



## Ammonia impurities in hydrocarbon streams

### Ammonia impurities in Ethylene or Propylene fluid streams



Ammonia (NH<sub>3</sub>) is a well-known, widely spread air pollutant, which is present almost everywhere in low ppm/ppb concentrations. Ammonia can be found in various processes, where gases are the basic media, such as steam crackers producing gaseous hydrocarbons for further production steps like polymerization. Gases like these are for example Ethylene, Propylene and even so called cracker gas, which is mostly a mixture of above mentioned gases as well as Water and Hydrogen. The gases of interest are separated and afterwards fed into a pipeline which is serving other chemical plants, producing for example Polyethylene. Ethylene and Propylene are widely used in industry chemistry and they are one of the most important compounds used.

Ammonia is a serious contamination in Ethylene and Propylene because it acts as poison for the catalysts in the Polyethylene (PE) and Polypropylene (PP) production. In order to increase the performance of the polymerization process for their production the sensitivity of the used catalyst has to be increased. Therefore the purity of Ethylene and Propylene is an important topic especially the contamination with Ammonia impurities.

Large quantities of Ethylene and Propylene are transported via pipe lines with lengths of several hundreds of km. Companies producing Ethylene or Propylene will lead in their products at different point into the pipe line for the transportation to the final users. The purity of Ethylene and Propylene especially the contamination with Ammonia at the point of lead in and extraction of the pipe line but also in the production process is important. There are growing concerns over the management of Ammonia impurities.

With the **IMS-Analyzer**, IUT Medical offers a high sensitive, reliable, and easy to operate analyzer. The **IMS-Analyzer** allows for the continuous, long-term direct measurement of low ppb of Ammonia in such streams (see **IMS-Analyzer** data sheet).

Compound	other names	Sum formula	CAS-No.	Structure
Ammonia	<ul style="list-style-type: none"><li>Hydrogen nitride</li><li>Trihydrogen nitride</li><li>Nitro-Sil</li></ul>	NH <sub>3</sub>	7664-41-7	
Ethylene	<ul style="list-style-type: none"><li>Ethene</li></ul>	C <sub>2</sub> H <sub>4</sub>	74-85-1	
Propylene	<ul style="list-style-type: none"><li>Propene</li><li>Methylethylene</li></ul>	C <sub>3</sub> H <sub>6</sub>	115-07-1	

# Application Note

## Ammonia impurities in Ethylene or Propylene fluid streams

NH<sub>3</sub> in processes like these can be a problem in terms of process efficiency, quality control and avoidance of damages, which cause the need to replace very expensive equipment such as catalysts. The fast, accurate and quantitative measurement of NH<sub>3</sub> in Hydrocarbon streams is a growing need in plastics manufacturing. An amount of NH<sub>3</sub> which is higher than 5 ppm can poison catalysts and impairs the quality of the produced polymers in an unacceptable way.

### Solution

The **IMS-Analyzer** is capable of detecting and quantifying NH<sub>3</sub> directly from f.i. Ethylene or even in the process step of steam cracking beforehand to avoid technical problems as well as ensuring the quality and efficiency. The outstanding sensitivity and resolution as well as the almost immediate response to concentration changes make the **IMS-Analyzer** to one of the most suitable process monitoring techniques available. Compared to other methods used in that field like process gas chromatographs, IMS is relatively cheap.

The following table provides information of the performance of **IMS-Analyzer** measuring Ammonia in hydrocarbon fluid streams:

Compound	Standard range	MDC	Resolution
Ammonia	0 - 5 ppm	< 50 ppb	0.1% of maximum

The **IMS-Analyzer** bases on the proven technology of ion mobility spectrometry (IMS) and also GC-IMS, which operates with atmospheric pressure conditions, highly selective and sensitive to Ammonia. Typical detection limits for Ammonia in such streams are less than 50 ppb without prior enrichment.

IMS is an atmospheric pressure, time of flight detection technique. The sensitivity, selectivity and speed of response make the technique superior in many aspects to other monitoring methods. Unlike electrochemical devices, the IMS units are impervious to extreme temperature or humidity conditions. In addition, in contrast to paper tape detection methods, the IMS units are designed for long term, continuous measurements with little or no maintenance and few consumables. The electronics are completely solid-state without moving parts or optics to require alignment.

### Advantages:

- Unique combination of GC column with IMS to a GC-IMS
- Real-time analysis of Ammonia
- High sensitivity in the lower ppb range without enrichment
- Superior selectivity and cross sensitivity rejection
- Automatic operation with Multi Point Sampler system (MPS)
- As stationary and mobile devices available
- Available in various protection classes (From general purpose to IP 55 and NEMA 4X)
- Also in explosion-proof design available

