

Identification of Bacteria by Pyrolysis-Gas Chromatography-Ion Mobility Spectrometry

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Abstract

This work presents a novel approach for rapid and reliable analysis of biological samples, crucial in medical, safety, and security sectors. The self-built device combines a pyrolyzer with a gas chromatograph and an ultra-fast ion mobility spectrometer. This portable system allows sensitive analysis of liquid and solid samples on-site, including viruses and bacteria. The sample undergoes pyrolysis under an inert atmosphere, breaking down larger non-volatile compounds into their volatile constituents. The gas chromatograph separates the constituents, while the ion mobility spectrometer provides an orthogonal dimension of separation and detection at the highest sensitivity. The method effectively differentiates between bacteria such as *Streptococcus Mitis* and *Streptococcus Suis*.

Keywords: Pyrolysis, GC, IMS, Bacteria, GC-IMS

The rapid and reliable analysis of biological samples is of utmost importance in various areas of interest, particularly in the medical, safety, and security sectors. We present a new approach using a self-built device that combines a low-cost pyrolyzer with a gas chromatograph and an ultra-fast polarity switching ion mobility spectrometer. This approach is field deployable and allows for rapid and sensitive analysis of liquid and solid samples, including viruses and bacterial pathogens. The sample is heated rapidly under an inert gas atmosphere in the absence of reactive gases, such as oxygen. This process, known as pyrolysis, transfers the solid or liquid sample into the gas phase while dissociating larger non-volatile compounds into more volatile constituents. The gas chromatograph then separates the complex sample matrix, and the eluting substances are detected using a dual-polarity ion mobility spectrometer, adding a second dimension of separation. The practical use case is the identification of bacteria, as shown with the two topographical plots for *Streptococcus Mitis* and *Streptococcus Suis* in **Fehler! Verweisquelle konnte nicht gefunden werden.** As is visible,

the two different bacteria of the same class can be clearly differentiated.

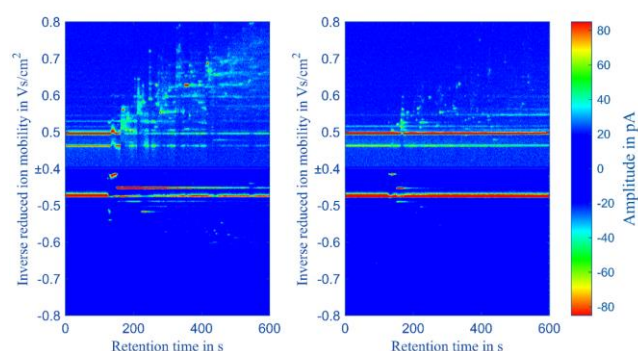


Figure 1. 2D-chromatogram of *Streptococcus Mitis* (left) and *Streptococcus Suis* (right) measured with the PY-GC-IMS at a concentration of 4×10^8 cfu/ μ l.

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