

FT-NIR Spectroscopy



Key Features:

- Non-destructive sampling
- Rapid screening for high sample throughput
- Easy-to-use Spectrum Touch software for users of all backgrounds
- Portable instrument allows analysis anywhere
- Accommodates disposable, inexpensive glass vials and Petri dishes, and surfaces are easy to clean

Near-Infrared Spectroscopy for Screening of Herb and Spice Adulteration

Safeguarding Your Herb and Spice Products

Food fraud is a subject which has become increasingly prominent over

recent years, with public attention being drawn by the fraudulent presence of horsemeat in place of beef, as revealed during the Europe-wide scandal of 2013. However, food fraud is not new – it has been seen throughout the history of trading goods. Food fraud is sometimes referred to as economically motivated adulteration (EMA), which is the intentional addition of a lower value substance to a product to increase profit margins and can take place at any stage in the supply chain. Herb and spice trading incorporates a wide range of products from diverse origins around the globe, with some countries at higher risk of EMA.

Adulterants – anything from cheaper plant material of similar appearance, to natural and synthetic dyes, or chemicals such as talc, to the next, as-yet-undiscovered adulterant – not only negatively impact consumer confidence, but can also have disastrous consequences for public health. Food safety standards are being strengthened and extended to require evermore detailed consideration of risks and risk management strategies. Product testing has long been an implicit part of consumer protection programs but has often been complex and expensive, making it unrealistic to analyze a large number of samples.

PerkinElmer's Spectrum Two N™ FT-NIR spectrometer, accompanied with the simple-to-use Spectrum Touch™ software, provides a new approach to safeguarding the authenticity of dried herbs and spices against the threat of fraud. The Spectrum Two N provides rapid, simple, non-destructive and cost-effective analysis of a dried food sample, comparing the result against a model to reveal whether the sample is authentic, as expected, or whether it contains unwanted material. Spectrum Adulterant Screen™, which is used with Spectrum Touch software and the Spectrum Two N FT-NIR spectrometer, applies advanced algorithms to screen for user-defined adulterants and unknown threats, producing straightforward results for users of any background, not just analytical chemists. Since the method is non-destructive, the very same sample can be returned to its container, or sent to a laboratory for further analysis.

Spectrum Two N FT-NIR: The System of Choice for Herb and Spice Analysis

Near-Infrared (NIR) spectroscopy is an already widely used technique in the food industry for quantitative analysis of nutritional and quality parameters. For dried materials like herbs and spices, NIR spectroscopy is the ideal solution as it is a non-destructive technique and requires no sample preparation, allowing the analyzed samples to be retained.

PerkinElmer's Spectrum Two N is an easy-to-use, portable FT-NIR (Fourier transform near-infrared) spectrometer, capable of reliable and robust NIR analysis. The Spectrum Two N can be used to screen for food fraud and economic adulteration – quickly, efficiently, and reliably – with virtually no training required.

Available with the Spectrum Two N, the Near Infrared Reflectance Module (NIRM) enables near-infrared diffuse reflectance analysis of both homogeneous and inhomogeneous samples, such as herbs and spices. It features an easily cleanable surface and rotating sample holder to provide a larger sampling area for analysis. Additionally, the NIRM can accommodate different-size sample containers, from a static vial suitable for materials such as saffron, to a Petri dish capable of holding 10s of grams of sample for producing a more representative spectrum. Finally, the NIRM was designed with method transferability in mind, making transferring methods to multiple instruments at different sites around the world as easy as possible.

The Spectrum Two N is specifically designed to be small enough to allow it to be portable and does not require a laboratory setting to operate. It is an easy-to-use, plug-and-play instrument. As such, it can be deployed wherever it is needed most – anywhere from a farm, to a factory intake reception, to a scientific laboratory.



Figure 1. Spectrum Two N FT-NIR with plug-and-play NIR Reflectance Module (NIRM) and Sample Spinner.

What About Traditional Screening Methods?

Previous applications of NIR spectroscopy to adulterant detection are either targeted or non-targeted. Targeted methods are those capable of accurately quantifying a known adulterant in a sample. However, they are only applicable to adulterants which have been pre-identified and for which a calibration has been developed. Calibration development can be a very time-consuming process involving preparation of dozens to hundreds of samples of varying adulterant concentrations; as such, targeted methods often miss new or uncommon adulterants. Alternatively non-targeted screening can be used which simply determines whether the sample is a pass or a fail. This method is often not as sensitive as a targeted method and gives no indication of why a failing sample has failed (no identification of the adulterant).

A best-of-both-worlds approach is a semi-targeted adulterant screening method which uses some prior knowledge of the sample and potential adulterants, and leads to a method which is sensitive, quick and simple, so anyone can perform onsite adulterant screening with confidence and reliable results. PerkinElmer's Adulterant Screen™ provides exactly this.



Figure 2. Sample Spinner on Spectrum Two N's Near Infrared Reflectance Module.

PerkinElmer's Adulterant Screen – For Simple, Yet Sensitive Detection of Economic Adulterants

Spectrum Adulterant Screen software delivers fast, simple measurement that is ideal for detecting, identifying and estimating adulterant levels in herbs and spices.

Our semi-targeted method provides a screening technique which is less time-consuming than targeted methods and provides more sensitivity and information than non-targeted methods.

Adulterant Screen provides:

- Simple pass/fail result to determine product authenticity
- Identity of adulterant, if present
- Estimation of adulterant levels
- Adulterant detection limit (%)

Adulterant Screen simply requires:

- A model of your authentic material. This should include as much natural variation as possible – different batches, geographical locations, pre-treatment etc.
- A library of adulterants – with only one spectrum of each adulterant required.

New adulterants can be added at any time by simply scanning one spectrum of the pure adulterant and adding it to your existing list of adulterants, increasing the longevity and usability of previously generated Adulterant Screen methods. No lengthy recalibration is required. Results are then presented in the easy-to-use Spectrum Touch program.



Figure 3. Analysis of a sage sample on a 100 mm Sample Spinner.

Guiding You Through the Process

With hardware that is simple to use and maintain, your software should also be easy-to-use. Spectrum Touch software allows users of any background to analyze materials – not just analytical chemists.

Spectrum Touch software enables users to access methods from a menu and run them with detailed step-by-step instructions, thus eliminating the need for costly and time-consuming training.

The results page shows an easy-to-read pass/fail result, color-coded red or green accordingly, with action instructions based on the result. More detailed results are also accessible from the drop-down menu, providing in-depth information should it be required.

Behind all this simplicity are innovative, quantitative and qualitative analysis algorithms, ensuring fast and accurate results.

Additionally, Spectrum Touch software can be optimized for use with PCs and touchscreen devices.

Spectrum Touch Software

- Simplified workflows
- Simplified results

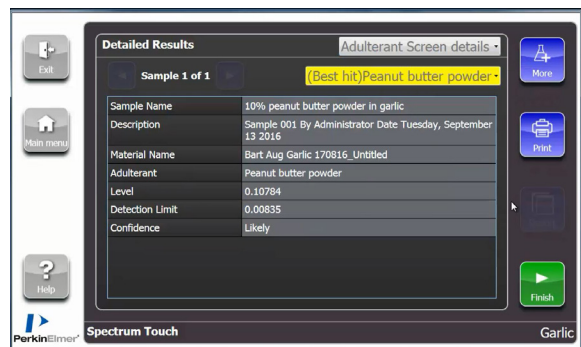
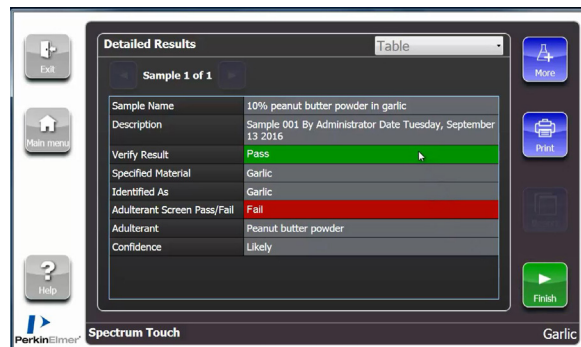
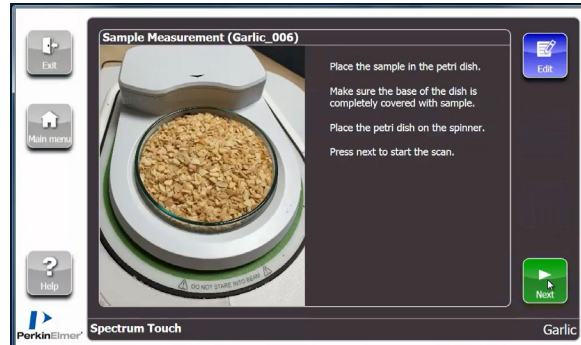
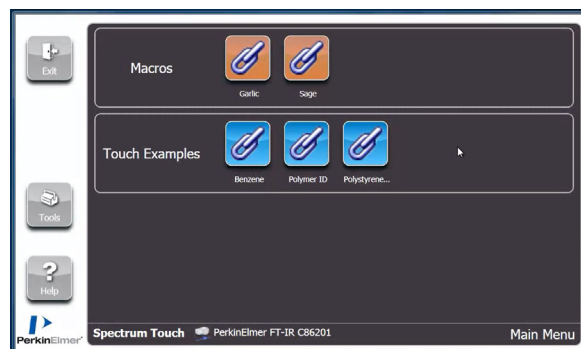


Figure 4. Example Spectrum Touch method and results for the screening of a garlic sample.

The Best Method is What Works for You

Adulterant Screen requires spectral reference libraries of authentic samples. These libraries require as much natural variation as possible for each product – different batches, geographical origins, plant species, pre-treatments, for example. A library of pure adulterants is also required, but with just one spectrum for each adulterant.

PerkinElmer can provide starter libraries for a wide range of herbs and spices. Optimal results, however, are observed when methods are tailored and tuned to your samples. The versatility of Adulterant Screen means these libraries can be altered at any time to include any samples you may choose to input.

The key is its simplicity: a pass/fail test to indicate the sample integrity – right on the spot. No more sending samples to busy third-party laboratories. No more waiting long periods of time for results.

Your Samples – Your Methods – Your Peace of Mind

OUR COLLABORATORS

PerkinElmer has developed and validated methods on a variety of herb and spice products using authentic samples provided directly from herb, spice and ingredient suppliers, as well as an independent food testing laboratory.



A PerkinElmer
Collaborator

Bart Ingredients Company Ltd.

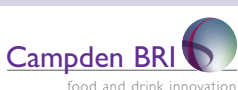
The Bart Ingredients Company Ltd, based in Bristol, UK, was first founded in 1963 and has grown over the last 50 years thanks to a continued passion and commitment to finding new and exciting ingredients across the globe. Their culinary experts work with flavors to create various herb and spice blends.



A PerkinElmer
Collaborator

Sleaford Quality Foods Ltd.

Established in 1968, Sleaford Quality Foods Ltd has over 50 years' experience supplying high-quality ingredients to the food manufacturing and foodservice/catering industries. The company specializes in dried and dehydrated food products from herbs and spices to potatoes, onion, fruit, and vegetables through to soups, bouillons, gravies, seasoning, and core ingredients. They supply customers with over 600 different products, all of which have passed extensive quality controls and testing, giving customers technical assurance and confidence.



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Campden BRI

Campden BRI, headquartered in Gloucestershire, UK is an independent food testing and research laboratory. Campden BRI provides technical, legislative and scientific support and research to the food and drinks industry worldwide – with a comprehensive range of services covering agri-food production, analysis and testing, processing and manufacturing, safety, training, and technical information services. Their membership organization consists of 2400 member companies worldwide.

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