



The FatIR™ Analysis System

The FDA now requires the amount of *trans* fat per serving to be indicated on the Nutrition Facts food label. To assist in meeting this requirement, Harrick Scientific has developed the FatIR™ System. This ATR FTIR oil analyzer complies with the FDA-approved AOAC method 2000.10 for routine quantitative ATR measurements of total *trans* fat content. The FatIR™ System is a straightforward analytical tool for fast, easy, and accurate determinations of *trans* fat concentration. In addition, it permits real-time *in situ* monitoring of the *trans* isomer formation during the processing of edible oils at temperatures up to 175°C.

APPLICATIONS

- ▶ Routine quantitative measurements of *trans* fat content, in accordance to AOAC method 2000.10.
- ▶ Real-time *in situ* monitoring of the *trans* fat formation during processing of edible oils at temperatures up to 175°C.
- ▶ Qualitative and quantitative analysis of liquids, pastes, and gels.

FEATURES

- ▶ Reproducible measurements.
- ▶ Convenient trough for containing liquid samples.
- ▶ Fixed 45° single reflection horizontal ATR configuration.
- ▶ SuperCharged™ ZnSe ATR optics for high throughput (greater than 85%)
- ▶ Simple to align and use.
- ▶ Safe, low-voltage heaters permit operation up to 175°C.
- ▶ K-type thermocouple directly measures the sample temperature and flips out of the way for easy cleaning of the ATR crystal.
- ▶ Low-voltage Temperature Controller allows for precise and safe regulation of the sample temperature, with options for direct, cascade and computer control.
- ▶ Secondary K-type thermocouple monitors the crystal temperature, permitting the cascade temperature regulation required for high temperature operation.
- ▶ Minimal sample preparation.
- ▶ Exchangeable ATR crystal.
- ▶ PermaPurge™ for rapid purging of the FTIR system.



INCLUDES

- ▶ RangeIR™ Liquid Analyzer with:
 - ▶ SuperCharged™ ZnSe mounted ATR crystal.
 - ▶ Two imbedded cartridge heaters.
 - ▶ Two K-type thermocouples.
 - ▶ Mating and PermaPurge™ hardware for the specified FT-IR spectrometer.
- ▶ Temperature Controller with USB to RS-485 adapter for computer control.

ORDERING INFORMATION

FatIR™, 110V.....	CATALOG No.
FatIR™, 220/240V.....	FAT-3-XXX
	FAT-4-XXX

REPLACEMENT PARTS

Top Plate Assembly, ZnSe.....	RAN-TOP-M
ZnSe Crystal.....	FAS-ATR-M
FKM Gasket.....	RAN-GSK
K-Type Thermocouple.....	008-148
Heater Assembly (two heaters plus connector).....	RAN-HTR
Cartridge Heater, 24V.....	HTRS-18



Under new FDA regulations, the amount of *trans* fat in a serving must be included in the Nutrition Facts panel. The Association of Official Analytical Chemists (AOAC) has developed an ATR-FTIR based method (AOAC Official Method 2000.10) that is in compliance with the new FDA regulations. This ATR-FTIR method is not only the simplest analytical method for the routine determination of the total *trans* fat content of fats, but it also allows for real-time *in situ* monitoring of *trans* isomer formation during the processing of vegetable oils and fats.

In light of this, Harrick Scientific has developed the FatIR™ Oil Analysis System, which complies with the AOAC requirements. The FatIR™ System is optimized for fast, easy, and accurate infrared measurements of the total *trans* fat content of oils and fats. Since much of the oil processing occurs at high temperatures, the FatIR™ Oil Analysis System was designed for real-time *in situ* ATR studies of oils and fats at temperatures up to 175°C.

The FatIR™ Oil Analysis System consists of a temperature-controlled trough style sampling accessory (the RangeIR™) and a low-voltage temperature controller. The RangeIR™ is a single reflection ATR accessory, based on our time-proven FastIR™. This design has the highest optical throughput (>85%) of any ATR accessory. Its simple optical configuration, consisting of only two fixed flat mirrors and a triangular prism ZnSe ATR crystal, provides optimum performance without the need for sensitive optical alignment adjustments. The design is inherently stable, an essential feature for operation of a system used at the extreme temperatures simulating oil processing conditions.

The FatIR™ System utilizes a trough configuration to simplify sample introduction and crystal cleaning. This configuration is required to contain oils and fats, especially at the higher temperatures where oil viscosity is lowered.

The two 24V cartridge heaters, in thermal contact with the crystal mounting plate, are operated by our low-voltage temperature controller. Two thermocouples are provided, one in the sample and one in contact with the ATR crystal, to enable cascade operation of the temperature controller. Cascade control is necessary at higher temperatures because the lag between the heater and sample temperatures can cause the controller to otherwise overshoot the set point, potentially resulting in damage.

When studying heat-induced changes in oils, it is important to precisely and accurately know the sample temperature. The FatIR™ System measures and controls the sample temperature directly, instead of recording the crystal or heater temperature, as is commonly done by other ATR accessories. This is important because the sample is exposed to a different thermal environment and hence is at a slightly lower temperature. With the FatIR™, the sample thermocouple is placed directly into the sample, providing the true value (and control) desired.

The FatIR™ System incorporates easily adjustable and highly stable kinematic mounting, for optimum alignment in the particular spectrometer being used. In addition, the

FatIR™ System is equipped with Harrick's patented PermaPurge™. This allows samples to be exchanged without interrupting the purge of the FTIR spectrometer, which, in turn, greatly enhances sample throughput.

Figures 1 and 2 show the ATR spectra of various readily available oils. These spectra were recorded at 65°C, the temperature used by AOAC method 2000.10. From Figure 1, it is clear that pizza oil has the highest concentration of species with *trans* double bonds, while olive oil has the lowest. Figure 2 shows the *cis* bond region and indicates that the pizza oil has the highest concentration of species with *cis* double bonds.

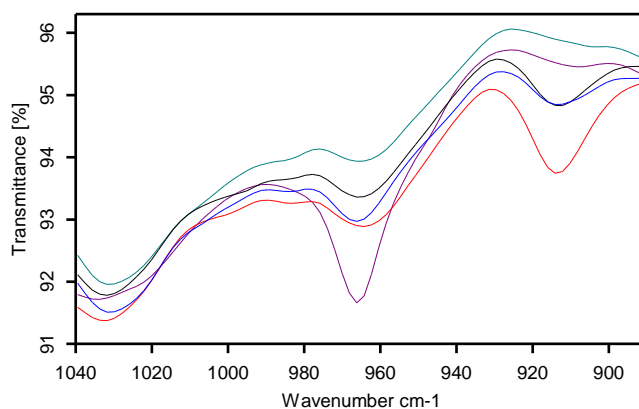


Figure 1. ATR spectra of the *trans* double bond region of several oils: extra virgin olive oil (green), peanut oil (black), canola oil (blue), corn oil (red) and pizza oil (purple).

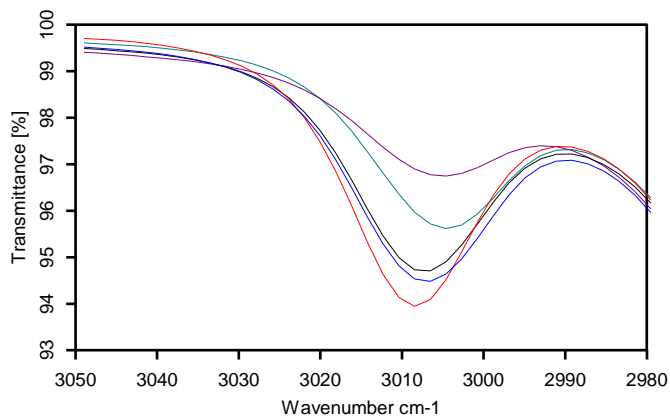


Figure 2. ATR spectra of the *cis* bond region of several oils: extra virgin olive oil (green), peanut oil (black), canola oil (blue), corn oil (red) and pizza oil (purple).