

Verifying Feed Ingredients On-Site with FeedME™ and the PHAZIR™



Identification and qualification of incoming animal feed ingredients can be rapidly determined. Handheld analyzers significantly enhance workflow and productivity.

In May of 2007, the FDA released a letter in response to melamine contamination appearing in ingredients labeled “wheat gluten” and “rice protein concentrate”. The letter states,

“Manufacturers are responsible for taking their own measures to ensure the safety of their products. Manufacturers should not wait for possible FDA testing of their materials as manufacturers bear the responsibility of ensuring only safe products are put on the market.”

Feed and food ingredients are international commodities and the chain of custody can be complex or obscure. The buyers and sellers of food and feed ingredients are both multinational and multifunctional. A given company may perform one or more functions, manufacture finished feed, ingredients, repackage and distribute. Additionally, the ingredients may change hands multiple times between manufacture and the final buyer. Custody records are only as reliable as the weakest link. Even the best suppliers make occasional errors. To assure the quality of purchased feed ingredients a new method is needed.

Polychromix, Inc. has developed a ready-to-use handheld feed ingredients analyzer for the identification of *authentic* feed ingredients. Counterfeit and adulterated ingredients are either identified by their composition or rejected as not representative. The PHAZIR™ is designed to satisfy both technical users and non-technical operators. The device is easy to use, just point and click and the result is presented on the display. The FeedME™, Feed ingredients for Manufacturing Evaluation PHAZIR™ application incorporates the functionality needed to satisfy quality assurance and control. The analyzer records the data needed for report generation as recommended by the FDA ALERT program.

Development:	Measurement of ingredient properties important to processing. Testing for homogeneity of finished product
Trade Missions:	Verification of material to be delivered.
Receiving warehouse:	100% verification of received ingredients. Comparison to authentic materials. Quantification of ingredient moisture content.
Dispensing & Compounding:	100% Final verification of ingredients.
Finished Product:	Determination of homogeneity within a production run. Determination of homogeneity between production runs. Moisture level at each stage of production.
Packaging:	Verification of packaging polymers. Verification of paper and cardboard packaging additives and coatings. Determination of packaging paper or cardboard moisture.
Post-production:	Analysis of retain samples of ingredients and finished product to verify longevity.

Table 1: Scenarios for handheld analyzers in feed ingredients authentication

In the end, feed is a manufactured product. The finished product needs to conform to specific requirements, nutritional content, density, texture, moisture and other parameters. To conform to these specifications, quality ingredients need to be used. The PHAZIR™ can be upgraded to perform for rapid food and feed ingredients analysis.

The PHAZIR™, by itself, is an ideal general purpose tool for on-site measurements. It can be used from the development of new feed products to analyzing retain samples. Table 1 outlines some scenarios.

NIR analyzers have been used in the agriculture and feed industry laboratory because the instruments are rapid, non-destructive, and create little waste. Below, the differences between laboratory NIR and portable NIR implementations are discussed.

Portability, a significant difference

Portable NIR analyzers enable 100% incoming inspection. The PHAZIR™ is designed for the warehouse environment; it is easy to use, rugged and integrates easily into existing workflows. In contrast to laboratory instrumentation, there is no requirement for sampling, an internal chain of custody, transportation of the sample and releasing the original container. Because inspection processes with a handheld NIR analyzer are simplified, errors are reduced and results are immediate.

FeedME™

Portable NIR systems eliminate the need to move the container and allow inspection through closed polyethylene liners. Moving the spectrometer reduces both errors and workplace hazards associated with moving large containers. Sampling through container liners avoids the release of dust and accidental chemical or biological contamination of the ingredient. Because the primary containment has not been breached, the material can be stored longer.

At the dispensing point, verifying the correct ingredient and qualities are critically important. Moisture, density, flow and homogeneity are also important process parameters. All of these parameters can be verified at-line before the production process begins.

Rapid Deployment

Using the PHAZIR™ for at-line measurements has the advantages of rapid deployment and simple integration into existing processes. The PHAZIR™ with the FeedME™ application software is a ready-to-use package for the feed industry. A warehouse operator can begin using the device with less than an hour of training.

The FeedME™ PHAZIR™ application is specific to the feed industry. The sample is collected in a standard, clear, 2 mil thick polyethylene bag is presented to the PHAZIR™. Each time the trigger is pressed, a signature (NIR infrared spectrum) of the material presented is recorded. This signature is compared against a library of signatures of known materials. The best match is presented on the display. If a good match is not found, then the result is reported as "unidentified." This usually indicates a counterfeit or adulterated material. The library is readily extended to new materials or production variants by submitting materials to Polychromix, accompanied by a certificate of analysis.

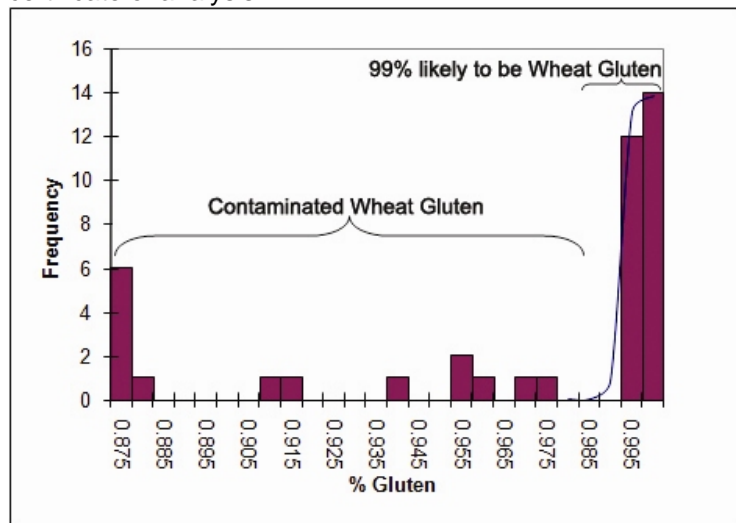


Figure 1. Melamine contamination of wheat gluten can be detected easily.

If a customer has specific needs, the QA/QC engineer can build the calibration equations, install the equations, test the PHAZIR and bring it to production technicians for use. The instrument is software customizable; the same tool can be used for many different applications. PHAZIR-MG™ is a Microsoft Windows application designed for rapid building of both qualitative and quantitative equations for the PHAZIR™. The software incorporates the functions needed for identification and quantitative results.



Figure 2. PHAZIR™ in use

NIR

Near-infrared spectrometers are frequently used in the feed and agriculture industry for the analysis of agricultural products. The near infrared region contains information that relates to the structure of the molecules that compose the material. Fat, carbohydrate, protein, water and other constituents each absorb light in a characteristic pattern in the near-infrared region. Some information about the physical properties appears as well. These patterns are used to deduce material identity and properties.

The performance of portable NIR instruments is directly comparable in most applications to laboratory NIR instruments. The optical resolution, wavelength accuracy, wavelength range, signal to noise ratio, and linearity of the PHAZIR™ platform is matched to common qualitative and quantitative applications.

The PHAZIR™ is primarily intended for solids sampling. A liquids adapter allows click-on conversion to analysis of liquid nutrients, surfactants, oils and other liquids.

Identification

Because many ground feed ingredients can be confused with one another, it can be difficult to visually verify the materials. The PHAZIR™ can be used in receiving to verify material supplied by the vendor.

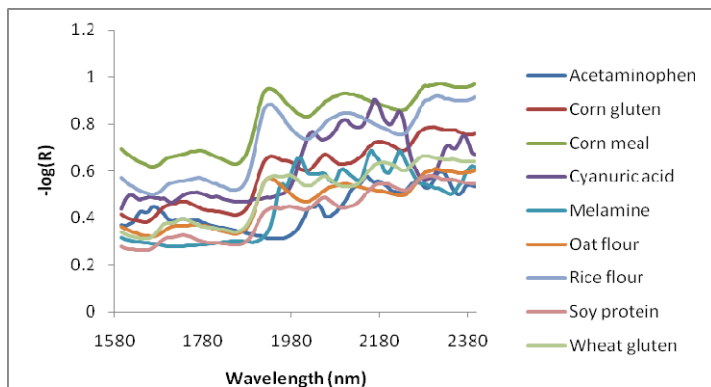


Figure 3. Spectra of feed ingredients and some possible contaminants.

In many cases, identification can be performed without opening the bag containing the raw material. Handheld instrumentation has significant advantages for the identification process when the material must be kept dry, aseptic, or is received in large, difficult to move containers. Using near-infrared, the verification process can include determination of moisture content. Unusually high or low moisture content can affect cost per weight, performance in extrusion and storage of raw materials. Verification of identity at the receiving dock can eliminate the need for a quarantine queue for receiving material.



Figure 4. Handheld instrumentation can be brought to the material being identified. Plastic liners do not need to be opened for analysis.

The PHAZIR™ can be used in the dispensing process to verify material just before addition to the hopper for an extruder. Because the visual inspection of the material being added is unreliable, the potential for error in adding improper material to the hopper are relatively high. Utilizing a PHAZIR™ as a final verification step can reduce errors.

Measurement and analysis time is rapid, typically less than 5 seconds and the result is displayed on the device for operator convenience. The internal database records the spectrum, result and user-entered identifiers such as user and lot number.

Qualification

The PHAZIR™ is also used for quantitative measurements. The finished product needs to conform to specific requirements, nutritional content, density, texture, moisture and other parameters. For example, knowledge of the moisture content of the materials entering the extruder can be used to optimize extruder and dryer operating parameters ensuring greater uniformity of product. Greater uniformity results in fewer rejects and process downtime.

Homogeneity is an important characteristic of the production process. Periodic grab sampling can assess homogeneity of the blended raw ingredients. The PHAZIR™ can be used to analyze the ratio of ingredients in a single or a grouping of grab samples. During enrobement, a spray is used to add vitamins and flavorings. Clogging and bearding of the spray nozzles can cause inhomogenous nutrient and moisture distribution within the product. Using the grab sampling process described above, moisture distribution can be assessed.

Verification of the material at various stages of production can also reduce the costs associated with out-of-specification production runs. The process can be checked and corrected in a timely manner, allowing for a greater number of in-specification lots to be produced. The PHAZIR™ can run applications that display up to eight quantitative values from a single measurement.

Preferred configuration

Description	Part #
PHAZIR™1624	PHZR-1624
Liquids adapter	PCX-ACC1
Extra battery	PHZR-BTRY-2
PHAZIR-MG™	PCX-MG-01-ID
Starter library	FeedME-V1-M1624

Features

- Rapid identification and quantification. Typically < 3 seconds.
- Bright LCD display for displaying spectra and results.
- Sampling through glass vials or plastic bags
- Interchangeable liquids and solids analysis with a simple click-on adapter
- 10-hour quick-change battery