5% NaCl and 2-2.5% other minerals.

Methods for the manufacture of heat-stable protein concentrates from casein for use in foods are described. According to one example lactic or rennet casein with about 35-40% TS and 3% polygalacturonic acid are mixed with water at a suitable ratio to obtain casein concentration of 10-30%, and the mixture is dissolved with 1 N caustic soda solution at 20-90°C with simultaneous pH adjustment to 6.8-11.0. The protein-polysaccharide complex is precipitated with a 5-30% CaCl₂ solution, separated, sprayed with hot water and shock-cooled. Other examples given involve the use of the patented methods with a mixture of skim-milk and why or a mixture of casein and yeast protein. The proteins may be used in meat, fish, dough and baked products, without adversely affecting their flavour.

The production of a coprecipitate from milk is described. Data on solubility and in vitro digestibility are also tabulated. NPU of the product ranged from 71.2 to 74.5.

Chojnowski, W., Smietana, Z., Poznanski, S., Jakubowski, J. & Rymaszewski, J.
Technology of production and properties of dried sodium 'proteinate'. (co-precipitate).
Production of an enzymic hydrolysate of casein on a kilogram scale.
J. Food Technol.

The scaling-up of a method for the production of an enzymic hydrolysate of casein is described. The spray-dried product is relatively free of the bitterness often associated with proteins subjected to enzymic treatment. The production of hydrolysate casein in quantity is providing an opportunity to investigate the dietary potential of pre-digested protein for patients suffering from digestive disorders as a result of pancreas malfunction.

Production of an enzymic hydrolysate of casein.
7(1975):6, G375.

Pre-digested casein, primarily for use in treatment of digestive disorders, has been produced on a pilot-plant scale, involving 2-stage hydrolysis, first with endopeptidase papain and then by an aqueous homogenate of porcine renal cortical tissue to remove the bitter peptide from the β-casein. The product is treated with chloroform and spray-dried to give 3-4% moisture, a low bacterial count and good storage of organoleptic qualities. It contains approx. 46% free amino acids, with the remainder as small peptides. Preliminary medical trials have proved satisfactory.

Costin, G.M., Rotaru, G., Lungulescu, G. & Matei, L.
Production of a milk protein coprecipitate.

A protein coprecipitate was made on the industrial scale from pasteurized skim-milk (0.05% fat, titratable acidity, 19°T) by addition of 0.06% CaCl₂; pre-heating to 58°C, heating to 91°C for 10-12 min, acidification to pH 5.3, washing the precipitate 3 times with water at 50°, 30° and 20°C respectively, pressing for 30 min with 10 kg/kg (?), comminuting to pass a 6 mm mesh, and drying in a drum drier with cold air for 30 min and air at 50-55°C for 4 h. The composition was (%): protein 79, ash 9.5, fat 1.5, lactose 1.5 and moisture 8.5.
Forsum, E., Hambraeus, L. & Siddigi, I.H.
Large scale fractionation of whey protein concentrates.

Gillies, M.T.
Whey processing and utilization. Economic and technical aspects (Book).

Comments
Large-scale fractionation of whey protein concentrates was performed by preparatory gel filtration. A prototype of a stacked column, KS 450, packed with Sephadex G-75 and equilibrated with 0,1 M phosphate buffer pH 6.3 was utilized. Both an ultrafiltered and a gel-filtered whey protein concentrate were fractionated into 3 different fractions, the protein composition of which was evaluated. By large-scale gel-filtration, \( \beta \)-lactoglobulin of high purity and preparations rich in \( \alpha \)-lactalbumin could be obtained in large quantities.

Information is arranged under the following headings:
(i) utilization versus pollution (pp. 3-23)
(ii) whey processing (including drying, fermentation and membrane processing) (pp 24-54)
(iii) proprietary processes for treating whey (including lactose removal, and spray and hot air drying) (pp 55-76)
(iv) properties and uses (including nutritional aspects, chemical problems, functional properties, and uses in human food and animal feeds) (pp 77-113)
(v) Patented processes for using whey (including animal feeds, confections, flavourings, edible yeast cell mass, whey beverages, dairy products and baked goods) (pp 114-207)

Company, inventor and patent number indexes are also provided.

Haggett, T.O.R.
Hydrolysis of lactic casein by proteolytic enzymes.

10% lactic sodium caseinate was 50% hydrolysed by 2 fungal enzymes: the fraction precipitated at pH 4.5 was made soluble with phosphoric acid, the remainder of the hydrolysate being treated with aminopeptidase and an adsorbent resin to reduce bitterness and off-flavours. Completely
Comments

acceptable fruit-flavoured acid beverages were made containing 0,5% of this hydrolysate, 0,5% of the acid-solubilized recovered "casein", 0,5% soluble whey protein and 0,05% guar gum.

Hill, R.D. & Zadow, J.G.

The complexing of whey proteins in HCl whey by carboxymethyl cellulose (CMC) has been studied. The efficiency of precipitation of CMC (the ability to form insoluble complexes with whey protein) increased with increasing degree of substitution (DOS) of CMC. The composition of the CMC-protein complex varied little over the range pH 2,8 - 4,0. Under optimum conditions for binding, the complex contained 61-68% protein and > 95% of the CMC originally in solution was precipitated in the complex.

Jaynes, H.O. & Chiang, C.T.

Kodjiev, A., Ratchev, R. & Panova, V.

Optimal conditions for obtaining protein hydrolysates of casein low Ca and high Ca coprecipitates using a mixture of pancreatin and an acetone precipitation from baker's yeast preparation were: pH 8,2 - 8,7, 65°C, 0,4% pancreatin, 0,2% yeast preparation, 16-18 DM, 6% Na₃P₂O₁₀, activated C treatment at 80°C before vacuum concentrate and spray drying. The dry hydrolysate contained 13-14% total N (80-85% amino-N) and could be used as a good component.
Kuipers, A.
(J.A. Meggle Milchindustrie)
Method of producing a milk protein concentrate.

Mellquist, C.O.
Proteins from dairy and slaughterhouse sewage.

Marshall, K.R.,
Kavanagh, J.A. & Parkin, M.F.
Ultrafiltration of acid casein whey.

Comments

Milk protein concentrate from which processed or natural cheese may be prepared without obtaining whey is produced by ultrafiltration of skim-milk which has been concentrated, preferably evaporated, while continuously supplying water to maintain the protein content of the filtrate constant. Finally the water content is adjusted by evaporation. The resulting concentrate is mixed with cream or other milk fat-containing emulsions, or enzymes and/or acidifying cultures, to enable the mass to thicken into cheese.

Proteins for human or animal nutrition were obtained by extraction of dried whey with glycerol and purification of the solid residue or by extraction of dried blood plasma or dried sewage sludge with propylene glycol, precipitation of the proteins from the solution with EtOH at -10°C, and purification of the precipitate.

Whey from casein, made by acidification of skim milk with Streptococcus cremoris starter was clarified, filtered and then treated in a batch process using Abcor tubular HFA180 membranes in a pilot or laboratory unit. The concentrate was spray-dried with or without previous pH adjustment. Whey protein concentrates with 35-85% protein in DM were produced. Spray-dried concentrations of high nutritional value (PER 3,2) were obtained, they were soluble in the pH range 2,5-10, had good whipping and foaming abilities, a high emulsification power and excellent heat setting and gelling characteristics.
Meggle, J.A.
Process for the production of a whey protein concentrate.

Moreno, V. & Lysak, D.A.
(General Foods Corp)
Method for producing heat and acid stable whey protein material.
US Patent 3 791 283 (1973)

Pompei, C. et.al.
Whey proteins purification by ultrafiltration and diafiltration.

Tucker, V.C. & Moss, D.C.
Freeze concentration of dairy products.

**Comments**

The process involves adjusting (preferably by cation exchange) the pH of whey or of a whey-buttermilk mixture to below the isoelectric point of the whey protein and subjecting the product to ultrafiltration, preferably at pH 2.5-3.3 and with heating to 40-65°C. The product may be used in the preparation of cakes, with curd fillings, special protein-rich foodstuffs, dips, salad dressings etc.

In one example a heat and acid-stable whey protein, suitable as an additive to acid beverages with a pH of 4.0 or below was prepared. The product contained (on dry basis) 67.3% protein, 13.2% lactose and 6.3% ash in addition to 0.77% Ca and 1.76% P. The product was incorporated successfully in grapes or orange flavoured beverages of pH 4.0 or below which were subsequently heat-treated and carbonated without adverse effects.

Pilot plant equipment was used for freeze concentration of milk, whey and milk-fruit beverages (500 kg/day). The concentrate being separated with a basket-type centrifuge. Optimum efficiency was attained by 2-stage treatment, removing approx. half the water content in each stage. Final concentration was 30% solids. Reconstituted product quality was good. Ice residue was melted to reclaim refrigeration.
1.4. Applications

Anon.  
(M.C.M. Klosterfrau, Vertriebsgesellschaft)  
Beverages and nutri-
ments and preparations  
for making them.  
British Patent  
1 379 582 (1975).  
Source: Food Sci. &  
Techn. Abstr.  
7(1975):6, P1421.

Bassi, R.K. &  
Sukumar, D.B.  
Protein enriched milk  
biscuits.  
J. Food Sci. Techn.  

Bouvy, F.A.M.  
Applications for lactase- 
treated whey.  
Food Prod. Dev.  

Chumachenko, N.A.  
Demchuk, A.P. &  
Roiter, I.M.  
Improving nutritional  
value of bread by addi-
tion of dried whey.  
Khlebopekarnaya i  
Konditerskaya Promysh-
lennost' 3(1974) p. 13-
15.  
Source: Food Sci. &  
Techn. Abstr. 7(1975):2,  
M229.

Groennip, A.H.M. van  
Possibilities for using  
milk protein in the  
dairy industry.  
Deutsche Milchwirtschaft  
25(1974):45  
Berl. Lebensmittel-Labor  
3, II-IV, VII-VIII.  
Source: Food Sci. &  
Techn. Abstr. 7(1975):2,  
P223.

Comments

The process according to 1 of  
the 3 examples given involves  
mixing whey protein suspension  
(1 kg in 3 kg water) with 666 g  
citric acid, freezing the mixture,  
granulating and freeze-drying it,  
and adding 333 g potassium bicar-
bonate at room temp. and normal  
RH (50-60%). On addition of  
water the dried product forms a  
suspension with vigorous forma-
tion of CO₂, giving a refreshing  
beverage without flocculation  
and containing readily assimil-
able protein.

The use of Na-caseinate in milk  
biscuits was studied.

The use of the enzyme lactase  
for lactose hydrolysis of  
lactose in whey was studied.

Addition of 2 or 5% dried whey  
to wheat dough improved the  
composition of the amino acids,  
flavour and substantially also  
the mineral content in the  
bread. The lactose present in the  
whey helps to keep the bread  
fresh and improves its appear-
ance.

After outlining the nutri-
tional value of milk proteins,  
the author deals in some de-
tail with uses of milk protein  
products for protein enrich-
ment of liquid milk and cul-
tured milks, and for improving  
the consistency of stirred  
yoghurt, and lists the various  
food products in which casein-
ates are used. Finally he
Gillies, A.J.,
Johnson, M.E.A. &
Reeves, R.K.H.
Dairy desserts made
with whey.
XIX Int. Dairy Congr.
Source: Food Sci. &
Techn. Abstr. 7(1975):5,
P1042.

Goldman, A. & Southward,
C.R.
Co-precipitates as food
ingredients.
XIX Int. Dairy Congress
Source: Food Sci. &
Techn. Abstr. 7(1975):5,
G259.

Guy, E.J.
Effect of cheese whey
protein concentrates on
baking quality and
rheological characteristics of sponge doughs made
from hard red spring wheat flour.
Cereal Sci. 19(1974):12,
p. 551.

Henselman, M.R.,
Donatoni, S.M. &
Henika, R.G.
Use of response surface
methodology in the
development of accept-
able high protein bread.
J. Food Sci. 39(1974):5,
p. 943-946.
Source: Food Sci. &
Techn. Abstr. 7(1975):4,
M502.

Bread was made with milk pro-
tein concentrate (MPC), soya
flour and fish protein concen-
trate (FPC) added to flour at
levels of 0, 4 and 8% to give
up to 20% additional protein.
15 bread samples (prepared
using different combinations
of the added proteins) were
analysed for loaf vol., spe-
cific vol., grain quality and
flavour. Bread made with

Lemon souffle and lemon dairy
whip of good quality were made
under laboratory conditions from
mixes incorporating sweetened
condensed whey instead of egg
album n, and it is suggested
that consumer trials be carried
out to assess the potential
market for these products.

The relationship between the
water absorption of coprecipi-
tates (Brabender farinograph)
and their application as food
ingredients was investigated.
It was shown that coprecipitates
with a wide range of water ab-
sorption characteristics can be
produced to meet a variety of
functions as ingredients in
foods (bread, pasta, savoury
snack products, meat products
etc.) their excellent nutri-
tional properties (PER 2.8)
make them particularly important
for protein supplementation of
foods of relatively low nutriti-
tive value.
either 7% MPC and 5% soya flour or 8% MPC and 4% soya flour had a min. soya character and a good balance between flour, yeast and milk flavours. FPC gave a bread with a fish flavour and was not tested further. A panel of 79 judges preferred the MPC/soya bread to a straight dough bread or one made with 6% added soya flour, the results show that high protein bread is acceptable if a suitable blend of added proteins is used.

Fluid sweet cheese whey, full fat soy flour, soybean oil and corn syrup solids, were combined, pasteurized, homogenized, condensed in vacuo to over 40% TS and spray dried or foam spray dried, yield a free flowing powder, readily reconstitutable with water to form a nutritious beverage with high protein content. A vitamin-mineral premix may be dry blended with the powder to increase the nutritional quality further. The formulation of the product is flexible and the taste quality readily lends itself to flavouring. The product shows good storage life and resists oxidative change in the dry state.

Soluble whey protein, as a liquid concentrate or spray-dried powder, was prepared by the ultrafiltration of lactic casein whey and incorporated in a number of food products. It is concluded that the protein, which has a good solubility (particularly at low pH) and high nutritional value, could be used for the fortification of acid beverages, confections and desserts or for partial replacement of egg white in many products.

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Production and properties of a nutritious beverage base from soy products and cheese whey.
IV Int. Congr. Food Sci. & Technol.

Humphries, M.A. & Marshall, K.R.
Food uses of soluble whey protein.
XIX Int. Dairy Congr.
**Humphries, M.H. & Sourthward, C.R.**
The use of rennet casein in food products.
XIX Int. Dairy Congr.
Source: Food Sci. &
Techn. Abstr. 7(1975):5,
P930.

Satisfactory bakery products were prepared using rennet casein (RC) in an insoluble form at a concentration of 3% of the flour as a substitute for dried skim milk, and a concentration of ≤ 20% of the flour for protein fortification. RC rendered soluble with sodium tripolyphosphate (6% by wt. of casein), could be used at 2-3.5% of product to wholly or partly replace dried skim milk or sodium caseinate in imitation milk, ice cream, and in coffee whiteners and whipped toppings in which RC showed satisfactory emulsifying properties.

**Igoe, R.S., Watrous, G.H. Jr., Koeny, P.G. & MacNeil, J.H.**
Utilization of cottage cheese whey in ice cream.
Dairy & Ice Cream Field
156(1973):5, p. 61-62,
66, 68.
Source: Food Sci. &
Techn. Abstr. 6(1974):11,
P1702.

The possibility of using cottage cheese whey in ice cream making was investigated in experiments involving the addition of i) acid or neutralized whey concentrate (29% TS) or ii) dried sweet whey to a standard ice cream mix containing 38,6% TS, including 10,1% fat, 10,2% cane sugar, 6,8% maize sweetener and 0,25% stabilizer. Organoleptic tests could not distinguish between ice cream containing 1% acid whey solids (8,9% or milk SNF) and control sample without whey; at the 2% level (17,7% of milk SNF) however the control was strongly preferred and at the 3% level (26,7% of milk SNF) the ice cream had unacceptable freezing characteristics. Better results were obtained with a neutralized product and at 2% 10 of 24 tasters could not distinguish it from the control.

**Kirk, D.J.**
Milk, and its replacers in baked foods.
Bakerst Digest 47(1973):
5, p. 76-79.
Source: Food Sci. &
Techn. Abstr. 6(1974):7,
P1016.

The use of dried skim-milk and milk by-products such as cheddar whey, cottage cheese whey, casein whey, and various whey blends in the production of bread, is discussed with reference to effects on the dough and bread characteristics and on the nutritional value of the product.
Neer, K.L., Plimpton, R.F. Jr. & Ockerman, H.W.
Bologna product characteristics as influenced by various sources and levels of cottage cheese whey.

Olsansky, C., Jetmar, M., Pazdersky, K., Havlickova, J., Bartosek, V. & Stary, M.
Possibilities of the use of caseinates in the dairy industry.

Osadchaya, N.T., Rakhmankulova, R.G., Asmaeva, Z.I. & Komlatskaya, V.M.
The effect of whey on the quality of bread and wheat flour dough.
Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya

Comments
3 whey protein preparations, containing respectively 0, 10 and 50% lactose each contained 26% carboxymethyl cellulose.
These preparations and dried cottage cheese whey were evaluated in Bologna products at 4 levels of 0, 3, 5, 7 and 10.5%.
Organoleptic and objective assessment showed that beef bologna containing spray-dried whey at a level of 3.5% to be at least as good as the all beef control.

The results of the studies on the use of sodium caseinate in dairy processing showed that (i) it did not improve the characteristics of whipping cream, (ii) it improved the consistency of and reduced serum separation in tvaroh produced using curd separators and in creamed tvaroh products, and (iii) in processed cheese manufacture it had favourable effects on structure and consistency of the finished products and partially replaced emulsifying salts. It is concluded that sodium caseinate in combination with other stabilizers and emulsifiers may find considerable application in the food industry.

Studies on the effect of added whey on the quality of wheat dough and bread are discussed. Addition of wheat dough and bread are discussed. Addition of whey resulted in increased titratable acidity and raising capacity of the dough, and improved the elasticity, crumb structure and crumb colour of the bread. No effects on the moisture content of the bread were observed.
Pfaff, W.
Hydrolysed milk protein for pastes and cooked sausages.
Source: Food Sci. & Techn. Abstr. 6(1975):10, S 1247

Comments
The technological advantages of using hydrolyzed milk protein in meat pastes and sausages are discussed. The improved emulsifying and water-binding capacity applies equally to high-fat, low-fat, pasteurized, and sterilized products. Some new spreads with varying fat and meat contents and medium-chain-triglycerides (for invalid diets) were more stable when containing milk protein than with non-protein emulsifiers.

Pfaff, W.
Hydrolysed milk protein for Frankfurter type sausage (Brohwrust).
Fleischwirtschaft 54(1974):1, p. 47-50

Use of hydrolyzed milk protein (HMP) in meat processing is discussed, and methods of evaluation of the emulsifying capacity of commercial products are discussed. Inclusion of 2% HMP, in Frankfurter-type products permitted the use of processing methods used for manufacture of white sausages (e.g. use of little or no nitrite, and pasteurization at 80°C). Flavour defects can be modified by spicing. The high heat conductivity of HMP enhances decomposition of nitrate residues. Brine from canned sausages contained < 0.005% HMP, showing that HMP becomes firmly bound to the meat protein during emulsification and sterilization.

Romanskaya, N.
Kalmysh, B.
Whey concentrate for non-alcoholic beverages.

The process involves the use of whey proteins in the form of a soluble heat-stable proteose-peptone fraction and amino acids, produced by suitable proteolytic enzymes which are subsequently inactivated at > 80°C; the product is partially neutralized, clarified, and concentrated 4-8 times. Natural syrups and flavourings are also added. Beverages prepared from the concentrate had a high nutritional value, very good flavour and appearance, and were further improved by carbonation.
Rund, K.F.
Viscous hydrolysed milk protein in meat processing.

Comments
The composition, nutritional value and characteristics of viscous hydrolysed milk protein and high-viscosity hydrolysed milk protein are discussed, with special reference to their use as emulsifiers, as water-binding agents and for prevention of separation of fat and jelly in sterilized sausages. Use of hydrolysed milk proteins in various boiling sausage, liver sausage and jelly products is discussed, with reference to the necessary modifications to recipes and processes.

Slanovec, T.
Utilization of whey for manufacture of Boninjska Skuta cheese.

Zurzul, D. et al.
Technological value of emulsifiers based on milk proteins and soy proteins in semi-dry sausage and cooked sausage manufacture.
2. Blood

Bates, R.P., Wu, L.C. & Murphy, B.
Use of animal blood and
cheese whey in bread:
nutritive value and
acceptance.
J. Food Sci.
Source: Food Sci. &
Techn. Abstr.

Comments
Breads in which water and dried
skim-milk were replaced with un-
refined pork blood and/or Cottage
cheese whey were compared with
commercial white bread and an
"organic" whole wheat bread. The
bread mixes contained up to 32%
whey or blood. Loaves were
evaluated for appearance, com-
position and acceptance. Rat
feeding studies in which the
breads contributed about 10%
protein to otherwise complete
diets indicated no significant
differences in growth performance
(adjusted protein efficiency
ratios) between commercial and
"organic" bread. Significantly
better performance was obtained
for loaves containing blood,
whey or blood-whey mixtures.
The experimental loaves were
comparable in acceptability to
commercial breads, although
loaf volumes were much lower
and crumb texture coarser.

Berezenko, A.M.
Effect of blood plasma,
some milk products and
a proteolytic enzyme
preparation on cooked
sausage quality.
Trudy, Ukrainskii
Nauchno-Issledovatelskii
Molochnoe Promyshlennosti
Source: Food Sci. &
Techn. Abstr. 7(1975):6,
S871.

Berezenko, G.M., Klepach,
L.A., Nikolaenko, A.F. &
Yavorslii, M.I.
Macro- and trace element
composition of boiled
sausages containing
supplementary blood
plasma and milk.
Kharchova Promislovist'
No 5(1973) p. 40-42.
Source: Food Sci. &
Techn. Abstr. 7(1975):6,
S750.

To improve the nutritive value
of dietetic sausages of the
USSR market, e.g. the low-fat
"Doctor's" sausage, tests with
inclusion in the recipe of (i)
dried skim-milk, (ii) Yaroslavl' cheese (iii) blood plasma and
(iv) butter were carried out.

The supplements of milk and blood
plasma proteins improved macro-
and trace element composition of
the products (especially by in-
creasing the contents of Ca and
P) and thus increased their bio-
logical value.
Cironeanu, I., Daniel, G. & Dragulici, D.
Production of blood plasma and its use in the meat industry.

Delaney, R.A.M. & Donnelly, J.K.
Proteins isolated from slaughter animal blood.
IV Int. Congr. Food Sci. & Technol.

Comments
The production of blood plasma is described "Parizer" or "Salam italian" sausages made with addition of 6% plasma were of fully satisfactory quality, and use of 10% plasma in other similar sausages is recommended.

Delaney, R.A.M., Donnelly, J.K. & Bender, L.D.
Concentration and characterization of porcine blood plasma.

This investigation was conducted to recover the valuable protein from animal blood in a form suitable for human consumption, i.e. free from undesirable colour, odour and flavour. Whole pig blood was separated in serum plasma and a haemoglobin fraction. The plasma was ultrafiltered and 4x concentrated. The concentrates were spray dried (<170°C) to yield powders containing 80-90% protein with < 10% denatured and an excellent amino acid profile. Protein solubilities of 100% were obtained between pH 3 and 10 and emulsification properties were superior to those of soy bean, skim milk and whey concentrates.

Using standardized operating conditions for ultrafiltration, pig blood plasma was concn. to 2,3:1, 3,7:1 and 4,0:1 vol. concn. ratios in 3 separate experiments. The conc. solutions were spray-dried directly at an air inlet temperature of 170°C and an outlet temperature of 75°C. The plasma protein concentrates designated PPC1, PPC2, and PPC3, contained 76,2, 86,6 and 88,5% protein respectively, on a dry weight basis. Ultrafiltration effected a 55% reduction in the mineral levels in the plasma concentrates. Plasma powders from the ultrafiltration concentrates exhibited protein solubility in water of about 100% in the pH range 3-10.
Halliday, D.A.
Blood - a source of proteins.

Comments

Dried plasma from blood is imported into the UK and used as a protein booster and stabilizer in meat products. It is suggested that processing plants attached to slaughterhouses in this country be used for this purpose, thus reducing import costs. Details of slaughtering and collection, and separation and storage of plasma and the red cellular fraction are considered. Utilization of the albumin as a meat stabilizer, and of the red cellular fraction to improve meat colour, in the horticultural and agricultural industries, is discussed.

Schuler, R.

Comments

The food prepared by separating from very finely beaten, fresh, uncoagulated blood the fibrin content, which is then washed with approx. 0.7-1.0% cooking salt solution, having an osmotic pressure corresponding to that of the blood, while continually stirring. The solution is removed, the fibrin is comminuted, preferably mechanically, spread on nets, sieves etc. for 1h to remove any residual solution, then frozen. To prepare spices e.g., yeast extract and autolysate are added, and optionally pigments, e.g. dried beetroot juice. The food may be used in meat dishes such as dumplings, sausages, meat fillings, gravy etc.

Tybor, P.T.
The properties of protein isolates prepared from slaughter animal blood.
Order No 74-1059.

Comments

Plasma and globin protein isolates were prepared from whole bovine blood. The powdered isolates were white, free-flowing, of good microbiological quality and contained 90% protein. Solubility, emulsification capacity and foaming properties indicate that the isolates may be useful in a variety of food processes.
Tybor, P.T., Dill, C.W. & Laudmann, W.A.
Effect of decolorization and lactose incorporation on the emulsification capacity of spray-dried blood protein concentrates.

Blood protein concentrates were prepared from the serum and decolorized haemoglobin fractions of bovine blood. The emulsifying capacity was dependent on protein concn. and was not affected by spray drying. However, when the serum protein fraction was subjected to the decolorization treatment, its emulsifying capacity was reduced. Lactose, when added to the serum proteins prior to spray drying, prevented this reduction.

Tybor, P.T., Dill, C.W. & Laudmann, W.A.
Functional properties of proteins isolated from bovine blood by a continuous pilot process.

Slaughter animal blood yields two distinct protein isolates, the plasma and globin. Protein accounts for better than 90% of each isolate weight. The proteinaceous material is a source of all the essential amino acids but the globin is limited by low levels of isoleucin and methionine. The solubility of the plasma isolate proteins was dependent upon spray drying conditions while the globin proteins were essentially unresponsive to the same drying treatments. Both isolates are excellent emulsifiers and good foaming agents under optimum conditions of protein concentration and pH.

Young, R.H. & Laurie, R.A.
Utilization of edible protein from meat industry by products and waste. II The spinning of blood plasma protein.

Spun proteins which may be acceptable as meat analogues have been fabricated from bovine blood plasma. It was found that plasma protein initially concentrated by partial freeze-drying, could be converted into a suitable form for spinning by denaturation with alkali followed by the addition of weak acid to effect stabilization of the resulting high viscosity solution. A method for producing textured plasma protein on a laboratory scale is described, together with some of the properties of the resultant products.

A mean analysis of the fibres was: 17.3% protein, 73.3% moisture and
Comments

8.6% ash. The fibres appeared to possess reasonable binding capacity and elasticity.
3. Other products from the food industry

Anon. (Union Laitere Vaudoise) Method of producing an animal protein hydrolysate which may be used for food purposes. Swiss Patent 545 596 (1974).

Animal protein hydrolysate is prepared by mixing water, pure HCl (sp.gr. 1.17) and animal protein, e.g. albumin in a wt. ratio of approx. 9:13:10, heating the mixture for several h, neutralizing it with a lay, e.g. Ca(OH)₂, and filtering and drying it. In a preferred embodiment a mixture of 62 parts by wt water, 92 parts by wt HCl and 70 parts by wt casein is cooked for 18-20 h, cooled to 28-32°C while gradually adding 105-115 parts by wt NaOH in the form of a 30% aqueous solution to adjust pH to 6.5-6.7 further cooled to 15-25°C, filtered and dried. By this method, reactions are readily controlled and an end product of uniform composition is obtained.


Proteins were extracted from the keratinous material of poultry feathers with a refluxing aqueous solution of N,N'-dimethylformamide (DMF), then precipitated from this extract and washed with water or methylene chloride. Some physical and chemical properties of the isolates were examined to determine the effects of isolating conditions on product quality. The most predominant amino acids in the isolates were serine, glutamic acid, proline, glycine, valine, leucine and arginine. Cysteine was high only with mild DMF extraction. Methionine, histidine and lysine were consistently low in terms of a well-balanced nutritional protein. Maximum solubilities of the protein isolates occurred between pH 8 and 12 and minimum solubilities between pH 4 and 6. Heating an isolate to 60°C with wet or dry heat produced no observable protein denaturation. At higher temperatures, protein solubility decreased more rapidly with wet than dry heat.
Gabor, M.
Utilization of industrial food wastes of animal origin in the form of protein hydrolysates.
Elelmez, Ipar.

Mitsyak, V.E.
Konyushenko, N.F. & Pshenichnaya, E.P.
Enzymic hydrolysis of meat or offals in production of dietetic and remedial foods.
Trudy, Ukrairskei Nauchno-Issledovatel'skii Institut Myasnoi i Molochnoi Promyshlennosti No 2, I(1972) p. 60-63.
7(1975):6, S771.

The raw material is minced, extracted twice with water (extracts being filtered off) and treated 4x with enzyme preparations (dried extracts from pig or ox pancreas and/or Bacillus subtilis preparation) treatment lasting each tim 2 h at 40°C, the enzyme being inactivated and the liquid hydrolysate filtered off. Extracts and hydrolysates are mixed, and either evaporated with 20-30% moisture, or dried to 8-10% moisture. Data on contents of essential amino acids, N, fat, ash, carbohydrate, protein N, and free amino acid N in the products are available, the use of the hydrolysates in production of various dishes are outlined.

Whitmore, R.A. & Jones, H.W.
Collagen dispersions
7(1975):5, G278.

A viscous collagen dispersion capable of forming a gel which will not melt upon prolonged boiling in water is heated and combined with cooking oil to form an emulsion. The emulsion is then cooled to produce a firm proteinaceous product which may be used as a substitute for meat products such as bacon.

Young, R.H. & Lawrie, R.A.
The recovery of edible protein from meat industry waste.
7(1975):5, G311.

Improved utilization of protein from meat wastes, specially blood plasma, lung and stomach tissues was studied. Conc. blood plasma protein was modified by alkali plus acid treatment to a viscous form which was spun in the laboratory to a meat analogue.
Young, R.H. & Lawrie, R.A.
Utilization of edible protein from meat industry by-products and waste.
I. Factors influencing the extractability of protein from bovine and ovine stomach and lungs.

Comments
Data concerning the effect of pH, salt concentration and temperature on the extractability of protein from meat waste tissues is presented. The tissues investigated so far include bovine and ovine stomach and lungs. It appears that native proteins can be recovered in quantity from these tissues at room temperature over a wide range of pH values using solvents of low salt concentration (e.g. 0-0.01 M NaCl). Protein isolates have been characterized and compositional differences detected using polyacrylamide gel electrophoresis incorporating sodium dodecyl sulphate.
D. OILSEED PROTEINS

1. Discussions of and comparisons between different oilseed proteins

Auerswald, W.
Consideration of nutritional requirements in the introduction of new protein sources.

Bombal, J. et al.
Concurrence of conventional proteins and non-conventional proteins.

Burrows, V.D. et al.
Food protein from grains and oilseeds. A development study projected to 1980.

Cater, C.M. et al.
Aqueous extraction - an alternative oilseed milling process.

Comments

After a brief discussion of methods for evaluation of the nutritional value of proteins, various factors of importance in evaluation of the nutritional value of new protein sources are discussed, including amino acid composition, complementation of different proteins, and the possible presence of mycotoxins, trypsin inhibitors, or other toxic materials.

The present and future uses of oilseed proteins, primarily from soybeans, in meeting world protein needs are reviewed with 41 referents.

The report is divided in 5 sections:
1) Human and animal usage of plant protein.
2) World and Canadian protein demand and supply.
3) Present and future trends in plant breeding and protein technology.
4) Economic aspects of protein production and utilization.
5) Regulation, sociological, technological, economic, and biological constraints on the production and usage of concentrated seed proteins.

The aqueous extraction process is designed for the simultaneous recovery of oil and protein concentrates from fresh coconuts and ground-nuts.
Demeczky, M. & Szigeti, Z. 
Production of food protein concentrates and isolates from oil seeds. 
Elemezési, Ipar. 

Fauconneau, G. 
The contribution of agricultural research to the fat industry. 

Hanson, L.P. 
Vegetable protein processing. 
Food Technology Review, Noyes Data Corporation, No. 16. 
(Ed. Noyes Data Corp. Park Ridge, New Jersey, USA 1974) 

Jones, J.J. 
Impact of vegetable proteins on dairy proteins. 

Lin, M.J.Y. et al. 
Quality of wieners supplemented with sunflower and soy products. 

A literature survey is given about the composition of extracted oil seed grits and on the production pattern of oil seed flours, protein concentrates and isolates. The application possibilities for meeting partially food protein requirements are outlined.

Research at INRA on production and quality of oilseeds and nutritional value of protein products from oilseed cakes is reviewed.

This book is based on US patents relating to the processing of proteins of vegetable origin (soybean, cottonseed, grain, and others).

Milk analogous based on soy protein, peanut protein, and coconut protein and cheese analogous based on soya and peanut protein are discussed.

6 experimental lots of wieners were prepared, which contained soy flour, soy concentrate, sunflower flour, two sunflower concentrates and a sunflower pH-activated concentrate. The sausage emulsions were evaluated by emulsion stability; the processed wieners were judged according to shrinkage, colour, peelability, firmness and cooking properties while the quality of the cooked wieners was determined by their organoleptic characteristics.
Manetia, I.S. & Tamhane, D.V.
Protein propagation through processed potatoes.

McCleary, C.W.
Vegetable proteins part 2.

Milner, M.
Protein-fortified cereal foods for developing countries.

Rege, D.V.
Toxic factors in oilseeds and proteins.

Roy, D.N. & Bhat, R.V.
Trypsin inhibitor content in some varieties of soya bean (Glycine max. L.) and sunflower seeds (Helianthus annuus L.)

Sambucetti, M.B. et al.
Protein enrichment of wheatflour in bakery products.

Comments
The processing of potatoes as dehydrated granules for the preparation of instant mashed potato is discussed with special reference to their fortification with soybean protein, cottonseed protein, groundnut protein, leaf protein or single cell protein.

The author discusses the application of vegetable proteins in the baking and confectionery industries and the nutritional value of these proteins. Possible alternatives to soya proteins such as derivatives of sunflower, rapeseed, and field peas are considered.

Low-cost wheat and other grains have suddenly disappeared from the surplus category in world market. One possibility for coping with this problem is to extend the scarce grain supply by admixture of starchy flours and oilseed protein concentrates.

The distribution of the following toxic and anti-nutritional factors in oilseeds is discussed: Trypsin inhibitors, phytohemagglutinins, goitrogenic agents, goitrogenic thioglucosides, cyanogenic agents, and gossypol.

The protein, fat, and moisture contents and the trypsin inhibitory activities of some varieties of soya beans and sunflower seeds are given. It is suggested that seeds having adequate amounts of fat and protein but free from trypsin inhibitor should be cultivated.

A composite flour containing soyflour and defatted sunflower seed was used to prepare seafood biscuits and crackers. NPU, available lysine and S-containing amino acids were determined.
Shigetoshi, M. et al.  
Process for treatment of oilcontaining seeds.  

Oilseeds containing a substantial amount of un-denatured protein is subjected to grinding under wet milling conditions in the presence of methanol, ethanol or acetone. The solids are separated into a fine particle fraction high in un-denatured protein and a coarse fraction high in fiber.

Staron, T.  
Legumins or non-conventional proteins in human nutrition: proteins from oily and leguminous seeds.  

The author discusses nutritional value, anti-nutritional factors, manufacture of flours, concentrates and isolates and possible ways of using non-conventional proteins from oily and leguminous seeds.

Tomas, B.  
Protein products of oil seeds and their application in meat industry.  


A review is given on vegetable proteins (esp. oilseed proteins) in human nutrition. Meat substitutes and extenders, and some pure oilseed products are discussed.

Weber, K.  
Verfahren und Vorrichtung zur Gewinnung von Öl- saatenschrot en mit differenzierten Anteil an wasserlöslichen Proteinen.  

In the conventional processing in oil mills the quality of the proteins is strongly impaired during desolventization. A new process for desolventization and the corresponding equipment relieves those problems and enables to adjust the level of water soluble protein in the meal.

Woodham, A.A.  
The effects of processing on the nutritive value of vegetable-protein concentrates.  

The protein quality of meals from soya-bean, ground-nut, cottonseed, and cruciferous oilseeds is discussed.
2. Soy proteins

2.1. Reviews


Comments

This is a review article dealing with some current aspects of interest about soybeans – nutritional value, use of soybean products as meat extenders, and government regulations.

Books, review articles, and patents since 1965 regarding unconventional proteins are listed. The booklet also refers to abstract journals, bibliographies, and periodicals that contain information on the subject.

This review from the World Soy Protein Conference in Munich 1973 discusses the expected scarce of animal protein in the future and how soy proteins instead could be used for overcoming this scarcity.

The use and market for soya beans are discussed.

In discussion the technology of vegetable protein foods, consideration is given to: primary products (the form in which they are harvested), secondary products (derived from primary products but used for further manufacturing), and tertiary products (intended for direct human consumption).

Based on the literature the manufacturing of textured proteins is described.
2.2. Treatments of soy proteins with heat, freezing, or enzymes

Hashizume, K. et al.  
Changes in the properties of soybean protein by freezing.  
IV. Production of new textured protein by freezing.  

Hashizume, K. et al.  
Changes in the properties of soybean protein by freezing.  
V. Improved production of new textured protein by freezing.  

Kudryavtseva, R.M. et al.  
Improving the quality of acid protein hydrolysates by using raw materials with a low carbohydrate content.  

Okubo, K. & Shibasaki, K.  
Food chemical studies on soybean proteins. XII. Effect of pH and heating on the solubility of water extracted protein.  

Comments

When a soybean protein solution is frozen and stored, the protein solution becomes insoluble on thawing. The insolubilization is promoted by the presence of free SH-groups in the protein, heat denaturation, and addition of small amount of urea before freezing. The article is written in Japanese with an English summary.

The effects on SH-contents after addition of CaCl₂ and Na₂SO₃ were studied as well as the influence of freezing rate on the quality of the textured protein. The article is written in Japanese with an English summary.

In order to improve the biological value of acid protein hydrolysates, the protein material must be hydrolyzed and the melanoid reaction kept to a minimum. This can be achieved by using the raw material after the carbohydrates have been removed. The raw material is first boiled with weak HCl, or treated with amylolytic enzymatic preparations. It is possible to remove 25% of the saccharides from soybean meal with HCl and 13% with enzymatic preparations.

The effects of heating on the solubility of water extracted protein at various pH was studied. The article is written in Japanese with an English summary.
Taira, H.
Heat destruction of amino acids in soybean products.

Yoshioka, K. & Kohda, Y.
Comparative studies on texture of textured vegetable protein and pork under several conditions.

Comments

The amino acid composition of the following soybean products are tabulated: mame-miso, natto, tofu, kori-tofu, aburaage, yaba, and kinako. The changes in amino acid composition after heating at different temperatures during different times were investigated.

Effects of pH and heating temperature on the texture of textured vegetable protein and pork loin were studied. The article is written in Japanese with an English summary.
2.3. Functional properties

Ehninger, J.N. & Pratt, D.E.
Some factors influencing gelation and stability of soy protein dispersions.

Ishino, K. & Okamoto, S.
On the appearance conditions of viscosity, spinnability and gel forming ability of alkaline dope solution of soybean protein.

dee Man, J.M. et al.
Coagulation properties of soybean milk.

van Megen, W.H.
Solubility behaviour of soybean globulins as a function of pH and ionic strength.

Miller, W.M.
Mechanical behaviour of two-phase fibrous systems as related to meat analogues.

Modić, P. et al.
Examination of textured vegetable proteins for absorption of water, fat, bouillon and water-fat system.

Comments

The study is concerned with investigations of gelling at concentration of soy isolates and at pH values which are feasible in a food system. Furthermore, the effects of addition of low levels of NaCl and different sugars were studied.

Viscosity, spinnability, and gel forming ability of alkaline solutions of soybean protein under high protein concentrations and high pH-values were studied. The article is written in Japanese with an English summary.

The coagulation properties of 55 samples of soybean milk with CaSO₄-solution as coagulant were studied.

The solubility behaviour of partially purified soybean globulins as a function of pH of dispersing medium was investigated.

Details are given of studies on the mechanical properties (dynamics compressive modulus, creep shear modulus, rheological properties) of meat analogues, using 2-phase egg albumen - soy protein fibre and silastic rubber-cotton thread model systems.

Textured soy proteins can absorb liquids in quantities which can increase their original weights up to 3.5 times. Fat absorption may be increased, but a substantial increase can be gained only in conjunction with addition of an emulsifying agent.


Comments

The study dealt with the effect of different factors on the hydration properties of textured vegetable proteins, which determines their use in foodstuffs production. These factors are: the grade of grinding, structure, water temperature and the presence of Ca$^{2+}$ and Mg$^{2+}$.

Soya protein isolates have good emulsifying properties in water/oil emulsions or in the more complex emulsions found in minced meat. They also show good water binding, fat binding, gelling, and viscosity control, which can be of value in sausage emulsions.

In order to investigate expansion characteristics of soybean protein gels, the effects of temperature, pH, ionic strength, coagulant, and protein component were studied.

Tensile strain of the heat-induced gel, water binding capacity, gel-forming properties, and emulsifying capacity for 7S and 11S protein fractions were investigated.

The article is written in Japanese with an English summary.

The conditions of film formation, stress, strain, and other properties of the films were studied. It seemed that SH/SS reactions were concerned with the strength of the films.

The article is written in Japanese with an English summary.

Effect of cathode-ray irradiation on the rheological properties of soybean protein solution was investigated by a RM-500 Rheometer.
2.4. Flavour

Bedenk, W.T. & Purves, E.R.

Beyeler, M. & Solms, J.
Interaction of flavour model compounds with soy protein and bovine serum albumin.

Goossens, A.E.
Protein food - its flavours and off-flavours.

Hashida, W.
Flavour potentiation in meat analogues.

Iwabuchi, S. & Shibasaki, K.
Studies of the aroma of miso.
II. Characterization of neutral and acidic compounds.

Roozen, J.F. & Piunik, W.
Improvement of the acid solubility of soy proteins by enzymic hydrolysis and its influence on their taste properties.

Comments

The flavour of ready-to-eat breakfast cereals containing soy protein is improved by incorporation of 2% NaHCO₃.

The interactions of model flavour compounds with soy protein isolate and with bovine serum albumin were investigated by a dialysis equilibrium method in aqueous systems.

The chemical composition of off-flavours found in soya protein and raw materials used for flavouring fabricated meat products are considered.

The topic is reviewed under the following headings:
1) vegetable protein products,
2) chemical condiments,
3) flavours in natural meats,
4) flavouring in simulated meats.

Aroma concentrates were prepared from miso by steam distillation followed by ether extraction. 33 peaks in neutral fraction and 5 peaks in acidic fraction were detected by gas chromatography.

The article is written in Japanese with an English summary.

This study was made to test the ability of 17 commercial proteolytic enzyme preparations to increase acid solubility of soybean proteins. Acid soluble hydrolysates with tolerable taste were obtained with some of these enzymes. A hydrolysate could be improved in taste by action of a second enzyme.
Wang, L.C. et al.
Apparent odor thresholds of polyamines in water and 2% soybean flour dispersions.

Wolf, W.J.
Lipoxygenase and flavor of soybean protein products.

Comments

Apparent odor thresholds of putrescine, cadaverine, spermidine, and spermine were determined in water and in 2% soybean flour dispersions.

A review is given on the evidence that lipoxygenase is responsible for undesirable flavors in soybeans. Processes that are used for inactivating lipoxygenase are described.
2.5 Soy flours, concentrates, and isolates

Alden, D.E.
Soy processing: From bean to ingredients.
J. Am. Oil Chemists' Soc. 52(1975):4, p. 244A-248A.

Anon.
Frozen textured vegetable protein is flavored to simulate meats.

Bernadini, E. & Bernadini, M.
Industrial scale equipment for the production of protein superconcentrates from seed meals.

Frazeur, D.R. & Huston, R.B.
Ger. Offen. 2,301,654

Goldschmiedt, H.
Soya proteins in food.

Harper, J.M. & Lorenz, K.
Production and evaluation of salt bed roasted full-fat soy flour.

Comments

This article deals with bean preparation, oil extraction, meal handling, and conversion of the meal into food ingredients. Soy flour, soy concentrates, soy isolates, and modified protein products, such as spun fibres and textured vegetable products, are covered.

The use of a frozen textured vegetable protein (Bontrae) flavoured with chicken, ham, and beef flavour is shortly discussed.

A commercial method of processing soya meal is described by which 90% superconcentrate and 30% protein soya meal can be obtained. Plant engineering problems are examined.

Protein material of 75% H₂O-solution and containing ≥ 25% denatured proteins was manufactured from aqueous suspensions of defatted soybean protein by filtration of H₂O-insoluble components and reverse osmosis of the liquid.

The manufacture and use of soy flour, soy protein concentrate, and isolated soy protein are described.

A full-fat soy flour is produced by roasting in a heated bed of salt followed by cooling and grinding.
Hayes, N.
Experiments with soya protein.
Food Proc. Ind.

Ionescu, I. et al.
Industrial production of some soya-bean protein derivatives.

Milligan, E.D. & Suriano, J.F.
Improved system for bulk meal storage.
J. Am. Oil Chemists' Soc.

Milligan, E.D. & Suriano, J.F.
System for production of high and low protein dispersibility index edible extracted soybean flakes.
J. Am. Oil Chemists' Soc.

Mousseri, J.
Processing conditions for and quality of soybean meal suitable for direct food use.

Okamoto, S. & Matsuura, K.
On decrease of redispersibility of dried soybean protein powder during storage period.

Comments
The manufacture of full fat soya, defatted soyas, special fine flour, toasted defatted soyas, concentrates, and isolates is shortly described.

Experiments on production of protein concentrates from soya beans are described. The procedure chosen consists of treatment of soya grits with NaOH, concentration of the extract to 25% dry matter, spray drying, packaging and storing.

A system was installed for bulk storage of soybean meal and operated in a manner designed to eliminate the problems commonly associated with such storage, such as hangups and damage to tank due to dropping of arched meal.

A standard flash desolventizing system has been combined with horisontal agitated meal stripping and cooking vessels operating at atmospheric pressure to provide an integrated system for the production of high, intermediate, or low protein dispersability index edible soybean flakes from extracted solvent-wet flakes.

The objects of the study were to determine the optimum processing conditions for obtaining soybean meal suitable for food use, and to evaluate the meal for its chemical, physical, nutritional and organoleptic properties.

During storage of dried soybean protein powder the protein sometimes is insolubilized during the storage. It was concluded that this probably was due to interactions of protein molecules by SH-groups or hydrophobic groups.


**Comments**

The protein isolated had a slightly greater antitrypsin activity, a higher urease activity, and a lower saponin content than the best commercial isolate. Low denaturation of proteins was confirmed by electrophoretic analysis.

This article deals with the extraction of objectionable flavors and inactivation of TI activity in raw hexane-defatted flakes by using a combination of processes (hexane: ethanol azeotrope extraction and live steam) to improve flavor and enhance nutritive value further.

Soybean protein used as a binder in ham or sausage processing was prepared by adding acid to defatted soybean milk to separate the protein from the whey, adjusting the pH, neutralizing, and heating followed by drying.
2.6. Gels and traditional Asian foods prepared from soybean

Aonuma, T. et al.
Method of preparing soy and miso-paste.
U.S. Patent 3 764 708

Iljas, N.
Development and quality of soybean-based food-tempeh.

Saio, K. et al.
Food use of soybean 7 S and 11 S proteins. Extraction and functional properties of their fractions.

Saio, K. & Shiratori, M.
Expansion property of soybean protein gel in different salt solutions.

Wang, H.L. et al.
Acid protease production by fungi used in soybean food fermentation.

Winson, A. & Hampson, E.J.
Protein-containing foods.
Brit. Patent 1 356 363

Wu, L.C. & Bates, R.P.
Protein-lipid films as meat substitutes.

Comments

The method of preparing soy and miso-paste of high quality comprises treating soybeans and/or carbohydrates with a current of superheated steam at specified pressure and temperature.

One part of fresh tempeh was mixed with two parts of chilli sauce and 2 parts of tomato sauce, and cooked for 10-15 min. The flavour acceptability of the product was good.

The behaviour of soybean 7 S and 11 S proteins when precipitated with Ca is described and discussed.

Gels like tofu were heated at 132°C and soaked in different salt solutions. The texture, expansion ratio and colour were extremely influenced by characteristics of salt solutions used. The article is written in Japanese with an English summary.

Growth conditions for maximum protease production by Rhizopus oligosporus, Mucor dispersus, and Actinomucor elegans, used in Oriental food fermentations, were investigated using three substrates (wheat bran, wheat, and soybeans).

An aqueous homogenate of soybeans was subjected to 3-stage lactic fermentation and the resultant curd pressed to remove liquid and either salted and stored to produce a cheese-like product or treated with beef or fish flavors.

A device is described, with which a protein-lipid film (yuba) on the surface of a heated soy milk solution is semi-continuously formed.
2.7. Textured soy proteins

Anon.
Frozen textured vegetable protein is flavoured to simulate meats.

Chiang, J.P.C. & Sternberg, M.
Physical and chemical changes in spun soy protein fibres during storage.

Cole, S.J.
Simulated meats from soy proteins.

Farmer, M.
Matching an unconventional product to traditional taste preferences.

Kneer, H.D. & Deceoek, A.
Texturiertes Sojaprotein in der Grossverpflegung.

Modic, P. et al.
Basic characteristics of textured vegetable proteins.

Modić, P. & Predović, I.
Principles of production and basic characteristics of textured vegetable proteins.

Comments

A hospital, which utilizes textured vegetable protein, claims nutritional superiority and cost savings over meat, as it does not contain any cholesterol and has 55% protein compared with 20% protein in beef.

The number of sulfhydryl groups decreases with storage time due to oxidation. EDTA and ascorbic acid will retard the aging of soya fibres by preventing the catalytic oxidation of sulfhydryl groups.

Flow diagrams for manufacturing of soy protein isolate, soy protein concentrate, and textured protein filaments are given.

An acceptability test of a chili containing textured soy protein instead of meat is shortly described. Some problems concerning the labelling of the product is discussed.

The use of textured soy protein as a replacement for meat is discussed. Some formulations of foods that contain soy protein and is intended for catering is given.

The basic properties of textured soy proteins are described (i.e. physical and chemical properties and biological and nutritive values).

The basic principles of productions and the most essential characteristics of textured soy protein are shortly described.
Schmitt, E.E.
Soy whey protein.

Schutz, H.G.
Textured proteins:
Consumer acceptance and
evaluation considerations.
Cereal Sci. Today

Spillane, P.A.
Texturized vegetable pro-
tein.
Food Progress 2 (1974): 8,
p. 2.
From: Food RA Abstracts

Trumić, Z. et al.
Determination of quality
properties of textured
vegetable proteins.
Tehnol. Mesa 14 (1973): 11
p. 376-377.

van der Ven, B.L.
Extrusie van Soja-Eiwit
en Textuurmetingen.
Voeding 36 (1975): 3, p. 149-
156.

Wood, P.S. & Franklin, J.E.
Texturized soya proteins.
p. 32-33.

Comments

A fibrillar soy whey protein
complex is produced by contacting
soy whey with a polysaccharide
solution containing carrageenan at pH 3.85-4.35 with
stirring.

The author discusses consumer
attitudes against textured protein
products and compares consumer
acceptability tests and
laboratory difference tests.

The impact and future use of
textured vegetable protein,
and the importance of plant pro-
tein compared with animal pro-
tein are briefly discussed.

Textured soy proteins have the
following indices controlled:
protein content in dry matter,
fat, ash, NaCl, glucides, total
number of bacteria, hydration
ability, organoleptic proper-
ties and number of thermophilic
bacteria.

The manufacturing of extruded
soy proteins is described.
Measurements of texture and
rehydration degree of extruded
protein have been performed.

The authors review the use of
textured soy proteins with re-
gard to manufacture, nutritional
aspects, applications in food
products, and legislation.
2.8. Soy proteins in cereal products

Bean, M.M. et al.
Status of high-protein bread flours for government purchase.

Christianson, D.D. et al.
Xanthan gum in protein-fortified starch bread.

del Valle, F.R. & Perez-Villaseñor, J.
Enrichment of tortillas with soy proteins by lime cooking of whole raw corn-soybean mixtures.

Dutescu, F. et al.
Effect of soya flour addition in dough making.

Henselman, M.R. et al.
Use of response surface methodology in the development of acceptable high protein bread.

Hoover, W.J.
Use of soy proteins in bakery products
J. Am. Oil Chemists' Soc. 52(1975):4, p. 267A-269A.

Comments

The properties and use of three different protein fortified flour blends developed for nutritional aid programs are described.

Xanthan improves the cohesion of starch granules and produces a bread-like structure comparable in appearance, mouthfeel, loaf volume, and staling to most commercial breads. Fortifying these starch-xanthan breads with soy protein is possible.

The traditional method for making corn tortillas was applied to whole raw corn-soybean mixtures. This method of enrichment gave tortillas with significantly higher protein content and protein quality than normal unenriched tortillas.

Different amounts of soya flour were added to wheat flour, and Farinograph, Amylograph and Extensograph values of the different doughs were determined. The results show that ≤ 15% soya flour may be added to wheat flour without affecting its biscuit-making or pasta-making properties.

Optimum levels of combinations of milk protein, soy protein, and fish protein were determined to produce a consumer acceptable bread with a protein level of 20%. Loaf volume, weight, and specific volume were measured and grain quality and flavour were judged.

A brief description of the products from soy used in the baking industry is given. The functional properties and the nutritional values are discussed.
Nazarov, N.I. et al.
Enrichment of macaroni goods with soya protein isolate.

Ranhotra, G.S. et al.
Preparation and evaluation of soy-fortified gluten-free bread.

Scanlon, J.
A new sweet whey-soy protein blend for the baker.

Sipos, E.F. et al.
Soy protein products for baked foods.

Surany, K. et al.
Studies on soybean enriched bread.

Wolf, S.K. & Cavanaugh, R.M.
Bread dough including large amount of non-wheat protein.
US Patent 3 756 832.

Comments

The use of soya protein isolate not only increases the nutritional value of the products as a result of the increased content of essential amino acids, particular lysine, but also considerably strengthens the structure of the finished product.

The addition of 20-40% soy isolate to unmodified wheat starch not only raised the protein content of the bread but improved the physical characteristics as well.

The properties of a new baking ingredient, that is a spray dried union of sweet dairy whey and soy protein, is described.

The production of soy protein isolate and soy protein concentrates is shortly reviewed. The nutritive value of soy protein is discussed. Some baking applications described in literature are reviewed.

Incorporation of 5-20% semi-fatted soy flour decreased the quality scores of the bread considerably. Addition of a commercial dough conditioner (Emplex) always gave better breads.

Bread having enriched protein, primarily L-lysine, is prepared in conventional manner using a bread dough comprising wheat flour, 2-12% by weight soy flour, 2-6% corn flour or 1-4% corn meal to mask the non-wheat flavor and 0.5% by weight NaCM-cellulose to improve bond quality.
2.9. Soy proteins in meat and fish

Adolphson, L.C. & Horan, F.E.
Textured vegetable protein products as meat extender.

Anderson, R.H. & Lind, K.D.
Retention of water and fat ... in cooked patties of beef and of beef extended with textured vegetable protein.

Anicic, V. et al.
Research into the suitability of added proteins for use in meat emulsions.

Anon.
Textured protein trims cost of frozen meat patties.

Anon.
Vegetable protein adds texture, nutrition to Mexican style foods. Holds line on ingredient costs.

Anon.
Improved soya/meat blends offer industry new opportunities.

Comments

The market for textured soy proteins is shortly discussed as well as some educational steps which have been taken in the development of markets for these products.

The results show that regardless of fat and moisture level of raw patties, patties containing 25% hydrated textured soy protein retain a greater percentage of moisture and a lesser percentage of fat in cooking than all-beef patties.

The suitability of using two soy protein preparations, dried beef blood plasma and a milk protein preparation in meat products was investigated.

A description is given of the production method used by Birchwood Meat and Provision, Wisconsin, for producing patties containing textured vegetable protein.

The manufacturing of some Mexican foods containing textured soya protein is described. The advantages with such foods are the lower ingredient costs and the nutritional value.

The market for soya protein blended with ground beef for use as a meat extender is reviewed.
Anon.
A progress report.
USDA scientists work
to improve flavour,
texture, nutrition of
meat blends.
Canner/Packer
From: Food RA Abstr.
28(1975):5, 2314.

Bakker, A.F.
Practical application
of soy protein concen-
trate presented by a
practical man.

Bartz, R.L.
Soya protein extenders
are available to match
product texture, colour.
Quick Frozen Foods

Carlin, A.F.
Use of soy concentrates
in fresh or frozen meat
loaves.
National Provisioner

Čortanovački, S. et al.
Possibility of using
textured vegetable pro-
teins in minced meat
products.
p. 344-345.

Čortanovački, S. et al.
Influence of changes in
the composition of spice
mixes on semi-dry sausages
prepared with textured
vegetable proteins.
p. 360-362.

Comments

By combining various protein
sources (i.e. beef, soya, whey,
fish, or blood plasma), blends
can be made with PER approxi-
mat ing that of casein that retain
the texture of muscle protein.

The use of a granulated soy
protein (Patti Pro) in com-
minuted meat products is de-
scribed.

Soya protein extenders are
excellent food sources con-
taining high-quality protein
which can be blended with pro-
cessed meat, fish or poultry
at levels of 20-30%. They have
better product appearance and
better quality and performance
in processing.

The influence on water and fat
retention, browning, cooking
shrinkage, and flavor in meat
loaves of textured soy proteins
containing 50% and 70% protein
were investigated.

On the basis of organoleptical
and some chemical examinations
it is concluded, that TVP beef
strips, added to ground beef
and pork as substitution for
the quantity of 8%, give de-
sirable products.

The effects of spices (black
pepper, sweet red pepper, gar-
lic and mace) on the orga-
oleptic properties of salami
containing textured soy pro-
tein were investigated. Mace
improved the flavour and aroma
significantly.
Dordević, M. et al.  
Possibilities of using textured vegetable proteins in the manufacture of certain cooked sausages.  

Formo, M.W. et al.  
Determination of soya products in meat-soya blends.  

Gerhardt, U.  
Soja: Eine wertvolle Ölf- und Eiweisspflanze.  
II. Verwendungsmöglichkeiten von Sojaeierweiss zu Fleischwaren.  

Guy, R.C.E. et al.  
Analysis of commercial soya additives in meat products.  

Isakov, M. et al.  
Influence of the addition of textured vegetable proteins on technological and physico-chemical properties and chemical composition of poultry meat-TVP-water systems and poultry meat-TVP-water-fatty tissue systems.  

Kosnyreva, L.M. et al.  
Improved quality of dried cooked meat by the addition of enzymatic soya hydrolysate.  

Comparative studies of the quality of dried meat, minced and dried on a belt for 50 min at 50-67°C manufactured with or without addition of an enzymic soya hydrolysate are described.  
The use of TVP in blood sausage (where 9% meat and 1% fatty tissue were replaced by TVP) and in liver sausage (where 5% meat and 5% liver were replaced by TVP) is described.

The accuracy of using magnesium, manganese, fibre, ash, hemicellulose, stachyose, phosphorus, potassium, copper, and zinc for the determination of soya flour in soya flour-ground beef mixtures is discussed.

The author discusses 1) the influence of soy protein on the functional properties of the product; 2) the difference between adding dry protein and adding an emulsion with fat and water; 3) the addition of soy protein to sausages; 4) the calorie content of soya sausage.

This study involved the extraction of the proteins with a solution of urea and 2-mercaptoethanol and the separation of meat and soy proteins by polyacrylamide gel electrophoresis.
Mason, H.K.,
The detection of soya in manufactured products.
From: Food RA Abstracts

Modić, P. et al.
Possibilities of using textured vegetable proteins in the manufacture of cooked sausages, semi-dry sausages and canned ground meat.

Modić, P. and Dordević, M.
Possibility of using textured vegetable proteins in paste manufacture.

Modić, P. et al.
Possibility of using textured vegetable proteins in the manufacture of ready-to-eat meals.

Nielsen, L.M. & Carlin, A.P.
Frozen, precooked beef and beef-soy loaves.

Polić, M. et al.
Comparative chemical and organoleptical properties of boiled, semi-dry and cooked sausages, and canned minced meat, prepared with and without textured vegetable protein.

Comments

A brief and simplified description is given of the electrophoretic detection of soya in meat products.

The possibilities of replacing a certain amount of beef and pork by hydrated ham-flavored and unflavored TVP were examined.

Studies on incorporation of textured soy protein into meat paste products are discussed.

5-20% of the meat in ready-made meals (meat-filled paprika, gulyas, drzavec, sauces and others) can be substituted with textured soy protein.

After storage at -4°F for 0, 2, 4, and 6 months, frozen raw or precooked beef loaves were compared with precooked frozen beef-soy loaves containing 30% hydrated, textured soy.

The chemical compositions of the products were not changed by incorporating the following amounts of TVP in them: 1) 6.5% in semi-dry sausages, 2) 6% in boiled sausages, 3) 10% in cooked sausages 4) 6.5-9% in minced meat 5) 6.5% in canned minced meat.
Polić, M. et al.
Comparative organoleptic and chemical properties of canned chicken meat prepared with and without textured vegetable proteins.

Predović, I. et al.
Possibility of using textured vegetable proteins in the manufacture of meat salads.

Savić, T.
Existing statutory regulations and use of textured vegetable proteins in meat industry.

Smith, G.C. et al.
Consumer response to ground beef containing textured vegetable protein.

Tateo, F.
The determination of soya protein in meat-based products: experience gained with the electrophoretic method of Parson-Lawrie.

Torell, R.N. & Staniec, W.P.
Comparative functionality of soy proteins used in commercial meat food products.
J. Am. Oil Chemists' Soc. 52(1975):4, p. 263A-266A.

Comments

Studies on the composition and organoleptic properties of poultry meat pastes containing 0.5, and 7% textured soy protein are described.

Research showed that 15% of meat or meat products in meat salads could be substituted by textured soy proteins without any loss of organoleptic properties or any decrease in shelf-life of the salads.

Patties containing less than 50% fat + TVP were found to be acceptable in appearance, have reasonably adequate retail caselife and would be marginally acceptable in palatability to retail consumers.

The method was used for the determination of soya protein in fresh meat products and in mixtures of meat and different levels of soya protein heated to 100°C or 125°C.

The use of soy isolates, concentrates, and texturized flours in meat food products is discussed. Functional characteristics of soy products in relation to their market application are reviewed.
Trumić, Ž.
Possibilities of using differently hydrated textured vegetable proteins in meat emulsion preparation.

Trumić, Ž. et al.
Comparative examination of the effect of different spices added to meat and textured vegetable proteins.

Yeo, V. et al.
Effects of soy curd on the acceptability and characteristics of beef patties.

Ziemba, J.V.
Vegetable protein moves into sausages.

Comments
The possibilities of using TVP hydrated in water in 1:1 to 1:3 relations as a replacement for beef in meat emulsion preparations were examined.

Studies on the use of spices to mask the flavour of textured soy proteins are described; results showed that mace and coriander gave the most effective neutralization of the taste of TVP.

Taste panel tests showed that by increasing pressure on the soy curd during manufacturing or by addition of flavoring to the curd before patty formation, increases in soy concentration became less detectable and the acceptability of the patties was increased.

The manufacturing and purchasing of two protein-extended sausages (one of wiener-type and the other of bologna-type) is described.
2.10. Soy proteins in beverages

Badui, S. & Josephson, R.V.

Mustakas, G.C.

Pompei, C. & Bazzoni, D.

Comments

Soybean protein, milk whey proteins and caseins were resolved and identified in commercial products and blends by acidic and alkaline urea starch gel electrophoresis and urea polyacrylamide gel isoelectric focusing.

A full-fat oilseed beverage is prepared by suspending full-fat oilseed flour in water, inactivating the lipoxygenase, precipitating the lipid-protein, resuspending the precipitate in water (pH 9), heating and cooling the suspension, adjusting the pH to 7 and clarifying.

The three basic ingredients in this milk substitute are: soya protein, ultrafiltered and dialysed, concentrated ultrafiltrate from cheese manufacture, sunflower and coconut oil.
2.11. Soy proteins in nutritional aid programs

Anon.
Infant protein need provided by soy-based formula.

Bressani, R.
Nutritional contribution of soy protein to food systems.
J. Am. Oil Chemists' Soc. 52(1975):4, p. 254A-262A.

Crowley, P.R.
Practical feeding programs using soy protein as base.
J. Am. Oil Chemists' Soc. 52(1975):4, p. 277A-279A.

Robinson, W.R. et al.
Development of soy-based foods of high nutritive value for use in the Philippines.

Shaw, R.L.
Incaparina: The market development of a protein food.

Comments

A soy-isolate formula containing 1.65 g protein/100 calories was found to support growth in infants as well as breast milk or a milk-based formula. The results indicate that amino acid requirements of infants are lower than previously reported.

This article attempts to define the various nutritional roles soybean protein plays, by means of basic nutritional information and in terms of food preparations for people in both developed and developing countries.

Recently, a new whey soy drink mix has been developed for use in preschool feeding programs and now is being introduced around the world.

Results are provided of a research program which was undertaken to develop processes for manufacturing soy-based foods on a scale and of a simplicity appropriate to the socio-economic requirements of relatively small population centers.

The experience of INCAP, the various food industry companies, governments and other agencies which were involved at the market development of Incarparina is outlined.
2.12. Nutritional and toxicological aspects

Bates, R.P. & Wu, L.C.
Protein quality of soy protein-lipid films (yuba) and derived fractions.

Kies, C.
Nutritional implications of textured protein products.

Kies, C. et al.
Triticale, soy-TVP, and millet based diets as protein resources for human adults.

Matthiensen, R.P. and Braun, W.
Sojaprotein - ein "verborgenes Allergen".

Nagarajan, V. et al.
Aflatoxin production in some varieties of soybeans (Glycine max, L.)

Nordal, J. & Fossum, K.
The heat stability of some trypsin inhibitors in meat products with special reference to added soybean protein.

Comments

The protein quality of yuba, of the whey remaining after film formation, and of the insoluble residue remaining after soy milk extraction from whole soybeans was determined by rat feeding studies.

The author reviews some investigations regarding protein quality of textured proteins and influence of heat and alkali on textured proteins.

Two of the objectives of the study were:
1) To define the relative protein values of the three test sources of protein;
2) To compare the effect of addition of triticale or millet flours to a soy-TVP based diet on protein value.

The difficulties in recognizing and avoiding allergens are demonstrated by a case of allergic urticaria due to soy protein found as a component of a soup for weight reducers.

Wide variations in aflatoxin content between different varieties of soybeans were found after inoculation with Aspergillus flavus or Aspergillus parasiticus.

The heat stability of the trypsin inhibitors commonly present in meat products was investigated. This included the naturally occurring inhibitors in meat or serum, and some of the soybeans proteins usually added to minced meat and sausages. The stability of the inhibitors was investigated both alone, and when mixed with meat and other compounds.
Schingoethe, D.J. et al. 
Studies in mice on the isolation and characterization of growth inhibitors from soya beans. 
p. 1304-1312. 
From: Food RA Abstr. 

Stankov, J. et al. 
Utilization of nitrogen from textured vegetable proteins by men. 
Tehnol. Mesa 14(1973):11 
p. 371-375.

Tajima, M. 
Amino acid composition of new protein products for food from soybeans. 
From: Chem. Abstr. 
82(1975):9, 56232.

Comments

Studies on the growth inhibitory effect of five fractions separated from the pH 4.4 supernatant from raw soya bean meal are reported.

The utilization of N from foods, in which 50% of animal proteins were substituted by textured soy proteins was studied by the method of N balance.

The amino acid compositions of 6 protein preparations from soybeans were similar to that of soybeans. The egg scores of the products were calculated to be 40-52. S-containing amino acids were limiting.
2.13. Juridical aspects

Baratt, B.
Vegetable protein. Newest industry baby with quarterback potential.
Food in Canada.

Costabile, Z.C.A.
Mexican regulations and standards for use of soy protein for human feeding.
J. Am. Oil Chemists' Soc.
52(1975):4, p. 276A.

Rakosky, J.
Soy protein in foods: Their use and regulation in the US.
J. Am. Oil Chemists' Soc.
52(1975):4, p. 272A-275A.

Comments

Two sets of regulations legalizing the use of protein material for certain specific food manufacturing purposes have been promulgated by the Government in Canada. The first cover the use and composition of protein material, and the second detail the labelling of "extended" and "simulated" products.

A sanitary code, adopted in Mexico in 1973, establishes a complete program of nutrition, including definitions for the use of soy products.

The regulations regarding the use of soy protein in US are discussed.
2.14. Miscellaneous


Comments

During ripening and germinating, the vicissitude of soybean protein components was studied by gel electrophoresis and ultracentrifugation.

The initial protein was prepared from defatted meal of unmaured soybean seed with urea by column chromatography. Little difference was found between the initial protein and 7S globulin from the matured seeds about amino acid composition, N-terminal amino acid composition and isoelectric point by the method of isoelectrofocusing.

Two simple, practical processes for the preparation of soymilk and soyflour for use by needy groups in Latin America are described.

Schools in the US used about 60 million lb. of hydrated textured vegetable protein in 1973-74. Plant proteins are projected to replace ca 2146 million lb. meats and other proteins in the US by 1980.

The addition of small amounts of DL-methionine enhanced the PER value of soy foods. Although slight flavour differences occurred during storage of fortified formulations containing soy protein, all flavour scores were satisfactory.
Coleman, R.J.
Vegetable protein - a delayed birth?

von Elbe, J.H. & Maing, I.-Y.
Betalains as possible food colorants of meat substitutes.

Hachiya, I. et al.
Food chemical studies of soybean protein. XII. Renaturation of 11S component.

Hill, J.E., & Breidenbach, R.W.
Protein of soybean seeds. I. Isolation and characterization of the major components.

Hill, J.E. & Breidenbach, R.W.
Proteins of soybean seeds. II. Accumulation of the major protein components during seed development and maturation.

Jakašá, K. and Dordević, M.
Effect of textured vegetable proteins on internal surfaces of tinplate cans during heat treatment.

Comments

The author discusses the relevance in using terms like "imitated meals" for textured soy proteins. He claims that the fabricated proteins should be sold as slices, chunks, granules etc., solely for what they really are.

Applications of betalain pigments in food containing soy protein curd was investigated by determining colour stability.

The renaturation in the quaternary structure of major protein component was observed by gel electrophoresis, when the soybean protein was neutralized to pH 8.6, after heating at alkaline or acidic pH, under which the conformational change occurred.

Soybean storage proteins were characterized by sedimentation and by polyacrylamide gel electrophoresis under dissociating and non-dissociating conditions.

Fresh weight and dry weight as well as quantitative and qualitative protein changes in the developing soybean seed were described from 12 days after flowering until maturity.

The corrosive effect of textured soy proteins added to meat products (20%) thermally processed in tinmed sheet cans was either identical to or less aggressive than that of the meat product without any addition.
Johnson, D.W.
Use of soy products in dairy product replacement.
J. Am. Oil Chemists' Soc. 52(1975):4, p. 270A-271A.

de Man, J.M. et al.
Composition of Ontario soybeans and soymilk.

Oluški, A. et al.
Microflora of textured vegetable proteins.

Potparić, M.
Physico-chemical, biological, technological and culinary properties of soy proteins.

Radley, R.W.
Soya bean adaptation to the cool, maritime climates of Northern Europe, with special reference to the UK.

Riedel, H.R.
Vollsoya-Protein-ein wichtiger Rohstoff für alle Süsswaren.

Comments

The use of soy protein products as replacements in dairy products like soybean milk, feeding replacements, vegetable cheese and whipped toppings is discussed.

Proximate analysis was performed on 55 samples representing varieties of Ontario grown soybeans. All of the samples were made into soymilk and composition of the milk determined.

Microflora of the samples investigated included micrococi, bacilli and lactobacilli. Pathogenic microorganisms were not isolated. From bacteriological point of view, samples of sausages containing textured soy protein did not deviate from control samples without textured protein.

The author emphasizes that textured soy proteins less and less are considered as additives in meat industry but as raw material which from biological and technological standpoint can justifiably replace a part of meat content in different meat products.

The principal limitations for growing soya beans in NW Europe are temperature and daylength. One variety has often yielded well, experimentally, in Southern England, but in general yields are at present too uncertain and the lowest pods to near the ground.

Recipes are given for the inclusion of soya protein in fillings for chocolates, fudges, toffees, and bonbon fillings.
Riedel, H.R.
Full protein soya – an important raw material for confectioners.

Sandulescu, C. & Marin, E.
Fractionation of soya protein by dextran gel chromatography.

Sandulescu, C.
Characterization of soya protein by their molecular weight.

Sandulescu, C. & Marin, E.
Some aspects of determination of isoelectric points of soya protein.

Shibasaki, K. et al.
Food chemical studies on soybean proteins.
XI. Stabilization of soybean proteins with sucrose, glycerol and ethylene glycol.

Sinclair, P. et al.
Soybeans in family meals.

Comments

Recipes are given for the inclusion of soya protein in fillings for chocolates, fudges, toffees, and bonbon fillings.

Compositions of the original and extracted beans and chromatography diagrams are presented in detail.

Soy proteins were characterized by using of Sephadex G25 gel.

Isoelectric points of proteins of two varieties are described and fractionated.

At low ionic strength, stabilizing effect of sucrose, glycerol and ethylene glycerol on inhibiting the aggregation of water extracted protein at various pH was low. At high ionic strength, stabilizing effect increased in the order sucrose, glycerol, ethylene, glycerol.

Information is given about vegetable-type green and dry soybeans, soybean sprouts, soy flour and grits, soy milk, soybean curd, and soybean mash or pulp. Included are tips on how to buy, how to store, how to prepare, and how to use these products in a family kitchen.
Smith, W.T. et al.
Pyrolysis of soya bean protein and an amino acid mixture having the same amino acid composition.

Spannuth, D.
Beeinflussung der Autoxydation von Fetten und fetten Ölen mittels geeigneter Sojamehle.

Tello, F.
Manufacturing and marketing of soy products for human consumption in Mexico.

Comments
A comparison of the pyrolysis of soya bean protein and of an amino acid mixture of the same composition was carried out. The pyrolysis occurred at 850°C and the neutral fraction was found to be larger from the soya bean protein. The results were basically the same qualitatively and only slightly different quantitatively.

The author reports the results of an ageing experiment with lard, showing that specially processed whole soymeals possess excellent antioxidative properties.

The following items are discussed:
1. The importance of distributing products that can be produced directly;
2. Ways of popularizing the acceptance of soy products through demonstration, promotion and publicity;
3. Commercial presentation of the product, cost, and keeping quality;
4. Distribution.
3. Cottonseed protein

Childs, E.A.
An enzymatic-chemical method for extraction of cottonseed protein.

Clark, S.P. et al.
Dehulling cottonseed and separating kernels and hulls: Comparison of several varieties.

Damaty, S.M. & Hudson, B.J.F.
Preparation of low-gossypol cottonseed flour.

Gardner, H.K. et al.
Liquid cyclone process for edible cottonseed flour production.

Harden, M.L. & Yang, S.P.
Protein quality and supplementary value of cottonseed flour.

Lawhon, J.T. et al.
Utilization of cottonseed whey protein concentrates produced by ultrafiltration.

Comments
A two-stage chemical technique extracted ca 15% of the cottonseed meal protein. Trypsin treatment increased protein extraction fivefold.

The proteinaceous components of cottonseed can be converted into several forms for use in foods. All of them require nearly complete separation of kernels and hulls. In research on improving separation processes, eight multiton lots of cottonseed were processed through pilot size commercial-type dehulling and kernel-hull separating machinery.

A process for production of fat-free cottonseed flours with very low contents of both free and bound gossypol has been developed.

The liquid cyclone process developed for producing food-grade, degossypolized, high-protein cottonseed flour and the SRRC pilot plant with its major innovations are described, including the operations of drying, comminution, liquid classification, filtration and desolventization.

Amino acid analyses and rat growth studies were used to determine the quality of proteins in glanded, glandless, and liquid cyclone processed cottonseed flours.

Glandless cottonseed flour and 3 ultrafiltration products made from it were mixed with wheat flour. Bread prepared from the blends contained ca 20.5% protein compared with 15.9% for wheat bread and had also a darker crust. Some physical properties of the dough were affected adversely by the addition.
Lii, C.-Y.
Investigation of the carbohydrates of glandless cottonseed flour.

Lin, S.H.C., et al.
Composition and characteristics of glandless and liquid cyclone process deglanced cottonseed wheys.

Olson, R.L. & Frazer, D.R.
Process for producing cottonseed protein isolates.
US Patent 3,814,748.

Ridlehuber, J.M. & Gardner, H.K.
Production of food-grade cottonseed protein by the liquid cyclone process.

Staats, L.G. & Tolman, N.M.
Acceptability of saltine crackers containing cottonseed protein products.

Comments

Glandless cottonseed flour was found to contain 16% carbohydrate. Analyses of water-soluble polysaccharides is reported.

Cottonseed wheys are liquid by-products from cottonseed protein isolation processes. These wheys when prepared in the laboratory contained 22-36% of the original flour solids. Whey proteins were water-soluble, heat stable and contained up to 7% lysine and 5% cystine.

Cottonseed flour or flakes are extracted for a short time with alkali and the extract is acidified to a pH in the range 7-8 to produce a major protein isolate substantially devoid of objectionable colour.

A brief background is given on the development of the liquid cyclone process. SRRC's pilot plant process is described and related to the commercial process that was intended to be operational in 1974. Some of the functional properties of the flours and results of their evaluation in foods are discussed.

Saltine crackers containing cottonseed products had 2-3 times as much protein as unfortified crackers and received acceptable ratings from a taste panel. Cottonseed concentrates were found to be more acceptable than isolates.
4. Rapeseed protein

Hermansson, A.-M. et al.
Functional properties of proteins for foods - modification studies on rapeseed protein concentrate.

Josefsson, E.
Effects of variation of heat treatment conditions on the nutritional value of low-glucosinolate rapeseed meal.

Kodagoda, L.P.
Isolation and functional properties of protein fractions from rapeseed flour.

Comments

Modification studies were made on a rapeseed protein concentrate of poor solubility.
Alkali, acid, and the enzymes pepsin and papain were used in the solubilization procedures.
Seven modified preparations were made and the effects on properties such as solubility, emulsion stability, swelling, foaming ability, and foam stability were tested.

The nutritional value of rapeseed meal, prepared from low-glucosinolate rapeseed, as affected by heat treatments of the seed at various temperatures and times and at various moisture contents was evaluated by feeding experiments with mice.

Details are given of the properties of rapeseed protein isolates and concentrates prepared by 2 methods: 1) a 3-stage sequential extraction with water, HCl, and NaOH, and 2) a single-stage extraction with NaOH.
5. Sunflower protein

Hagenmaier, R.D.  
Aqueous processing of full-fat sunflower seeds: yields of oil and protein.  

Huffman, V.L. et al.  
Selected functional properties of sunflower meal.  

Lin, M.J.Y. et al.  
Certain functional properties of sunflower meal products.  

Pokrovskii, A.A. et al.  
Study of the biological effectiveness of protein extracts from sunflower seed.  

Sabir, M.A. et al.  
Phenolic constituents in sunflower flour.  

Sabir, M.A. et al.  
Chlorogenic acid-protein interactions in sunflower.  

Šašek, A.  
Die Elektrophorese der Eiweisstoffe der Sorten- und Hybridensamen von der Sonnenblume.  

Comments

Undehulled sunflower seeds were comminuted and extracted with water containing 0.2% Na$_2$SO$_4$ at pH 10, which extracted from the fiber 85% of the protein. Isolate was prepared by addition of acid.

The following functional properties have been measured: Emulsion capacity, water adsorption capacity, water retention, foam volume, and foam stability.

Functional properties including water absorption, fat absorption, emulsification, whippability, and foam stability were determined on the sunflower flour, protein concentrates and isolates.

Analysis of the amino acid composition of sunflower protein extracts and growth tests on rats showed the protein to be of reduced biological value due both to processing of the seed and preparation of the protein extracts.

8 of 10 phenolic compounds in the aqueous methanolic extracts from 3 varieties of sunflower were tentatively identified and quantitated by their spectrophotometric and chromatographic characteristics.

The objectives of the study were:
1) To determine the quantity of bound and unbound chlorogenic acid among protein fractions;
2) To characterize the types of linkage between the low molecular weight proteins and proteins and chlorogenic acid.

The identification of protein fractions of sunflower seeds was carried out by the use of starch-gel-electrophoresis.
6. Peanut proteins

Ayres, J.L. et al. 
Processing of edible peanut flour and grits. 
J. Am. Oil Chemists' Soc. 

Cater, C. 
New peanut protein recovery can add to food supply. 
Oil Mill Gazetteer 
From: Food Sci. & Technol. 

Ishaq, R. et al. 
Acceptable dishes from unfamiliar foodstuffs from 
VI. Groundnut flour. 
Science and Industry, 
Pakistan 9(1972): 3/4, 
p. 248-252. 
From: Food Sci. & Technol. 

McWatters, K. & Heaton, 
E.K. 
Development of snack-type chips from peanuts. 
Research Bulletin, College 
of Agriculture Experiment Stations, University of 
Georgia (1972):106, p. 5-17.

Mitchell, J.H., Jr. 
Peanut flakes. 
US Pat. 3 800 056 (1974) 
From: Food Sci. & Technol. 

Comments

Edible peanut flour and grits have been produced by a commercial prepress solvent extraction method. Soluble carbohydrate profile indicates peanut flour is lower in raffinose and stachyose than soy flour.

A technique for chemical inactivation of aflatoxin allows recovery of protein concentrates and isolates suitable for human consumption.

The possible incorporation of groundnut flour, to improve the nutritional quality of familiar dishes in Pakistan with minimum alteration in appearance, taste and flavour is discussed.

A snack-type peanut chip product was developed. The size of peanut particles used in the preparation of the chips significantly affected moisture, oil and protein content and also affected the texture of fried chips.

Steamed peanuts are dried to a moisture content of 2-3%, separated from skins and germs, ground to a fine consistency, cooked with water and then drum dried to yield a thermostable, bland flavoured flaked product. Applications include simulated meat formulations and meat and fish extenders.
Nagaraj, H.K. & Subramanian, N.  
Studies on groundnut protein concentrates prepared by alcohol and acid washing of the defatted flour.  

Srikanta, S. & Rao, M.S.N.  
Effect of wet heating on the physicochemical properties of groundnut proteins.  

Whitaker, T.B. & Dickens, J.W.  
Variability of aflatoxin test results.  

Young, C.T. et al.  
Some environmental factors affecting free amino acid composition in six varieties of peanuts.  

Youtsuhashi, K. & Shibasaki, K.  
Studies on peanut proteins. IV. Fractionation and purification of conarachin I and II by column chromatography.  

Comments  
Defatted groundnut flour was extracted with 80% ethanol, 80% isopropanol and 0.05 N HCl with a view to obtain protein concentrates.

The nutritive value of groundnut meal after heat treatment is recorded. The solubility, gel filtration, polyacrylamide gel electrophoresis, DEAE-cellulose chromatography and spectral characteristics of protein extracted from wet heated groundnut meal were studied.

Using 12 lb samples, 280 g subsamples of shelled peanuts the Waltking method of analysis, and densiometric procedures, the sampling, subsampling, and analytical variances associated with aflatoxin test procedures were estimated.

The study involved observations of free amino acids in six varieties of peanuts under irrigated and nonirrigated conditions.

Conarachin I and II were fractioned from conarachin fraction by gel filtration chromatography on a Sepadex G-200 column, and purified by re-gel filtration and by ion exchange chromatography on a DEAE-Sephadex A-50 column. The article is written in Japanese with an English summary.
Youtsuhashi, K. & Shibasaki, K.
Studies on peanut proteins. V. Molecular dimension and subunit structure of conarachin I and II.

Comments
Conarachin I was heterogeneous and consisted of three kinds of main proteins, which possessed glycine, threonine and serine as the N-terminal amino acids. Conarachin II consisted of five subunits, which possessed glycine, leucine, aspartic acid and glutamic acid as the N-terminal amino acids. The article is written in Japanese with an English summary.
7. Coconut proteins

Grandadam, Y.  
Coconut proteins.  
Inds. Aliment. Agric.  
90(1973):9/10,  
p. 1253-1268.  
From: Food RA Abstr.  

Gunetileke, K.G. & Laurentius, S.F.  
Conditions for the separation of oil and protein from coconut milk emulsion.  
J. Food Sci. 39(1974):2,  

Molina-Aguirre, M.R.  
Research to improve methods for optimizing the nutritive value of defatted coconut flours.  
G457.

Comments

Methods of protein extraction from copra cakes and the fresh kernels are described. The yield, cost quality and composition of the protein obtained by these methods are compared.

Coconut milk was centrifuged to obtain cream and skim milk. The cream was chilled to 17°C or below. On warming to 25°C the emulsion broke with separation of oil and protein. Amino acid compositions of different protein fractions were determined.

Preliminary studies on chemical and enzymic methods for extraction of protein from coconut meat are described; ficin treatment gave best results. An enzymic-chemical method was then developed, based on initial treatment of an aqueous suspension with a 0.5% solution of ficin followed by treatment of the residue with NaOH.
8. Miscellaneous proteins

Eklund, A.
Some chemical and biological properties of a protein fraction from nigerseeds (Guizotia Abyssinica Cass.) soluble in hot aqueous ethanol.

Comments
A nigerseed protein fraction soluble in a hot water-ethanol solution of sodium chloride was isolated. It contained high levels of caprine and chologenic acid and inhibited the proteolytic digestion of casein by trypsin in vitro. Weanling male rats failed to grow when fed on this protein fraction as the sole source of protein. Histo-pathological examinations of the main animal organs did not show any abnormalities.

Guerra, M.J. & Park, Y.K.
Extraction of sesame seed protein and determination of its molecular weight by sodium dodecyl sulfate polyacrylamide gel electrophoresis.

McConnell, L.M. et al.
High-protein bread from wheat-faba bean composite flours.

Piana, G. et al.
Food value of the protein fraction of cashew nuts (Anacardium occidentale L.)

Sastry, M.C.S. et al.
Effect of dehulling and heat processing on nutritional value of sesame proteins.

The soluble protein fraction of crude protein and urea N content of cashew nut are tabulated. Results of feeding tests are given.

Processing of edible sesame flour involves use of hot lye treatment of the seed for dehulling, followed by drying, screw pressing, and solvent extraction. The effect of such processing on protein quality, especially lysine availability has been studied.
Umoh, I.B. & Oke, O.L.  
Nutritive value of some lesser known oilseeds in rats.  

Comments  
The protein nutritional values of *Irvingia gabonensis*, *Citrullus vulgaris*, and *Parkia filicoidea* were evaluated in a series of feeding trials with weanling littermate Wistar rats.
E. OTHER VEGETABLE PROTEINS

1. Vegetable proteins - review articles


Comments
Five experimental emergency foods were developed based on wheat flour plus various protein supplements (fish protein concentrate, defatted soy flour, rapeseed protein concentrate, dried buttermilk, dried peas and casein). Detailed tables are given of the amino acid composition of the protein supplements and the composition, chemical score, limiting amino acids and protein efficiency ratio of the 5 blends. Two of the mixtures are under test in Afghanistan.


Comments
The author discusses addition of specific amino acids to vegetable proteins to improve quality of human and animal diets. Practical aspects of amino acid fortification considered included costs, methods of supplementation and acceptability both at government and consumer levels.


Bird, K.
Plant proteins in USDA feeding programs.
Cereal Sci. Today

Comments
Plant protein foods in use or being considered for use in several USDA food programmes are briefly considered: textured vegetable proteins; high protein enriched macaroni; analogues (non-meat proteins); wheat-soy macaroni; lysine fortified wheat flour; cup-cans (entrees in individual serving-size cans); formulated pizzas; a formulated milk-based product; formulated bakery items; and soy-fortified corn meal or tortilla flour. The system of introduction of new food is described. Changes which need to be made to improve the plant protein programmes are outlined. A brief description is given of the following child nutrition programmes: the National School Lunch programme; the School Breakfast programme; the Special Food Service programme for children; and the Special Milk programme. 2 family feeding programmes considered are: the Food Stamp programme and the Food Distribution programme.

Bird, K.M.
Plant proteins: progress and problems.

Greuell, E.H.M.
The structure of vegetable protein for human consumption.

Horan, F.E.
Nutritional cereal blends.
Conception to consumption
Cereal Sci. Today

The future of vegetable proteins in food products is summarized in diagrammatic form. Tables show: allocation of income for food expenditure by selected countries; major components of world food production; % of protein supplied by cereals, and vegetable proteins versus animal proteins. 2 methods of approaching the development of low-cost, highly nutritious foods are considered: the pull-through endeavour - where a market exists and the requirements are for the supplier to meet the stipulated specifications.

Current programs in which textured vegetable proteins are being used are described as well as projected usage of plant proteins by 1980.
Comments

for the product at a competitive price; and the push-through endeavour where an individual company attempts to design a product, develop a market and a viable business in a selected country e.g. ADM Co. project in Thailand. The 3 phases of this project considered are: a marketing study including food habits and nutritional needs; product development for a specific market; and market tests.

Foods containing combinations of gram, groundnut, rice, maize, sesame and gur have been prepared as snack foods for children in Pakistan. Protein content 10.5-12.2%. Methods of preparation are outlined.

Present knowledge of plant proteins (occurrence, localization, structure and function) is reviewed. Special attention is paid to cereal proteins (wheat proteins - gliadin, glutenin, wheat albumins and globulins, hordein and other barley proteins, rye proteins, oat proteins, maize proteins, rice proteins), proteins in pulses (arachin and conaradin, legumin, vicilin; glycinn and other soy proteins - phaseolin and conphaseolin, concanavalin), other seed proteins (edestin) and root crop proteins and fruit proteins. It is considered that plant proteins are not given sufficient attention in comparison with animal protein. (127 ref.)

The plant protein industry in Canada is discussed with reference to rapeseed, sunflower seed, peas, wheat, oats, faba beans and alfalfa.

Food-deficient developing countries will need to depend for their protein need on plant foods particularly cereals, legumes and oilseeds. Only in the past ten years has the con-
Pirie, N.W.
Plants as sources of unconventional protein foods.

Symposium on quality improvements of plant protein.

Papers presented at this symposium, which formed part of the 165th National Meeting of the American Chemical Society, held in Dallas, Texas in April 1973, are given. They were: Need for improved plant proteins in world nutrition, by M. Milner (pp. 548-549). Biochemical basis of the differences in plant protein utilization, by M.L. Kakade pp. 550-555, 75 ref.); The need for rapid assays of protein quality, by M.W. Adams (pp. 556-557); and Genetic improvement of plant protein, by V.A. Johnson & C.L. Lay (pp. 558-566, 45 ref.)
2. Cereals

Anderson, R.A. et al.
Milling characteristics of triticale.
Food Technol. 28(1974):11, p. 66, 68, 70, 72, 74, 76.

Anon.
New high protein oat now being used in breakfast cereal.

Blessin, C.W. et al.
Composition of three food products containing defatted corn germ flour.

Jäckering, G.
Protein-rich baking product of long shelf life and with stability against cutting and crumbling, and method of producing it.

Kies, C. et al.
Triticale, soy-TVP and millet based diets as protein suppliers for human adults.

Ludewig, R.
Maizorice, a maize with the shape of rice kernels.

Comments

Milling of several triticale grains showed that triticale is a good potential source of protein-rich supplements for food products, as well as a source of flour and starch fractions for food, feed, and industrial applications. (20 ref.)

A new strain of high-protein oats "Hinoats" has been developed in Canada. General Foods has marketed the product as a breakfast cereal.

Incorporation of defatted corn germ flour in a cookie formula improved amino acid and mineral composition of the baked product. Similar effects occurred on corn muffins. Addition to ground beef increased yield of the boiled meat product.

Bakery product which could serve as a substitute for bread comprises a mixture of 30-70% wheat proteins, a balance of corn starch plus yeast. The result is a high protein, storage-stable product which is firm enough to allow cutting and does not crumble.

Soy-TVP and triticale flour showed better protein value than the millet flour. Improvement in protein value was achieved by mixing triticale with millet flour. Triticale flour had greater supplementary effect on the soy-TVP diet than the millet flour.

The production of simulated rice from maize is described. Maize flour mixed with 32% water is pressed to rice kernel size under pressure and dried. An existing
Comments

Plant can produce 20 t/24 h, which is sold in South Africa for 44-48 cents/kg, vs. 94 cents/kg for real rice. Maizorice is cooked in 6-8 min with a 350% increase in vol., and contains 9% protein, vs. 5% for rice. It can be stored for 6 months at 15-20°C.

Recent research on the proteins of wheat and flour is reviewed.

Protein concentrates have been prepared from the byproducts left after flour extraction of cereal grains including wheat, rice, rye and triticale. The byproducts were extracted with mild alkali, the extract was separated from the fibrous material, then treated with heat and/or acid to precipitate the protein concentrates. Products were dried by freeze-, drum-, or spray-drying. Optimum conditions were established for extraction time and pH, precipitation temperature and precipitation pH. Products normally containing 25-50% protein were obtained in yields of about 20%. Products containing up to 80% protein were obtained by including steps in the process whereby high purity starch and fat could be selectively removed as valuable side-products. All concentrates contained less than 1% fiber. Nutritional studies, and functional properties such as baking quality, protein solubility, and dispersibility are discussed.

Triticale: First man-made cereal (Ed. C.C. Tsen).

Divided into seven parts
1. Triticale in various countries
2. Breeding and genetics
3. Kernel and endosperm structures and graded standards of triticale
4. Biochemistry
5. Nutrition
6. Triticale as food source
7. Triticale utilized as feeds.
Woerman, J.H. & Satterlee, L.D.
Extraction and nutritive quality of wheat protein concentrate.

Youngs, C.G. & Craig, B.M.
Production and utilization of field peas (Pisum sativum L.)
IV International Congress of Food Science and Technology 8a, 1974, p. 67-69.

Comments

The purpose of the study was to find the optimal wet (alkaline) extraction conditions to yield a high quality wheat protein concentrate (WPC) from bran and shorts milling fraction. Factors considered: WPC yield, amino acid balance and functional properties. WPC is high in lysine compared to whole wheat or wheat flour. Nutritive value of bran WPC is high with a high PER and high digestibility.

Production of protein concentrates from pea flour by wet milling or dry milling with air separation was investigated. Wet milling yielded 33% protein concentrate with 58% protein + 67% starch with 0.8% protein but involved evaporation of 5 lb water/1 lb flour processed and produced denatured protein. Dry milling produced 35% concentrate with 55% undenatured protein and more economic processing. Concentrates have been successfully incorporated into cereal foods, meat analogues and milk replacers.
3. Peas and beans

Aykroyd, W.R. & Doughty, J.
Legumes in human nutrition.

Fetuga, B.L. et al.
Protein quality of some unusual protein foodstuffs—studies on African locust-bean seed.

Hove, E.L.
Composition and protein quality of sweet lupin seed.

Comments

Contents:

History of legumes.
Production and consumption.
Composition and nutritive value.
Methods of processing and cooking.
Effects of processing on nutritive value.
Toxic substances.
Legume proteins.
Observations on the value of legumes in human feeding.
The place of legumes in human diets. (119 ref.)

The proximate composition, amino acid composition and the quality of the protein of the African locust-bean (Parkia filicoides Welw.) seed, seed with pulp, and various processed forms, with or without amino acid supplementation, were assessed. The seeds contained (mg/g protein): 67 lysine, 6.1 methionine and 8.9 tryptophan. Diets containing 100 g protein/kg supplied by the seed did not support growth in rats, demonstrating that the protein was of poor quality. Utilization of the protein of locust-bean seeds was improved by cooking, and by removal of the tough leathery outer tests of the seeds. Supplementation with methionine alone resulted in positive growth and a very substantial increase in protein values. Supplements of methionine and tryptophan caused further improvement in protein quality and increased the growth of rats to almost that obtained with whole egg.

Two varieties of lupin seeds were analysed for moisture, protein, lipid, ash, fibre, amino acids, carbohydrates, calcium, phosphorus, zinc, iron, copper and manganese. Whole seeds, hulls and kernels were examined. The dehulled lupin seeds effectively supplemented the protein of barley meal in the diets of rats.
Liener, I.E.
Toxic factors associated with legume proteins.
Indian Journal of Nutrition and Dietetics

McConnell, D.H. et al.
High protein bread from wheat-faba bean composite flours.
Cereal Science Today

Patel, K.M.
Horsebean as protein supplement in breadmaking.
1. Isolation of horsebean protein and its amino acid composition.

Comments

Possible toxic factors in legume proteins discussed include: the trypsin inhibitor in soybeans; other anti-nutritional factors in legumes, such as phytohaemagglutinin, goitrogens, cyanogenic glycosides, anti-vitamin factors, metal-binding constituents, oestrogenic factors and toxic amino acids: lathyris. The incidence of toxic properties in the raw material is reviewed together with the means of reducing the risks by cooking, other processing, methods and attention to food consumption patterns. (80 ref.)

The addition of faba bean flour to hard red spring wheat flour at the rate of 10, 20, 30 and 40% results in a progressive decrease in loaf volume, and a deterioration in crumb grain. This may be overcome by using faba bean concentrate instead of faba bean flour. Addition of faba bean protein concentrate (9%) to wheat flour yielded a composite flour with 20% protein. Color grain and volume of loaves were comparable to the wheat flour control.

A protein isolate was prepared from horsebean (Vicia faba) by extraction with water or dilute Ca(OH)₂ solution using rapid agitation. Protein in clarified liquor was precipitated after adjustment to pH 4.25 with 6N HCl. Following precipitation and centrifugation, protein curd was washed with water, centrifuged, and finally freeze- or oven-dried. Final protein isolate was light tan. Protein content of isolate prepared at laboratory and pilot scale ranged from 71 to 83% (N x 6.25). Total yield based on flour or flake wt. was 16.5-21%. Horsebean flour and horsebean protein isolate exhibited a relatively high concentration of essential amino acids. Lysine content in both was 3.5 times that of wheat flour. (30 ref.)

Comments

Extraction of great northern beans with 2% NaCl solution yielded a high protein powder (bean protein concentrate - BPC) composed of 65% globulins and 35% albumins. The emulsion capacity of the albumins were good, as was the foam stability. When BPC was added to white bread at high levels a major decrease in loaf vol. occurred. Addition to a soft wheat flour cookie formulation improved the spread of the cookies during baking.
4. Leaf proteins

Aurelli, G. & Galoppini, C.
Proteins from leaves.

Bickoff, E.M. & Kohler, G.O.
Alfalfa protein.
United States Patent 3823 128.

Burström, H.G. & Lexander, K.
Leaf proteins for human consumption.

Chandramani, R. et al.
Leaf protein - its extraction and nutritive value.
Farm. Fact. 7 (1973): 10, p. 34-35.

Desmukh, M.G. et al.
The yields of leaf protein from various short-duration crops.

Contents

After a survey on the use of proteins extracted from leaves, the herbaceous cultivations agronomically and economically most suitable to industrial production of proteins for human nutrition are taken into account and various techniques for separation and purification of the protein fraction are described. Content of essential amino acids of leaf proteins is also examined in comparison with the FAO and with the most common vegetable and animal food.

Juice obtained from alfalfa or other leafy green crops is treated to remove a highly pigmented chlorplastic protein fraction, followed by precipitation of the protein separated from chlorophyll and other pigments.

A number of species was selected for field trials and processing of extractable protein of good quality on a pilot scale. The most suitable processing principle for each type of raw material was studied by fractionating, coagulating and decolorizing the proteins. The quality of the protein concentrates was described in terms of nitrogen content, methionine content and digestibility.

The yields of leaf protein from some short-duration crops were determined. The yields depend on species, variety, season, fertilizers and frequency of cutting. Good yields were obtained from cowpea (11.2 kg/ha/day of extractable protein) and also from cauliflower, cabbage and knolkhola.
Dev, D.V. et al.
The yields of extracted leaf protein from lucerne (Medicago sativa L.)

Dunham, D.
Alfalfa - an economical source of protein.

Iatsko, M.H. et al.
On manufacturing vitamin - protein concentrates out of coniferous needles.

Ishino, T.
Leaf protein concentrate.

Oke, O.L.
Leaf protein research in Nigeria. Review.

Oke, O.L.
Leaf proteins: Extractability from some Nigerian leaves.
IV International Congress of Food Science and Technology 8a, 1974, p. 58-60.

Oke, O.L. et al.
Nutritive value of leaf protein. Comparison of in vitro and in vivo methods.

Contents

Effects of fertilizers, frequency of cutting raw spacing and simazine were studied.

Maize leaves gave a high extractability on a small scale but was poor on a large scale. Legumes gave high values, as much as 400 kg protein/ha could be extracted up to 8 weeks and this decreased subsequently. As much as 90% of the proteins of green vegetable leaves were extractable in some cases. Up to 300 kg protein/ha could be obtained in 5-6 weeks.
Olatunbosun, D.A. et al.
IV International Congress of Food Science and Technology 8a, 1974, p. 18-20.

Parrish, G.K. et al.
The prospects of leaf protein as a human food - and a close look at alfalfa.

Pirie, N.W.
Effects of processing conditions on quality of leaf protein.

Comments

Leaf protein supplements of 10 g (7 g protein)/day to normal diet produced remarkable improvements in 26 children suffering from kwashiorkor including increase in serum proteins, increased wt and mental alertness and reduced oedema.

Gives extraction methods, yield factors and nutritional considerations on leaf proteins with alfalfa LPC as a specific example. (35 ref.)

Amino acid analysis and experience on non-ruminant herbivores suggest that leaf protein will be a useful food if not damaged during processing. Some members of the mixture loosely called leaf protein are conjugated with other substances, e.g. nucleic acids, lipids and chlorophylls. All of them can form complexes with leaf components such as sugars, polyphenols and unsaturated fatty acids. The dissociation of a pre-existing complex and the prevention of the formation of one is often advantageous, but care is needed lest the pursuit of a desirable objective has other unwanted results. For example: some delay between making an extract and heat-coagulation diminishes the amount of nucleic acid in the product but increases conjugation with polyphenols and so diminishes digestibility and availability of lysine and possibly the S amino acids. Washing the coagulum at pH 4 makes filtration easy, and removes any risk that alkaloids may be present, but, especially if protein was coagulated at the minimum temperature, increases the risk that photosensitising phophorbide will be made. Solvent extraction simplifies storage and removes colour but also removes nutritionally valuable carotene and unsaturated fatty acids.
Pirie, N.W.

Satterlee, L.D. & al.

Comments

The ideal preparative procedure will depend on the source of the leaf, the group of consumers for which the protein is intended, and the scale of intended consumption. Discusses methods for juice extraction; food - fodder; sources of leaf; protein quality and acceptability.

The possibility of using plant protein to fortify snack foods is noted. Basic steps for production of leaf protein concentrate are outlined. A computer was used to select a combination of plant protein and grain sources that would give a high protein and essential amino acid flour at the least cost. The formulation consisted of 45.5% alfalfa, 10.6% soybean, 26.7% potato and 17.2% glandless cottonseed. Both freeze-dried and dehydrated alfalfa extracted with ethanol to remove chlorophyll was used in the formulation. The high protein flour (HPF) was mixed with cornmeal and water and extruded to produce a puffed product called a collet. Soybean protein was also used instead of the alfalfa. Collets were flavoured with a cheese coating and evaluated for appearance, aroma, texture and flavour. Soy snacks and snacks containing HPF with extracted freeze-dried alfalfa were acceptable. As fortification increased, puffing ability decreased and the texture became spongy. Snacks made of extracted freeze-dried alfalfa were acceptable at the low level of fortification. Snacks fortified with HPF containing dehydrated alfalfa were not acceptable at any level of fortification.

(140 ref.)

Singh, N.
A bibliography of relevance to leaf protein research and development.
Comments

Singh, N.  
Prospects for leaf protein research and development.  

Time, E.K.  
Manufacture of protein concentrate from green plants.  
Nor. Lantbruk 22(1973)  
p. 16-17.

Trägårdh, C.  
Production of leaf protein concentrate for human consumption by isopropanol treatment.  
A comparison between untreated raw juice and raw juice concentrated by evaporation and ultrafiltration.  
Lebensmittel-Wissenschaft u. Technol. 7(1974):4  
p. 199-201.

Two concentration methods, evaporation and ultrafiltration were studied. The concentrated raw juice was then treated with isopropanol in order to precipitate, defat and decolour the protein solution. One reason for the investigation was to find methods to reduce the recovery costs for the lipid containing isopropanol and the remaining water. The results show that this may be possible. Ultrafiltration seems to be the most interesting method.
5. Miscellaneous

Figueiredo, A. de
Cassava - its importance as a food and feed.
Deutsche Lebensmittel-

Comments
Aspects covered include: areas of production of cassava; production statistics for the leading producing nations; exports and imports; composition of cassava tubers and leaves; enrichment of cassava with soybean protein; manufacture of cassava flour and other products; and toxicity of cassava due to the presence of the glycoside linamarin.

Hunter, C.J.
Edible seaweeds - a survey of the industry and prospects for farming the Pacific Northwest.

In Oriental countries seaweeds (Laminaria, Porphyra and Undaria) are used primarily as food. The US harvest is used mostly for the production of chemicals. The possibilities of growing edible seaweeds in the Puget Sound Basin are discussed. The high prices of imported seaweeds, the presence of a large Oriental community in that area and the suitable growing conditions suggest that edible seaweeds can be grown and marketed successfully in the Puget Sound Basin.

Westerlind, E.
Potatoes as a protein source.

The potato tuber contains about 2% of crude protein = 9% of dry matter with a high lysine content. The potato protein is of good quality and has in tests on humans been comparable to protein from eggs. Certain cultivation factors can influence the protein content, e.g., weather and manuring.
F. SINGLE CELL PROTEIN


Anon.
En million kroner til proteinforsøg.

Anon.
Single cell protein I.
Food Processing

Anon.
World prepares for single cell protein.

Bekers, M. et al.
Production of microbial protein.
USSR Otkrytiya, Ixobret. Prom. Obraztsy, Tovarnye

Cepigo, S.V. et al.
Microbiological synthesis of proteins.
Fortschritte Verfahrenstechnik der Lebensmittelverarbeitung Symp.
Frankfurt. 1971.

Champagnat, A. &
Adrian, J.
Pétrole et protéines.

Davis, P. (ed.)
Single cell protein.

Harada, T.
Role of microorganisms in food production.

Comments

Bioteknisk Institut i Danmark
har fått ett anslag till forsknings-
projektet att göra protein ur halm
med hjälp av mikroorganismer.

Includes a table of world SCP
production.

An elementary presentation of
biochemical, technical and micro-
biological aspects of SCP pro-
duction from hydrocarbons.

Reviews, new data, and round-
table discussions on SCP processing,
properties and standardization.
Heydeman, M.T.
Protein production by unicellular organisms.

Iwamoto, H.
Application of micro-organisms to biomass-production and natural resource development.

Karban, V.I. et al.
Single cell protein.

Kato, K.
Present status of international activities on the production of single cell protein.
Jap.

Lipinsky, E.S. & Litchfield, J.H.
Single-cell protein in perspective.

McCormick, R.D.
Baker's yeast - world's oldest food - its newest source of protein and other ingredients.

McNamara, S.H.
Some legal aspects of providing food for hungry populations.

Comments
A review with 57 refs on recent progress on single-cell protein production.

A review with tables on production and protein content of SCP. Also discusses some economic aspects.

Short comments to SCP.
Odell, A.D.
Single cell protein.
Food in Can. 34(1974):8,

Porter, J.R.
Microbiology and the food
and energy crisis.
ASM News 40(1974):11,
p. 813-825.

Skinner, K.J.
Single-cell protein moves
toward market.
Chem. Engng News

Széchényi, E.
Some protein problems and
the importance of fermention-
tation in protein produc-
tion.
Eleimészéi ipar 29(1975):4,
p. 102.

Thomas, B.
Microbial proteins and their
use in human nutrition.
Tehnologija mesa

Townsley, P.M.
New dimension in protein
production. Fungi, algae,
bacteria.

Wang, D.I.
Single cell protein.
CICP V2N11, A743045

White, D.H. &
Hillman, J.S.
Protein efficiencies
of high protein products
and processes.
Paper for the 67th
AIChe annual meeting.

Discussion of the North American
situation. Barely touches the
SCP issue.
2. Production of cell mass


Anon. ICI protein (1974)


Comments

Comments the Shell Co. technique of growing organisms directly on natural gas without first converting it to methanol.

A Torula yeast grown on ethanol produced from petroleum.

Quotes Soviet press agency Novosti. A yeast is grown on petroleum.

BP proteins technology in a 100 000 tons/yr plant starting up in 1978.

Reports on attempts to grow molds on the effluents from the food industry.

Laboratory process where a mold converting cellulose to sugars which are utilized by a yeast.

Commercial brochure about ICI's process of growing a Pseudomonad on methanol.

Commercial brochure about BP's process of growing a Pseudomonad on methanol.

A. calcoaceticus grown on ethanol. Best efficiency and composition of cells obtained with high growth rate, limited by ethanol concentration.
Comments

Abd-El-Akher, M.A.
et al.
Production of high protein feed additives from fermented whey.
I. Physical studies on cultivation of yeast in whey.

Bednarski, W. et al.
Production of bacteria mold biomass on whey medium.

Bellamy, W.D.
Single cell proteins from cellulosic wastes.

Bernstein, S. & Eversen, T.C.
Protein production from acid whey via fermentation.

Bomar, M.K. & Schmid, S.
Eiweiss aus Cellulose.

Callihan, C.D. & Irwin, G.H. Jr.
Growth of bacteria on an alkali treated cellulosic for food protein production.

Cheng, W.-S.
Use of amylolytic microorganisms for the production of a high protein product.

Recommends the use of a thermophilic Actinomyces sp. able to degrade lignins.

Report on a pilot scale process using a yeast.

Report on a laboratory scale process utilizing bacteria.

Cellulomonas uda grown on alkali treated sugar cane bagasse in batch and continuous culture.
Comments

Chierici, L. et al.  
Yeast grown on N-paraffins, a new source of protein. Animal experiments.  
Oli, Grassi, Deriv.  
10(1974):1, p. 2-4  
:2, p. 11-14.

Cooney, J.J. et al.  
Hydrocarbon utilization by Cladosporium resinae.  
Dayton Univ. Ohio, USA.  

Cooney, C.L., Levine, D.W. et al.  
Production of single-cell protein from methanol.  

Daly, W.H. & Ruiz, L.P. Jr  
Fabrication of single-cell protein from cellulosic wastes.  
Louisiana State Univ.  
Baton Rouge, USA.  
(1975) Feb r. 66 p.

Deb, D.B. et al.  
Edible alga of manipur - (Lemanea-Australis) - presence of silver.  

Du Chaffaut, J.A. & Magnoux, C.R.  
Protein material from hydrocarbons by fermentation.  
Ger. Offen. 2,330,427  
Brit. Appl. 28231/72  

Dunlap, C.E. et al.  
Single-cell-protein production from cellulosic wastes.  

Hansenula polymorpha grown at 37° and a thermophilic mixture of bacteria grown at 55°, both in continuous culture, are compared with other methanol-utilizing SCP sources.

Use of flocculating agents to remove Cellulomonas cells from medium.

Yeast production on hydrocarbons is increased by letting bacteria, which are later removed, consume the carboxylic acids first formed in the medium.


Fofanov, V. et al.  
Hydrogen bacteria as a possible source of forage and food proteins.  

Grethlein, H.E. & Converse, A.O.  
Single-cell protein from refuse.  
Specialrapport från IVA. (1974)

Grigoryan, A.N. et al.  
Microbiological production of protein for animal feed from gaseous hydrocarbons.  
Ger. (East) 101179 USSR (1973) C 12CB 711228.

Han, Y.W. et al.  
Cellulose fermentation: Effect of substrate.  
Pretreatment on microbial growth.  

Hang, Y.D.  
Production of food yeast from acid brine.  
CICP V2N11 B743373.

Harrison, D.E. et al.  
Microbial protein.  
Protein Pseudomonas feed.  
Ger. Offen. 2418385  
C 12 D Brit. 18,460/73  
1973-04-17, 9 pp.  
1974-10-31

Harrison, D.E.F. et al.  
Yield and productivity in single-cell protein production from methane and methanol.  

The paper contained in municipal waste supports growth of Candida utilis, if first hydrolyzed at low pH and high temp.
Hayes, W.A.
Mushroom cultivation — prospects and developments.
Process Biochem.
p. 21-28.

von Hofsten, B.
Industridlat svamp-mycel — ett nytt livsmedel.(In Swedish)
Livsmedelsteknik (1974):9
p. 403-406.

von Hofsten, B. & von Hofsten, A.
Ultrastructure of thermo-tolerant basidiomycete possibly suitable for production of food protein.
Appl. Microbiol.

Hottinger, H.H. et al.
Utilization of fish oil by Candida lipolytica and Geotrichum candidum.
I. Basal conditions.
J. Milk Food Technol.

Humphrey, A.E.
Production of food and feed by fermentation.

Humphrey, A.E.
Fermentation.

Sauvageot, J.J.
Microbiologie des préparations de protéines alimentaires d'origine unicellulaire.
1. Spirulines.

Comments

Discusses the cultivation of Agaricus bisporus on fertilized compost.

Industrial cultivation of mould for use in food.

Sporotrichum pulverulentum grown on cereal flours.

Samples from different places where Spirulina spp grow are analyzed as regards their content of other microorganisms.
Jaleel, S.A.  
Proteins from micro-algae – another single cell protein.  
Chem. Ind. Developm.  

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