

FT-IR Spectroscopy

Key Features and Benefits

- Complete implementation of AOCS Cd 14e-09 for *trans*-fat in edible oils and fats, for reliable measurement at levels of 1% or better
- Touchscreen-enabled, workflow-driven software interface with built-in SOPs and clear instructions for confidence in analysis
- Supplied with a calibration template and SOP for rapid commissioning



Trans-fat FT-IR Analysis Pack for Spectrum Two

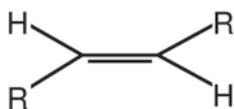


Figure 1. A *trans* double bond. The deformation vibrational mode caused by the H atoms moving out of the plane of the bond is highly characteristic of *trans*-fats in the infrared spectra of edible fats and oils.

Introduction

Trans-fats are mono- or polyunsaturated fats in which one or more of the double bonds is in a *trans* configuration (Figure 1). *Trans*-fats are present in small concentrations (2–5% of total fat) in milk and meat products from ruminants such as cattle and sheep, but otherwise are found only in processed, partially hydrogenated fats such as some vegetable shortenings and margarines.

Consumption of *trans*-fats has been shown to increase the risk of heart disease, and there is increasing pressure on food manufacturers both to reduce their use of synthetic *trans*-fats and to label clearly the *trans*-fat content. Regulators in some countries (such as Switzerland, Denmark and Austria) have imposed strict limits on the amount of *trans*-fat that may be present in food ingredients, while in the U.S., Canada, much of South America, South Korea, Taiwan and Hong Kong labelling of the *trans*-fat content of foods is mandatory.

These requirements have led to a need for a rapid, straightforward analytical method to measure the *trans*-fat levels in fats and oils. Gas chromatographic methods provide adequate sensitivity, but generally require a time-consuming transesterification step in sample preparation to produce fatty acid methyl esters (FAMES) suitable for analysis.

AOCS Cd 14e-09

Because of the distinctive molecular structure of *trans*-fats, the infrared spectrum contains a band that is not present in the spectra of other types of fats and oils. This feature has been used by the American Oil Chemists' Society (AOCS) to develop a standard test method, Cd 14e-09, for *trans*-fats in edible oils and fats by FT-IR with attenuated total reflectance (ATR) sampling.

The analytical method is based around an ATR measurement. A thermostated ATR accessory is used to guarantee the sample is liquefied and to ensure reproducibility. The sample spectrum is measured, and then the negative second derivative is taken to minimize the effects of the baseline and nearby overlapping bands. The height at 966 cm^{-1} is then compared to a calibration curve to obtain the concentration of *trans*-fat.

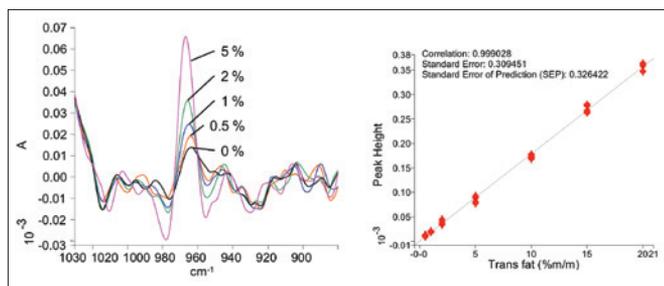


Figure 2. Spectra of the calibration standards, and the calibration plot.

The *trans*-fat FT-IR Analysis Pack

The *trans*-fat FT-IR Analysis Pack is an add-on kit for the Spectrum Two FT-IR spectrometer, comprising an ATR accessory with temperature controller and dedicated software for *trans*-fat analysis. At each step of the analysis pictorial and text instructions are provided (see Figure 3), and all instrument settings and data processing parameters are contained within the app.

The performance of the system is sufficient to offer detection limits below 1% *m/m trans*-fat. Figure 4 shows spectra of some commercial fat and oil samples along with the calculated *trans*-fat content. Reported values for the known *trans*-free samples are all well below 1%.

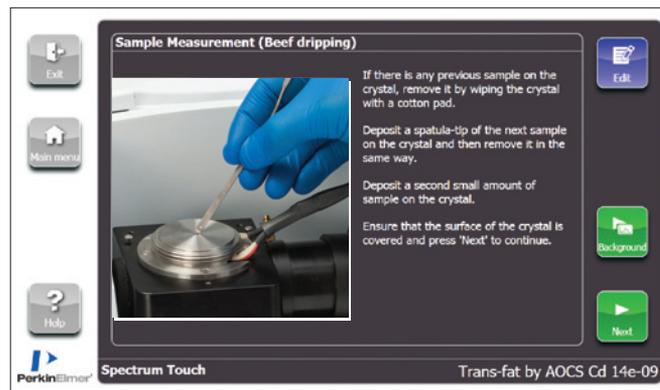
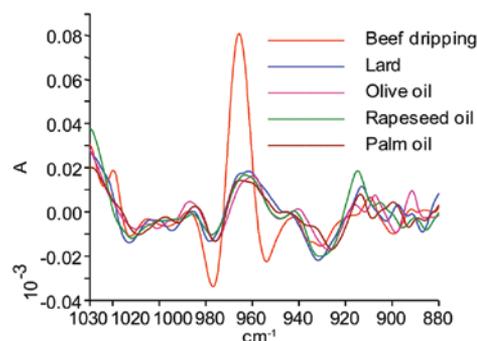


Figure 3. Spectrum Touch software.



Commercial sample	TFA (%m)
Beef dripping	5.51
Lard	0.50
Olive oil	0.03
Rapeseed oil	0.32
Palm oil	0.25

Figure 4. Second-derivative spectra of commercial fat and oil samples, and the calculated *trans*-fat values.

Contents of the kit

- Single-reflection ZnSe ATR sampling accessory for Spectrum Two
- Temperature controller (supported temperature range: 0–130 °C)
- Spectrum Touch software and App for AOCS Cd 14e-09
- Application-specific user manual and SOPs
- Carry case