



AB 088

**TESTING LABORATORY OF WOOD, WOOD-BASED MATERIALS,
PACKAGING, FURNITURE AND CONSTRUCTIONS**

SOLID BIOFUELS TESTING SECTION

Poznań, 18.05.2021



TEST REPORT
No. 1480/2021/S.M

Subject of the order Quality testing of wood pellets – RADEX Sp. z o.o. Sp. k.

Order No A-1480-BBI/2021

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 RADEX Sp. z o.o. Sp. k.
ul. Komunalna 2, 14-200 IŁAWA

ENplus® ID / Sample No. 6mm-RADEX-26.04.2021-1 ENplus

Performance date 30.04 – 18.05.2021

Operators Monika Kubińska, M.Sc.
Jacek Pawłowski, M.Sc.
Dariusz Radoński, B.Eng.
Małgorzata Walkowiak, M.Sc.Eng.

Compiled by

Authorized by

| | |
|--|--|
| | |
|--|--|

Małgorzata Walkowiak, M.Sc.Eng.

Magdalena Witczak, PhD.Eng.

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 the sample of solid biofuels in the form of pellets with diameter of 6 mm, described by the customer as pellets produced from chemically untreated by-products and residues from the wood processing industry.

Sample number: 6mm-RADEX-26.04.2021-1 ENplus.

Identification number: A-1480-BBI/2021

2. DELIVERY DATE OF TESTED SUBJECTS

The sample was taken by the customer and delivered to the laboratory on 30th April 2021.

3. TEST METHODS

- EN ISO 14780:2017-07 Solid biofuels – Sample preparation (Method 16M)
- EN ISO 18134-2:2015-11 Solid biofuels – Determination of moisture content – Oven dry method – Part 2: Total moisture – Simplified method (Method 1M)
- EN ISO 18134-3:2015-11 Solid biofuels – Determination of moisture content – Oven dry method – Part 3: Moisture in general analysis sample (Method 1M)
- EN ISO 18122:2016-01 Solid biofuels – Determination of ash content (Method 2M)
- EN ISO 17828:2016-02 Solid biofuels – Determination of bulk density (Method 4M)
- EN ISO 18125:2017-07 Solid biofuels – Determination of calorific value (Method 6M)
- EN ISO 16948:2015-07 Solid biofuels – Determination of total content of carbon, hydrogen and nitrogen (Method 7M)
- EN ISO 16994:2015-06 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 17831-1:2016-02 Solid biofuels – Determination of mechanical durability of pellets and briquettes – Part 1: Pellets (Method 10M)
- EN ISO 17829:2016-02 Solid biofuels – Determination of length and diameter of pellets (Method 11M)
- EN ISO 16968:2015-07 Solid biofuels – Determination of minor elements (Method 13M)
- CEN/TS 15370-1:2006 Solid biofuels – Determination of ash melting behaviour – Part 1: Characteristic temperatures method (14M Method)

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. | Pellets durability tester | TUMBLER 3000 | BIOENERGY ANLAGENPLANUNG | M10/42 |
| 10. | Sieve 3.15 mm | - | RETSCH | M9/34 |
| 11. | Caliper | SD-10 | BAKER | M3/14 |
| 12. | Microwave oven | MARS 6 | CEM CORPORATION | M13/80 |
| 13. | Atomic Absorption Spectrometer | 280FS AA | AGILENT TECHNOLOGIES | M13/66 |
| 14. | Atomic Absorption Spectrometer | 280Ze AA | AGILENT TECHNOLOGIES | M13/67 |
| 15. | System for determination of characteristic temperatures of ash melting behaviour | PR-37/1600 | Radio Research Institute | M14/88 |
| 16. | Sieve 0.075 mm | - | ATEST | M14/91 |

5. TESTS RESULTS

Tests results are presented in record No 1/1480/2021.

6. DECLARATION

The test results refer only to the sample and do not necessarily mean that similar products or seemingly identical have the same properties.

The Test Report cannot be copied in parts, only in its entirety.

Record No. 1/1480/2021

Sample name: Wood pellets
Name of Producer: RADEX Sp. z o.o. Sp. k.
 ul. Komunalna 2, 14-200 IŁAWA
ENplus® ID/sample No.: 6mm-RADEX-26.04.2021-1 ENplus

| 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 | 0.1 | 6 ± 1 or 8 ± 1 | | |
| Length | mm | 15.9 | 9.1 | 3.15 < L ≤ 40 | | |
| Moisture | w-% _{ar} | 6.39 | 0.23 | ≤ 10 | | |
| Ash | w-% _d | 0.23 | 0.02 | ≤ 0.7 | ≤ 1.2 | ≤ 2.0 |
| Mechanical durability | w-% _{ar} | 97.3 | 0.1 | ≥ 98.0 | ≥ 97.5 | |
| Fines (< 3.15 mm) | w-% _{ar} | 0.51 | 0.06 | ≤ 1.0 (< 0.5%) ⁴ | | |
| Gross calorific value | MJ/kg _d | 20.83 | 0.05 | - | | |
| Net calorific value | MJ/kg _{ar} kWh/kg _{ar} | 17.97 | 0.07 | ≥ 16.5 | | |
| | | 4.99 | 0.02 | ≥ 4.6 | | |
| Bulk density | kg/m ³ _{ar} | 655 | 11 | 600 ≤ BD ≤ 750 | | |
| Carbon | w-% _d | 51.18 | 0.81 | - | | |
| Hydrogen | w-% _d | 6.76 | 0.14 | - | | |
| Nitrogen | w-% _d | < 0.08 | - | ≤ 0.3 | ≤ 0.5 | ≤ 1.0 |
| Sulfur | w-% _d | 0.0046 | 0.0004 | ≤ 0.04 | ≤ 0.05 | |
| Chlorine | w-% _d | 0.006 | 0.001 | ≤ 0.02 | | ≤ 0.03 |

Sample name: Wood pellets
Name of Producer: RADEX Sp. z o.o. Sp. k.
 ul. Komunalna 2, 14-200 IŁAWA
ENplus® ID/sample No.: 6mm-RADEX-26.04.2021-1 ENplus

| 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 |
| Ash shrinkage temperature SST ^{2,3} | °C | 1210 | 31 | Should be stated | | |
| Ash deformation temperature DT ^{2,3} | °C | 1480 | 51 | ≥ 1200 | ≥ 1100 | |
| Ash hemisphere temperature HT ^{2,3} | °C | 1490 | 20 | Should be stated | | |
| Ash flow temperature FT ^{2,3} | °C | 1500 | 12 | Should be stated | | |
| Arsenic | mg/kg _d | < 0.1 | - | ≤ 1 | | |
| Cadmium | mg/kg _d | 0.124 | 0.003 | ≤ 0.5 | | |
| Chromium | mg/kg _d | < 0.5 | - | ≤ 10 | | |
| Copper | mg/kg _d | 0.80 | 0.04 | ≤ 10 | | |
| Lead | mg/kg _d | < 0.5 | - | ≤ 10 | | |
| Mercury | mg/kg _d | < 0.05 | - | ≤ 0.1 | | |
| Nickel | mg/kg _d | < 0.5 | - | ≤ 10 | | |
| Zinc | mg/kg _d | 6.84 | 0.32 | ≤ 100 | | |

_d dry _{ar} as received

1. the expanded uncertainty was determined for coverage factor $k = 2$ and 95% confidence level
2. characteristic ash melting temperature determined in an oxidizing atmosphere
3. ash received at 815°C
4. 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)

End of report