DVLS Liquefied Gas Injector (ASTM D7756-13 & EN 16423): a High Pressure Liquid Sampling Chromatography Technique for the Analysis of Oily Residues and Contaminants in C3 and C4 Streams

Oily Residues Analysis in LPG by GC

To control the residue content in LPG there are several methods available. The conventional methods (ASTM D2158, EN 15470 & EN 15471 and ISO 13757) are not direct injection GC based and require evaporation of large volumes of the liquid sample. Alternative methods are ASTM D7756-13 and EN 16423: fast, safe and accurate methods to determine oily residues in LPG by gas chromatography with the DVLS Liquefied Gas Injector (LGI).

High Pressure Liquid Sampling

The LGI incorporates a direct, on-column LPG injection through an innovative large volume high pressure liquid sampling technique developed by Da Vinci Laboratory Solutions (DVLS).

The direct injection approach of the LGI includes the proven fuel direct injection technique used by the automotive industry to inject fuel into the automotive engine combustion chamber. The LGI is configured on top of the GC and consists of a high pressure injection valve connected to an injection needle.

The DVLS Liquefied Gas Injector installed on the GC

The LGI pressure station and the GC enable a constant pressure of the liquid sample and allow to inject a representative and repeatable amount of the sample.

The sample container is installed on the front side of the pressure station and pressurized to 25 bar. The waste sample is vented to a central waste system. The controller box on top of the GC drives the injection cycling.

Application Range

The DVLS Liquefied Gas Injector offers laboratories a proven GC standard for the following applications:

- Residu and light contaminants in LPG (ASTM D7756-13, EN 16423)
- Elemental Sulfur in LPG
- Desulfurization additives in LPG: DIPA, MEA & DEA
- Inhibitors, additives and Dimers in Butadiene: ρTBC, VCH and NMP
- Natural Gas Condensate

Boosting Laboratory Efficiency

DVLS Liquefied Gas Injector (ASTM D7756-13 & EN 16423)

The LGI Pressure Station

The LGI Injector

The LGI Controller Box

Proven Technology

The DVLS Liquefied Gas Injector was introduced in 2010 and received several awards since that time. In 2010 the LGI was awarded as the Best New Technology at the Gulf Coast Conference in Galveston, U.S.A. In 2013 the DVLS R&D team received the CE award for the design of the Liquefied Gas Injector.

The LGI technology also sets the standard for the analysis of oily residues in LPG as it was approved as ASTM D7756 in 2011.
In 2012 the ASTM D7756 method was revised to extend the application range of the method to the analysis of light contaminants such as benzene, toluene, C7-C10 hydrocarbons and DIPA in LPG.
In 2013 ASTM published a revision for ASTM D7756 to include a full precision as a result of the Round Robin conducted in 2012.

The latest standard is the harmonized EN 16423 method dedicated to the determination of residue in LPG with the LGI.

Since its introduction the LGI has been successfully sold and installed at customer sites in Africa, Australia, Asia, Europe and the U.S.A.

Technical Specifications

- Analysis time < 30 minutes
- Detection limits of < 1 mg/kg for individual components
- Flexible sample size, micro-second range up to 250 mS (large volume)
- Oily Residue analysis range of 10—600 mg/kg

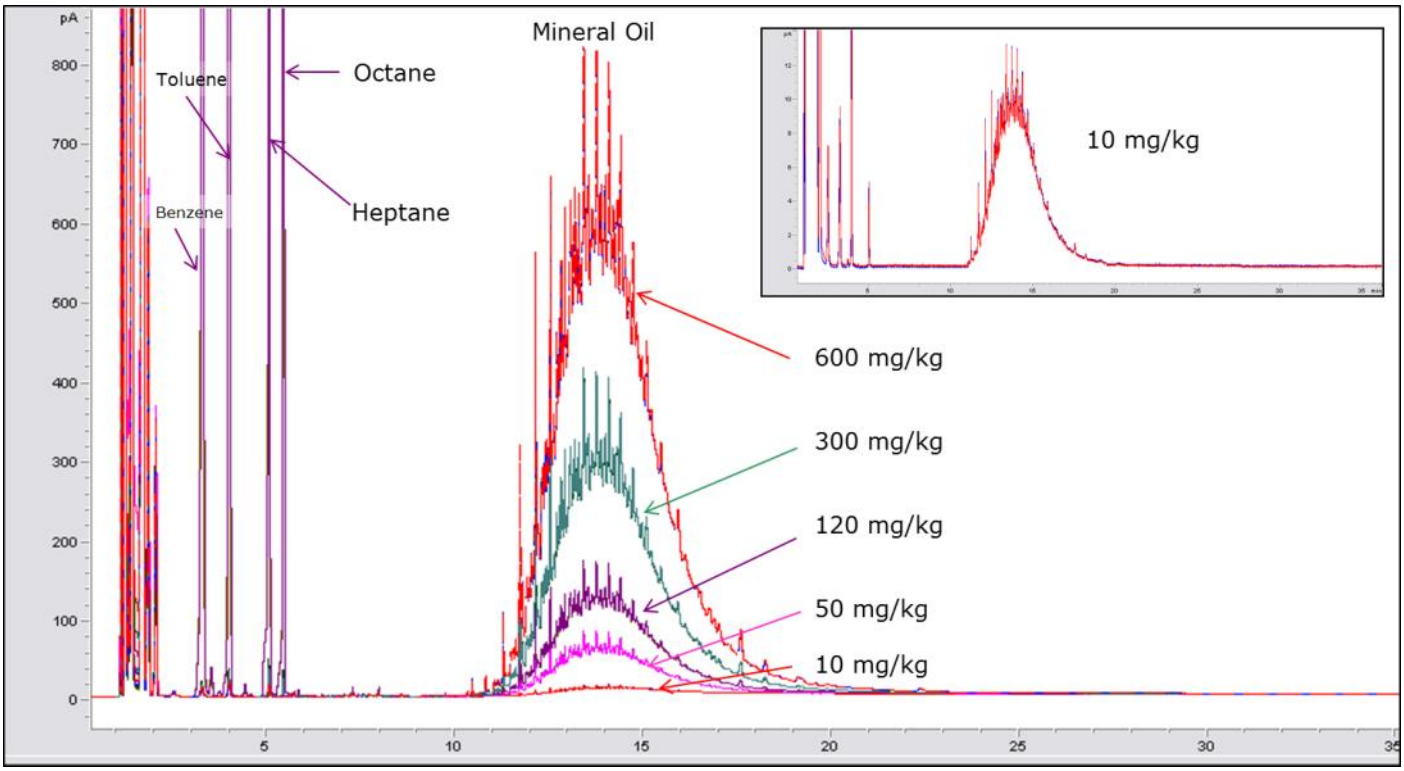


Figure One: LGI Analysis of Oily Residues in LPG

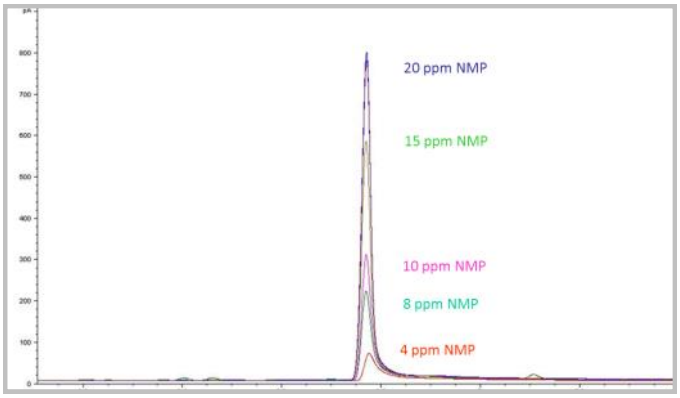


Figure Two: LGI Analysis of five concentrations of NMP in Pentane

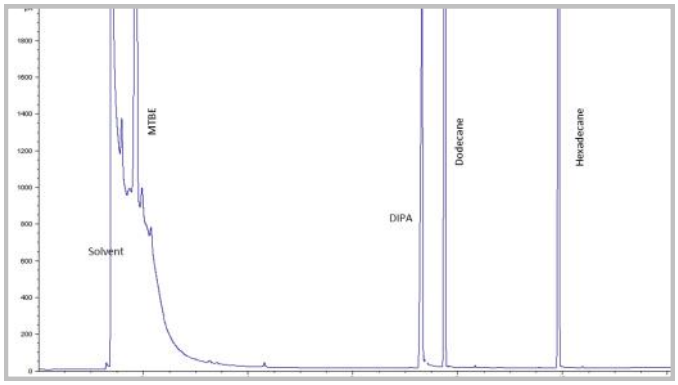
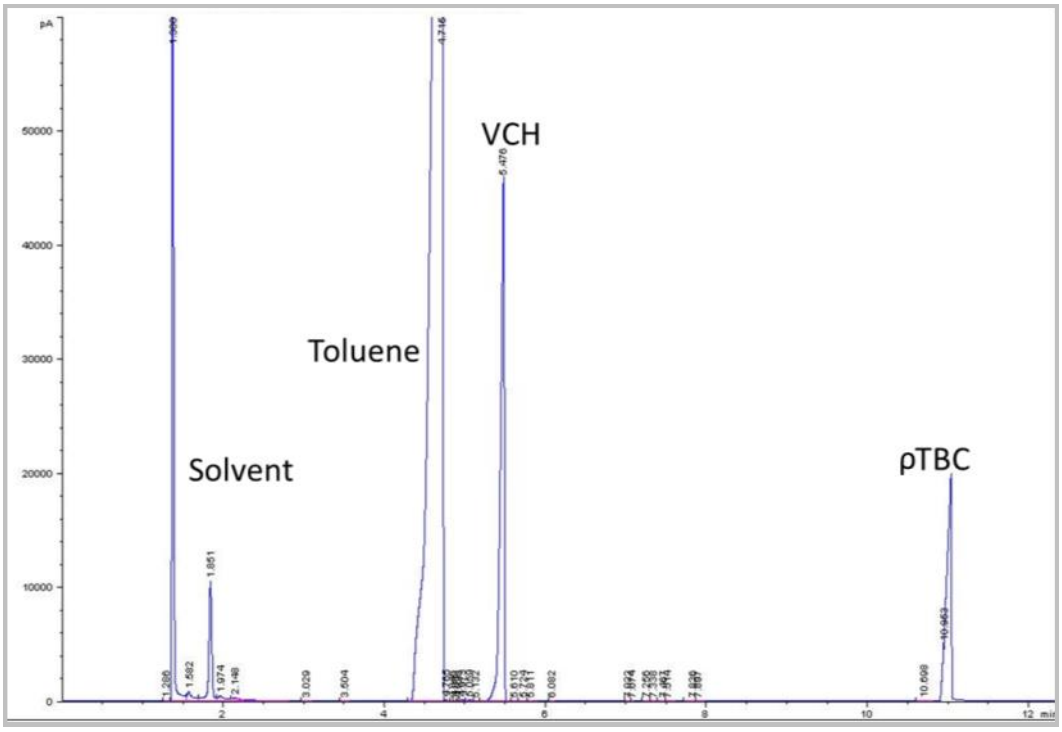


Figure Three: LGI Analysis of DIPA in LPG

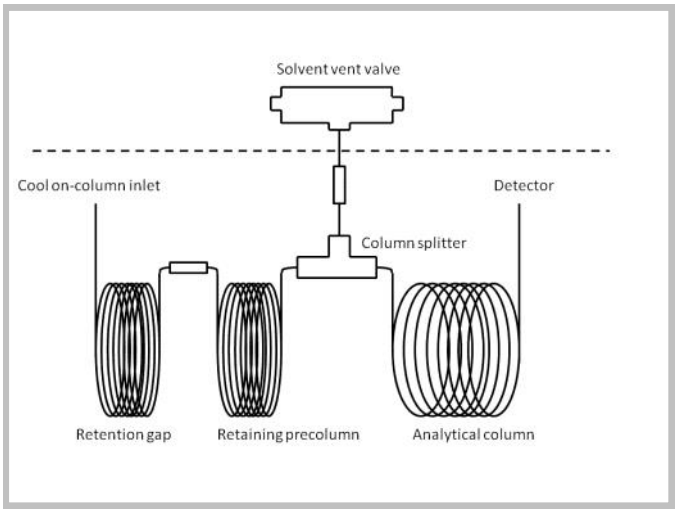
Figure Three: LGI Analyis of VCH and ρTBC in Butadiene



DVLS Liquefied Gas Injector (ASTM D7756-13 & EN 16423)

Column Configuration

The LGI is configured on top of the GC and consists of a high pressure injection valve connected to an injection needle. The GC is equipped with an inlet, a retention gap, a precolumn, an analytical column and a solvent vapor exit. The LGI injects the sample into a 5 meter Sulfinert® coated stainless steel capillary column.
The retention gap is connected to a 3 meter non polar retaining column, with an exit for flushing the LPG or Butadiene light ends.
Subsequently, the exit is closed and the flow is switched to the non-polar analytical column for the elution of oily residues and contaminants in the C3 and C4 streams.



The Typical Column Configuration of the DVLS LGI

Safe and Efficient Design

The LGI solution consists of the injector, the pressure station, the controller box and the GC.
This innovative design provides laboratories with a safe, reliable and efficient method to determine oily residues and contaminants in C3 and C4 streams as a result of:

- Large volume injection
- High pressure liquid sampling
- Safe and easy connection of sample container
- No need for sample evaporation
- No need for sample preparation
- Reduced bench space by installing the Controller box on top of GC

Key Benefits of the DVLS Liquefied Gas Injector

- GC alternative for ASTM D2158, EN 15470, EN 15471 & ISO 13757
- Approved as ASTM D 7756-13 and EN 16423
- High pressure large volume injection
- Safe and efficient design
- Proven technology for high pressure injection
- Fast analysis time of < 30 minutes
- Detection limits of < 1 mg/kg for individual contaminants in liquefied gases

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