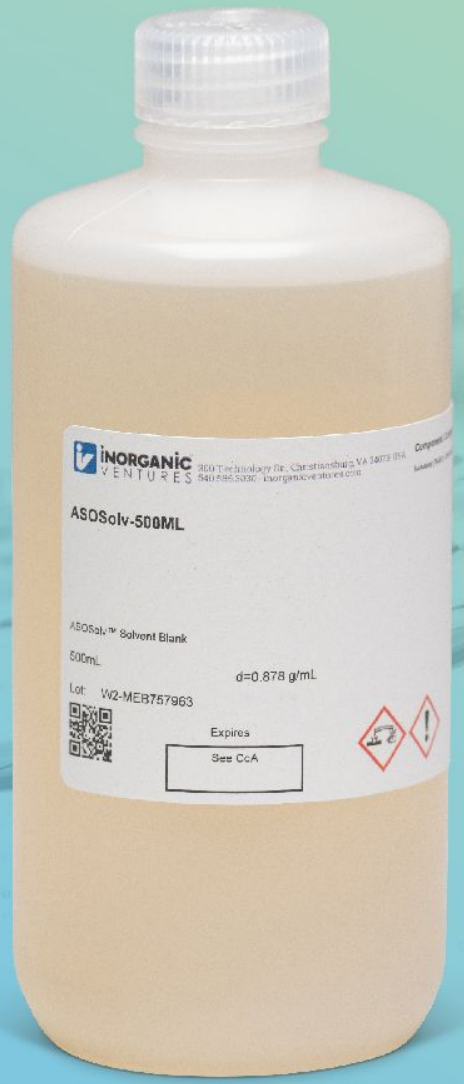
OIL ANALYSIS

INDUSTRY DEEP DIVE SERIES

SPEAKERS:

Mike Booth
Innovation & Applications Development Manager
Inorganic Ventures

Sergei Leikin, PhD
Managing Director
Texas Scientific Products



Less Friction, More Flow:

Simplifying ICP Oil Analysis with ASOSolv™

SEPTEMBER 10 @ 9:00 AM EST

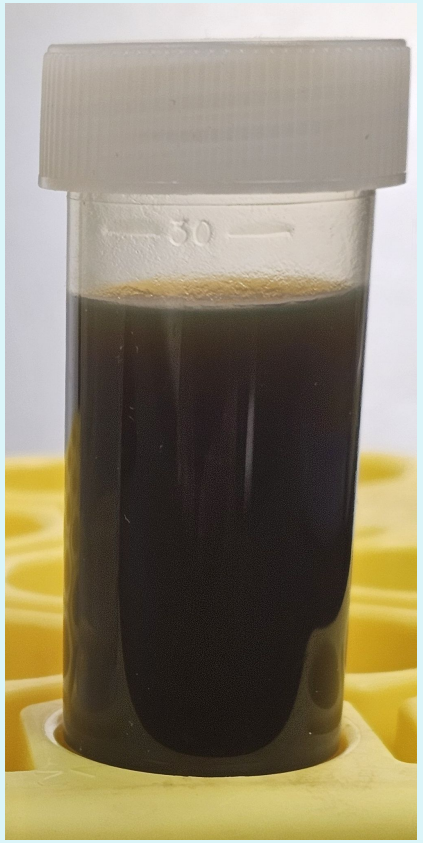
ICP Oil Analysis: Challenges, Limitations, and an Innovative Aqueous Calibration Approach

Dr. Sergei Leikin, Texas Scientific Products LLC

Oil Types

Diesel

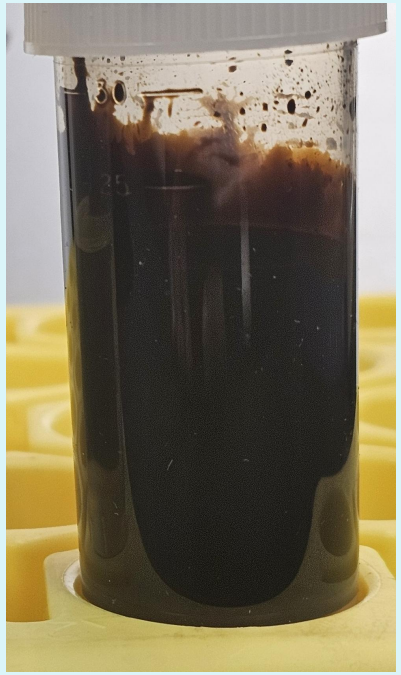
Heavy



Pictures are courtesy of Hunt Refining

Different Oil Types = Different Sample Introduction Challenges

Crude



Solidified at Room Temperature

Pictures are courtesy of Hunt Refining and Ketjen Corporation

Different Oil Types = Different Sample Introduction Challenges

Viscosity and Physical Properties

Sample Uptake, Nebulization, Aerosol Transport

Sample Introduction Components

ASTM Standard Methods for Oils Analysis by ICP-OES

D5185 and D4951

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D5185 – 26

Standard Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)[1]

This standard is issued under the fixed designation D5185; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

Costs associated with maintenance due to engine and machine wear can be significant. Therefore, diagnostic methods for determining the condition of engines and other machinery can be important. This test method is intended to quantify, for the purpose of equipment monitoring, the concentration of metals in used lubricating oils. Although the precision statement was determined by analyzing a variety of used oils this test method can, in principle, be used for the analysis of unused oils to provide more complete elemental composition data than Test Methods D4628, D4927, or D4951.

1. Scope*

1.1 This test method covers the determination of additive elements, wear metals, and contaminants in used and unused lubricating oils and base oils by inductively coupled plasma atomic emission spectrometry (ICP-AES). The specific elements are listed in Table 1.

1.2 This test method covers the determination of selected elements, listed in Table 1, in re-refined and virgin base oils.

1.3 For analysis of any element using wavelengths below 190 nm, a vacuum or inert-gas optical path is required. The determination of sodium and potassium is not possible on some instruments having a limited spectral range.

1.4 This test method uses oil-soluble metals for calibration and does not purport to quantitatively determine insoluble particulates. Analytical results are particle size dependent, and low results are obtained for particles larger than a few micrometers.[2]

1.5 Elements present at concentrations above the upper limit of the calibration curves can be determined with additional, appropriate dilutions and with no degradation of precision.

1.6 For elements other than calcium, sulfur, and zinc, the low limits listed in Table 2 and Table 3 were estimated to be ten times the repeatability standard deviation. For calcium, sulfur, and zinc, the low limits represent the lowest concentrations tested in the interlaboratory study.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific warning statements are given in 6.1, 8.2, and 8.4.

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C1109 Practice for Analysis of Aqueous Leachates from Nuclear Waste Materials Using Inductively Coupled

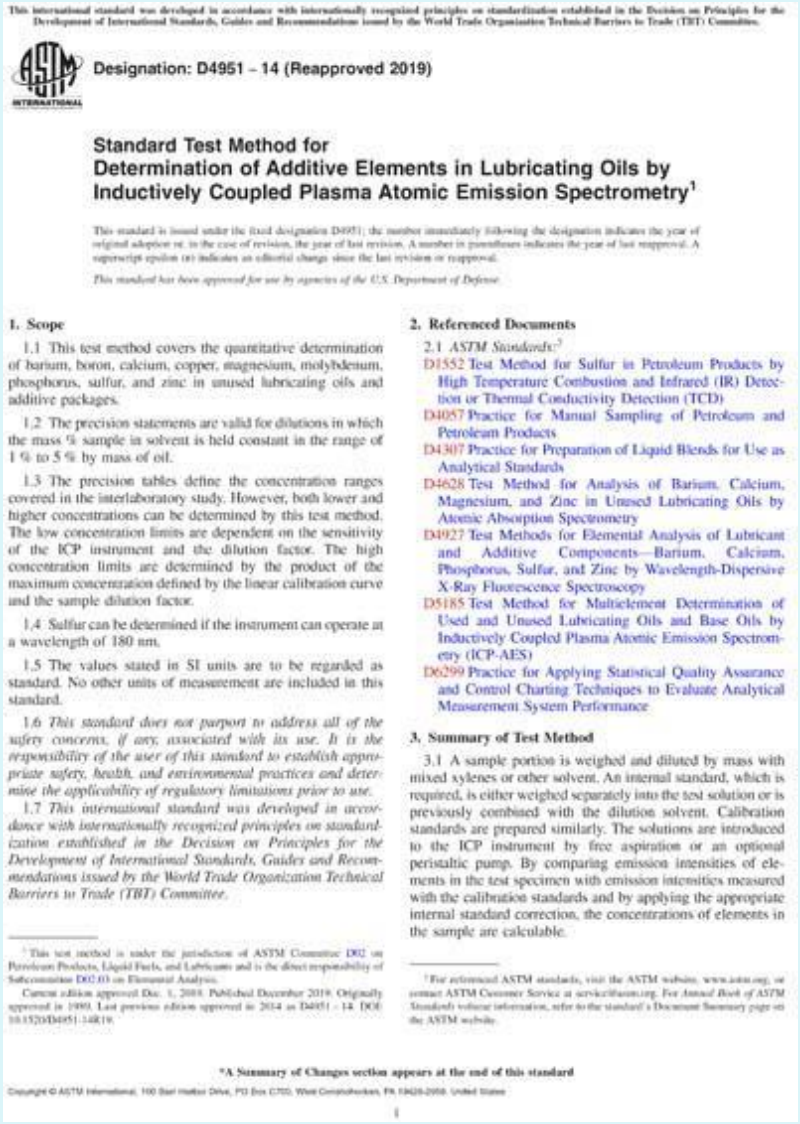
[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.03 on Elemental Analysis.

Current edition approved March 1, 2026. Published April 2026. Originally approved in 1991. Last previous edition approved in 2018 as D5185 – 18. DOI: 10.1520/D5185-26.

[2] Eisentraut, K. J., Newman, R. W., Saba, C. S., Kauffman, R. E., and Rhine, W. E., *Analytical Chemistry*, Vol 56, 1984.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard



This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D4951 – 14 (Reapproved 2019)

Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry[1]

This standard is issued under the fixed designation D4951; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the quantitative determination of barium, boron, calcium, copper, magnesium, molybdenum, phosphorus, sulfur, and zinc in unused lubricating oils and additive packages.

1.2 The precision statements are valid for dilutions in which the mass % sample in solvent is held constant in the range of 1 % to 5 % by mass of oil.

1.3 The precision tables define the concentration ranges covered in the interlaboratory study. However, both lower and higher concentrations can be determined by this test method. The low concentration limits are dependent on the sensitivity of the ICP instrument and the dilution factor. The high concentration limits are determined by the product of the maximum concentration defined by the linear calibration curve and the sample dilution factor.

1.4 Sulfur can be determined if the instrument can operate at a wavelength of 180 nm.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1552 Test Method for Sulfur in Petroleum Products by High Temperature Combustion and Infrared (IR) Detection or Thermal Conductivity Detection (TCD)

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4307 Practice for Preparation of Liquid Blends for Use as Analytical Standards

D4628 Test Method for Analysis of Barium, Calcium, Magnesium, and Zinc in Unused Lubricating Oils by Atomic Absorption Spectrometry

D4927 Test Methods for Elemental Analysis of Lubricant and Additive Components—Barium, Calcium, Phosphorus, Sulfur, and Zinc by Wavelength-Dispersive X-Ray Fluorescence Spectroscopy

D5185 Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)

D6299 Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance

3. Summary of Test Method

3.1 A sample portion is weighed and diluted by mass with mixed xylenes or other solvent. An internal standard, which is required, is either weighed separately into the test solution or is previously combined with the dilution solvent. Calibration standards are prepared similarly. The solutions are introduced to the ICP instrument by free aspiration or an optional peristaltic pump. By comparing emission intensities of elements in the test specimen with emission intensities measured with the calibration standards and by applying the appropriate internal standard correction, the concentrations of elements in the sample are calculable.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.03 on Elemental Analysis.

Current edition approved Dec. 1, 2019. Published December 2019. Originally approved in 1990. Last previous edition approved in 2014 as D4951 – 14. DOI: 10.1520/D4951-14R19.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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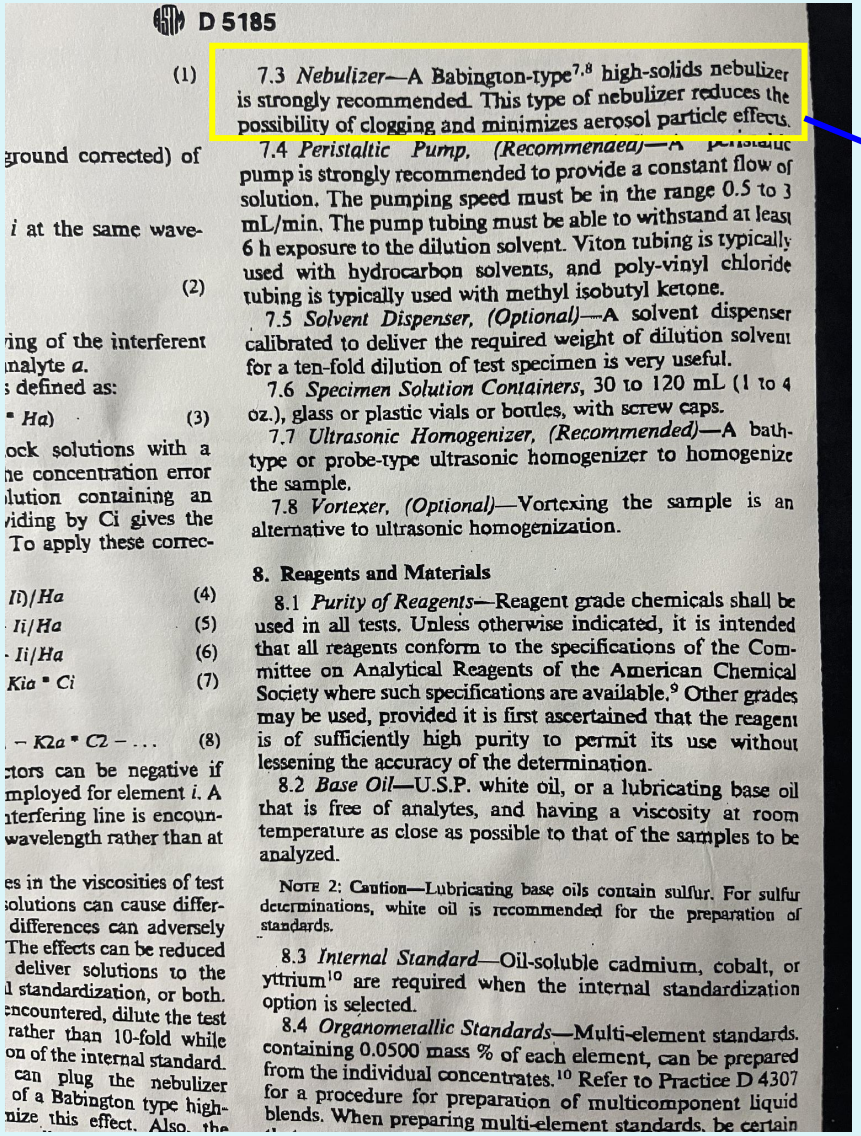
TSP TEXAS SCIENTIFIC PRODUCTS

High-Solids Capable Nebulizer is Recommended



D 5185

(1)

7.3 *Nebulizer*—A Babington-type[7,8] high-solids nebulizer is strongly recommended. This type of nebulizer reduces the possibility of clogging and minimizes aerosol particle effects.

7.4 *Peristaltic Pump, (Recommended)*—A peristaltic pump is strongly recommended to provide a constant flow of solution. The pumping speed must be in the range 0.5 to 3 mL/min. The pump tubing must be able to withstand at least 6 h exposure to the dilution solvent. Viton tubing is typically used with hydrocarbon solvents, and poly-vinyl chloride tubing is typically used with methyl isobutyl ketone.

7.5 *Solvent Dispenser, (Optional)*—A solvent dispenser calibrated to deliver the required weight of dilution solvent for a ten-fold dilution of test specimen is very useful.

7.6 *Specimen Solution Containers*, 30 to 120 mL (1 to 4 oz.), glass or plastic vials or bottles, with screw caps.

7.7 *Ultrasonic Homogenizer, (Recommended)*—A bath-type or probe-type ultrasonic homogenizer to homogenize the sample.

7.8 *Vortexer, (Optional)*—Vortexing the sample is an alternative to ultrasonic homogenization.

8. Reagents and Materials

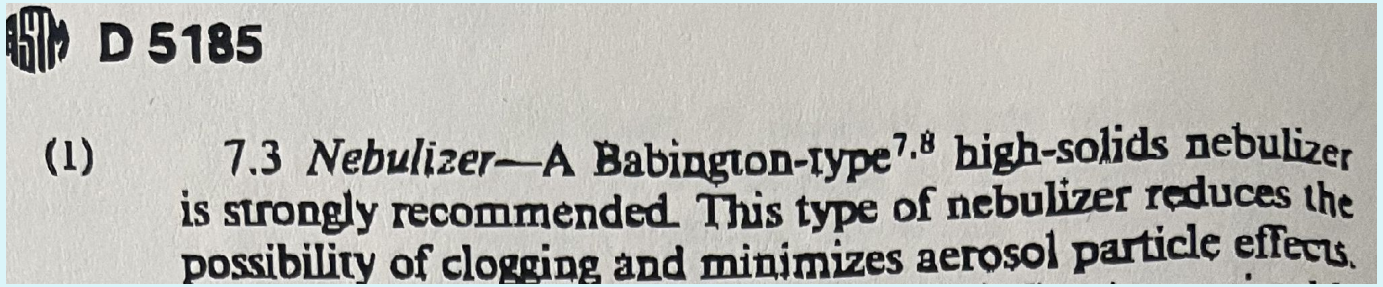
8.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[9] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.2 *Base Oil*—U.S.P. white oil, or a lubricating base oil that is free of analytes, and having a viscosity at room temperature as close as possible to that of the samples to be analyzed.

NOTE 2: Caution—Lubricating base oils contain sulfur. For sulfur determinations, white oil is recommended for the preparation of standards.

8.3 *Internal Standard*—Oil-soluble cadmium, cobalt, or yttrium[10] are required when the internal standardization option is selected.

8.4 *Organometallic Standards*—Multi-element standards, containing 0.0500 mass % of each element, can be prepared from the individual concentrates.[10] Refer to Practice D 4307 for a procedure for preparation of multicomponent liquid blends. When preparing multi-element standards, be certain



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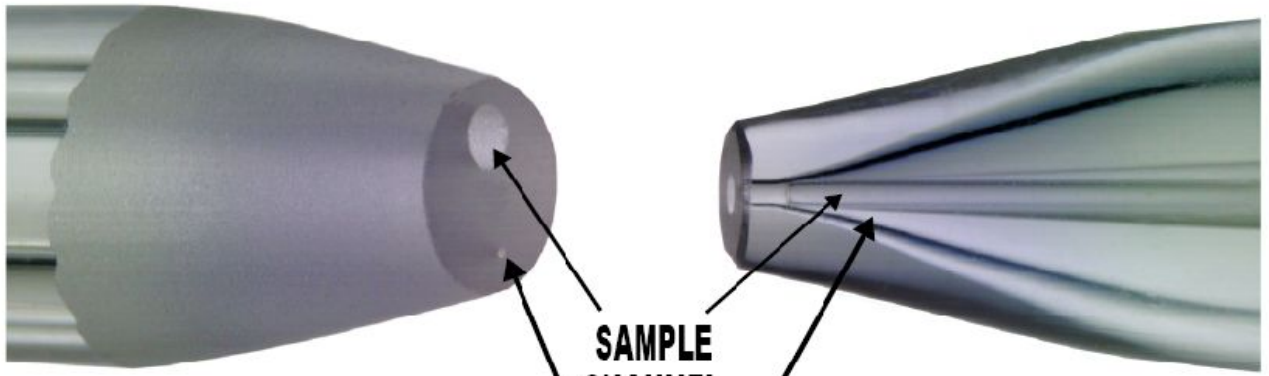
(1) 7.3 *Nebulizer*—A Babington-type[7,8] high-solids nebulizer is strongly recommended. This type of nebulizer reduces the possibility of clogging and minimizes aerosol particle effects.

Images of Non-concentric Nebulizer, Compared to Glass Concentric Nebulizer

NON-CONCENTRIC GAS CHANNEL is larger than concentric sample channel



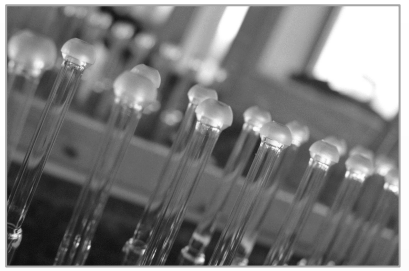
CONCENTRIC GAS CHANNEL converges to a small and restricted area which easily clogs

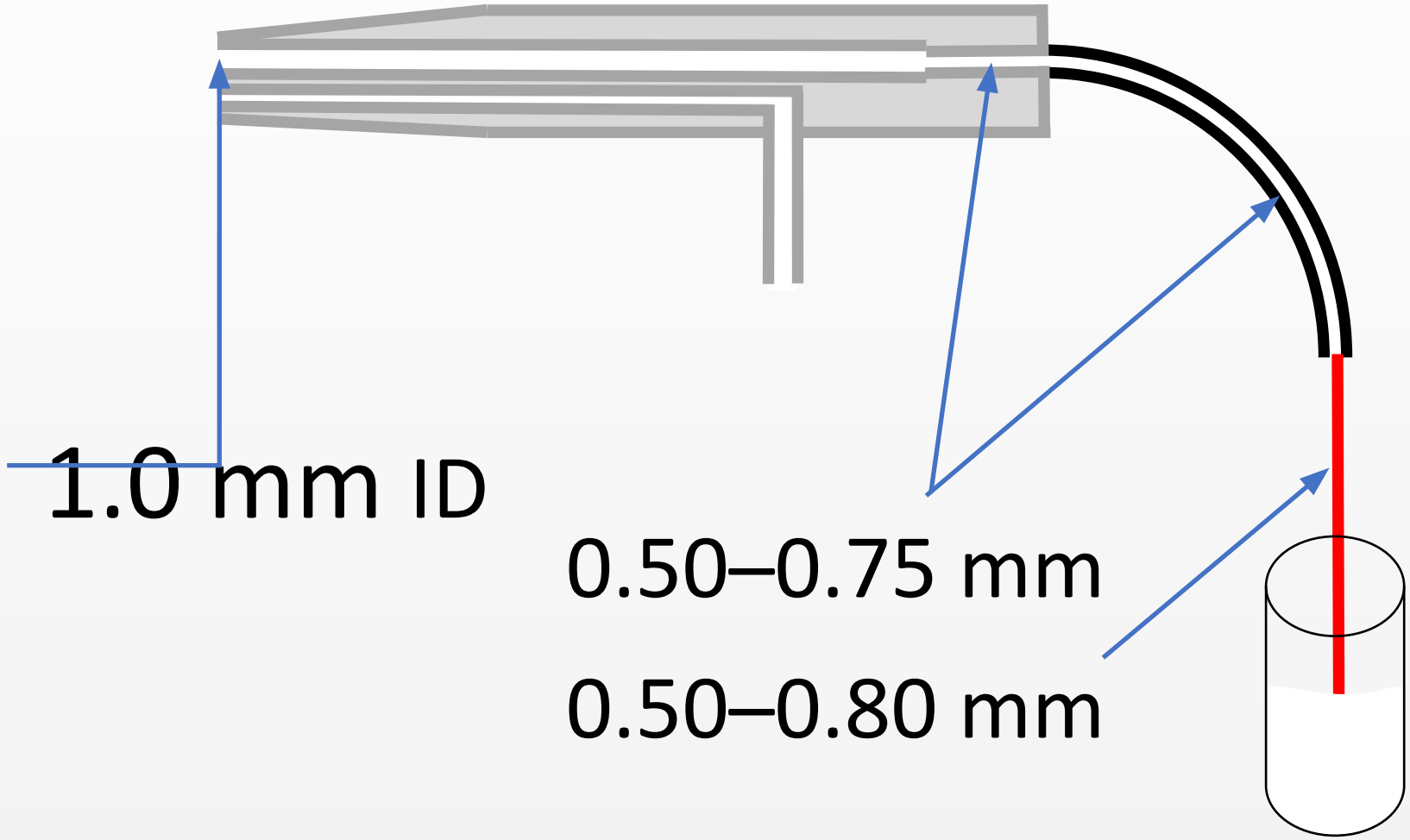
NON-CONCENTRIC SAMPLE CHANNEL is 0.75 mm or 5x larger than concentric sample channel

CONCENTRIC SAMPLE CHANNEL is very small at 0.15 - 0.25 mm

TSP
TEXAS SCIENTIFIC PRODUCTS

OptiMist® Nebulizer Sample Introduction Geometry Prevents Blockages





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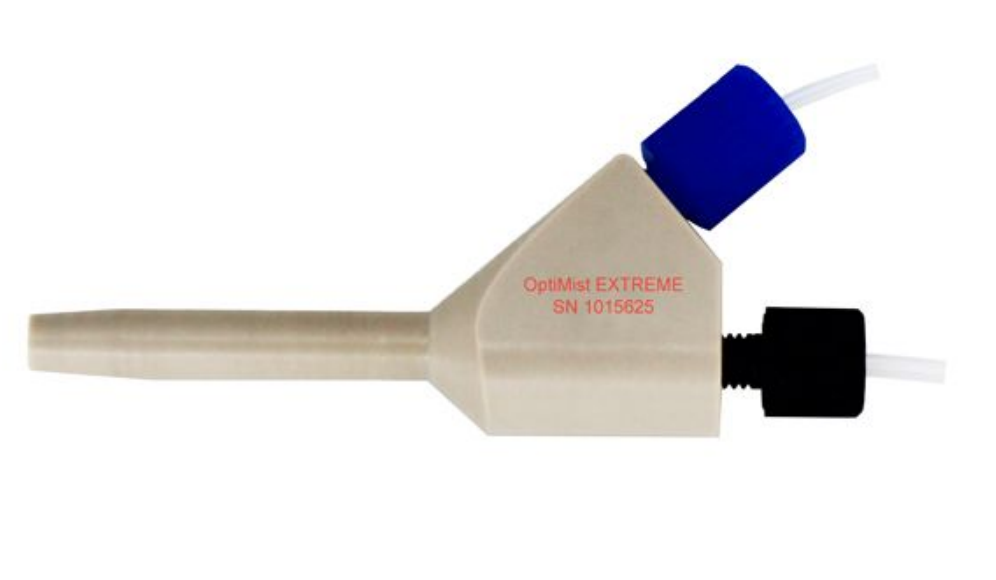
TEXAS SCIENTIFIC PRODUCTS

Robust and Reliable Nebulizers for Oils Analysis

OptiMist® Ultimate and OptiMist® Extreme



US Patent # 11,378,518

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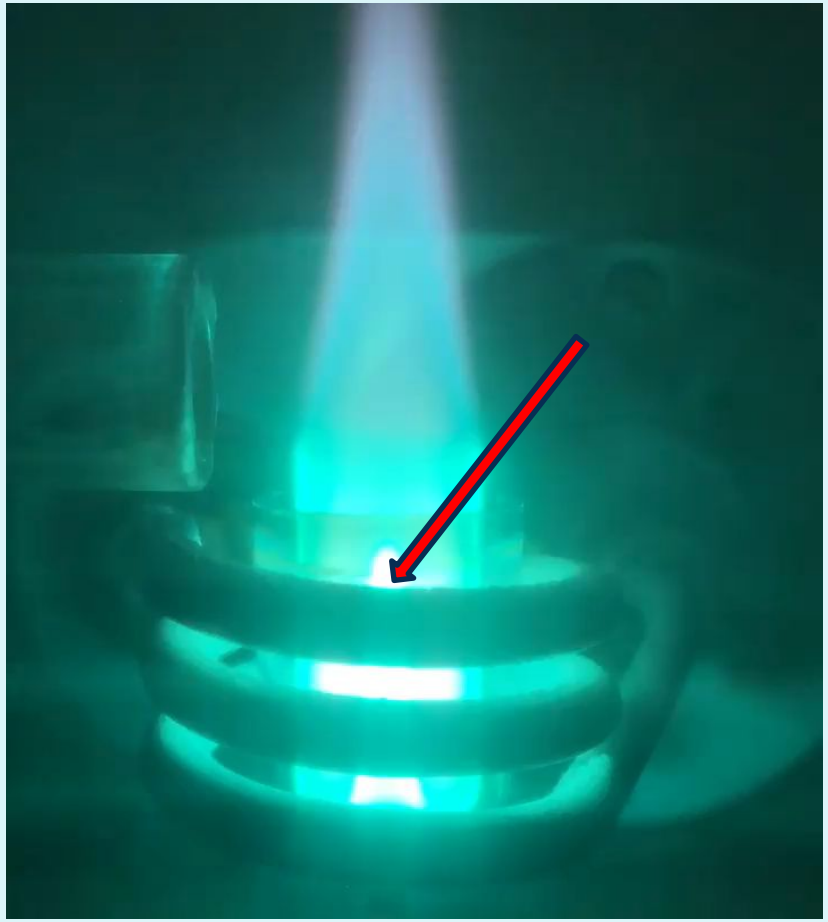
TEXAS SCIENTIFIC PRODUCTS

Carbon “Bullet” in Organic Matrix



Limitations of Organometallic Standards for ICP-OES/ICP-MS Oil Analysis

- Carbon Build-up on the Torch
- Excessive Wear of the Sample Introduction Components

EXTRA MAINTENANCE

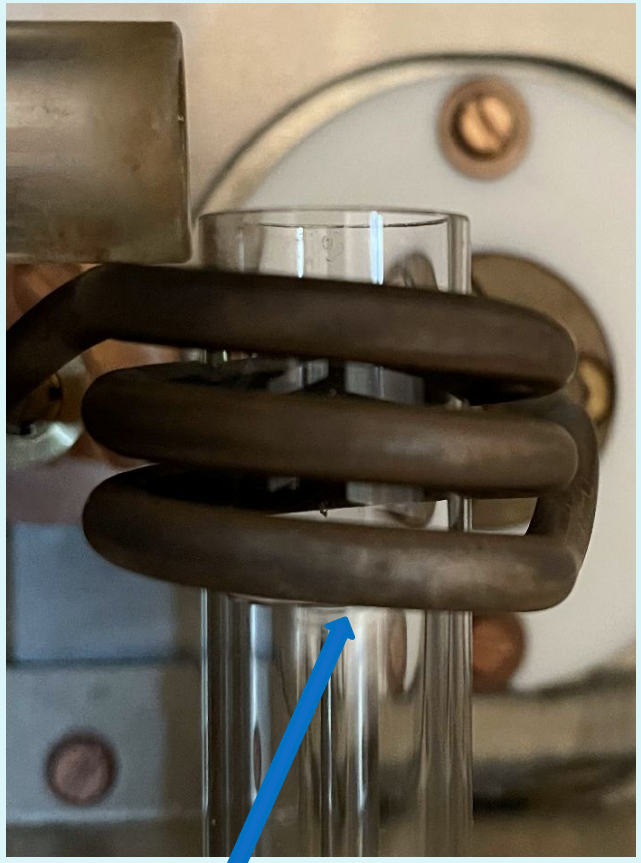
SIGNIFICANT COST for HIGH PRODUCTIVITY LABORATORIES!

Limitations of Organometallic Standards for ICP-OES/ICP-MS Oil Analysis

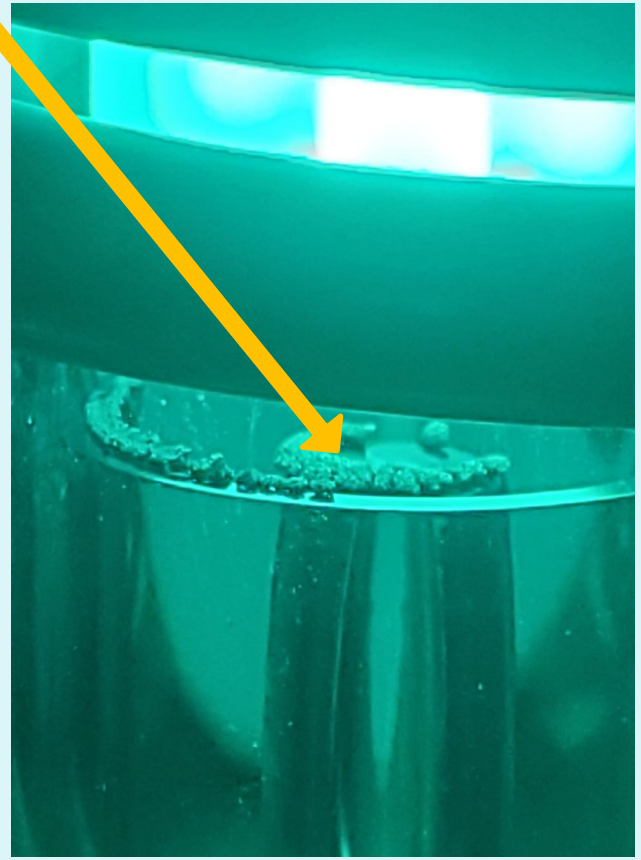
- Calibration Standards Must be Prepared Daily!
- Separate Calibration for Sulfur is Required

  Organometallic Standards are Made from Sulfonated Compounds
- Shelf Life: 6 - 12 months
- Limited Availability of the Analytes

Sample Deposition (Carbon Buildup) on the Torch Injector Tip



No gap



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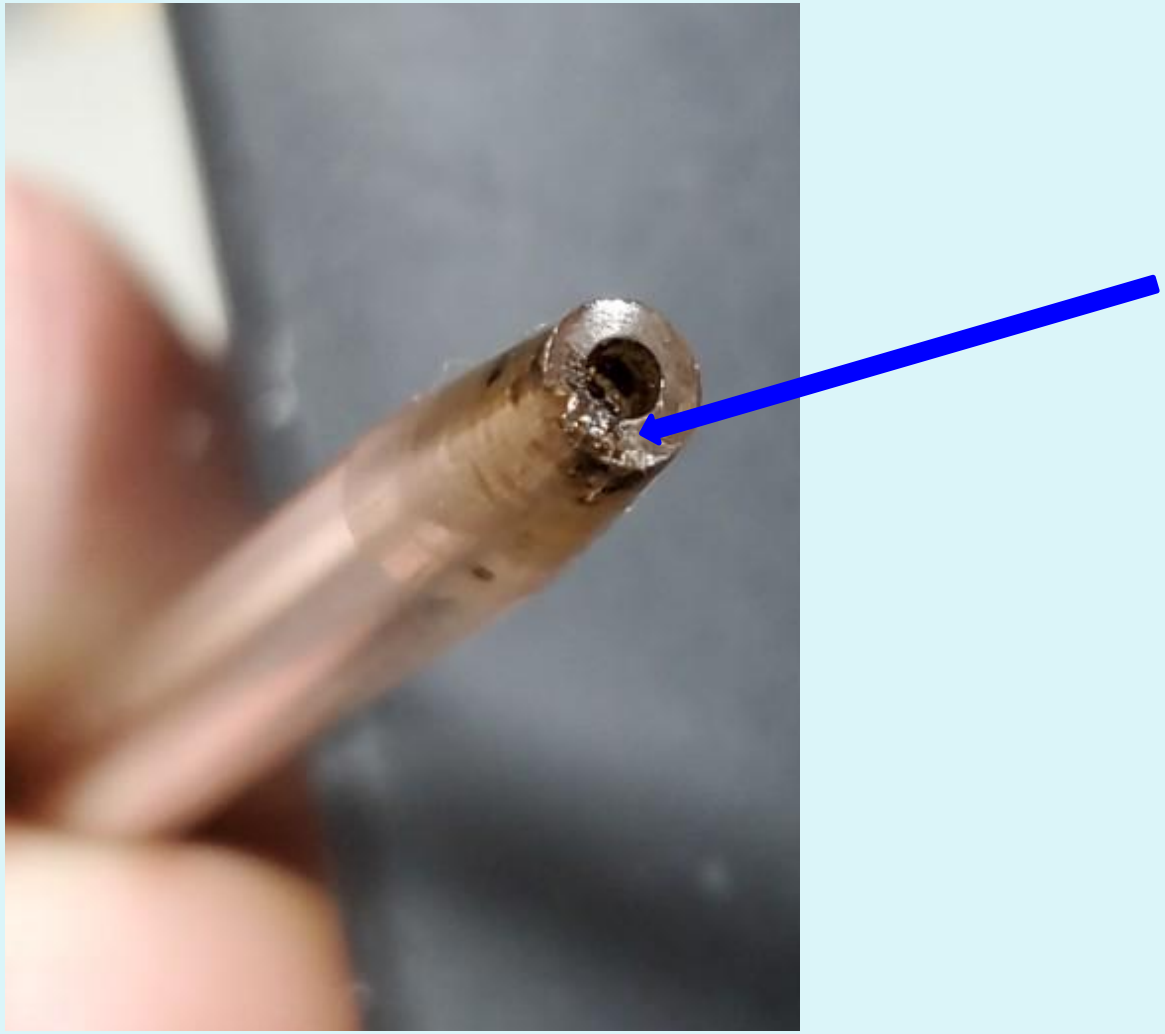
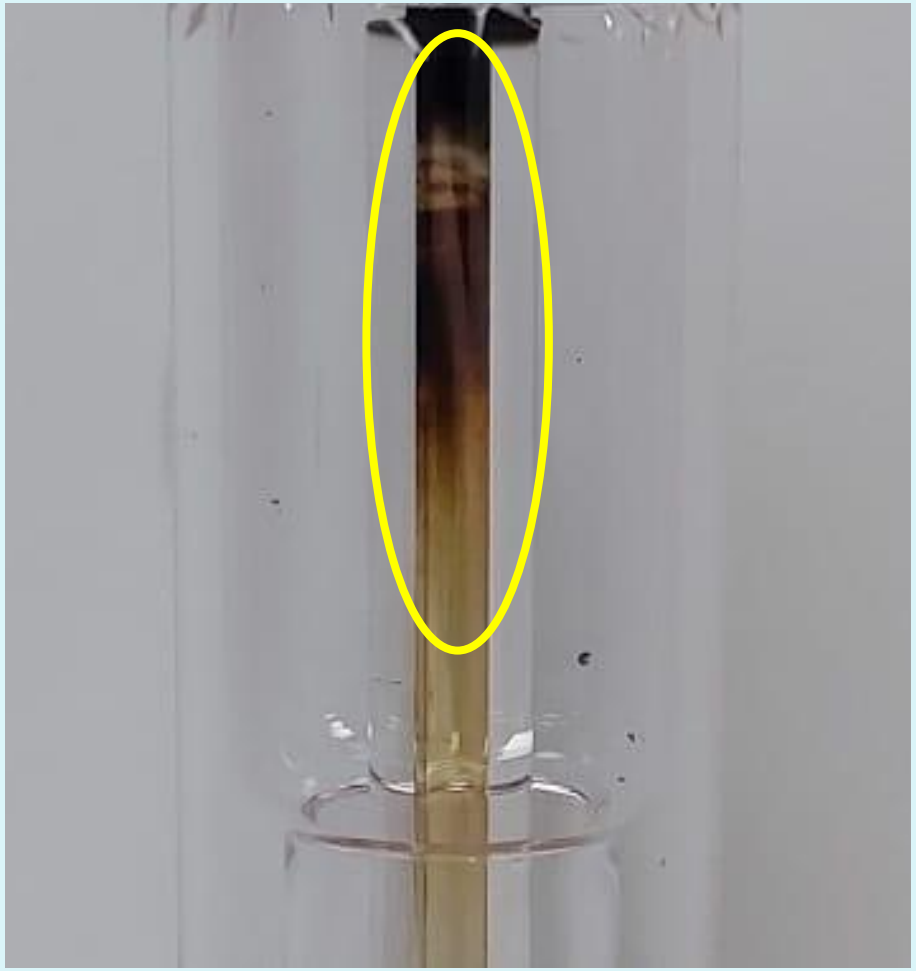


Sample Deposition (Carbon Buildup)

Inside the Torch

Inside the Torch Injector



Limitations of Organometallic Standards for ICP-OES/ICP-MS Oil Analysis

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- Calibration Standards Must be Prepared Daily!
- Separate Calibration for Sulfur is Required

  Organometallic Standards are Made from Sulfonated Compounds
- Shelf Life: 6 - 12 months
- Limited Availability of the Analytes

Aqueous Calibration - Why NOT?

Aqueous Standards and Oil Samples are not Naturally Compatible (Mixable)

What if They Could Be Mixed?

Could Aqueous Calibration with ASOSolv ™ Provide a New Approach to ICP Oil Analysis?

- Reduced Carbon Build-up
- Reduced Wear of the Sample Introduction Components
- Stability after Dilution with ASOSolv ™ - TWO WEEKS!
- ?
- ?
- ?

Thank you for your attention!
Questions ?

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WWW.TXSCIENTIFIC.COM

Introducing ASOSolv™

MIKE BOOTH, INNOVATIONS AND APPLICATIONS DEVELOPMENT MANAGER

INORGANIC™ VENTURES | Refine your results. Redefine your industry.

WHAT IS ASOSOLV™

- **ASOSolv™ is a newly developed solvent used for the ICP analysis of oil samples**
  - ASOSolv™ is comparable to other commercially available solvents for metals analysis of oil samples.
  - ASOSolv™ is unique due to its compatibility with aqueous standards.

Aqueous **S**tandards in **O**rganic **S**olvent

INORGANIC™ VENTURES | Refine your results. Redefine your industry.

WHAT IS ASOSOLV™ NOT?

- **ASOSolv™ is *not* a direct replacement for traditional organometallic standards.**
- **ASOSolv™ is a part of sample/standard prep.**
  - No CRMs will be provided in an **ASOSolv™** matrix as a stock or custom at this time.

BENEFITS OF ASOSOLV™

- **Flexibility**
  - Compatible with both aqueous and traditional organometallic CRMs
- **High Purity Solvent**
  - Trace Metals Impurity Data for 66 elements on each lot of ASOSolv™
- **Sustainability**
  - ASOSolv™ is sourced from green, less toxic starting materials compared to traditional solvents
- **Clean Workflow**
  - ASOSolv™ leaves little to no carbon buildup on ICP Sample Introduction Systems

INORGANIC™ VENTURES | Refine your results. Redefine your industry.

BENEFITS OF ASOSOLV™ & AQUEOUS CRMS

- **More Elements**
  - CRMs designed for use with ASOSolv™ will include 33 elements. Sulfur included!
- **Easy Standard Preparation**
  - CRMs are designed for fast and easy 10x dilutions to reach working standard concentrations.
- **Stability**
  - Prepared working standards are stable for weeks.

INORGANIC™ VENTURES | Refine your results. Redefine your industry.

BENEFITS OF ASOSOLV™ & AQUEOUS CRMS

- **More Tests Per Bottle**
  - Aqueous CRMs are certified in wt./wt. with a density much higher than traditional organometallic standards.
  - 30% increase in analyte comparing a 500mL of aqueous CRMs vs. 400g of traditional organometallic CRMs when µg/g concentrations are the same.
- **Benefits of an IV Stock**
  - Fast 2-day turnaround time for ASOS Series CRMs, designed for use with ASOSolv™.
  - 5-year TCT shelf life

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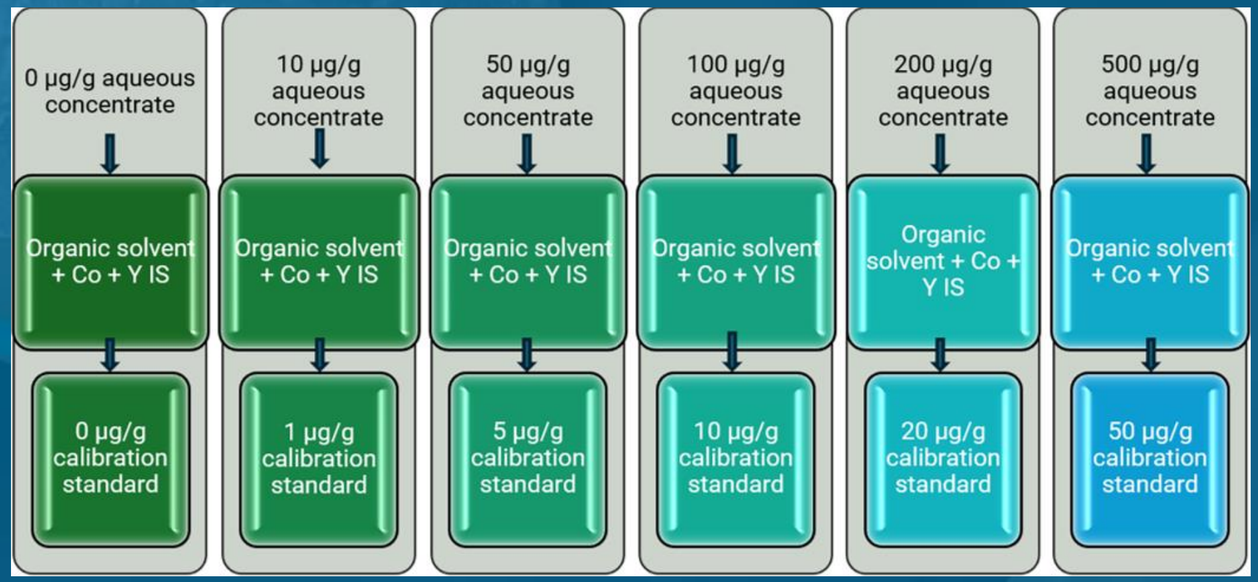
HOW TO USE ASOSOLV™

- **If using traditional organometallic standards:**
  - Simply dilute as you would with any other solvent!
- **If using aqueous standards:**
  - We recommend using our ASOS series standards and perfroming 10X dilutions.
  - For ASOSolv™ to remain effective, the organic solvent must remain as 90% of the matrix.
  - The ASOS CRM series is split for stability and to prevent spectral interferences.



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Best Lines (nm)	Results NIST SRM 1085c (mg/kg)	NIST SRM 1085c Certified Values (mg/kg)	NIST reported 95% Coverage Interval (mg/kg)	Percent Recovery NIST SRM 1085c Certified Values (mg/kg)
Ag 328.068	292	298	290-309	98.0%
Al 167.078	292	292	264 - 321	100.0%
B 182.641	311	304	301 - 308	102.3%
Ba 230.424	301	306	296 - 317	98.4%
Ca 315.887	302	299	269-330	101.0%
Cd 226.502	295	301	291-310	98.0%
Cr 267.716	305	302	289-314	101.0%
Cu 324.754	298	298	28310	100.0%
Fe 238.204	315	301	298-313	104.7%
K 766.491	282	295	282-309	95.6%
Mg 285.213	294	300	294-305	98.0%
Mn 257.611	298	299	289-311	99.7%
Mo 203.909	309	305	295-316	101.3%
Na 589.592	293	300	289-310	97.7%
Ni 231.604	299	306	295-316	97.7%
P 213.618	302	304	302-307	99.3%
Pb 220.353	308	303	294-312	101.7%
Si 288.158	297	293	288-297	101.4%
Sn 189.991	292	298	291-306	98.0%
Ti 334.187	299	300	288-311	99.7%
V 292.464	291	285	278-291	102.1%
Zn 334.502	281	285	273-296	98.6%

RESULTS OF USING ASOSOLV™ & AQUEOUS CRMS

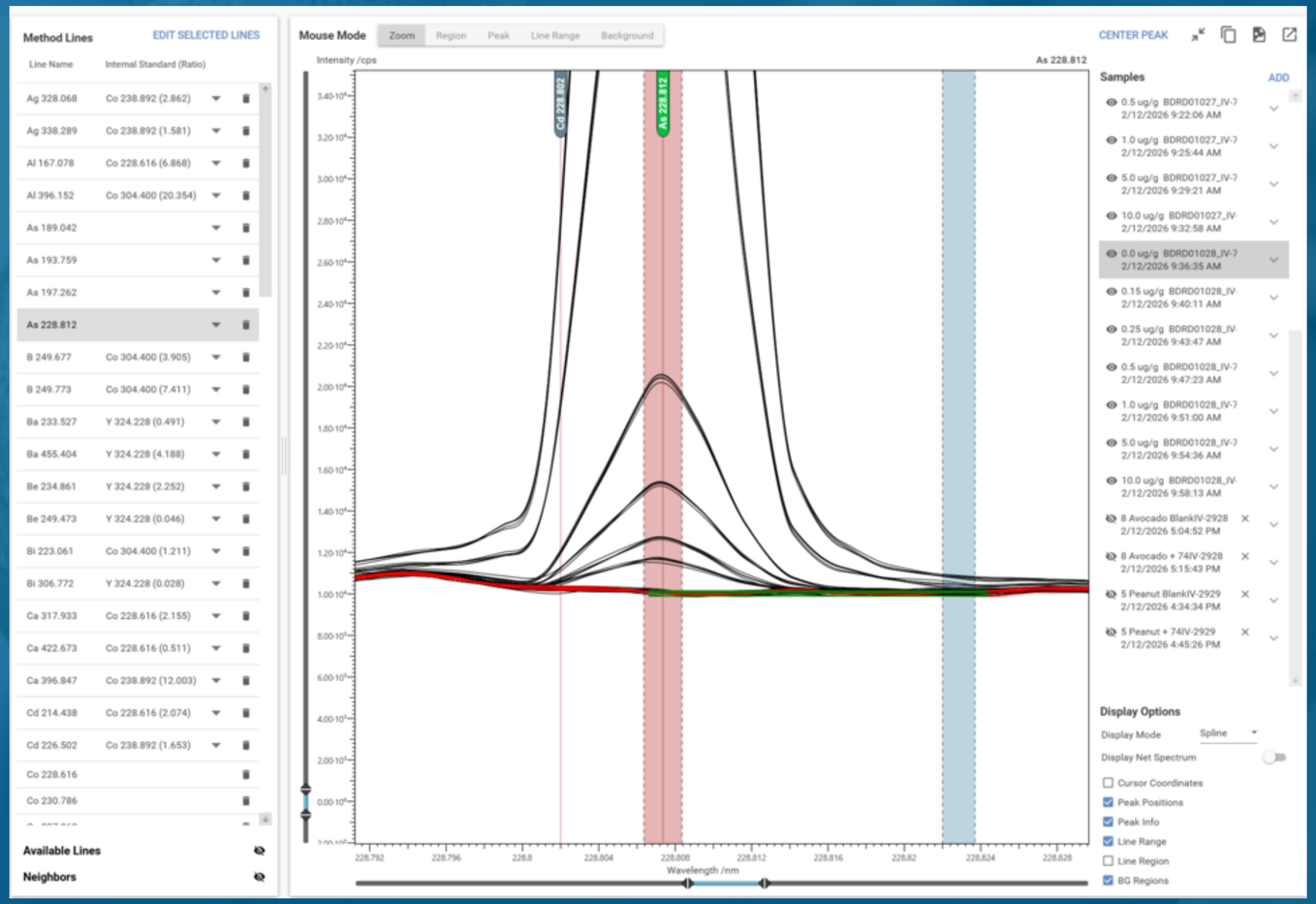
NIST SRM 1085c

Tested against a calibration curve made from aqueous CRMs diluted in ASOSolv™

Most elements returned results within 2% of the certified values

ASOSOLV™ PURITY & EDIBLE OILS APPLICATIONS

- Low Trace Metals Impurity levels in ASOSolv™ open the door to low detection limit applications.



0 µg/g As Standard

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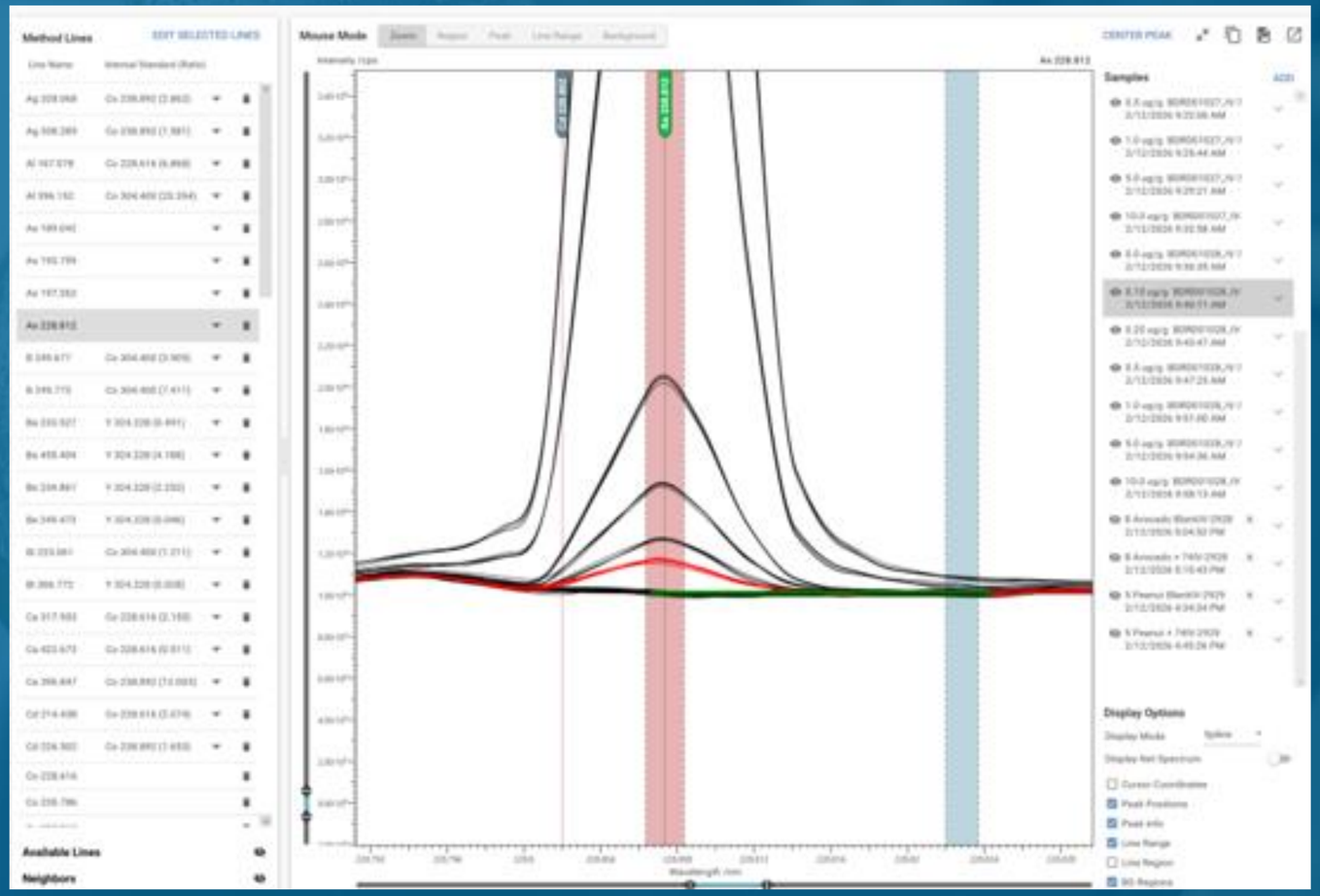

0.15 µg/g As Standard

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ASOSolv™ Products & Pricing

Size	ASOSolv Pricing
500 mL	$58
1 gallon	$108
5 gallon	$478

IV Part #	Size (mL)	Kit Price
ASOS-1-CAL-500PPM	2x500	$404
ASOS-1-CAL-200PPM	2x500	$299
ASOS-1-CAL-100PPM	2x500	$265
ASOS-1-CAL-50PPM	2x500	$256
ASOS-1-CAL-10PPM	2x500	$239
ASOS-1-CAL-5PPM	2x500	$234
ASOS-1-CAL-2.5PPM	2x500	$232
ASOS-1-CAL-1PPM	2x500	$231
ASOS-1-CAL-BLANK	2x500	$230

- **CRMs designed for ASOSolv™:**
  - Designed to be diluted 10x each to support working standards ranging from 0-50 µg/g
- **Elements split into two matrices:**
  - Ag, Al, B, Ba, Bi, Ca, Cd, Cr, Cu, In, K, Mg, Na, Ni, P, Pb, S, and Sr in HNO3
  - As, Be, Fe, Hg, Li, Mn, Mo, Sb, Se, Si, Sn, Ti, V, Zn, and Zr in HCl/HF

IV Part #	Size (mL)	Kit Price
ASOS-1-CAL-500PPM	2x500	$404
ASOS-1-CAL-200PPM	2x500	$299
ASOS-1-CAL-100PPM	2x500	$265
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ASOS-1-CAL-10PPM	2x500	$239
ASOS-1-CAL-5PPM	2x500	$234
ASOS-1-CAL-2.5PPM	2x500	$232
ASOS-1-CAL-1PPM	2x500	$231
ASOS-1-CAL-BLANK	2x500	$230

CAN ASOSOLV™ BENEFIT YOUR WORKFLOW?

- **Reliable Supply Chain**
  - Organometallic standards are difficult to source consistently, with slow response times and long order lead times. ASOSolv™ and ASOS series CRMs are stock products.
- **Adressing Standard Instability**
  - Organometallic CRMs can be prone to quality and stability issues due to their starting materials, causing lot-to-lot variability. Aqeuous standards are shelf stable and working standards diluted with ASOSolv™ are stable for 2 weeks!
- **Struggle with Instrument Downtime?**
  - Carbon buildup on the ICP Sample Introduction System forces analysts to stop, clean, or swap equipment between oil and aqueous sample runs. ASOSolv™ burns clean and limits carbon buildup.
- **Running Both Oil and Aqueous Samples?**
  - Switching between oil and water-based analyses requires significant time, equipment changeover, and added maintenance overhead. Try running both sample types in ASOSolv™!
- **Limited Element Coverage with Traditional Organometallic CRMs**
  - Stock ASOS series CRMs cover 33 elements including sulfur! Other CRMs can be designed as custom products tailored for easy use with ASOSolv™, including expansion into rare earth elements.

MORE ASOSOLV™ RESOURCES

A SMARTER APPROACH to OIL ANALYSIS

METHODS, CHALLENGES, AND MODERN SOLUTIONS FOR ICP LABORATORIES

Traditional oil analysis methods can introduce challenges related to solvent handling, standard stability, and contamination control. This guide explores practical approaches to elemental analysis and demonstrates how **ASOSolv™** supports safer, more flexible workflows for wear metals, additive elements, and edible oils.

TRUSTED BY LABS WORLDWIDE SINCE 1985

INORGANIC VENTURES

Testing Wear & Additive Metals in Lubricating Oils

ICP-OES Analysis Using Aqueous CRMs and ASOSolv™

Summary

Inorganic Ventures has developed a hybrid aqueous/organic solvent system for ICP-OES calibration of wear and additive metals in lubricating oils. This approach pairs aqueous inorganic certified reference materials (CRMs) with ASOSolv™, a bio-derived organic solvent that provides complete miscibility for both aqueous standards and oil samples. The method was validated against NIST SRM 1085c (Wear Metals in Lubricating Oil), with most elements recovering within 2% of certified values. The hybrid approach covers all elements required by ASTM D5185-18 and ASTM D6595-16, adds sulfur to the calibration panel, and is compatible with both aqueous and traditional organometallic CRM workflows.

Background

The determination of wear metals, additive elements, and contaminants in lubricating & base oils by ICP-OES is a critical quality and condition monitoring tool for engines, gearboxes, and industrial machinery. These analyses have traditionally relied on organometallic certified reference materials (CRMs). While functional, this approach carries well-documented limitations: organometallic standards have variable long-term stability, impede the analysis of sulfur (a key diagnostic element), and require dilution in solvents such as kerosene or xylene that present significant health and environmental hazards.
Inorganic Ventures has developed ASOSolv™ to address each of these limitations. By using aqueous inorganic standards diluted in ASOSolv™, laboratories gain the stability and traceability of aqueous standards while retaining full compatibility with their existing oils testing workflows.

Method Overview

Calibration Standards

The ICP-OES was calibrated for 27 elements using two sets of six calibration standards (0, 1, 5, 10, 20, and 50 µg/g). Standards are prepared as 1:10 w/w dilutions of 10x aqueous concentrates in ASOSolv™, which contained cobalt (Co) and yttrium (Y) as internal standards at concentrations of 15 µg/g and 5 µg/g, respectively. This single-step dilution process mirrors the workflow already in use in most oils testing laboratories. **For this experiment, the two standard sets were split by matrix for elemental stability:**

- Set 1 (1% v/v HNO_3): Ag, Al, B, Ba, Bi, Ca, Cd, Cr, Cu, Fe, In, K, Li, Mg, Mn, Na, Ni, P, Pb, S, V, and Zn (22 elements)
- Set 2 (2% v/v HCl / 0.06% v/v HF): Mo, Sb, Si, Sn, and Ti (5 elements)

Sulfur is included in the HNO_3 standard set. This is a meaningful advantage as traditional organometallic starting materials are commonly alkyl aryl sulfonates, which contribute large, unquantified amounts of sulfur to the standards and make S determination impossible. The aqueous inorganic S used in these hybrid standards contains no carryover contamination, enabling accurate sulfur determination from the same calibration run.

Sample Preparation

Oil samples are diluted 1:10 w/w directly with ASOSolv™ containing Co and Y internal standards. Because the density of ASOSolv™ (~0.88 g/mL at 20°C) is close to the density of typical lubricating oils, volume-to-volume dilutions are also acceptable and consistent with most current laboratory practices. This sample preparation procedure was intentionally designed to mimic the traditional organometallic CRM workflow to minimize any disruption during method adoption.

INORGANIC VENTURES

Testing Trace Metals in Edible Oils

ICP-OES Analysis Using Aqueous CRMs and ASOSolv™

Summary

Inorganic Ventures has extended its hybrid aqueous CRM/organic solvent methodology to the analysis of trace metals in edible oils by ICP-OES. This approach uses aqueous inorganic CRMs diluted in ASOSolv™, to calibrate for 32 elements relevant to edible oil safety and quality. The method is designed to meet the low detection limit requirements imposed by international regulatory action limits for heavy metals in food-grade oils. ASOSolv™'s trace metallic impurity (TMI) profile and ultra-low background for regulated analytes make it uniquely suited to this application, where solvent blank contributions can be the limiting factor in achieving low detection limits.

Background

Regulatory bodies worldwide set strict action limits for heavy metals in edible oils, reflecting the public health significance of dietary exposure to contaminants such as arsenic, cadmium, lead, and mercury.

Element	Action Limits (ppm)
As	0.10
Cd	0.05
Fe	1.0–1.5
Hg	1.0
Pb	0.08–0.10
Sn	15–20
Zn	1.0–1.5

Table 1 Regulatory action limits for heavy metals in edible oils

Achieving these detection limits requires not only sensitive instrumentation but also diluents and calibration standards with rigorously controlled trace element backgrounds. Traditional organometallic oil standards and many commercial solvents are not well-suited to this task: their TMI profiles are not reliable, and background contributions from the diluent can elevate detection limits or create false positives for regulated analytes.

INORGANIC VENTURES

Thank you!

INORGANIC™ VENTURES | Refine your results. Redefine your industry.