Near-infrared spectroscopy

EXPEC 1370 analyzer

Based on near infrared diffuse reflectance spectroscopy technology, the EXPEC 1370 analyzer is particularly suitable for use in laboratories of the grain and oil processing and feed industries for accurate and rapid testing of raw materials, processes and finished product quality thanks to its accuracy and speed, simultaneous detection of multi-component indicators and ease of operation.

EXPEC 1370 analyzer

■ Measuring accessory

Ø100 sample tray, Ø100 special sample tray (shallow tray for powder samples), sample gland, dustpan, scraper, brush

■ Product features

- Suitable for a wide range of sample types, such as granules, flakes, powders, pastes, etc.
- Customized sample trays for special samples, e.g. fertilizer, asphalt
- Easy loading, flattening of granular samples and scraping of powder samples
- Sample tray is easy to clean and can effectively prevent cross contamination
- Rotation of the sample tray to improve the representativeness and accuracy of the measurement of inhomogeneous samples
- Fast analysis of multiple components such as moisture, crude fat, crude protein, crude fiber, crude ash, etc. within 10 seconds
- Advanced grating technology and indium gallium arsenide detector for excellent signal-to-noise ratio
- Instrument built-in standard substance, with automatic diagnosis and fault prompt function
- Auto-collimation module design is adopted for the light source that light source replacement can be achieved easily without the need for adjustment
- Software applicable to different management permissions

Place the sample tray

Change the light source

■ Typical application scenarios

■ Specifications and parameters

| Name	Specification
Host size	(403 x 391 x 373.5) mm
Weight	20 kg
Applicable samples	Grain and feed samples or other products
Sample status	Solids such as granules and powders
Assay method	Diffuse reflection
Light source	Tungsten halogen lamp
Light source power	5 V/10 W
Detector	TEC refrigerated and temperature-controlled indium gallium arsenide (InGaAs) detector
Wavelength range	(1000~1800) nm & (1000~2500nm optional)
Wavelength accuracy	±0.2 nm
Wavelength repeatability	<0.01 nm
Spectral resolution	(10.95±0.3) nm@1529.5nm
Absorbance noise	<50uA
Stray light	<0.15%
Scanning speed	5 times/s
Analysis time	<30 s
Preheating time	30 min
Power supply	(220±20) V~/50Hz
Communication interface	USB 2.0
Environmental temperature	(5~35)°C
Environmental humidity	(5%~85%) RH, non-condensing

Dedicated analysis software RIMP

■ Product overview

RIMP analysis software is a special software product, has features of friendly user interface, and simple operation, and a professional software product combining instrument measurement and analysis, model management and network management of three major functions, support different rights management, administrator, operator and researcher account with different operating rights.The measurement data is stored, viewed, retrieved, counted and outputted report using a database, and the test data can be configured to be automatically uploaded to a network management system.The software supports mainstream chemometric algorithms, including partial least squares (PLS) regression and artificial neural network (ANN) methods for quantitative analysis and soft independent modeling of class analogy (SIMCA) method and cluster analysis for qualitative analysis, etc. The generated models support the model encryption function to better protect the ownership of the model.

■ Measurement analysis

Measurement analysis is used for spectral acquisition and automatic prediction in routine analysis work.The interface is user-friendly, intuitive and easy to operate, regardless of the operator's skill level. Its main functions are as follows:

- User management: new users can be created and managed with different rights.
- Logbook management: records information about the operation of the instrument (logins, parameter modifications, model updates, exceptions, etc.).
- Instrument diagnostics: self-test of instrument hardware, light source energy, absorbance noise and wavelength accuracy.
- Data management: stores sample spectra and component property values in the database and provides data backup functions.
- Sample management: provides functions for users to add product groups, add products, delete product groups and edit product properties.
- Statistical analysis: provides statistical methods such as minimum, maximum, mean, variance and extreme deviation.
- Report output: provides editable report templates to realize the customization function of reports.
- Trend view: allows the view of historical trend graphs of the property values of each component.
- Off-line prediction: provides the ability to re-predict historical spectra and models.
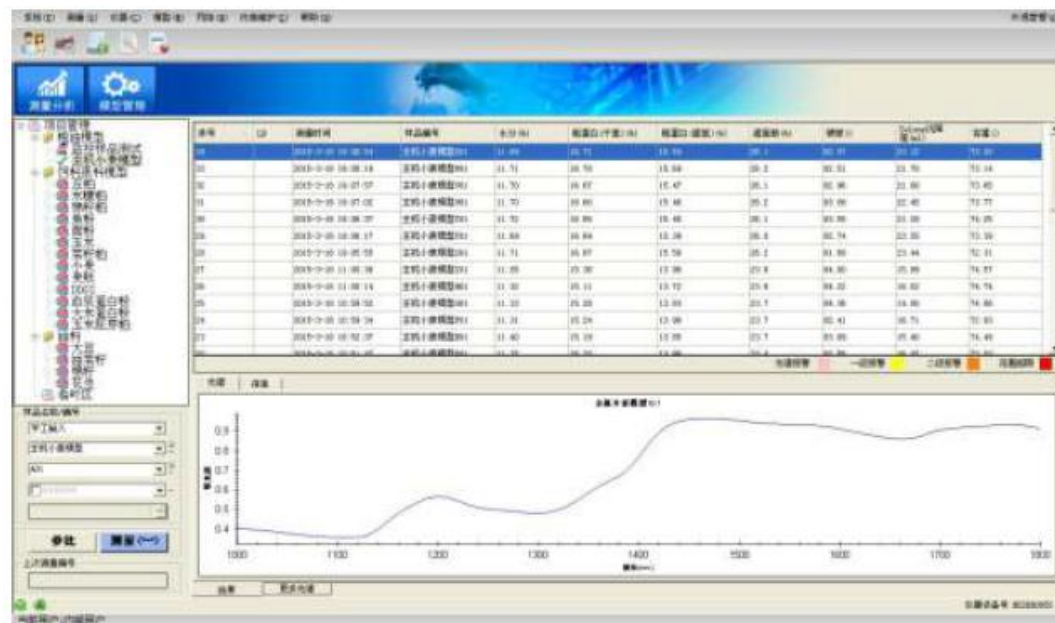
RIMP software measurement and analysis interface

■ Model management

Model management is a tool used to establish a special relationship between the spectra and chemical values of a sample.It uses chemometric techniques to statistically analyse the data and build the corresponding mathematical models.Its main functions are as follows:

- One-click modeling: for quick and easy development and validation of models without the need for any chemometrics knowledge.
- Expert modeling: users can optimize models by directly adjusting the modeling process parameters according to their own experience.
- Quantitative analysis: provides quantitative algorithms of partial least squares regression (PLS) and artificial neural network (ANN).
- Qualitative analysis: provides quantitative algorithms of soft independent modeling of class analogy (SIMCA) and cluster analysis.
- Visual reporting: provides interactive visual views, mainly including property, pretreatment and model report views.
- Model evaluation: provides external validation for the accuracy and repeatability of the models built.
- Model encryption: encrypts and binds the model created for use with instruments to better protect ownership of the model.
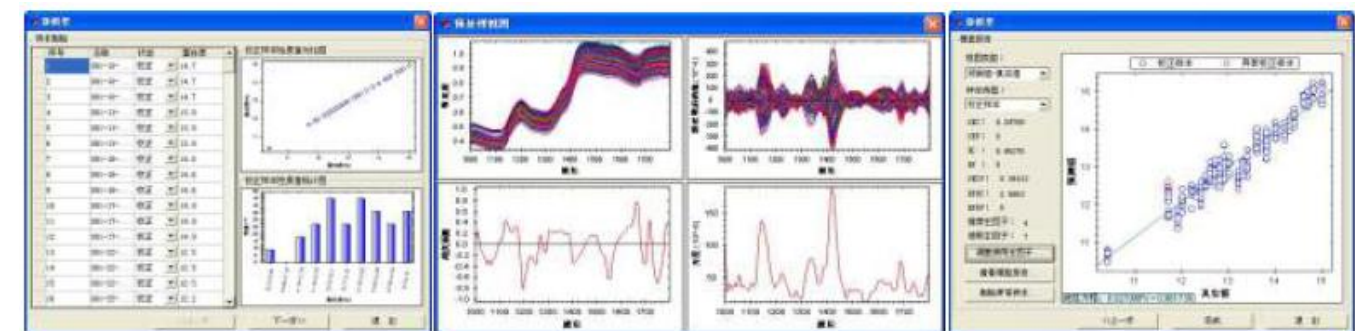
Property view　　　　Pretreatment view　　　　Model report view

■ Networking function

The networking function is implemented by the network management platform.The network management platform consists of a host and multiple sub-computers.The host is used to scan modeling samples, monitor and upgrade models.The host model is adjusted to match the data analyzed by the standard chemical analysis laboratory.The host model is upgraded and updates are automatically released to the sub-computers via the network.
Through networking, the web server can obtain real-time information on the performance and status parameters of each instrument, the sample testing records of the instrument, etc. Through the comprehensive judgment of this information, the operation of the instruments in different locations can be understood in a timely manner, realizing the real-time monitoring of the group of instruments.

NIR model map

■ Overview of the NIR base model

By establishing long-term cooperation with domestic grain authority testing institutions and central laboratories of domestic grain, oil and feed groups, we have continuously developed and accumulated model data, as well as after more than 10 years of efforts, we now have more than 50 kinds of basic models, especially for the grain, oil and feed industry, and have accumulated thousands of spectra. These analytical models can be used with simple calibration, with high analytical model data accuracy and the average error generally controlled within 5% relative error, and excellent test results can be obtained.

■ List of the NIR base models

Sample source	Variety	Test indicators
Grain	Wheat	Moisture, crude protein, crude fat, crude fiber, ash, Zeleny settling value, wet gluten, hardness, fatty acid value
	Flour	Moisture, crude protein, ash, wet gluten, settling value, water absorption
	Corn	Moisture, crude protein, crude fat, crude fiber, ash, starch, phosphorus, amino acids
	Frozen corn	Moisture
	Fine rice	Moisture, crude protein, straight-chain starch, taste quality, consistency
	Brown rice	Moisture, crude protein, fatty acid value
	Rice	Moisture, crude protein, fatty acid value, straight-chain starch, tasting score
Oilseeds	Soybeans	Moisture, crude protein, crude fat, water-soluble protein, fatty acid value
	Soybean meal	Moisture, crude protein, crude fat, crude fiber, ash, protein solubility, amino acids
	Rapeseed	Moisture, crude protein, crude fat, erucic acid, thioglycoside, palmitic acid, stearic acid, linoleic acid, oleic acid, linolenic acid
	Rapeseed meal	Moisture, crude protein, crude fat, crude fiber, ash, protein solubility, amino acids
	Cottonseed	Moisture, crude protein, crude fat
	Cottonseed meal	Moisture, crude protein, crude fat, crude fiber, ash
	Corn germ	Moisture, crude protein, crude fat
	Oil sunflower	Oil sunflower meal
	Moisture, crude fat	Moisture, crude protein, crude fat
	Safflower seed	Moisture, crude fat, linoleic acid
	Peanut flour	Moisture, crude fat
	Peanut kernel cake	Moisture, crude protein, crude fat, ash
	Peanut meal	Moisture, crude protein, crude fat, ash
	Sesame cake	Rice bran
	Moisture, crude fat	Moisture, crude protein, crude fat, ash, fiber, acid value
	Rice bran meal	Moisture, crude protein, ash
Feedstuffs	Fish meal	Moisture, crude protein, crude fat, ash, calcium, phosphorus, acid value, salt, amino acids
	DDGS	Moisture, crude protein, crude fat, crude fiber, ash, calcium, phosphorus
	Corn germ meal	Moisture, crude protein, crude fat, crude fiber, ash
	Cottonseed protein	Moisture, crude protein, ash
	Rice protein powder	Moisture, crude protein, crude fat, ash
	Meat & bone meal	Moisture, crude protein, ash, calcium, phosphorus
	Broken rice-flour	Moisture, crude protein, crude fat, ash
	Secondary flour	Moisture, crude protein, crude fat, crude fiber, ash
Feedstuffs	Whey powder	Moisture, crude protein, ash, lactose, salt
	Corn protein powder	Moisture, crude protein, crude fat, ash

Sample source	Variety	Test indicators
	Plasma protein powder	Moisture, crude protein, ash, solubility
	Fermented soybean meal	Moisture, crude protein, ash, acidity, small peptides (acid-soluble protein)
	Wheat bran	Moisture, crude protein, ash
	Meat meal	Moisture, crude protein, crude fat, ash, amino acids
	Cassava	Moisture, crude protein, ash
	Beer lees	Moisture, crude protein, crude fat, crude fiber
	Shrimp shell powder	Moisture, crude protein, ash
Finished feed	Large pig feed	Moisture, crude protein, crude ash, calcium, phosphorus, salt, crude fat, crude fiber
	Creep feed	Moisture, crude protein, crude ash, calcium, phosphorus, salt, crude fat, crude fiber
	Pig concentrate	Moisture, crude protein, crude ash, calcium, phosphorus, salt, crude fat, crude fiber
	Small and medium pig feed	Moisture, crude protein, crude ash, calcium, phosphorus, salt, crude fat, crude fiber
	Layer chicken and duck mix	Moisture, crude protein, ash, calcium, phosphorus
	Meat chicken and duck mix	Moisture, crude protein, crude fat, crude fiber, ash, calcium, phosphorus, salt
	Shrimp feed	Moisture, crude protein, crude fat, ash, calcium, phosphorus, salt
	Fish mix	Moisture, crude protein, crude fat, ash, calcium, phosphorus
Forage industry	Hay	Fructans, NDF, IVPD, potassium, crude ash, ADF, sugars, WSC, crude fat, magnesium, crude protein, lignin, phosphorus, calcium, dry matter
	Alfalfa hay	NDF, IVPD, potassium, crude ash, ADF, crude fat, magnesium, crude protein, lignin, phosphorus, calcium, dry matter, moisture, RUP
	Alfalfa silage	NDF, IVPD, potassium, crude ash, ADF, crude fat, magnesium, crude protein, lignin, phosphorus, calcium, dry matter, moisture, RUP
	Fresh maize silage	NDF, crude protein, ADF, dNDF, IVPD, NDF, starch, dry matter
Petrochemicals	Gasoline	Octane number (RON, MON), density, olefins, aromatics, initial distillation point, 10% distillation range, 50% distillation range, 90% distillation range, final distillation point, oxygen content, sulfur content
	Diesel fuel	Cetane number, density, initial distillation point, 50% distillation range, 90% distillation range, 95% distillation range, final distillation point, freezing point, cold filter point, viscosity at 20°C, sulfur content
	Aviation coal	Flash point, density, viscosity at 20°C, initial distillation point, 10% distillation range, 50% distillation range, 90% distillation range, final distillation point
Food	Cooking oil	Unsaturated fatty acids, acid value, iodine value
Textile	Cotton-polyester blend	Cotton content, polyester content
	Cotton-spandex blend	Cotton content, spandex content
	Spandex-polyester blend	Spandex content, polyester content
Tea	Black tea	Moisture, tea polyphenols, caffeine, free amino acids, water extracts
	Instant tea powder	Moisture, tea polyphenols, caffeine
	Tea polyphenol products	Moisture, tea polyphenols, caffeine
Brewing industry	Wine lees	Moisture, acidity, starch, reducing sugar
	Brewing wheat	Moisture, crude protein, starch
	Brewing rice	Moisture, crude protein, starch
	Brewing corn	Moisture, starch
	Brewing sorghum	Moisture, starch, tannins
Additives industry	Non-dairy creamer	Moisture, crude protein, crude fat