FrontLine®
TECHNICAL INFORMATION FOR TODAY'S FEED PROFESSIONAL

A Guide to Soy Protein

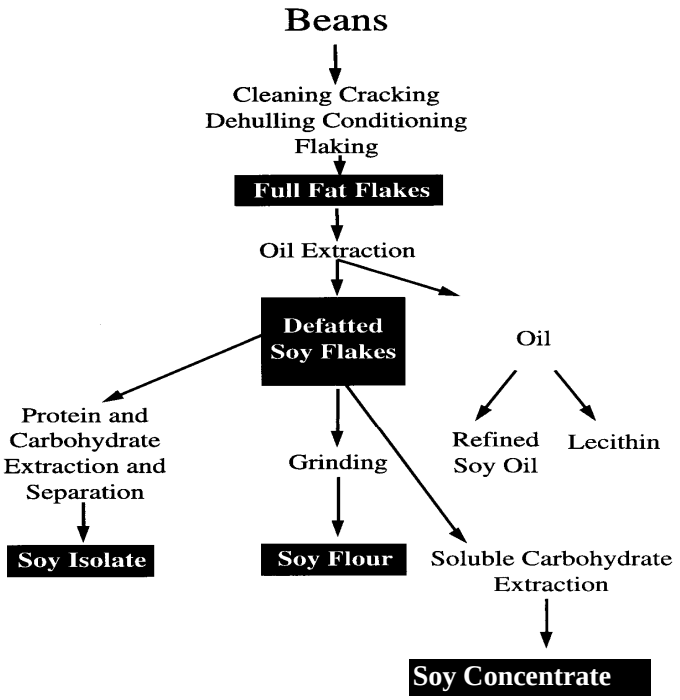
As essential building blocks of life, amino acids are critical nutrients in any animal diet formulation. Protein, as the precursor of amino acids, is available from many biological sources. Conventional wisdom shows that soybeans appear to be the world's most efficient source of protein. When properly processed for specific applications, soybean protein can be well utilized by virtually all classes of animals. This article will examine how soy proteins are produced along with their chemical, physical and nutritional characteristics, to give a better understanding of how these products fit into formulations, now and in the future**.**

Soybean Composition

Both storage proteins and lipid bodies are contained in the usable meat of the bean (called the cotyledon). The complex carbohydrate component of the soybean is also contained in the cell walls of the cotyledon. The outer layer of cells, called the hull or seed coat, makes up about 8% of the bean's total weight. The raw, dehulled bean is, depending upon variety, approximately 18% oil, 38% protein, 30% carbohydrate, and 14% moisture and ash. The carbohydrate component is normally about 15% soluble carbohydrate (Sucrose, Stachyose, Raffinose, etc.), and about 15% insoluble carbohydrate (dietary fiber). The oil component has about 0.5% lecithin.

Soybean Processing

Beans are received from the producer and stored under controlled conditions until used. The first step in soybean processing is cleaning.



Milk Products
The Milk Replacer Source™
FOR MORE INFORMATION, CALL OR WRITE MILK PRODUCTS, LLC
P.O. Box 150, Chilton, Wisconsin 53014, (920) 849-2348, Fax (920) 849-9014 www.milkproductsinc.com

Beans destined for uses where the microbiological standards of the finished product are critical, receive intensive cleaning to remove dirt and other debris. After cleaning, the beans are conditioned (to make removal of the hull easier), cracked and dehulled, and rolled into flakes. The flakes are subjected to a solvent bath that extracts the oil. The solvent is then removed and the flakes are dried, creating the soy flakes that are the source of soy protein products. The soy flakes from beans processed principally for human food are the source for the three basic types of soy protein: flours, isolates and concentrates.

Types of Soy Protein for Animal Nutrition

Each type of soy protein has its own set of characteristics and common uses.

Soybean Meal (Soy Flour) Soybean meal and soy flour (made from soybean meal) are generally good protein sources for many classes of livestock, but do contain compounds which are not well utilized by some classes of animals. These compounds include the oligosaccharides and a protein matrix which is not well digested by very young animals.

Soybean meal is the simplest form of soy protein with a protein content of either 44% or 48% depending upon the level of fiber included. Soybean meal is toasted under moist heat conditions to improve its nutritional value. Normal toasting procedures reduce but do not eliminate trypsin inhibitor or urease, nor does normal toasting significantly reduce the antigenic properties of soybean meal. Processed soybean meal retains the level of oligosaccharides native to the bean. Oligosaccharides (such as Raffinose and Stachyose) are soluble carbohydrates that are poorly utilized by some species of animals.

	Concentrate (SPC)	Flour	Isolate (SPI)
g/100g product			
Protein (as is)	64	48	92
Fat (Min.)	0.3	0.3	0.5
Moisture (Max.)	10	10	5
Fiber (Crude)	4.5	3.0	<1
Ash	7	7	4

Soy Isolates In the 1950s, soy protein isolates were perfected for food use. Isolates are produced through chemical isolation, drawing the protein out of the flake through solubilization and separation followed by isoelectric precipitation. They are a minimum of 90% protein on a moisture-free basis and can be made with a high percentage of soluble protein and a low flavor profile. They have no dietary fiber and are often high in sodium. The processing that produces isolates is relatively complex, with much of the valuable protein in the soybean lost in the separation steps of the process or rendered less digestible by the severe chemical conditions in the isolation process.
Isolate manufacture is not a very economical or nutritionally beneficial use of the raw material. The cost of isolate products is high.

FOR MORE INFORMATION, CALL OR WRITE MILK PRODUCTS, LLC
P.O. Box 150, Chilton, Wisconsin 53014, (920) 849-2348, Fax (920) 849-9014 www.milkproductsinc.com

Soy Concentrates In the 1960s, so called "traditional" concentrates were developed to overcome the problems associated with soybean meal, but at a lower cost than isolates. Concentrates are approximately 65% protein as-is (70% protein on a dry weight basis), recovering almost all of the protein in the bean. Traditional concentrate manufacturing practices not only increase the protein content, but can also significantly reduce growth-limiting factors which have limited the inclusion rate of soy protein for feeding young animals:

- Trypsin inhibitor
- Urease, lectins, goitrogens
- Saponins
- Indigestible and fermentable sugars:
  - Stachyose
  - Raffinose
  - Sucrose
  (which can cause flatulence and diarrhea)
- Pathogenic organisms
- Unpleasant flavors (may cause feed rejection)
- Soy antigens

In the 1980s, a new generation of soy protein concentrates was developed. Specially processed concentrates are currently the most highly developed forms of soy protein that commercial technology allows. These concentrates have also shown an improved feeding performance in certain animal species. Anti-nutritional factors listed above are reduced to insignificantly low levels or totally eliminated.

Source:
Central Soya Chemurgy Division, The Protein Book - A Guide to Soy Protein for Animal Nutrition

FrontLine®
TECHNICAL INFORMATION FOR TODAY'S FEED PROFESSIONAL

July, 1990

Milk Products
The Milk Replacer Source™

FOR MORE INFORMATION, CALL OR WRITE MILK PRODUCTS, LLC
P.O. Box 150, Chilton, Wisconsin 53014, (920) 849-2348, Fax (920) 849-9014 www.milkproductsinc.com