



TENNESSEE BUREAU OF INVESTIGATION

Forensic Services Division

Forensic Chemistry Standard Operating Procedure Manual

Gas Chromatography - Fourier Transform Infrared Spectroscopy

22.0 GAS CHROMATOGRAPHY - FOURIER TRANSFORM INFRARED SPECTROSCOPY

22.1 Application

Gas Chromatography - Fourier Transform Infrared Spectroscopy (GC-IR) is an analytical technique that combines the separation capabilities of GC with the compound selectivity of IR. This instrument is used within the unit as a confirmatory test for compounds of interest.

22.2 Equipment

The TBI FCU currently utilizes Hewlett-Packard/Agilent GCs coupled with a Thermo Fisher Scientific FTIR and a GC-IR system manufactured entirely by Thermo Fisher Scientific. Each instrument utilizes deuterated triglycine sulfate (DTGS) detectors for use as with traditional FTIR. All of these systems utilize liquid nitrogen MCT detectors for detection of the GC eluent. The hardware systems are controlled by OMNIC proprietary software for data collection.

22.3 Standards

A check solution that consists of a combination of working standards appropriate for the column length will be used for GC component performance verification. These solutions contain the following compounds:

- Amphetamine, methamphetamine, and phentermine for long columns
- Cocaine, hydrocodone, and pethidine for short columns

Traceable polystyrene and/or glass standards provided by the manufacturer will be used for FTIR component performance verification.

22.4 Method

Methodology for the GC-IR follows the same procedure as outlined in the Gas Chromatography chapter (Section 21.1.4). The TBI FCU has several GC-IR methods to produce quality results for a wide variety of analytes. Please note that the analyst must manually adjust the GC temperature control and ramp on older instruments since they lack method storage capabilities.

The operating instructions for each specific instrument can be found in instrument notebook or in Lab Documentation folder in Ensur.

The data obtained from this instrument will include a Gram Schmidt reconstruction similar to a gas chromatogram as well as a FTIR spectrum unique to analyte(s) of interest. The Gram Schmidt reconstruction **cannot** be used for retention time comparisons because integration is not possible.

22.5 Quality Assurance

Quality control protocols for the GC-IR follow the same procedure as outlined in the Gas Chromatography chapter (Section 21.1.5).

Running daily primary standards for making spectral comparisons to unknown samples is not required since all primary standards and samples are run using the same FTIR spectral parameters. Consult the instrument logbook for these parameters.



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22.6 Performance Verification and Acceptance Criteria

The performance verification and acceptance criteria follow the same criteria outlined in the FTIR (Section 20.6) and GC (Section 21.1.6) chapters. Please refer to these sections for specific verification and acceptance requirements.

If any of the criteria are not met, the instrument will be removed from service, and the unit supervisor will be notified.

Please note that the check solutions differ based on the instrument's column length. Refer to the instrument maintenance manual to determine the correct performance verification check solution.

Refer to Appendix G for other maintenance requirements and intervals.

22.7 Criteria for Initial Evaluation

Since the GC/IR is not as sensitive than a GC/MS, any peak present in the Gram-Schmidt reconstruction that is not present on the previously run acceptable blank will be considered valid for further comparison.

22.8 Interpretation

The analyst should review all peaks in the Gram Schmidt reconstruction to ensure all legally significant compounds are identified within in the sample.

The analyst will also review the compound of interest's spectrum to determine if it matches the primary reference standard. The lot number and the run date of the primary standard will be noted in either the electronic library or in the primary standard spectra notebook to ensure case file traceability.