Application Note:
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# Analysis of Petroleum Hydrocarbons Standard for Underground Storage Tank Monitoring on a Thermo Scientific Ultrafast Column

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**Key Words**

- Ultrafast
- Petrochemical
- Environmental
- Hydrocarbon
- GC

## Abstract

Underground storage tanks (UST) used to store various petroleum-based substances such as gasoline, diesel fuel, and fuel oil are monitored for leaks as authorized by the Resource Conservation and Recovery Act (RCRA). Gas chromatography is used for the analysis of these samples which often have a wide range of molecular weights.

## Introduction

Underground storage tanks (UST) used to store various petroleum-based substances such as gasoline, diesel fuel, and fuel oil are monitored for leaks as authorized by the Resource Conservation and Recovery Act (RCRA). Leaking underground storage tanks (LUST) contaminate ground water and soil and besides the environmental impact there is a significant financial impact involved with fines and cleanup. UST monitoring is usually done by gas chromatography (GC) with a flame ionization detector (FID). These petrochemicals often have a wide molecular weight range which necessitates a temperature programmed run in order to get adequate retention of components with higher volatility and later eluting the high molecular weight components in the same chromatographic run. The chromatographic run time of these types of samples typically takes more than 20 minutes. Thermo Scientific UltraFast technology makes it possible to reduce the total analysis time to less than four minutes. A Total Recoverable Petroleum Hydrocarbons (TRPH) analytical standard mixture is representative of the molecular weight range typically found in UST samples.

## Experimental Details

**Chemicals and Reagents**

Florida TRPH Standard

**Peak ID**

| | | | |
|---|---|---|---|
| 1. | n-Octane (C8) | 2. | n-Decane (C10) |
| 3. | n-Dodecane (C12) | 4. | n-Tetradecane (C14) |
| 5. | n-Hexadecane (C16) | 6. | n-Octadecane (C18) |
| 7. | n-Eicosane (C20) | 8. | n-Docosane (C22) |
| 9. | n-Tetracosane (C24) | 10. | n-Hexacosane (C26) |
| 11. | n-Octacosane (C28) | 12. | n-Triacontane (C30) |
| 13. | n-Dotriacontane (C32) | 14. | n-Tetratriacontane (C34) |
| 15. | n-Hexatriacontane (C36) | 16. | n-Octatriacontane (C38) |
| 17. | n-Tetracontane (C40) | | |

| Sample Handling Equipment | Part Number |
|---|---|
| Vials and closures: 2 mL clear vial and Si/PTFE seal | 60180-599 |

| Separation Conditions | | Part Number |
|---|---|---|
| Instrumentation: | Thermo Scientific Trace Ultra GC (Ultrafast configuration) with TriPlus Autosampler | |
| Column: | UFC-M1, 2.5 meter X 0.1 mm ID X 0.4 µm film UltraFast Column | UFMC00000010906 |
| Septum: | Thermo Scientific BTO 12.7 mm septa | 31303228 |
| Liner: | PTV Siltek Metal Liner, 2 X 2.75 X 120 mm | 45302044 |
| Injection syringe: | 10 µL fixed needle, Thermo Scientific | 36520060 |

| | |
|---|---|
| Carrier gas: | Helium |
| Split flow: | 100 mL/minute |
| Column flow: | 0.5mL/minute |
| Split ratio: | 200:1 |
| Oven temperature: | 50 °C (0.5 minute hold) -340 °C (2 minute hold) at 200 °C /minute |

| | |
|---|---|
| Injector type: | PTV |
| Injector mode: | Constant temperature |
| Injector temperature: | 330 °C |

| | |
|---|---|
| Detector details: | |
| FID parameters: | |
| Temperature: | 350 °C |
| Air flow: | 350 mL/minute |
| Hydrogen flow: | 35 mL/minute |
| Nitrogen makeup flow: | 30 mL/minute |

| **Separations Conditions** (using conventional column) | | **Part Number** |
|---|---|---|
| Column | TG-1MS 15m x 0.32mm x 0.10 | 26099-0360 |
| Gas: | Helium, | |
| Flow Rate: | 1.5 | |
| Injector: | 300 °C, split 40:1 | |
| InjVol: | 1 | |
| Temp: | 40 °C (2 minute hold)-330 °C (1 minute hold) at 15 °C /minute | |
| Detection: FID 330 °C | | |

| **Data Processing** | |
|---|---|
| Software: | ChromQuest |

## Results

Thermo Scientific Ultrafast column technology can be used to achieve fast analysis of a wide molecular weight range of petroleum hydrocarbons such as those found in Underground Storage Tank monitoring. Excellent separation of a mixture of even numbered alkanes from C8 (n-octane) to C40 (n-tetracontane) was accomplished in less than 3.5 minutes (Figure 1). Analysis of these types of samples on a conventional GC capillary column requires >20 minutes (Figure 2). Since temperature programming is required for this analysis the time needed for the GC oven to cool down to the initial temperature also needs to be considered. The time required to cool down the Ultrafast from 340°C to 50°C for this analysis is approximately 90 seconds, where the time required to cool down a conventional GC oven for the same temperature range is approximately 4 minutes, thus further decreasing the overall run-to-run time. Laboratories doing UST analysis can do approximately five times more analyses per day using Ultrafast technology versus conventional GC columns.

## References


http://www.epa.gov/oust/
http://www.epa.gov/oust/eparecovery/
http://www.floridadep.org/waste/categories/tanks/


## Conclusions

Analysis of sample containing a wide molecular weight range of hydrocarbons such as those found in Underground Storage Tanks (UST) monitoring can be done in slightly more than three minutes with the use of a Thermo Scientific Ultrafast column. This is approximately five times faster than doing the same analysis using conventional GC capillary columns. five times more analyses per day using Ultrafast technology versus conventional GC columns.

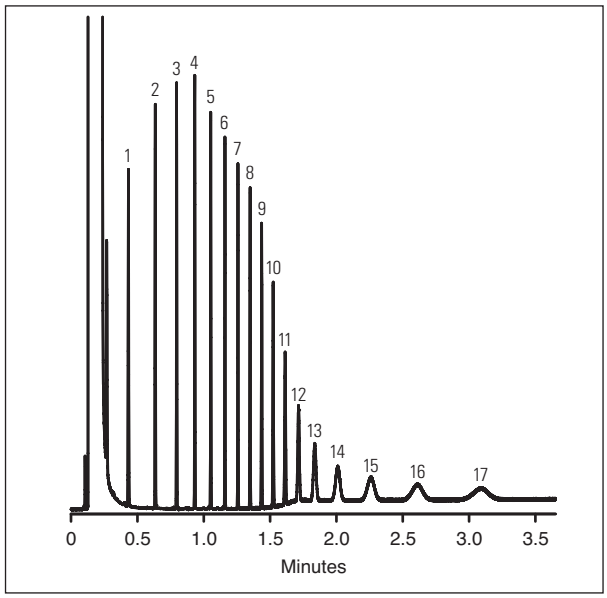


Figure 1. Ultrafast Analysis of Petroleum Hydrocarbons

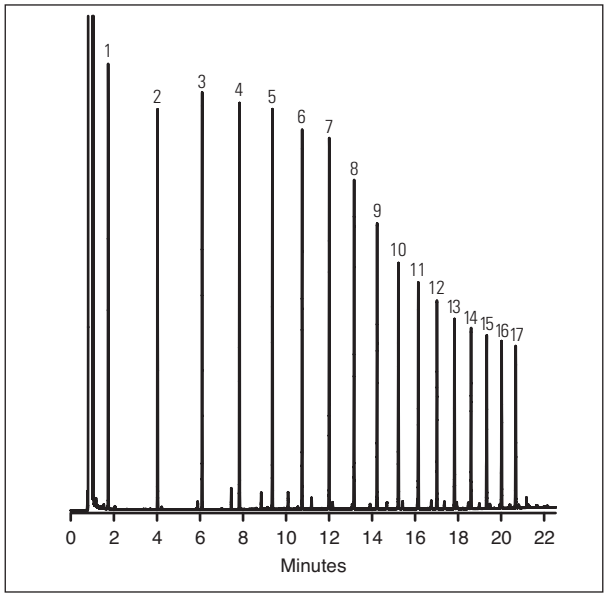


Figure 2. Petroleum Hydrocarbons for UST Monitoring-Conventional GC Capillary

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