

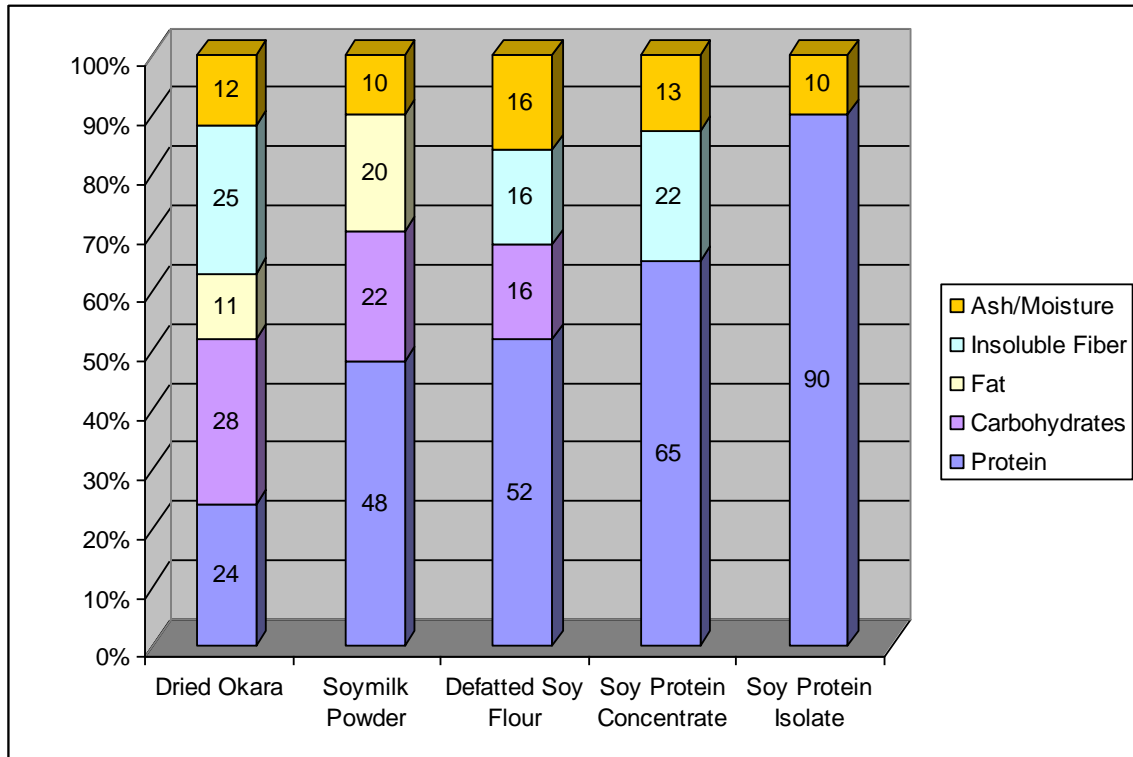
SOY PROTEIN – Sources and Utilization

Rajendra Gupta, ProSoya Inc., Ottawa, Canada

Soy protein is available from various sources – soy flours, soy protein concentrates and isolates, textured soy proteins, soymilk powder, dried tofu, okara, etc. They are selectively used in a whole range of products to enhance nutrition and as functional ingredients. Functional properties include foaming, whitening, fat and water absorption, crust formation, gelation, viscosity, solubility etc.

Soybeans are, environmentally and economically, the lowest cost source of edible protein. Chinese have been using soybeans for 5000 years as nutritious food source. The age old consumption of soybean protein has been in the form of soymilk, tofu, yuba, okara, toasted soy flour, soybean sprouts, miso, nato, tempeh, and soy sauce. With the introduction of soybean to the West in the last century, and its cultivation in large farms mainly for its oil contents, technologies were developed for the utilization of soybean meal left after oil extraction.

To date, the main use of defatted soybean meal (up to 55% protein) is for making animal feeds. A small fraction is used for producing food ingredients. The term soy protein ingredient is typically used for processed edible dry soybean products other than meal products for animal feed. They provide desirable functionalities in processed foods at less cost than animal derived alternatives, such as dried milk solids, casein, egg yolk, egg white, an gelatin. Key such ingredients are shown in the bar graph along with their nutritional components.



Dried Okara powder is a low cost, highly insoluble fiber ingredient that can absorb over 4 times its weight of water. It is dried form of the insoluble residue in the extraction of soymilk from soybeans. It used as a thickening and protein enriching agent in sauces, gravies and soups, and as a water absorbing protein rich fiber in baked products. As it has no taste of its own, it does not alter the taste profile of the product. Many ready to eat meat-like vegetarian foods are made

using okara, including soy sausages, pate, okara and vegetable sauté, okara burgers and okara tempeh.

Soy milk Powder produced from liquid soymilk, extracted from whole or dehulled soybeans, by concentrating and spray-drying, in a way similar to dairy milk powder, can have solubility similar to dairy milk powders. It has almost 50% more protein than the skim milk powder, and can be produced at a cost significantly lower than the dairy milk powder. As it also has high quality fat and carbohydrates, its use could save almost 50% over the use of skim milk powder in many applications. Being a grain product, soymilk powder can also replace 25% to 50% of wheat and other flours in cookies and other baked goods, thus making them nutritionally superior.

Soy milk powder is most often used for making soy beverage mixes, frozen dessert mixes, reconstituted soymilk, tofu, soy yogurt, etc. When sold directly to consumers, soymilk powder formulations are typically instantized for rapid dispersion and dissolution in water. It is a lower cost and wholesome alternative to soy protein isolates in many applications where fat and carbohydrates of soymilk are advantageous or acceptable.

Just like liquid soymilk, extraction process determines the taste profile and functionality of soymilk powder. Soymilk made using oxidation free grinding of soybeans in cold or warm water yields soymilk powder with most bland taste and very high solubility.

Defatted Soy Flour is classified based on its heat treatment, indicated by the Protein Dispersibility Index (PDI). Higher the heat treatment, lower the PDI, the enzyme activity, and protein solubility, but higher the digestibility and the flavor stability. Typical applications are as follows:

PDI	Use
10-25	Protein Beverages Baby Foods Meat Products Gravies, sauces and soups Hydrolyzed Vegetable Protein
30-45	Nutrition Fat and water absorption Emulsification Bakery mixes Meat products
50-75	Bakery and donut mixes Fat and water absorption control Pastas Baby foods Breakfast cereals
80 and higher	Bleaching agent - white bread No-fat soymilk and tofu Fermentation

Soy Protein Concentrate is made by removing a portion of the carbohydrates (sugars) from dehulled and defatted soybean meal. The most common method used is alcohol extraction. However this method results in loss of the soy isoflavones. The other method is the water extraction method to remove the sugars. This method has good retention of the isoflavones in the final product. Soy protein concentrate retains most of the fiber of the original soybean. It is widely used as functional or nutritional ingredient in a variety of food products, mainly in baked foods, breakfast cereals and in some meat products. It is also used in meat and poultry products

to increase water and fat retention, and to improve nutritional values (more protein, less fat).

Soy protein concentrate should contain at least 65% protein on a moisture free basis. The protein can have different solubility characteristics, depending on the extraction method. Some applications, such as drinks, require a highly soluble protein. The soy protein concentrate made with the alcohol wash have low solubility. They are available in different forms: granules, flour and spray dried powder.

Soy Protein Isolate is the soy protein with the highest content of protein. It is made from defatted soy meal by removing most of the fats and carbohydrates, yielding a product with 90 percent protein. Soy protein isolate has a very neutral flavor compared to many other soy products. The consumption of soy protein isolate does not cause flatulence because most of the carbohydrates have been removed,

Soy protein isolate is used in the food industry for nutritional (increasing protein content), sensorial (better mouthfeel, bland flavour) and functional reasons (for applications requiring emulsification, water and fat absorption and adhesive properties).

Soy protein isolate is used in the following food products:

- meal replacements
- breakfast cereals
- energy and protein bars
- snacks
- weight loss ready-to-drink beverages
- soups, sauces and prepared foods
- baked foods
- Soy beverages
- ice cream, yogurt and other dairy or dairy-free products
- meat alternatives
- processed meat, poultry and fish products

Functionality optimized soy proteins isolates have been developed for different applications. Thus for beverages, there is high solubility soy protein isolate whereas for meat application it has moisture and fat binding properties.

In conclusion, if you have a food application that requires solution, look no further than soy protein.

Rajendra Gupta, Ph. D.
President
ProSoya Inc.
2-5310 Canotek Road, Ottawa, Canada K1J 9N5
+1-613-745-9115
gupta@prosoya.com
www.prosoya.com