SOY PROTEIN TOO BIG TO FAIL

Author & Protein Application Specialist, Henk Hoogenkamp, gives his expert opinion on the potential of soy protein.

SOYBEANS are known to contain specific proteins that cause allergic reactions or inhibit the absorption of other nutrients such as the so-called anti-nutritional proteins like trypsin inhibitors and lectins (carbohydrate-binding proteins). Humans and some animals have intolerances or sensitivities to these proteins.

In the early 1990s, the term "soy protein" was changed to "vegetable protein" as a strategic move to ease concerns and improve negative perception of soy. Today, soy negativism lingers primarily due to the attempts of the US-dominated soy industry to position its protein source as a pseudo-pharmaceutical ingredient to alleviate symptoms like high cholesterol, pre-menstrual symptoms (PMS), and some forms of cancer.

SOY PROTEIN BACKLASH

Ever since the popularisation of "natural" and "clean-label" food, as well as the many attempts to elevate soy protein as a "health protein", soy protein has become a red flag and focal point of consumer purchasing resistance. Women, especially, have not forgotten the heavy influx of propaganda around soy genistein as a means to suppress PMS and a few more ailments.

Words such as "isoflavones" and "genistein", which were heavily promoted by the soy protein industry to treat a host of health issues, have now been eliminated from the vocabulary of the modern consumer. There is also the destruction of the Amazon forests largely due to the expansion and land grabbing for soy crop production, and it becomes clear why increasing numbers of consumers have second thoughts about purchasing foods formulated with soy protein ingredients.

Nevertheless, despite all the negativism, soy protein has dominated the plant protein category for many years and is still the most important source of plant protein globally.

Although the soybean is a cheap commodity with great nutritional value to the world of food security, it is also one of the most destructive monoculture facets of modern agriculture associated with ecological tropical disasters in the Amazon regions that contribute to climate change and water pollution.

The soy industry faces an uphill task of easing consumer concerns that soy protein ingredients are not being sourced from cleared Amazon forests. The current political climate, which is affected by the Ukraine war, may complicate the world's ability to create alternate crop supplies. These conditions are worsened by the drop in potassium exports from Russia and Belarus, which could potentially crush the much-needed fertilisers for soy crops.

ALTERNATIVES: EASIER SAID THAN DONE

Although the market domination of soy protein will not change anytime soon, soy must share the limelight with emerging plant proteins from barley, rice, pea, fava, and chickpea. Pea protein has become a formidable competitor and is now regarded as a premium alternative in the upper echelon of applications, including premium plant-based meat alternatives, and pea protein-formulated beverages.

Another major market change is the increasing dominance of China in the foray of soy protein processing. China is not only the world's top soy importer, but also possesses top-notch soy protein processing facilities, including protein isolation and extrusion processing. China, not the US, now operates the world's largest soy protein-processing facilities.

STILL NUMBER 1

Despite soy being classified as an allergen, soy plant protein remains as the world's "champion ingredient" used in many different processed foods and formulated (plant) meat products, as well as massive amounts for animal nutrition. The use of soy protein in formulated plant-meat products shows a healthy growth curve, though pea protein, and single-cell protein (fungi), and cultured protein ingredients like "non-animal milk proteins" are catching up.

Plant proteins are on the upswing and the number of consumers that are switching to a plant-based diet is accelerating with its demand growing. An increasing number of consumers prefer convenience foods while insisting on the use of natural and healthy ingredients. This has created a growing demand for natural yet functional ingredients with superior flavour and nutritional profiles.

There are interesting new alternative plant protein developments, some of which are the much needed upcycled ingredients:

- Oat protein
- Canola (rapeseed) protein
- Potato protein
- Wheat protein
- Barley protein
- Sunflower protein
- Leaf plant protein (Rubisco)
- Hemp protein
- Coffee flour

- Mycellium or fungi (protein)
- Fava bean protein
- Mung bean protein
- Chickpea
- Lemnacea protein (Lentil Protein - Duck wheat)

For the soy protein industry, it will be important to see the emergence of alternative protein sources as a vehicle to collaborate, rather than consider these plant proteins as competitive threats. When everything is said and done, the soybean remains a powerhouse of high-yielding oil and protein for mass market appeal, profitability, efficacy, and performance, which oftentimes makes soy protein the most logical way forward.

SOY PROTEIN PROCESSING CHOICES

Separating the components using a variety of technologies like crushing, solvent extraction, aqueous extraction, or dry fractioning are possible processing steps for ultimately purifying the soybean protein ingredient.

In simple terms, the soybean is crushed and generally subjected to hexane solvent extraction to remove the oil, which yields defatted soy flour with 50% protein content. The defatted soy flour or soy flakes still contain soluble and insoluble carbohydrates and fibres, so these components will need to be removed further downstream.

Most, if not all, of today's soy protein manufacturing are made from the soy flakes to manufacture soy protein concentrate (65% protein) and soy protein isolate (90% protein). In 2021, some 1.5 million metric tons of soy protein concentrate, and soy protein isolate were produced worldwide.

Using hexane and chemicals like hydrochloric acid (HCl) as processing aids will likely become a target for discussion, now that an increasing number of customers prefer natural and clean ingredients in their food of choice. In addition, the traditional manufacturing process of soy protein ingredients cannot be considered ecologically friendly when taking the large amount of clean water needed. For example, it takes about 30L of clean water to produce 1kg of soy protein isolate. Hence, innovative and alternative technologies will expectedly become available to manufacture soy protein. Dry fractioning is such a method, which separates the various particle components and allows the plant protein bodies to be kept intact while using high-speed airflow to separate components based on size and density.

MOVING TO CLEAN SOY PROTEIN ISOLATE

Nearly all conventional soy protein ingredients — including soy protein isolate, soy concentrate, and soy flour — have undergone hexane processing. Hexane is a by-product of gasoline refining, and the chemical is a cheap and efficient method to extract oil from the soybeans.

The Centers of Disease Control and Prevention (CDC) have classified hexane as a neurotoxin and hazardous air pollutant. However, the FDA does not require food and meat companies to test their products when foods contain soy protein ingredients. The huge drive to natural and clean-label foods has opened the doors for hexane-free soy protein ingredients.

The US market for soy protein ingredients used in branded formulated foods has declined in recent years. The exception is the rapid growth of soy protein-formulated plant-based meat alternatives such as those made by Impossible Foods. Pea protein has become a formidable competitor and sales of these ingredients are growing rapidly, with demand outstripping availability at times.

To offset the negativism and proactively make "clean soy protein" ingredients available. Soy protein companies like ADM and Gushen (China) have developed "hexane-free plant protein" products. Gushen is spearheading these changes and now has the world's largest hexane-free soy production facility in full operation.

Legacy foods companies are also actively engaged in reformulation projects while contemplating to either switch to hexane-free "clean soy" or use an alternative source of protein ingredient. These alternative protein applications include plant-meat, vegan foods, and beverages, textured crunchy protein crisps for nutri-bars, infant formulations, as well as (sports) nutrition

and wellness beverages. As can be expected, these formulation changes come at a cost and will drive up the price: clean-soy protein isolates typically cost some 40% more.

NON-HEXANE- OR ORGANIC SOY PROTEIN

Hexane-extracted soy protein is banned in organic formulated foods. Aside from organic foods, there is also a growing demand for hexane-free processed soy protein ingredients. It will be interesting to see if the large soy companies will react to these market dynamics and eventually give in to these specific processing requests.

On the heels of hexane-free soy protein come acid-wash-free soy protein ingredients. One step further is the demand for organic-grown and processed soy protein isolate, an example of which is the non-GMO organic expeller-pressed soy protein. This market remains rather fragmented and will probably not make it beyond a few thousand metric tons, at best.

ALLERGY: NOT AN AFTERTHOUGHT

The hypoallergenic status of protein has become a strong driver for food formulation, thus prompting some companies to eliminate soy protein ingredients from processed foods and replace it with pea protein, rice protein, fava protein, barley protein, and hydrocolloids.

These days, both the FDA and USDA's Food Safety and Inspection Service (FSIS) are taking food allergies much more seriously. The FDA has identified nine food categories that account for more than 90% of all food allergies. According to the CDC, 12.2 million people in the US are suffering from food allergy.

Concern over food allergens makes it difficult for soy to be considered the lead protein in allergen-sensitive applications. Soy proteins, at inclusion levels from 1 to as much as 12%, are often the dominant ingredients in processed meat and meat analogs. In South Africa, an inclusion level of 10% soy protein in hotdogs is quite normal. The food legislation in South Africa allows soy protein to count as part of the minimum meat protein requirements.

In a veggie hotdog, a soy isolate inclusion level of 6–10 percent is typically needed to simulate meat texture and appearance in conjunction with a similar amount of wheat-gluten. It is theorised that a too high daily intake of some plant protein ingredients may ultimately cause allergic responses.

For many years, management of US dominated soy protein industry tried hard to increase the inclusion level of their ingredient in processed meat products in overseas territories. Their aim was to load up sausages and hams with the highest possible amount of soy protein to maximise production. Inclusion levels of 4% soy isolate in English breakfast sausages and 6% soy protein isolate in Eastern European bologna-type sausages did negatively change the characteristics of the products to the point of consumer rejection.

SOY'S NON-ALLERGIC ALTERNATIVES

Now that all-natural pea protein, barley protein, and rice protein ingredients have been introduced, these proteins are expected to further strengthen specifically the toolbox of food formulators due to their superior taste and hypoallergenicity.

Approximately 1.5% of North American adults and 6 percent of children below three years old have food allergies, prompting US and EU authorities to develop legislation mandating allergy-warning labels on foods. Food allergies are increasingly common. A recent study by the CDC reported that 6.4% of children under 18 have food allergies, an increase of more than 50% since 2007.

Theoretically, all protein-containing foods can cause an allergic reaction. Many people without clinical symptoms can become hypersensitised when an offending protein triggers an antibody response. Every subsequent re-exposure increases sensitivity until a full-blown allergy develops.

Most people outgrow their food allergies, except for peanuts, fish, and shellfish, which often provoke a life-long allergy. There are indications that a growing number of people are developing soy allergy sensitivities.

An anaphylactic reaction is a severe allergenic response that occurs when the body's immune system overreacts to a particular allergen. Food, insect stings, medications, latex, and other substances may cause these reactions. There is strong medical evidence that food allergy is increasing among Western populations.

Now that new varieties of the soy plant have been developed with low levels of anti-nutritional and allergenic proteins, this will also allow the elimination of the need for heat treatment, which is normally applied before using raw soybeans. These gene-manipulated soy species could significantly reduce or eliminate intolerance of allergic response in both humans and animals. APFI