

TECHNICAL INSIGHTS

Evaluating Soybean Roasting Efficacy

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What analytical tests are available for evaluating soybean roasting, heat treatment, or heat damage?

- Protein Dispersibility Index (PDI)
- KOH (potassium hydroxide) solubility
- 16 hr in situ rumen undegraded protein (RUP) & RUP intestinal digestion

What considerations or drawbacks should be considered with KOH analytical tests?

- KOH solubility has been developed and researched with de-fatted soybean meal (SBM).
- Some assume that guidelines developed for KOH can be applied to all soy-based feeds, including roasted soybeans.

However, many researchers have suggested that these methods and SBM guidelines may not be appropriate for full-fat soybeans (FFSB).

How does KOH solubility assess overprocessing?

- Traditional guidelines for KOH solubility were developed by relating soybean solubility in 0.2% potassium hydroxide solution to amino acid availability (particularly lysine) and rumen bypass protein (RUP) levels for ruminant studies.
- Raw SBM is benchmarked at 100% solubility, and KOH solubility decreases as SBM heat treatment and processing increases.

How does KOH perform with FFSB?

While there is a relationship between lysine availability and KOH solubility in SBM, poultry researchers have questioned the relationship between KOH and FFSB processing.

- Scientists have speculated the poor correlation between KOH and roasting efficacy could be due to differences in particle size.

According to the US Soybean Export Council: *"In the case of FFSB, protein solubility in KOH as a quality measure to evaluate treatment should therefore be used with caution since the solubility does not seem to be related to over-processing in the same way as for SBM."*

Rock River Laboratory does not recommend KOH solubility analysis for FFSB.

How does PDI perform with FFSB?

The protein dispersibility index measures how much protein is dispersed in water after grinding the sample and blending it with water.

PDI is currently one of the most common analytical tests for SBM processing evaluation, as it detects both under and overprocessing and is extremely simple to perform.

PDI analysis comes with notable challenges:

- With PDI, the desirable range is narrow between 9 to 11% (Hsu and Sattler)
- When considering the assay coefficient of variation, analysis and interpretation with FFSB are difficult.

Palic et al. (2011) observed a repeatability limit of 2.1%, and a reproducibility limit of over 7%, for 7 different FFSB sampled and roasted for different lengths.

- Given the extremely narrow ideal range and relatively large method repeatability errors, these authors concluded that PDI was not appropriate for FFSB.

The fat concentration in FFSB likely affects the sample solubility in water, understanding soy oil is hydrophobic.

Rock River Laboratory does not recommend PDI analysis for FFSB.

What laboratory analyses are appropriate for FFSB, including High Oleic Acid Soybeans?

Rock River Laboratory recommends the following:

- Comprehensive Nutrition Analysis by NIR - nutrient profile
- Fatty acid profile by wet chemistry - total fatty acid (TFA) and fatty acid profile, including oleic acid content (% of TFA)
- 16h in situ RUP - determine if roasting is adequate to achieve substantial rumen bypass protein
- RUP intestinal digestibility - appropriate to determine if soybeans are over-roasted

What guidelines are available?

RRL RUP and RUPid guidelines available at:

<https://bit.ly/RUPguide>