

CERTIFICATE OF ACCREDITATION

Daeduck Analytical Research Institute

Accreditation No. : KT690

Corporation Registration No. : 160111-0253990

Address of Laboratory : N28-dong 291 KAIST Daehak-ro, Yuseong-gu, Daejeon,
Republic of Korea

date of Initial Accreditation : January 21, 2016

Duration : February 07, 2020 ~ February 06, 2024

Scope of Accreditation : Attached Annex

Date of issue : March 13, 2020

This testing laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025 : 2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique)



LEE Seung Woo

Administrator

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02 Chemical Test

02.004 Related to mines and ceramic products

Test method	Standard designation	Test range	Field testing
KS E 3707 : 2016	Determination of calorific value of coal and coke	(15 ~ 40) MJ/kg	N
ISO 540 : 2008	Hard coal and coke - Determination of ash fusibility	(900 ~ 1 500) °C	N
ISO 1928: 2012	Solid mineral fuels - Determination of gross calorific value by the bomb calorimetric method and calculation of net calorific value	(15 ~ 40) MJ/kg	N
ISO 17830 : 2016	Solid biofuels - Particle size distribution of disintegrated pellets	(0.1 ~ 99.5) %	N
ISO 16968 : 2015	Solid biofuels - Determination of minor elements	As : (0.1 ~ 100.0) mg/kg Cd : (0.1 ~ 100.0) mg/kg Cr : (1.0 ~ 200.0) mg/kg Cu : (1.0 ~ 200.0) mg/kg Pb : (1.0 ~ 200.0) mg/kg Hg : (0.01 ~ 10.0) mg/kg Ni : (1.0 ~ 200.0) mg/kg Zn : (1.0 ~ 1 000.0) mg/kg	N
ISO 16994 : 2016	Solid biofuels -- Determination of total content of sulfur and chlorine	Chlorine : (0.01 ~ 3.00) % Sulfur : (0.01 ~ 3.00) %	N
ISO 16948 : 2015	Solid biofuels - Determination of total content of carbon, hydrogen and nitrogen	Carbon : (30.0 ~ 85.2) % Hydrogen : (4.10 ~ 9.10) % Nitrogen : (0.1 ~ 16.3) %	N

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Test method	Standard designation	Test range	Field testing
ISO 17828 : 2015	Solid biofuels - Determination of bulk density	(100 ~ 800) kg/m ³	N
ISO 18125 : 2017	Solid biofuels - Determination of calorific value	(15 ~ 40) MJ/kg	N
ISO 18846 : 2016	Solid biofuels - Determination of fines content in samples of pellets	(0.1 ~ 50.0) %	N
ISO 17831-1 : 2015	Solid biofuels - Determination of mechanical durability of pellets and briquettes. -Part 1: Pellets	(60.0 ~ 99.5) %	N
ISO 18122 : 2015	Solid biofuels - Determination of ash content	(0.1 ~ 40.0) %	N
ISO 18134-2 : 2017	Solid biofuels - Determination of moisture content - Oven dry method - Part2: Total moisture - Simplified method	(0.1 ~ 60.0) %	N
ISO 17829 : 2015	Solid biofuels - Determination of length and diameter of pellets	Length (0.1 ~150.0) mm, Diameter (0.1 ~ 25.0) mm	N

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Test method	Standard designation	Test range	Field testing
ISO/DIS 21404:2019	Solid biofuels - Determination of ash melting behaviour	(500 ~ 1 500) °C	N
ISO 16967:2015	Solid biofuels - Determination of major elements - Al, Ca, Fe, Mg, P, K, Si, Na and Ti	Al: (10 ~ 4 720) mg/kg, Ca: (10 ~ 28 400) mg/kg, Fe: (10 ~ 3 200) mg/kg, Mg: (10 ~ 6 280) mg/kg, P: (10 ~ 2 980) mg/kg, K: (10 ~ 49 000) mg/kg, Si: (10 ~ 20 080) mg/kg, Na: (10 ~ 1 710) mg/kg, Ti: (10 ~ 1 360) mg/kg	N
ISO 16995:2015	Solid biofuels - Determination of the water soluble chloride, sodium and potassium content	Cl: (10 ~ 4 200) mg/kg, Na: (10 ~ 2 000) mg/kg, K: (10 ~ 44 800) mg/kg	N
ISO 18123:2015	Solid biofuels - Determination of the content of volatile matter	(1.0 ~ 85.0) %	N

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Test method	Standard designation	Test range	Field testing
ISO/TS 16996:2015	Solid biofuels - Determination of elemental composition by X-ray fluorescence	Al: (0.000 1 ~ 0.472 0) %, As: (0.000 1 ~ 0.002 0) %, Ca: (0.000 1 ~ 2.840 0) %, Cd: (0.000 1 ~ 0.002 0) %, Co: (0.000 1 ~ 0.010 0) %, Cr: (0.000 1 ~ 0.010 0) %, Cu: (0.000 1 ~ 0.010 0) %, Fe: (0.000 1 ~ 0.320 0) %, K: (0.000 1 ~ 4.900 0) %, Mg: (0.000 1 ~ 0.628 0) %, Mn: (0.000 1 ~ 0.050 0) %, Mo: (0.000 1 ~ 0.020 0) %, Na: (0.000 1 ~ 0.171 0) %, Ni: (0.000 1 ~ 0.010 0) %, P: (0.000 1 ~ 0.298 0) %, Pb: (0.000 1 ~ 0.010 0) %, Sb: (0.000 1 ~ 0.010 0) %, Ti: (0.000 1 ~ 0.136 0) %, V: (0.000 1 ~ 0.010 0) %, Zn: (0.000 1 ~ 0.100 0) %	N
ISO 17827-1:2016	Solid biofuels - Determination of particle size distribution for uncompressed fuels - Part 1: Oscillating screen method using sieves with apertures of 3,15 mm and above	(0.1 ~ 99.5) %	N
ISO 17827-2:2016	Solid biofuels - Determination of particle size distribution for uncompressed fuels - Part 2: Vibrating screen method using sieves with aperture of 3,15 mm and below	(0.1 ~ 99.5) %	N

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Test method	Standard designation	Test range	Field testing
ASTM D7582-15	Standard Test Methods for Proximate Analysis of Coal and Coke by Macro Thermogravimetric Analysis	Moisture : (0.15 ~ 21.6) % Ash : (0.3 ~ 16.7) % Volatile Matter : (1.0 ~ 46.4) %	N
ASTM D5373-16	Standard Test Methods for Determination of Carbon, Hydrogen, and Nitrogen in Analysis Samples of Coal and Carbon in Analysis Samples of Coal and Coke	Coal - C: (54.9 ~ 84.7) % H: (3.25 ~ 5.10) % N: (0.57 ~ 1.80) % Coke - C: (86.6 ~ 97.9) % H: (0.03 ~ 3.83) % N: (1.00 ~ 1.90) %	N
ASTM D409/409M-16	Standard Test Method for Grindability of Coal by the Hardgrove-Machine Method1	41 ~ 115	N
DIN EN ISO 18134-3 : 2015	Solid biofuels - Determination of moisture content - Oven dry method - Part 3 : Moisture in general analysis sample	(0.1 ~ 60.0) %	N
DD CEN/TS 15370-1 : 2006	Solid biofuels - Method for the determination of ash melting behaviour Part1: Characteristic temperatures method	(500 ~ 1 500) °C	N
DIN EN 15440 : 2011	Solid recovered fuels. Methods for the determination of biomass content - Annex A. Determination of biomass content using the selective dissolution method - Annex B. Determination of biomass content using the manual sorting method	Selective Dissolution Method: Biomass content: (0.1 ~ 99.5) %, Manual Sorting: Biomass content: (0.1 ~ 99.5) %	N

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02.004 Related to mines and ceramic products

Test method	Standard designation	Test range	Field testing
Notification No.2019-10 by Korea Forest Research Institute Wood products Quality Standard Annex 11 Wood Pellet	Size	Length : (0.1 ~ 150.0) mm Diameter : (0.1 ~ 25.0) mm	N
	Bulk density	(100 ~ 800) kg/m ³	N
	Moisture Content	(0.1 ~ 60.0) %	N
	Ash Content	(0.1 ~ 40.0) %	N
	Fines	(0.1 ~ 50.0) %	N
	Durability	(60.0 ~ 99.5) %	N
	Calorific value	(15 ~ 40) MJ/kg	N
	Total Content of Sulfur and Chlorine	-	N
	- Ionchromatography	Sulfur : (0.01 ~ 3.00) % Chlorine : (0.01 ~ 3.00) %	N
Total Content of Nitrogen	Nitrogen : (0.1 ~ 16.3) %	N	
Trace Elements of As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn	As : (0.1 ~ 100.0) mg/kg Cd : (0.1 ~ 100.0) mg/kg Cr : (1.0 ~ 200.0) mg/kg Cu : (1.0 ~ 200.0) mg/kg Pb : (1.0 ~ 200.0) mg/kg Hg : (0.01 ~ 10.0) mg/kg Ni : (1.0 ~ 200.0) mg/kg Zn : (1.0 ~ 1 000.0) mg/kg	N	
Ash Melting Behaviour	(500 ~ 1 500) °C	N	
Notification No.2018-8 by Korea Forest Research Institute Wood products Quality Standard Annex 12 Wood Chip	4.4 Moisture Content	(0.1 ~ 60.0) %	N
	4.5 Ash Content	(0.1 ~ 40.0) %	N
	4.6 Calorific value	-	N
	-4.6.1 Carbon, Hydrogen, Nitrogen	Carbon : (30.0 ~ 85.2) % Hydrogen : (4.10 ~ 9.10) % Nitrogen : (0.1 ~ 16.3) %	N
	-4.6.2 Calorific value	(15 ~ 40) MJ/kg	N
4.7 Total Content of Sulfur and Chlorine	Sulfur: (0.01 ~ 3.00) % Chlorine: (0.01 ~ 3.00) %	N	

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02.004 Related to mines and ceramic products

Test method	Standard designation	Test range	Field testing
Notification No.2018-8 by Korea Forest Research Institute Wood products Quality Standard Annex 14 Molded Charcoal	5.2.2 Measurement of Size and weight -Diameter -Height -Weight	Diameter : (100.0 ~ 200.0) mm Height : (20.0 ~ 40.0) mm Weight : (0.1 ~ 3.0) kg	N
	5.2.3 Moisture content	(0.1 ~ 60.0) %	N
	5.2.4 Ash content	(0.1 ~ 40.0) %	N
	5.2.5 Gross calorific value	(15 ~ 40) MJ/kg	N
	5.2.6 Fixed carbon	(0.1 ~ 99.0) %	N
	5.2.7 Trace Elements Content -EPA 3051A MICROWAVE ASSISTED ACID DIGESTION OF SEDIMENTS, SLUDGES, SOILS, AND OILS -EPA 3050B ACID DIGESTION OF SEDIMENTS, SLUDGES, AND SOILS	As : (0.1 ~ 100.0) mg/kg Cd : (0.1 ~ 100.0) mg/kg Cr : (1.0 ~ 200.0) mg/kg Cu : (1.0 ~ 200.0) mg/kg Pb : (1.0 ~ 200.0) mg/kg Hg : (0.01 ~ 10.0) mg/kg Ni : (1.0 ~ 200.0) mg/kg Zn : (1.0 ~ 1 000.0) mg/kg Ba : (0.01 ~ 30.0) mg/kg	N
	5.2.8 Total content of Sulfur	-	N
	-5.2.8.1 Ionchromatography	Sulfur : (0.01 ~ 3.00) %	N
Notification No.2018-8 by Korea Forest Research Institute Wood products Quality Standard Annex 15 Charcoal	7.2.2 Size	(0.1 ~ 99.5) %	N
	7.2.3 Moisture content	(0.1 ~ 60.0) %	N
	7.2.4 Ash	(0.1 ~ 40.0) %	N
	7.2.5 Gross calorific value	(15 ~ 40) MJ/kg	N

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Test method	Standard designation	Test range	Field testing
Ministry of Environment Notification No.2014-135 Standard test method for SRF(Solid Refuse Fuel)	Chapter 2 Determination of Particle Size Distribution 6.1 Manual sieving 6.2 Mechanical sieving	(0.1 ~ 99.5) %	N
	Chapter 3 Material Appearance	(0.1 ~ 99.5) %	N
	Chapter 4 Calorific Value	(15 ~ 40) MJ/kg	N
	Chapter 5 Total Moisture	(0.1 ~ 60.0) %	N
	Chapter 6 Ash content	(0.1 ~ 40.0) %	N
	Chapter 7 Determination of Volatile matter	(0.1 ~ 80.0) %	N
	Chapter 8 Fusibility of Ash	(500 ~ 1 500) °C	N
	Chapter 9 Bulk density	(100 ~ 800) kg/m ³	N
	Chapter 10 Determination for Carbon, Hydrogen and Nitrogen	Carbon : (30.0 ~ 85.2) % Hydrogen : (4.10 ~ 9.10) % Nitrogen : (0.1 ~ 16.3) %	N
	Chapter 11 Chlorine and Sulfur 7.1 Oxygen bomb method	Cl : (0.01 ~ 3.00) % S : (0.01 ~ 3.00) %	N
	Chapter 12 Metals -Inductively Coupled Plasma/Atomic Emission Spectrometry -Mercury-Thermal Decomposition Amalgamation Atomic Absorption Spectrophotometry	Pb : (1.5 ~ 200.0) mg/kg Cd : (0.1 ~ 100.0) mg/kg Cr : (1.0 ~ 200.0) mg/kg As : (0.1 ~ 100.0) mg/kg Sb : (1.5 ~ 200.0) mg/kg Co : (1.0 ~ 200.0) mg/kg Cu : (1.0 ~ 200.0) mg/kg Mn : (0.4 ~ 200.0) mg/kg Ni : (1.2 ~ 200.0) mg/kg Tl : (0.8 ~ 200.0) mg/kg V : (1.0 ~ 200.0) mg/kg Hg : (0.01 ~ 10.0) mg/kg	N
Chapter 13 Biomass content - Selective Dissolution Method - Manual Sorting	Selective Dissolution Method: (0.1 ~ 99.5) % Manual Sorting: (0.1 ~ 99.5) %	N	
ASTM D1857/D1857M-18	Standard Test Method for Fusibility of Coal and Coke Ash	(900 ~ 1 500) °C	N

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Test method	Standard designation	Test range	Field testing
ASTM D2961/D2961M-19	Standard Test Method for Single-Stage Total Moisture Less than 15 % in Coal Reduced to 2.36-mm (No. 8 Sieve) Topsize	(0.1 ~ 15.0) %	N
ASTM D3173/3173M-17a	Standard Test Method for Moisture in the Analysis Sample of Coal and Coke	Coal: (0.1 ~ 25.0) % Coke: (0.1 ~ 3.0) %	N
ASTM D3174-12(Reapproved 2018)	Standard Test Method for Ash in the Analysis Sample of Coal and Coke from Coal	Coal: (0.1 ~ 30.0) % Coke: (0.1 ~ 20.0) %	N
ASTM D3175-18	Standard Test Method for Volatile Matter in the Analysis Sample of Coal and Coke	Coal: (0.1 ~ 50.0) % Coke: (0.1 ~ 20.0) %	N
ASTM D3302/D3302M-19	Standard Test Method for Total Moisture in Coal	(0.1 ~ 35.0) %	N
ASTM D4239-18e1	Standard Test Method for Sulfur in the Analysis Sample of Coal and Coke Using High-Temperature Tube Furnace Combustion -3.1 Combustion Method A (1350 °C)	(0.1 ~ 7.0) %	N
ASTM D5865/D5865M-19	Standard Test Method for Gross Calorific Value of Coal and Coke	(15 ~ 40) MJ/kg	N
ASTM D5016-16	Standard Test Method for Total Sulfur in Coal and Coke Combustion Residues Using a High-Temperature Tube Furnace Combustion Method with Infrared Absorption	(0.01 ~ 3.00) %	N

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Test method	Standard designation	Test range	Field testing
ASTM D6349-13	Standard Test Method for Determination of Major and Minor Elements in Coal, Coke, and Solid Residues from Combustion of Coal and Coke by Inductively Coupled Plasma - Atomic Emission Spectrometry	SiO ₂ : (2.04 ~ 73.73) % Al ₂ O ₃ : (1.04 ~ 29.54) % Fe ₂ O ₃ : (0.39 ~ 47.94) % MgO: (0.40 ~ 7.29) % CaO: (1.04 ~ 44.03) % TiO ₂ : (0.06 ~ 1.47) % K ₂ O: (0.09 ~ 2.53) % P ₂ O ₅ : (0.10 ~ 1.34) % Na ₂ O: (0.17 ~ 7.44) % MnO ₂ : (0.02 ~ 0.09) % BaO: (0.13 ~ 3.00) % SrO: (0.02 ~ 1.1) % SO ₃ : (0.14 ~ 10.0) %	N
ASTM D6357-19	Test Methods for Determination of Trace Elements in Coal, Coke, & Combustion Residues from Coal Utilization Processes by Inductively Coupled Plasma Atomic Emission, Inductively Coupled Plasma Mass, & Graphite Furnace Atomic Absorption Spectrometry	Sb: (0.17 ~ 5.71) mg/kg As: (0.56 ~ 138.79) mg/kg Be: (0.42 ~ 13.11) mg/kg Co: (0.76 ~ 47.18) mg/kg Cd: (0.02 ~ 0.84) mg/kg Cr: (2.37 ~ 221) mg/kg Cu: (3.43 ~ 107.06) mg/kg Mn: (11.69 ~ 419.61) mg/kg Mo: (0.40 ~ 20.52) mg/kg Ni: (2.00 ~ 113.32) mg/kg Pb: (1.57 ~ 66.99) mg/kg Zn: (3.76 ~ 202.31) mg/kg V: (4.50 ~ 293.17) mg/kg	N
ASTM D6722-19	Standard Test Method for Total Mercury in Coal and Coal Combustion Residues by Direct Combustion Analysis	Hg: (0.017 ~ 0.586) mg/kg	N

End.