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SOLID BIOFUELS TESTING SECTION



AB 088

Poznań, 17th April 2023



TEST REPORT No. BDB-23-A-1291

Subject of the order Quality testing of wood pellets (A2) – Mako Pellet Sp. z o.o.

Order No. A/DBD/BDB/1291/2023

Name and address of the customer Control Union Poland Sp. z o.o.
al. Wojska Polskiego 45, 65-764 Zielona Góra

Name and address of the producer Mako Pellet Sp. z o.o.
Makowiska 13, 86-050 Solec Kujawski

ENplus® ID / Sample No. PL050; 6mm/MakoPellet/A2/2023-1

Performance date 23.03 – 17.04.2023

Operators Jacek Pawłowski, M.Sc.
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Magdalena Witczak, PhD. (Eng.)

Compiled by

Authorized by

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A qualified electronic signature has been affixed to this document, which according to the law is equivalent to written form.

1. IDENTIFICATION (DESCRIPTION OF TEST SAMPLE)

The object of the assessment was a sample of pellets with the diameter of 6 mm, described by the customer as pellets made of chemically uncontaminated sawdust.

Sample number: 6mm/MakoPellet/A2/2023-1.

Identification number: A-1291/2023.

2. DELIVERY DATE OF TESTED SUBJECTS

The sample was taken by the customer and delivered to the laboratory on 23rd March 2023.

3. TEST METHODS

- EN ISO 14780:2017 Solid biofuels – Sample preparation (Method 16M)
- EN ISO 18134-2:2017 Solid biofuels – Determination of moisture content – Oven dry method – Part 2: Total moisture – Simplified method (Method 1M)
- EN ISO 18134-3:2015 Solid biofuels – Determination of moisture content – Oven dry method – Part 3: Moisture in general analysis sample (Method 1M)
- EN ISO 18122:2015 Solid biofuels – Determination of ash content (Method 2M)
- EN ISO 17828:2015 Solid biofuels – Determination of bulk density (Method 4M)
- EN ISO 18125:2017 Solid biofuels – Determination of calorific value (Method 6M)
- EN ISO 16948:2015 Solid biofuels – Determination of total content of carbon, hydrogen and nitrogen (Method 7M)
- EN ISO 16994:2016 Solid biofuels – Determination of total content of sulfur and chlorine (Method 8M)
- EN ISO 18846:2016 Solid biofuels – Determination of fines content in quantities of pellets (Method 9M)
- EN ISO 17831-1:2015 Solid biofuels – Determination of mechanical durability of pellets and briquettes – Part 1: Pellets (Method 10M)
- EN ISO 17829:2015 Solid biofuels – Determination of length and diameter of pellets (Method 11M)
- EN ISO 16968:2015 Solid biofuels – Determination of minor elements (Method 13M)
- EN ISO 21404:2020 Solid biofuels – Determination of ash melting behaviour (Method 14M)

4. EQUIPMENT OF THE TEST STANDS (elementary)

No.	Name	Type	Producer	Lab.No.
1.	Analytical balance	LE26P-0CE	SARTORIUS	M7/2
2.	Analytical balance	CPA225D-0CE	SARTORIUS	M8/57
3.	Laboratory drier	Redline RF115	BINDER	M1/47
4.	Calorimeter	C6000	IKA	M6/83
5.	Elemental analyzer	Flash EA 1112	THERMO ELECTRON CORPORATION	M7/8
6.	Furnace	FCF 7SM/pl	CZYLOK	M2/4
7.	Ionic chromatograph	ICS-1100	THERMO SCIENTIFIC	M8/54
8.	Laboratory balance	PS 6000/C/2	RADWAG	M3/50
9.	Laboratory balance	WLC 6/F1/R	RADWAG	M9/46
10.	Pellets durability tester	TUMBLER 3000	BIOENERGY ANLAGENPLANUNG	M10/42
11.	Sieve 3.15 mm	-	RETSCH	M9/34
12.	Caliper	SD-10	BAKER	M3/14
13.	Microwave oven	MARS 6	CEM CORPORATION	M13/80
14.	Atomic Absorption Spectrometer	280FS AA	AGILENT TECHNOLOGIES	M13/66
15.	Atomic Absorption Spectrometer	280Ze AA	AGILENT TECHNOLOGIES	M13/67
16.	Mercury analyzer	DMA80	Milestone	M13/117
17.	System for determination of characteristic temperatures of ash melting behaviour	PR-37/1600	Radio Research Institute	M14/88
18.	Sieve 0.075 mm	-	ATEST	M14/91

5. TESTS RESULTS

Tests results are presented in Record No. 1/1291/2023.

6. DECLARATION

Test results presented in this Report refer to the tested samples only.

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Record No. 1/1291/2023

Sample name: Wood pellets
Name of Producer: Mako Pellet Sp. z o.o.
 Makowiska 13, 86-050 Solec Kujawski
ENplus® ID / Sample No. PL050; 6mm/MakoPellet/A2/2023-1

Origin:		1. Woody biomass				
Traded form:		Wood pellets				
Classification of origin according to EN ISO 17225-1:2014		1.2.1 Chemically untreated by-products and residues from the wood processing industry				
Parameter	Unit	Value	Uncertainty [±] ¹	Threshold value acc. to ENplus® Handbook, Part 3 version 3.0		
				A1	A2	B
Diameter	mm	6.1	0.2	6 ± 1 or 8 ± 1		
Length	mm	16.4	7.4	3.15 < L ≤ 40		
Moisture	w-% _{ar}	9.4	0.3	≤ 10		
Ash	w-% _d	0.49	0.04	≤ 0.7	≤ 1.2	≤ 2.0
Mechanical durability	w-% _{ar}	98.3	0.5	≥ 98.0	≥ 97.5	
Fines (< 3.15 mm)	w-% _{ar}	0.30	0.04	≤ 1.0 (< 0.5%) ²		
Gross calorific value	MJ/kg _d	20.63	0.07	-		
Net calorific value	MJ/kg _{ar} kWh/kg _{ar}	17.16	0.10	≥ 16.5		
		4.77	0.03	≥ 4.6		
Bulk density	kg/m ³ _{ar}	625	11	600 ≤ BD ≤ 750		
Carbon	w-% _d	50.55	0.36	-		
Hydrogen	w-% _d	6.56	0.13	-		
Nitrogen	w-% _d	0.09	0.02	≤ 0.3	≤ 0.5	≤ 1.0
Sulfur	w-% _d	0.0074	0.0003	≤ 0.04	≤ 0.05	
Chlorine	w-% _d	0.009	0.001	≤ 0.02		≤ 0.03

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Ash shrinkage temperature SST ^{3,4}	°C	1260	25	Should be stated		
Ash deformation temperature DT ^{3,4}	°C	1350	51	≥ 1200	≥ 1100	
Ash hemisphere temperature HT ^{3,4}	°C	1370	19	Should be stated		
Ash flow temperature FT ^{3,4}	°C	1390	12	Should be stated		
Arsenic	mg/kg _d	< 0.1	-	≤ 1		
Cadmium	mg/kg _d	0.14	0.01	≤ 0.5		
Chromium	mg/kg _d	< 0.5	-	≤ 10		
Copper	mg/kg _d	0.97	0.13	≤ 10		
Lead	mg/kg _d	< 0.5	-	≤ 10		
Mercury	mg/kg _d	0.0021	0.0001	≤ 0.1		
Nickel	mg/kg _d	< 0.5	-	≤ 10		
Zinc	mg/kg _d	7.07	0.03	≤ 100		

_d dry _{ar} as received

1. the expanded uncertainty was determined for coverage factor $k = 2$ and 95% confidence level

2. at factory gate, at the end of production or when loading truck for deliveries to end-users (< 0.5% when filling pellet bags or sealed big bags)

3. characteristic ash melting temperature determined in an oxidizing atmosphere

4. ash received at 815°C

End of report