Renewable fuels

Analytical methods for the production and quality control of renewable fuels

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The production of renewable fuels from organic matter, such as biodiesel or bioethanol, is demanding and requires precise and reliable analysis. Metrohm provides top-quality analytical instruments, know-how, and first-class, on-site service to enable and support your processing needs.

The table below serves as an overview of several parameters of interest that can be analyzed by different techniques using Metrohm instrumentation. More detailed information is found in the corresponding linked Metrohm application documents.

Missing your application here? Please contact your local Metrohm organization to discuss possible solutions.

Fuel type	Parameter and Matrix	Standard	Analysis technique	Application document
Biodiesel * Part of the specifications ASTM D6751 (B100) and ASTM D7467 (B6-20)	Acid number and free fatty acids (FFA) in feedstock (oils, fats, UCO, ...)	ASTM D664, IP 177, EN 14104, EN 12634, IP 449	Potentiometric titration	AB-141, AB-404, AN-T-179
	Iodine number (olefin content) in feedstock (oils, fats, UCO, ...)	EN 14111	Potentiometric titration	80006020
	Bromine number in feedstock (oils, fats, UCO, ...)	ASTM D1159	Potentiometric titration	AB-177, AN-T-182, AN-T-187
	Alkali and alkaline earth metals in feedstock (oils, fats, UCO, ...)		Ion chromatography	AN-C-101
	Water content in feedstock (oils, fats, UCO, ...)	ASTM E1064, ASTM E203, ASTM D6304	Coulometric Karl Fischer titration (KFC), NIR spectroscopy	
	Methanol content during transesterification		NIR spectroscopy Process analysis	
	Free and total glycerin in B100	ASTM D7591	Ion chromatography	AN-P-068
	Oxidation stability* of B100	EN 14112, EN 15751*, EN 16568, ASTM D6751	Stability measurement	AN-R-009, AN-R-034
	Water content in B100	ASTM D6304, EN ISO 12937, IP 438, DIN 51777	Coulometric Karl Fischer titration (KFC), NIR spectroscopy	AB-209
	Acidity* in B100 and blends up to B20	ASTM D664*, EN 14104	Potentiometric titration, Photometric titration	AB-404, AN-T-247
Renewable diesel	Acid number in feedstock	ASTM D664, IP 177, EN 14104, EN 12634, IP 449	Potentiometric titration	AB-404, AN-T-179
	Iodine number in feedstock	EN 14111	Potentiometric titration	
	Water content in feedstock		Coulometric Karl Fischer titration (KFC)	
	Organic chlorine in feedstock	ASTM D7359, UOP 991	Combustion ion chromatography (CIC)	
	Heat stable salts in amine solution		Ion chromatography	AN-S-389, AN-S-343, AN-S-144
	Acid degradation products (carboxylic acids) in amine solutions for gas sweetening	IFP 0803	Ion chromatography	AN-O-046
	Total amine content in aqueous amine solution	IFP 0507	Potentiometric titration	
	CO_2 content in aqueous amine solution	IFP 0508	Ion chromatography	AN-N-009
	H_2S content in lean amine solution	IFP 0518	Potentiometric titration	
	Acidity in lean amine solution	IFP 0504	Potentiometric titration	
	Bromine number in production process		Potentiometric titration	
	Conductivity in production process		Conductivity measurement	AB-102
	pH value in production process		pH measurement	AB-188
	Blend consistency monitoring		NIR spectroscopy Process analysis	
	Cetane number		NIR spectroscopy	AN-NIR-080

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Process step	Parameter and Matrix	Standard	Analysis technique	Application document
Fuel ethanol (bioethanol) * Part of the specification ASTM D4806	Water content* in bioethanol	ASTM D7923, ASTM E1064*, ASTM E203*, ISO 6296, IP 439, EN 15489	Coulometric Karl Fischer titration (KFC), Volumetric Karl Fischer titration (KFT)	WP-061, AN-K-014, AB-209, AN-PAN-1047
	Acidity* in bioethanol	ASTM D7795, EN 15491	Potentiometric titration	AN-T-199, AN-T-200
	Inorganic chloride* in bioethanol	ASTM D7319*, ASTM D7328, ASTM D6751, EN 15492, EN 15484, ASTM D512	Ion chromatography, Potentiometric titration	AN-S-241, 80006007
	Existent sulfate* in bioethanol	ASTM D7318, ASTM D7319, ASTM D7328, EN 15492	Potentiometric titration, Ion chromatography	80006020, AN-S-241, AN-S-211
	Total sulfate* in bioethanol	ASTM D7319, ASTM D7328, EN 15492	Ion chromatography	AN-S-241, AN-S-211
	pHe value* in bioethanol	ASTM D6423, EN 15490	pH measurement	AN-T-173, AN-T-183
	Conductivity in bioethanol	EN 15938	Conductivity measurement	AN-T-209
	Anions (fluoride, acetate, formate, nitrate, sulfate) in bioethanol		Ion chromatography	AN-S-244
	Copper in bioethanol		Voltammetry	AN-V-194
	Denaturant content in bioethanol		NIR spectroscopy	
	Moisture, fat, starch, fiber, and protein in grain samples for milling		NIR spectroscopy	
	Ethanol content in fermentation mash/broth		NIR spectroscopy, Process analysis	AN-PAN-1057, AN-NIR-093, WP-071
	Brix and sugar content (glucose, maltose, dextrin (DP4), maltotriose (DP3)) in fermentation mash/broth		NIR spectroscopy, Process analysis	AN-PAN-1057, AN-NIR-093, WP-071
	Organic acid content (acetic acid, lactic acid) in fermentation mash/broth		NIR spectroscopy, Process analysis, Electrochemistry	AN-PAN-1057, AN-NIR-093, WP-071, AN-EC-035
	Solids in fermentation mash/broth		NIR spectroscopy, Process analysis	AN-PAN-1057, AN-NIR-093, WP-071
	Glycerol content in fermentation mash/broth		NIR spectroscopy, Process analysis	AN-PAN-1057, AN-NIR-093, WP-071
	Water content in molecular drying sieves		NIR spectroscopy	
	Water content in corn oil		NIR spectroscopy	
	Protein, moisture, fat, color, and starch in dry distiller grains (DDG)		NIR spectroscopy	

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Process step	Parameter and Matrix	Standard	Analysis technique	Application document
Sustainable aviation fuel (SAF) * Part of the specification ASTM D7566	Acid number* in sustainable aviation fuel	ASTM D3242*, IP 354 UOP 565	Photometric titration	AN-T-242
	Mercaptan sulfur* in sustainable aviation fuel	ASTM D3227*, IP 342, UOP 163	Potentiometric titration	AB-135
	Water content* in sustainable aviation fuel	ASTM D6304*, EN ISO 12937, IP 438, DIN 51777	Coulometric Karl Fischer titration (KFC)*, NIR spectroscopy, Process analysis	WP-061, AN-K-070, AB-209
	Total fluorine, chlorine, and sulfur content* in sustainable aviation fuel	ASTM D7359	Combustion ion chromatography (CIC)	
	Iodine number in feedstock	AOCS Cd 1d-92, EN 14111	Potentiometric titration, NIR spectroscopy	AB-141, AN-T-109
	Acid number in feedstock		Potentiometric titration	AB-404
	Water content in feedstock		Coulometric Karl Fischer titration (KFC), NIR spectroscopy	AB-141
	Blend consistency monitoring		NIR spectroscopy Process analysis	

Analysis techniques

TITRATION – SPECIFIC, ACCURATE, AND RELIABLE

Potentiometric titration is a well-established method for monitoring process parameters, such as acidity, or analyzing quality parameters of the final products. It is included in many standards and specifications due to its reliability. Titration is an inexpensive method that can be automated to optimize laboratory efficiency.

NIR SPECTROSCOPY – MULTI-PARAMETER ANALYSIS WITHIN MINUTES

Near-infrared (NIR) spectroscopy can be used to monitor the production process as well as assess the quality of fuels quickly. Compared to traditional methods, results can be obtained within one minute without the need for additional reagents or chemicals.

PROCESS ANALYSIS – DEPENDABLE ONLINE, INLINE, AND ATLINE SOLUTIONS

Online monitoring of parameters optimizes process efficiency and reduces production costs. Metrohm Process Analytics provides various analytical techniques for such purposes, including titration, photometry, ion chromatography, and NIR spectroscopy.
The same high quality Metrohm laboratory techniques from the laboratory can now be used right on the process line for the most accurate results delivered directly to the process control room.

ION CHROMATOGRAPHY – HIGHLY EFFICIENT AND ROBUST ANALYSIS

Ion chromatography (IC) is a precise multi-parameter method for quantifying ionic impurities. When combined with a combustion oven, combustion ion chromatography (CIC) can effectively analyze the content of organic halides and sulfur even in challenging matrices.
Using Metrohm Inline Matrix Elimination to remove the matrix of fuels increases the robustness of the analysis and system.