

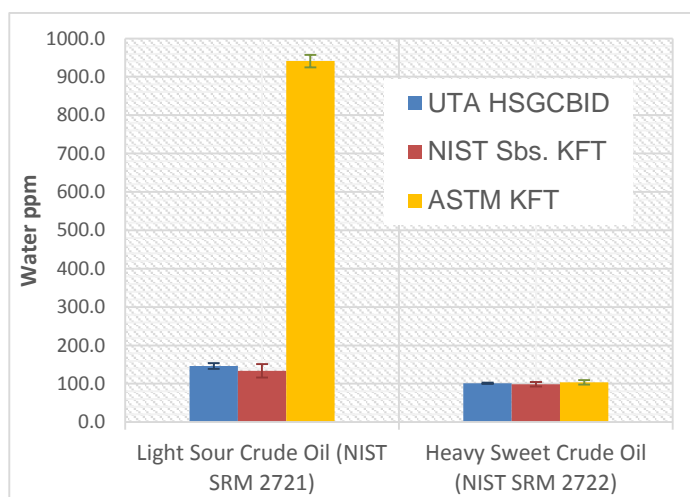
## Analysis of Trace Water in Petroleum Products by GC

- Down to ppm level water analysis using Shimadzu's Unique Barrier Discharge Ionization Detector (BID), which offers 100 times higher sensitivity than conventional Thermal Conductivity Detector (TCD)
- Watercol, Supelco's unique Ionic Liquid GC column, enables separation of water from typical organic components



Water in petrochemical feedstocks can cause problems for processors. Freezing of pipe lines and valves and poisoning of expensive catalysts are just a few examples. Monitoring water in petroleum from an upstream source to the downstream processing plant is critical to insure uninterrupted operation. Unlike the Karl Fischer analysis, the GC water analyzer does not suffer from the adverse effects of the petroleum matrix which can skew the KF results. Head-space GC is a cleaner approach to automated sample introduction that bypasses the undesirable chemical interference that would otherwise be present. Shimadzu's proprietary BID or TCD and Supelco's water analysis column "Watercol" are combined to separate and measure the water in a formulation of feedstock and provide a sensitive and accurate result. Measurements can be made in a wide concentration range from ppm to 100%.

### Water Analysis of Liquid Petroleum Products



Products	HSGCBID		
	mg Water Measured	ppm Water	RSD%
Motor Oil	0.386	770 ± 2.9	0.4
Transmission fluid	0.497	996 ± 9.2	0.9
Engine Oil	0.131	261 ± 5.8	2.2
Gear Oil	0.104	207 ± 6.9	3.3
Power Steering Fluid	0.123	245 ± 5.6	2.3
3 in One Oil	0.223	445 ± 21.0	4.7
M-Pro7 LPX Gun Oil	0.831	1630 ± 15.9	1.0
CLP Gun Oil	1.634	3260 ± 87.4	2.7
Synthetic Gun Oil	0.117	234 ± 3.4	1.5
Remington Moistureguard Rem Oil	0.165	330 ± 8.1	2.5
Remington Rem Oil	0.048	116 ± 4.5	3.9
WD-40	0.365	728 ± 5.0	0.7
Transformer Oil (NIST RM 8506a)	0.0061	12.1 ± 0.8	6.6
Light Sour Crude Oil (NIST SRM 2721)	0.071	146 ± 7.6	5.2
Heavy Sweet Crude Oil (NIST SRM 2722)	0.051	102 ± 1.7	1.7

	Light Sour Crude Oil (NIST SRM 2721)		Heavy Sweet Crude Oil (NIST SRM 2722)	
	ppm	RSD%	ppm	RSD%
HSGCBID	146.1	5.2	101.6	1.7
NIST Sbs. KFT	134.0	13.1	99.0	5.9
ASTM KFT	941.0	1.7	104.0	5.6

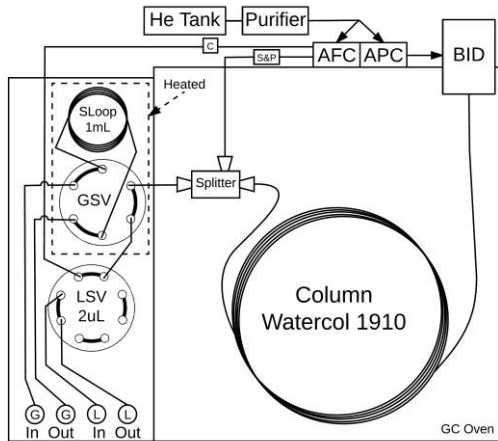
↑ **Water concentration of commercial oil products and NIST reference materials by HS-GC-BID method.**

← **Crude Oil from NIST SRM. As shown in the table, sulfur components led to inaccurate results using KFT methods due to unwanted by-reactions, while HS-GC-BID method had no interference.**

# GC System Configuration

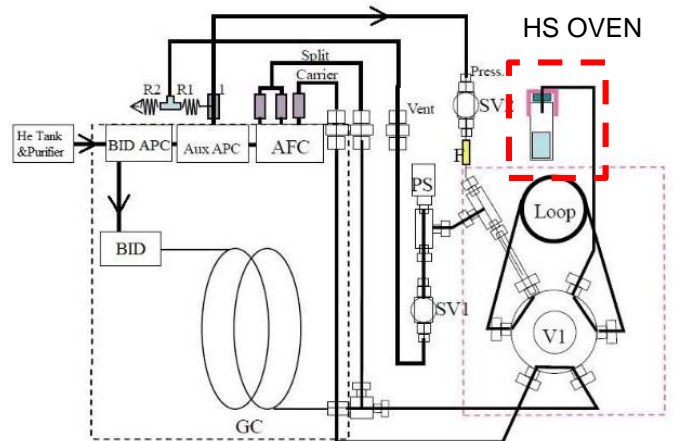
Analytes	Water
Instruments	GC: Shimadzu GC-2010 Plus BID, Data Integration: Shimadzu LabSolutions LC/GC
Carrier Gas	Helium (Purity >99.9999%) with Supelco High Capacity Gas Purifier
Column	Supelco Watercol 1460/1900/1910

## Liquid/Gas Sampling Valve + GCBID



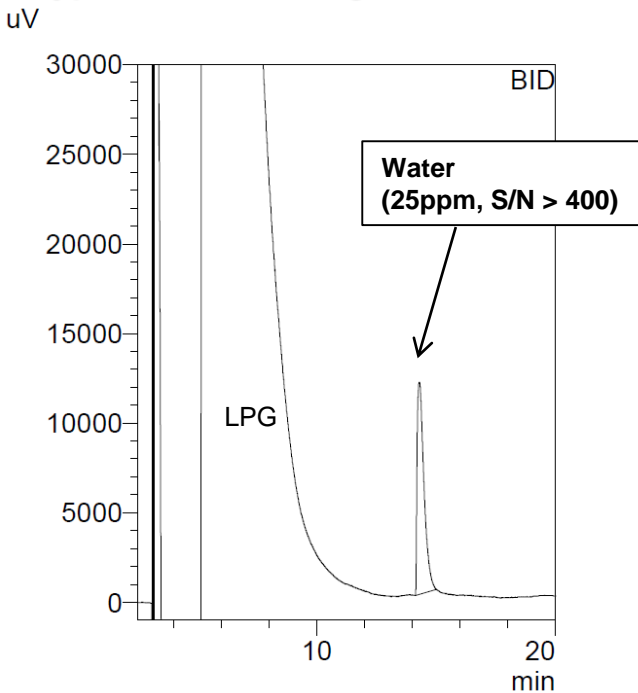
Sample	Liquefied Petroleum Gas(LPG)
Sample Introduction	Valco Liquid Sampling Valve
Target Concentration	1-100 ppm water

## Headspace Sampler HS-20 + GCBID

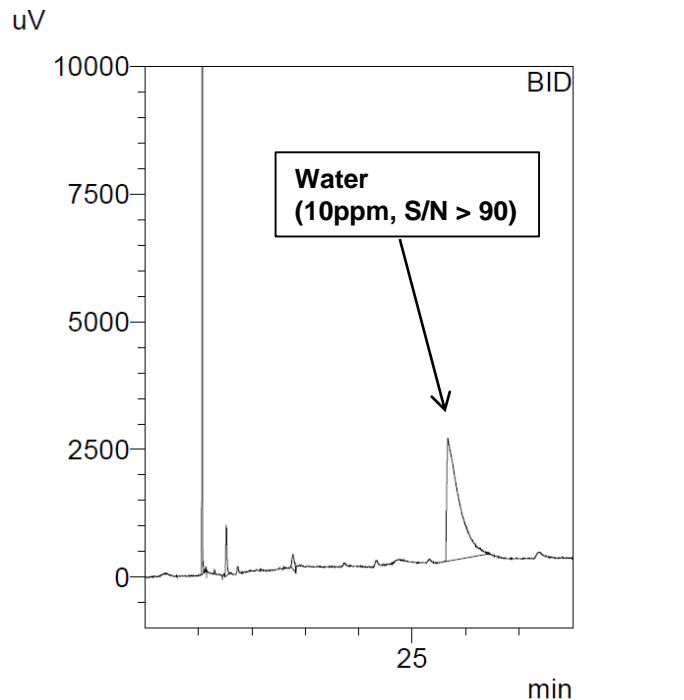


Sample	Liquid Petroleum Products NIST Reference Materials (Motor, Crude, Transformer Oil, etc.)
Sample Introduction	Shimadzu Headspace Autosampler HS-20 (Up to 90 vials)
Target Concentration	10–10,000 ppm water

## Typical Chromatograms



25ppm Water in LPG Standard by Liquid Sampling Valve+GCBID (2uL Liquid, Split 1:5).



10ppm Water in Mine Oil (KFT Water Standard) by HS-20+GCBID (1mL Gas, Split 1:100).

