

Using near-infrared tools to monitor heat damage in soya bean products

Problem

Soya beans are an excellent source of protein but they also contain anti-nutritive components, which need to be deactivated by heat prior to feeding to swine or poultry. Adequate processing intensity is required both to sufficiently deactivate anti-nutritive components and to avoid unnecessary damage to amino acids. Inappropriate processing leads to potentially high penalties for livestock growth.

Solution

Instruments for near-infrared spectroscopy (NIR) equipped with specialised calibration models can reliably measure soya bean processing indicators such as trypsin-inhibitor activity (TIA) or protein solubility (solubility in potash, KOH).

Benefits

Measuring processing indicators by NIR-instruments supports optimal processing performance. With NIR-analysis, a full screening for amino acids and processing indicators costs about 100 EUR per sample. With traditional wet chemistry the same service would cost a high 4-digit number.

Practical recommendation

- Understanding the background: NIR-instruments (Figure 1) are measuring spectral information. These are compared to calibration data-bases (produced using wet chemical analysis) to derive values for various parameters.
- Calibration statistics provide the standard error of calibration (SEC) which is essential to understand variance and accuracy of measurements.
- NIR is suitable for analysing unprocessed soya beans as well as common feed products: soya bean full-fat toasted, soya expeller (cake, see figure 2), and solvent-based soymeal.
- For monitoring processing performance, representative samples are essential. Ideally, processors collect sub-samples (each 0.5 kg) taken over a minimum of three consecutive days and submit one mixed 0.5 kg sample for analysis. Quartering is a recommended method for creating the final sample, see link to video in 'Further Information').

Applicability box

Theme

Processing and handling of harvested feed

Context

An analytical tool to evaluate the quality of soya bean processing

Application time

On demand

Required time

Time for sample collection, posting to laboratory and interpretation of testing reports should be accounted.

Period of impact

Analysis results are available within minutes once the sample is inserted into the near-infrared device. Results provide rough indications if adjustments for the processing technology are necessary.

Equipment

Sampling material

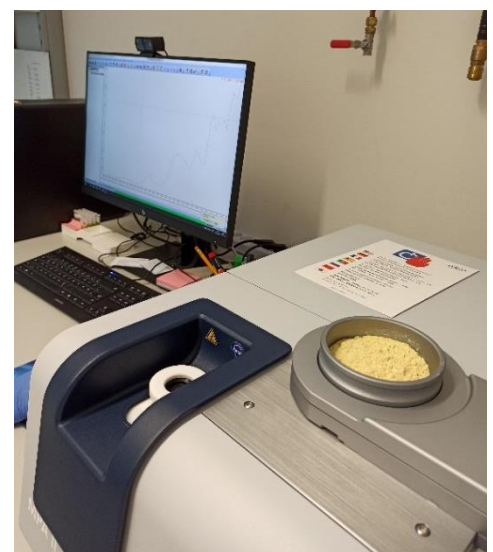


Figure 1: The milled sample is inserted in the NIR instrument. The results are then available within seconds Photo: Imprint Analytcs

- A large spectrum of reliable results is available within seconds: dry matter; content of crude protein, sugar and oil; main amino acids and processing indicators (TIA, protein solubility, digestible amino acid content).
- Results support operations at several stages in a soya bean processing enterprise: sorting of batches of raw soya beans, monitoring processing performance and designing feed mixes.
- TIA and protein solubility are key parameters to monitor soya bean processing performance. The measured TIA value can differ about +/- 2 mg from the true value. This accuracy is sufficient to detect general trends: optimum processing (<3 mg) and clear cases of under-processing (>10 mg). Protein solubility in KOH (< 78%) is suitable to indicate over-processing. The measured KOH value can differ about +/- 3 percentage points from the true value.
- Over/under processing of soya is often related to inappropriate settings in the processing technology. For optimising any adjustments, it is recommended to coordinate with the manufacturer of the technology.



Figure 2: Soya bean cake is a suitable component for feed rations. Photo: Donau Soja, Ina Jäger

Further information

Video

Check out our [video on detecting heat damages](#) in processed soya bean with NIR.

Organic Farm Knowledge

[Organic Farm Knowledge](#) provides access to further leaflets and videos about soya bean processing. Visit the website and enter 'soybean' into the search mask.

Further recommended links

Quartering is an adequate method to reduce the quantity of samples as you can [see in the video](#) from Gilson Company Inc.

Background

Insights presented in this Practice Abstract are based on a collaborative study with 30 soya bean processors within the project OK-Net EcoFeed. The study used NIR to assess the quality of soya bean feed products. Analysed feed products were solvent-based meal, expeller and full-fat toasted soya beans. Results of this study show similar patterns to previous studies by EVONIK and the Bavarian State Research Center for Agriculture (LfL): Assessed samples from small-scale soya bean processors from Central Europe show signs of under-processing where trypsin-inhibitor activity is not sufficiently reduced.

About this practice abstract and OK-Net EcoFeed

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OK-Net EcoFeed: This practice abstract was elaborated in the Organic Knowledge Network on Monogastric Animal Feed project. The project is running from January 2018 to December 2020. The overall aim of OK-Net EcoFeed is to help farmers, breeders and the organic feed processing industry in achieving the goal of 100% use of organic and regional feed for monogastrics.

Project website: ok-net-ecofeed.eu

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