Proton Transfer Reaction Mass Spectrometer (PTR-MS)

A Real-Time Instrument for High-Resolution VOC Detection

INTRODUCTION:

The Proton Transfer Reaction Mass Spectrometer (PTR-MS) is a state-of-the-art analytical instrument designed to measure volatile organic compounds (VOCs) in the atmosphere with high sensitivity and rapid time response. Operating on the principle of proton transfer reactions between hydronium ions and target VOCs, PTR-MS enables real-time, quantitative analysis of trace gases without the need for sample pre-treatment. It is widely used in atmospheric chemistry, air quality research, and emissions monitoring.

OBJECTIVES:

- Real-time detection of VOCs in ambient air
- Source characterization of anthropogenic and biogenic emissions
- Air quality monitoring and chemical transformation studies
- Support for climate change and health impact assessments
- Field deployment for continuous atmospheric measurements

KEY SPECIFICATIONS:

- Detection Range: ~pptv to ppbv
- Time Resolution: 1–10 seconds (adjustable)
- Mass Range: m/z 20–500
- Ion Source: H_3O^+ (Hydronium ions)
- Inlet System: Heated capillary with controlled flow
- Calibration: Standard VOC gas mixtures and zero air

DATA OUTPUT:

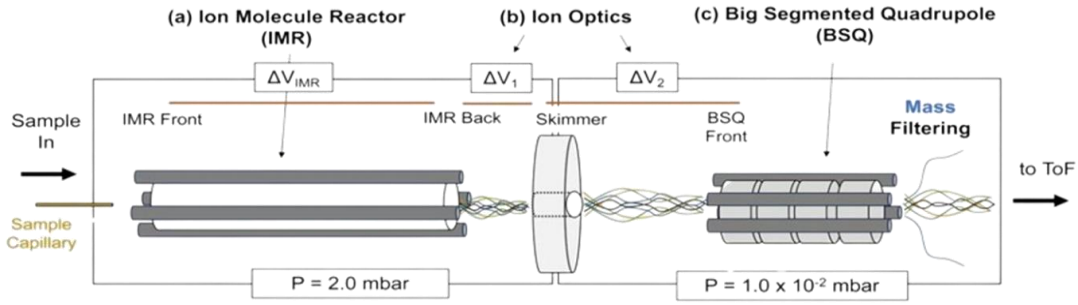
- VOC concentration (ppbv or µg/m³)
- Mass spectra of detected organic compounds
- Time-resolved chemical composition
- Signal intensity (counts per second)
- Diagnostic system parameters

MEASUREMENT & WORKING PRINCIPLE:

PTR-MS relies on the soft ionization of VOCs via proton transfer from H_3O^+ ions. Compounds with a higher proton affinity than water are ionized in a drift tube and sent into a Time-of-Flight (TOF) mass analyzer. This allows mass-to-charge ratio (m/z) determination with high precision. The real-time mass spectra provide immediate quantitative data for multiple organic species simultaneously.

KEY FEATURES:

- High Sensitivity & Fast Response: Ideal for time-resolved VOC tracking
- Minimal Fragmentation: Enables accurate identification of parent compounds
- Field Deployable: Suitable for stationary and mobile applications
- Low Detection Limits: Trace detection of reactive gases
- Integrated Calibration System: Ensures reliable and reproducible measurements



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