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Taifun Soy Info

Specialist information for soy producers and processors

Soy analyses and laboratories

Today, numerous soybean constituents can be qualified and quantified using modern analytical methods. Further processing, quality assessment and payment for the harvest often depend on these analyses.

Following, an overview of the most important analysis parameters and methods is given. It also lists laboratories that have experience in carrying out these analyses. No claim is made to completeness. Also a listing is not to be seen as a recommendation.

Crude protein content and amino-acid composition

The most widespread and common wet chemical method for protein determination is the so-called **Kjeldahl method**. Here, a defined sample quantity is decomposed with sulphuric acid and the nitrogen is converted into ammonium sulphate. By adding a strong base (e.g. NaOH) ammonia is released and can be determined titrimetrically. The nitrogen content determined in this way is converted to the protein-forming amino acids using a specific factor (approximate value for soybeans: 6.25). The protein content of soybeans is about 36 - 48 % of the dry matter.

A **NIRS** instrument (Near Infrared Spectroscopy) with an appropriate calibration is suitable for the non-destructive determination of protein content. Through electromagnetic radiation molecules are stimulated to vibrate. In the near-infrared range, mainly bonds involving hydrogen atoms absorb radiation. The near-infrared radiation stimulates the molecular bonds to oscillate and characteristic absorption bands for certain groups of atoms are formed.

First of all, the instrument must be calibrated for the substance to be analysed, which means that NIR spectra are recorded for known quantities of the substance to be analysed. Another non-destructive measuring method is the **NIT** (Near Infrared Transmission) method. The part of the infrared rays that has penetrated the samples is measured and, with appropriate calibration, the protein content is determined. IG NITNET, founded in 1998, calibrates and certifies appropriate devices to ensure the accuracy of measurements in order to achieve the same values with the same devices and to strengthen confidence in the measurements (http://www.bwv-rlp.de/nitnet/). With both instruments, the measurement runs without any interference and the sample can be used for other purposes. The costs for NIRS or NIT devices are between 20,000 and 40,000 €.

For soy food or feed quality not only the amount of protein but also the **amino acid composition** is important. Even a slight temperature excess during the heat treatment of soybeans can reduce the content of the essential amino acids lysine, methionine, cysteine and tryptophan. These contents can be determined wet-chemically, but nowadays also with the NIRS method.

Laboratories using wet chemical methods are e.g. the Pieldner Institute in Stuttgart or the SGS Fresenius Group. At Evonik, samples can be analysed using NIRS. In addition, NIRS devices are often also available at elevators, cooperatives, or in farm shops.

Fat content

The crude fat content of soybeans is approx. 20% of the dry matter. It can be determined by extraction with solvents such as light petroleum or hexane. In addition, appropriately calibrated NIRS devices can also measure the oil content of soybeans.

Further feed analyses

The parameters defining feed quality vary depending on the animal species. First of all the Weender analysis of dry matter, raw ash, raw protein, raw fat, raw fibre, starch and sugar is important. This analysis can be carried out in any feed laboratory such as the LUFAs. A list of the laboratories in Germany can be found here: http://www.vdlufa.de/en/index.php/links/lufa

For pigs and poultry, the essential/limiting amino acids are also of great interest. If the success of a soybean treatment has to be monitored, the content of **antinutritive constituents** must also be analysed. In soybeans, these are mainly trypsin inhibitors (see below), urease and lectins.

Trypsin inhibitor activity (TIA)

The direct determination is performed according to the A.O.C.S. method. The activity is expressed in mg trypsin inhibitor/g crude protein. An untreated bean has values of approx. 25mg/g, a toasted bean should contain < 2mg/g. Since direct detection is very costly, an indirect determination is often made via the activity of the equally heat-sensitive urease. Urease occurs naturally in soybeans and converts urea into ammonia. For the analysis an urea solution is added to the soybean sample. Subsequently, a measurable amount of nitrogen in the form of ammonia is released per minute by the urease present. For optimally toasted soybeans, this amount should be below 0.4 mg/g dry matter/min. This value is relatively easy to determine, but due to the indirect measuring method it is very error-prone (EST GmbH, 2016).

Protein digestibility

The longer the heating process of the soybeans and the higher the temperatures, the more the values of the antinutritive constituents decrease. However, protein digestibility deteriorates at higher temperatures due to a change in the amino acid pattern. To measure this, the **protein solubility** in water (PDI) or in caustic potash solution (KOH) is added to the heat treatment monitoring. The optimum range for the PDI for soybeans is 10-35%, for KOH 78-85%. Values below 10% (PDI) or below 72% (KOH) indicate overheating (Bellof 2016).
The LUFA Speyer offers this analysis.

Genetically modified organisms (GMOs)

The analysis of contaminations with GMOs is usually carried out in the laboratory by PCR (Polymerase Chain Reaction) or, more rarely, with rapid strip tests (for details see Taifun Soy Info No. 10). With the PCR method, traces as low as 0.01% can be detected. For conventional food, the legal tolerance limit for contamination by components from approved GMOs is 0.9% (only incidental and technically unavoidable components). This tolerance limit also applies to organic products, although in Baden-Wuerttemberg, within the framework of organic monitoring, GMO contents of more than 0.1% were never found in tests of organic maize and organic soy products. Further analysis by the authorities are therefore to be expected if more than 0.1% GMOs are found in organic products.

The number of events admitted worldwide is currently about 25 and will continue to increase in the future. Therefore, the scope of analysis must also be constantly adapted and updated. A list of approved events as well as the current status of the events registered for approval can be found here: www.transgen.de

Accredited laboratories for the analysis of genetic contaminations by PCR are for example Eurofins GeneScan, Planton GmbH or GeneCon International GmbH.

Pesticides

MRLs are set at Community level in the EU for each active substance and each product analysed (Regulation (EC) No 396/2005). Not only toxicological effects and consumption quantities are taken into account, but also the so-called good agricultural practice. This highest permissible residue level thus generally regulates the marketability of a product (BVL, 2015).

Due to the worldwide cultivation of herbicide-resistant soybeans (Roundup Ready®) that can be treated with **glyphosate**, residue analysis for glyphosate and **AMPA** (aminomethylphosphonic acid, the main degradation product of glyphosate) is of particular importance. The so-called QuPPe (**Qu**ick **P**olar **Pe**sticides) method is used, which allows the simultaneous analysis of several highly polar pesticides that cannot be detected in other combined tests. The exact method description can be found here:
http://www.eurl-pesticides.eu/docs/public/tmplt_article.asp?CntID=887&LabID=200&Lang=EN

Analyses for pesticide residues other than glyphosate/MPA are usually carried out with combined tests, using GC-MS and LC-MS/MS (for polar to moderately non-polar pesticides). These tests can detect over 500 active substances with a detection limit of 0.005-0.1 mg/kg (depending on the active substance). The recognized detection methods for Germany can be found in the "Amtliche Sammlung von Untersuchungsverfahren nach § 64 LFGB, nach § 35 des Vorläufigen Tabakgesetzes und nach § 28b des Gentechnikgesetzes".
In Germany the **Bundesverband Naturkost Naturwaren** (BNN) has established its own laboratory accreditation with its own round robin tests to guarantee high quality and a uniform standard in pesticide analysis. It also makes it easier for members and interested companies to choose the right laboratory. Laboratories recommended according to BNN guidelines can be found here:
https://n-bnn.de/qualitätsarbeit/anerkannte-labore

Cadmium

Since soybeans can genetically absorb more cadmium than other species, analysis for cadmium is often indicated. How much cadmium is absorbed also depends on the variety. For example, Merlin and Sultana show high cadmium accumulation, while ES Mentor shows low cadmium accumulation (Vollmann et al., 2015). Cadmium can be detected by atomic absorption spectrometry (AAS) or ICP-MS after pressure digestion. The **maximum content of cadmium in soybeans is 0.2 mg/kg** (EC Regulation No 1881/2006). Cadmium detection tests are usually offered by laboratories that also analyse pesticide residues, e.g. the laboratory Friedle in Tegernheim.

Sources

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www.sojafoerderring.de

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