



# Analysis of Natural Gas by FT-IR; Calibrations & Validations

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**Problem:** Traditionally, natural gas has been analyzed by relatively cumbersome and time-consuming gas chromatographic methods that are not conveniently adaptable to field use.

**Objective:** The objective of this program was to investigate and define the use of midband Fourier transform infrared (FT-IR) spectroscopy as a rapid and reliable means of estimating natural gas composition and derived properties in the field.

**Importance of Project:** This method provides a quick and simple way of estimating the concentrations of the major natural gas components and their derived properties simultaneously. Compared to the gas chromatographic procedure, the spectroscopic method offers advantages in cost, time required per analysis, and adaptability to use in remote locations.

**Technical Approach:** Since methane, ethane, propane, and butane each have dis-

tinct infrared spectra, the measurement of their individual concentration can be performed. Using standards, calibration models were constructed to correlate actual concentration of components with FT-IR spectra. The calibration models were validated using a set of independently procured and analyzed natural gas samples.

**Accomplishments:** A fast experimental protocol was established for the simultaneous determination of methane, ethane, propane, and butane in nitrogen from FT-IR spectra. Correlation between blending partial pressure or GC-based analysis and FT-IR data produced squared correlation coefficients ( $r^2$ ) in excess of 0.98. Total required analytical time is approximately 1 to 2 minutes.

**Military Impact:** Improved analytical chemical speed and convenience facilitates obtaining compositional data on natural gas in the laboratory or in field. The method may also be used as an on-line analyzer for natural gas pipelines.

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