Soy protein isolate contains up to 90% protein; the non-protein calories are very low and may be disregarded with respect to calories. For this reason, soy isolate is especially suitable for slimming food with an extremely low calorie content.

In selecting the proteins suitable for our products we also paid attention to color. Isolated soy proteins meet our color requirements well.

Soy protein isolate has good physical qualities which, from the functional point of view, are important for the preparation of food. Dispersion and suspension power are especially important. A further advantage is the relatively wide range of special soy protein types available. This means that they can be used in many ways, which makes it technically possible to adapt them to special requirements.

The storage qualities of the product are naturally important for the industrial manufacture of food. Consequently, great importance is attached to the investigation of the shelf life of our products. The storage tests of the packed products were carried out under normal conditions, i.e. at 20 C and at ca. 40% humidity, as well as at 4 C and ca. 55% humidity and at 38 C and ca. 90% humidity. At certain intervals the products were tested for taste, smell, and color. It was established that soy protein isolates, both as raw materials and as ingredients in our low-calorie end-products, have relatively good shelf life when correctly stored. Storage may be described as correct if there are normal room temperatures in the warehouse and if the products are exposed neither to direct sunshine nor high humidity but are stored in a cool, dry place.

REFERENCES

1. "Ernährungsbericht 1972," Deutsche Gesellschaft für Ernährung e.V., Frankfurt a.M., West Germany, 1973.
2. Gutezeit, G., Ernährungs-Umschau 10:346 (1972).
3. Aretz, H.H., H. Schulz, and G. Probst, Klin. Wschr. 49:125 (1971).
4. Holtmeier, H.H., "Diät bei Übergewicht und gesunde Ernährung," Georg Thieme Verlag, Stuttgart, West Germany, 1969.
5. Rapoport, S.M., "Medizinische Biochemie," Verlag Volk und Gesundheit, Berlin, West Germany, 1969.
6. Delauchaux, A., Rev. Med. Suisse Rom. 87:636 (1967).
7. Lang, K., "Biochemie der Ernährung," Bd. I, Verlag von Dr. Dietrich Steinkopff, Darmstadt, West Germany, 1957.
8. Lang, K., and O.F. Ranke, "Stoffwechsel und Ernährung," Springer Verlag, Berlin, West Germany, 1950.
9. Berg, G., and W. Fekl, Medizin und Ernährung 12:185 (1971).
10. Hegsted, D.M., "Proteins, Nutrition–A Comprehensive Treatise," Vol. I, Academic Press, New York, N.Y., 1966.
11. Meyer, E.W., in "Proceedings of International Conference on Soybean Protein Foods," ARS 71-35, United States Department of Agriculture, May 1967.
12. Zipfel, W., "Lebensmittelrecht," Bd. I, Stand 1, Verlag C.H. Beck, München, West Germany, 1973.

Protein Based Whipping Agents

J.W. MANSVELT,
Lenderink & Co. B. V., Schiedam, The Netherlands

INTRODUCTION

Aeration, the incorporation of a great number of small air bubbles into a food, transforms this food into a gas liquid dispersion, called foam or sponge. The air bubbles are surrounded by an extremely thin, but often tough, lamella and are usually small enough to be visible to the naked eye.

To create a foam structure, two requirements must be met: the composition to be aerated must contain a sufficiently large percentage of a *surface active agent*, and a sufficiently large amount of *energy* must be expended on the system.

SURFACE ACTIVE AGENTS

Surface active agents are substances characterized by the presence of hydrophobic and hydrophilic groups in the same molecule. Consequently, when present in dispersed systems, these molecules tend to concentrate in the interface between the two immiscible phases: oil-water, solid-liquid, and air-liquid. There, through specific orientation and possibly intermolecular bonding, stable two-dimensional network structures will develop that increase the stability of the dispersion. In the case of air-liquid dispersions (foams and sponges) the surface active agents are called whipping agents or aerating agents. They may be present in the original food (egg albumen in eggs), they may be formed during processing (protein derivatives in beer), or they may be added intentionally during the processing operation (egg albumen in the production of nougat or glycerol-monostearate in the case of cake batters).

To satisfy food law requirements, whipping agents should preferentially be of natural origin. Proteins and protein derivatives find general application and such products as egg albumen and gelatin have been used traditionally. More recently, modified natural proteins of vegetable or animal origin, tailor-made to any specific application under strict laboratory control, are finding increased use. Being standardized to a high degree, they are better adapted to modern, continuous in-line processing.

BEATING OR WHIPPING

To supply the energy needed for the enormous expansion of the air-liquid interface that takes place during foam formation, mechanical means are used; and the operation is, therefore, called beating or whipping. The equipment used for this operation varies greatly: from the simple household wire whisk to big industrial in-line equipment. Aerating equipment can be designed for batch operation or for continuous processing and can be designed to operate under atmospheric pressure and to use air under increased pressure.

The process used for introducing aeration may be subdivided in two different systems that both have their advantages and disadvantages. In the one-step system all, or nearly all, of the ingredients used in the formula are mixed together and then whipped into a foam. In the case of the two-step system a part of the ingredients first is whipped into a light foam, while the rest of the ingredients are incorporated either as such or into a solution or a syrup. The use of the simple one-step system or the more complicated two-step system depends upon a number of factors, including moisture content and the presence or absence of fats, oils, or other foam inhibiting substances.

ADVANTAGES OF AERATION

The effects of aeration on the end product are two-fold. First, there is a definite improvement in quality. This is particularly noticeable in texture and consistency—smoother, less sticky, better eating characteristics, and better digestibility. In the second place, there is the effect of the density reduction.

In the case of foods sold as pieces or portions of a given wt, there is a volume increase that improves sales appeal. In the case of foods sold at a given volume, aeration will, of course, reduce the wt of ingredients used and, thus, lead to a reduction in ingredients costs.

The effects realized through aeration depend upon the degree of aeration chosen, that is on the amount of air incorporated. In a number of cases, even fairly small volumes of air can bring about considerable improvements in texture and consistency.

USES OF AERATION

The scope of aeration through protein based whipping agents is wide. Typical applications include such fields as sugar confectionery, nougat, fondant cream, marshmallow; biscuits and cookies; snacks, including aero fat types; desserts, chilled, frozen, canned, instant; foam headings in soft drinks; special ice cream products and frozen items; salads; vegetable creams; etc.

Study of Nutritive and Biological Value of Textured Soy Proteins in Adults, Children, and Rats

G. DEBRY, Department of Nutrition and Metabolic Diseases, University of Nancy, Nancy, France, and **B. POULLAIN** and **R. BLEYER**, Research Group of Nutrition and Dietetics, National Institute of Health and Medical Research, Nancy, France

INTRODUCTION

We here summarize the various studies which were carried out in our laboratory on extruded textured soy protein. We studied: (A.) the acceptance by adults, (B.) the acceptance by children, (C.) the comparison of the nitrogen balance of adults who first ate a diet of normal foods and then ate a diet in which meat protein was replaced by textured soy proteins, and (D.) the comparison of the efficacy of soy protein diets with casein diets for the growth of rats previously fed a protein free diet for 14 or 42 days.

STUDY OF ACCEPTABILITY OF TEXTURED SOY PROTEINS BY ADULTS FOR A 3 WEEK PERIOD

Protocol

Ten volunteer adults participated for 3 weeks. Each subject ate a daily lunch of 40 g dried soy protein instead of meat protein. Three kinds of dried soy protein were used in the dishes: ham flavor, beef flavor, and no flavor. The adults ate normal food at dinner. The weekly menu was repeated three times.

Results

The acceptance and digestive tolerances were quite satisfactory. These satisfactory results were probably due to the good quality of soy protein. However, the preparation and treatment of the recipes and the art of cooking also played important roles.

COMPARISON OF THE ACCEPTABILITY OF A FIXED DIET AND AN AD LIBITUM DIET BY CHILDREN

Protocol

Subjects: Two groups of children in good health participated. For several months, all children lived in an

TABLE I

Acceptance of Soy Protein by Children
Soy Protein Offered and Consumed[a]

Group I infants[b]	Week of fixed diet		Week of ad libitum feeding	
	Offered	Consumed	Offered	Consumed
Average of 11 subjects	10	9.7	9.5	8.2
t	1.02	1.28	0.08	2.58

[a]Soy protein (in g) offered and consumed.
[b]Average age: 33 months.

TABLE II

Acceptance of Soy Protein by Children
Soy Protein Offered and Consumed[a]

Group II infants[b]	Fixed diet		Ad libitum feeding	
	Offered	Consumed	Offered	Consumed
Average of 12 subjects	7.5	7.1	8.3	8.3
t	0.99	1.52	1.41	1.95

[a]Soy protein (in g) offered and consumed.
[b]Average age: 48 months.

TABLE III

Nitrogen Balance Studies on Adults[a,b]
Comparison of Digestibility, Net Protein Utilization, and Biological Value of Meat with Textured Soy Protein

Subjects	Meat			TVP		
	CDU	NPU	BV	CDU	NPU	BV
Average value on 10 subjects	89.5	39.3	43.6	87.7	30.9	35.7
t^c	2.42	14.8	17.1	4.88	13.6	15.6

[a]Comparison of digestibility, net protein utilization, and biological value of meat with textured soy protein.
[b]NPU = net protein utilization, TVP = textured vegetable protein, and BV = biological value.
[c]No significant differences were found according to student's t test.