

Sulfur Summary



The quality of many petroleum products, crude oils, and natural gases closely relate to the amount of sulfur present. Knowledge of sulfur concentration is necessary for processing purposes as many sulfur compounds are odorous, corrosive to equipment, and inhibit or even destroy catalysts employed in downstream processing.

Various techniques are utilized in measuring sulfur compounds in crude oil, petroleum products, condensates, LPGs, and gases. Due to regulatory and quality requirements, sulfur measurement has become a must in transportation and processing facilities.

Typical results are measured as total sulfur, volatile sulfur, H₂S, and sulfur mercaptan speciation. Total sulfur values incorporate sulfur as elemental, H₂S, and sulfur mercaptans into one value. Methods are also available to speciate the sulfur results or measure each separately.

Sulfur mercaptans are hydrocarbon chains that contain sulfur. These are naturally occurring substances similar to H₂S but not as corrosive. Commonly found in natural gas is methyl mercaptan (molecular model seen to the right). In liquid petroleum gases we see methyl and ethyl mercaptans, while heavier hydrocarbons will include heavier molecular weight mercaptans. Mercaptans are compounds that produce unpleasant smells and are used to assist in detecting gas leaks for natural gas lines but are corrosive at higher concentrations. For more information on H₂S, along with the methods specific to testing H₂S, please reference the separate summary regarding this highly corrosive and monitored substance. Total sulfur and H₂S are tested using different techniques due to the reactive nature and instability of H₂S in comparison to other sulfur compounds.

Zedi currently offers ASTM D4294 and UOP 163 for sulfur analysis.

Please find the table below that compares a variety of methods available in testing sulfur compounds in various matrices. Methods are measured as total sulfur unless otherwise indicated.

Sulfur Method Summary Table

Sample Matrix	Petroleum Products					Light Hydrocarbons	
Method	ASTM D4294	ASTM D3120	ASTM D5453	ASTM D1266	ASTM D4045	ASTM D3120	ASTM D5453
Measurement Type	X-Ray Fluorescence	Oxidative Microcoulometry	Ultra Violet Fluorescence	Lamp Method	Hydrogenolysis and Rateometric Colorimetry	Oxidative Microcoulometry	Ultra Violet Fluorescence
Sulfur Detection Range	>1ppm	(3-1000)ppm	(1-8000)ppm	(0.01-0.4)%	(0.02-10)ppm	(3-1000)ppm	(1-8000)ppm
Other	Also applicable to Crude Oil	For gasoline, diesel, and other fuel additives.	For spark ignition fuel, diesel fuel, and engine oil	For materials such as gasoline to gas oils	Used for distillates, condensates, and alcohols.	For gasoline, diesel, and other fuel additives.	For spark ignition fuel, diesel fuel, and engine oil
Sample Matrix	LPG - Gaseous Fuels			Natural Gas	Liquid Hydrocarbons		
Method	ASTM D4468	ASTM D6667	UOP 212	ASTM D3246	ASTM D7493	UOP 163	
Measurement Type	Hydrogenolysis and Rateometric Colorimetry	Ultra Violet Fluorescence	Potentiometric Titration	Oxidative Microcoulometry	GC and Electrochemical Detection	Potentiometric Titration	
Sulfur Detection Range	(0.001-20)ppm	(1-200)ppm	>1ppm	(1.5-100)ppm	(0.1-100)ppm	>0.2ppm	
Other		Volatile Sulfur	H ₂ S, Mercaptans, and Carbonyl Sulfide		Volatile Sulfur containing compounds	H ₂ S and Mercaptans Similar to ASTM D3227	

NOTE: Not all available methods are expressed in above table.

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