European pellet standards

Pellet@las project final workshop
Bryssels, Belgium, 18.11.2009

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Convenor of the CEN/TC 335 working group 2

Multipart standard EN14961 – Pellets

- **General requirements – Part 1 (FprEN 14961-1)**
  - For industrial use
  - Approved by national CEN committees, to be published in early 2010
- **Separate product standards for**
  - Part 2 - wood pellets for non-industrial use
  - Part 6 – non-woody pellets for non-industrial use
  - Product standards targeted for non-industrial use in small-scale appliances, such as,
    - households and
    - small commercial and public sector buildings

Specification and classes (prEN 14961-1)

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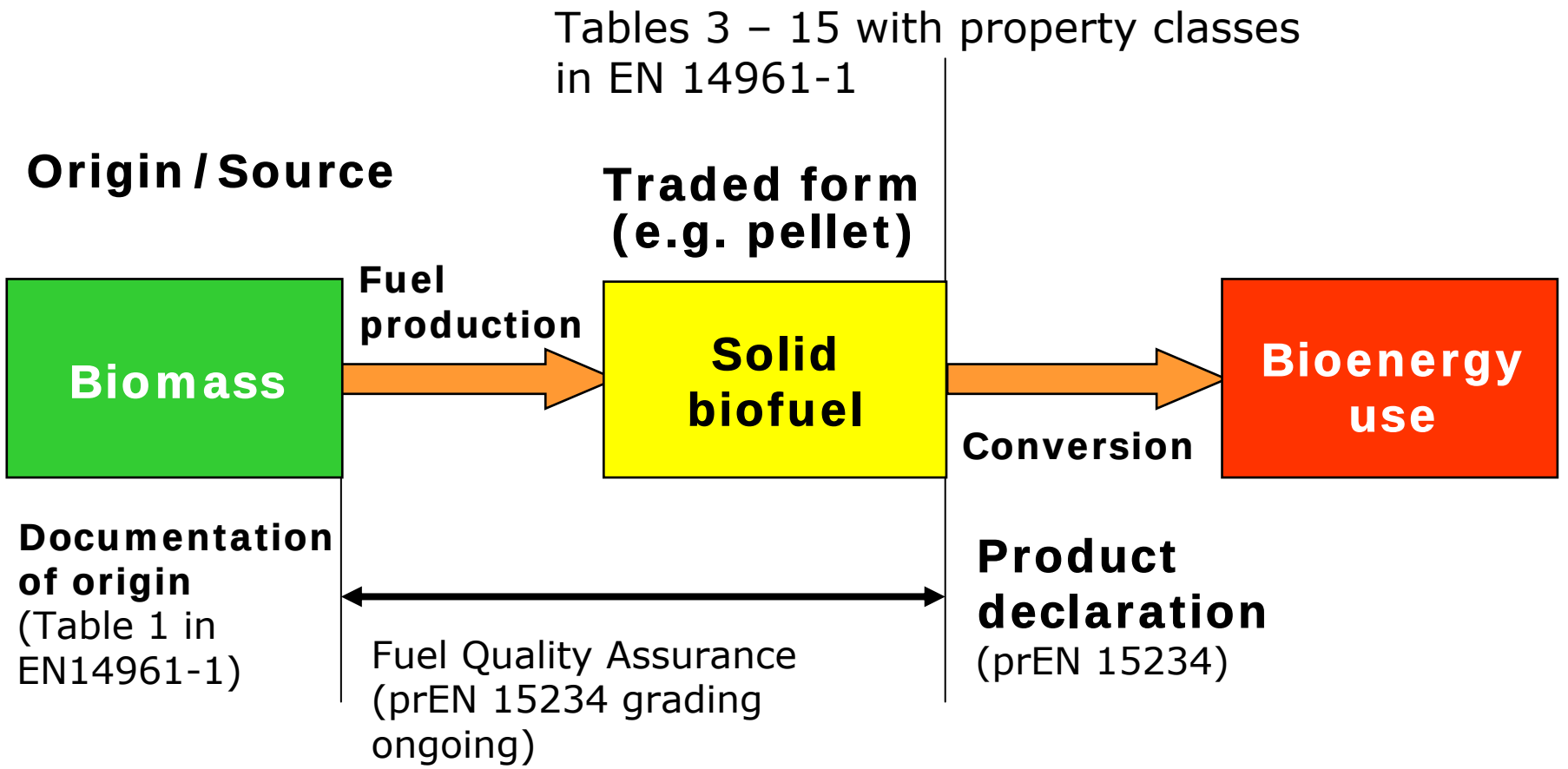
- Classification is based on **origin** and **source**, **major traded forms** and **properties**
- Hierarchical classification system in table format:
  1. **Woody biomass**
  2. **Herbaceous biomass**
  3. **Fruit biomass**
  4. **Biomass blends and mixtures**
     - blends = intentional, mixtures = unintentional
- Special requirements for chemically treated biomass
- **Chemical treatment** defined as any treatment with chemicals other than air, heat or water (e.g. glued, painted, coated, lacqued or otherwise treated wood, without halogeneted compounds and heavy metals)

Solid biofuel utilisation chain



1.2 Wood processing industry by-products and residues (Table 1, EN 14961-1)

1.2.1 Chemically untreated wood residues	1.2.1.1 Without bark (broadleaf)
	1.2.1.2 Without bark (coniferous)
	1.2.1.3 With bark (broadleaf)
	1.2.1.4 With bark (coniferous)
	1.2.1.5 Bark from industry operations (broadleaf)
	1.2.1.6 Bark from industry operations (coniferous)
	1.2.1.7 Blends and mixtures
1.2.2 Chemically treated wood residues, fibres and wood constituents	1.2.2.1 Without bark (broadleaf)
	1.2.2.2 Without bark (coniferous)
	1.2.2.3 With bark (broadleaf)
	1.2.2.4 With bark (coniferous)
	1.2.2.5 Bark from industry operations (broadleaf)
	1.2.2.6 Bark from industry operations (coniferous)
	1.2.2.7 Fibres and wood constituents
	1.2.2.8 Blends and mixtures

- Cork is under bark
- Chemically treated wood may not include heavy metals or halogenated compounds as a result of treatment with wood preservatives or coating

Flexible classification – Part 1

- Classification is ”flexible”, and hence the producer or the consumer may select property from each property class
- This classification does not bind different characteristics with each other
- The fuel supply chain shall be unambiguosly traceble back over the whole chain
- For most commonly traded forms (e.g. pellets), a table including property classes
  - Example **M10**, means that moisture content has to be less than ≤10% on average

Flexible classification – Part 1

- Some of the properties are **normative** (mandatory)
  - **origin and source** always to be stated
  - normative properties vary depending on both origin and traded form
  - moisture content (M), and ash content (A) for all fuels
- Some properties are **informative** (voluntary), but they are recommended to be stated

Specification for traded forms – EN14961-1

- Briquettes (Table 3)
- **Pellets (Table 4)**
- Wood chips (Table 5)
- Hog fuel (Table 6)
- Wood logs (Table 7)
- Sawdust (Table 8)
- Shavings (Table 9)
- Bark (Table 10)
- Straw bales, reed canary grass bales and Miscanthus bales (Table 11)
- Energy grain (Table 12)
- Olive residues (Table 13)
- Fruit seed (Table 14)
- General master table for others (Table 15)

Photo: Vapo Oy

Biofuel pellet prEN 14588, term 4.23

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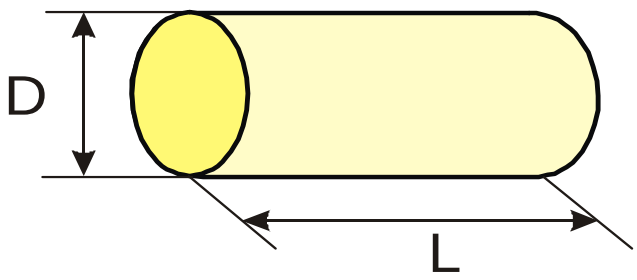
- **Densified biofuel**
  - made from pulverised biomass
  - with or without pressing aids
  - usually with a cylindrical form,
  - random length and typically 5 to 40 mm, with broken ends
- **The raw material for biofuel pellets can be**
  - woody biomass,
  - herbaceous biomass,
  - fruit biomass, or
  - biomass blends and mixtures
  - Pellets are usually manufactured in a die
  - The total moisture is usually less than 10% of their mass

Pellets – Normative properties (Part 1)

Origin (Table 1 - Part 1)

- Woody biomass 1
- Herbaceous biomass 2
- Fruit biomass 3
- Blends and mixtures 4



Dimensions

Class	Diameter (D)	Length (L)
D06	≤ 6 ± 1,0 mm	3,15 ≤ L ≤ 40 mm (95 w-%)
D08	≤ 8 ± 1,0 mm	3,15 ≤ L ≤ 40 mm (95 w-%)
D10	≤ 10 ± 1,0 mm	3,15 ≤ L ≤ 40 mm (95 w-%)
D12	≤ 12 ± 1,0 mm	3,15 ≤ L ≤ 50 mm (95 w-%)
D25	≤ 25 ± 1,0 mm	10 ≤ L ≤ 50 mm (95 w-%)

- Maximum length of pellets: 45 mm in classes D06, D08 and D10 (≤ 5 w-%)

Pellets – Normative (Part 1)

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Moisture (M)

- M10 ≤ 10 % as received
- M15 ≤ 15 % as received

Drying oven, moisture content prEN 14774-1 – 3

Ash content (A)

- A0.5 ≤ 0.5 % dry basis
- A0.7 ≤ 0.7 % dry basis
- A1.0 ≤ 1.0 % dry basis
- A1.5 ≤ 1.5 % dry basis
- A3.0 ≤ 3.0 % dry basis
- A5.0 ≤ 5.0 % dry basis
- A7.0 ≤ 7.0 % dry basis
- A10.0 ≤ 10.0 % dry basis
- A10.0+ > 10.0 % dry basis, minimum value to be stated

High temperature laboratory furnace Ash content prEN 14775

Bulk density (BD) (kg / m³)

- To be stated in the following classes BD550, BD600, BD650, BD700 and BD700+ (minimum value to be stated)

Pellet - Normative (Part 1)

Amount of fines (F)

When loaded or packaged

Fines < 3,15 mm

- F1.0 ≤ 1,0 w-%
- F2.0 ≤ 2,0 w-%
- F3.0 ≤ 3,0 w-%
- F5.0 ≤ 5,0 w-%
- F5.0+ > 5,0 w-%, maximum value to be stated

3,15 mm sieve according to ISO 3310-2
Particle size distribution prEN 15149

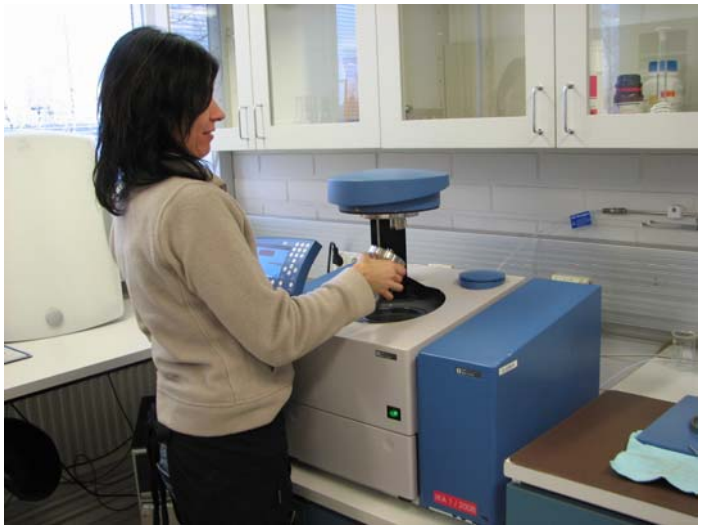
Additives

- Type and amount of pressing aids, slagging inhibitors or any other additives to be stated
- The amount of additives should not be more than 20 w-% of pressing mass. If the amount of additive is more than 20 w-% of the pressing mass then these are blended pellets

Pellets – Normative (Part 1)

Net calorific value as received (Q)

- **Minimum value to be stated** (calculation by taking into account the selected moisture category and the typical variation of the net calorific value of dry matter at constant pressure)



Calorimetric bomb prEN 14918
Photo: ENAS Oy

$$q_{p,\mathrm{net,ar}} = q_{\mathrm{p,net,d}} \times \left(\frac{100 - M_{\mathrm{ar}}}{100}\right) - 0{,}02443 \times M_{\mathrm{ar}}$$

- $q_{p,net,ar}$ net calorific value as received, (MJ/kg)
- $q_{p,net,d}$ net calorific value (constant pressure) dry basis (MJ/kg)
- M_{ar} total moisture (w-%)
- 0,02443 is the correction factor of the enthalpy of vaporization (constant pressure) for water (moisture) at 25 °C [MJ/kg per 1 w-% of moisture]

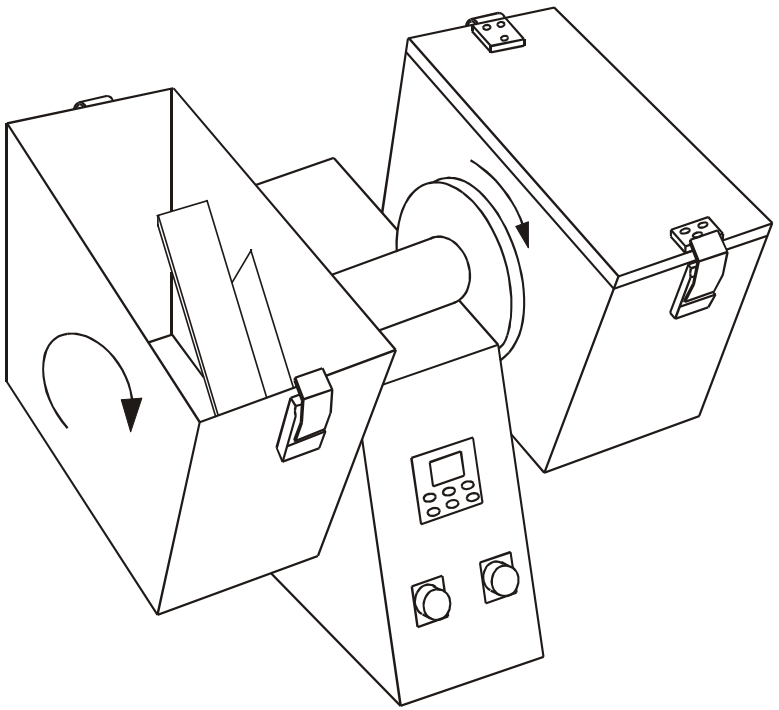
Calculation formula is available in EN 14961-1 in Annex C

Pellets – Normative (Part 1)

Mechanical durability (DU)

- DU97.5 ≥ 97.5 % pellets after testing
- DU96.5 ≥ 96.5 % pellets after testing
- DU95.0 ≥ 95.0 % pellets after testing
- DU95.0- < 95.0 % pellets after testing, minimum value to be stated

Test portion 500 ± 10 g
50 ± 2 rpm for 500 rotations



Testing apparatus for mechanical durability according prEN 15210-1

Normative / informative for pellets (Part 1)

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Sulphur (S)

- Sulphur is normative only for chemically treated biomass (1.2.2, 1.3.2, 2.2.2,3.2.2) or if sulphur containing additives have been used

- S0.02 ≤ 0.02 w-% dry basis
- S0.05 ≤ 0.05 w-% dry basis
- S0.08 ≤ 0.08 w-% dry basis
- S0.10 ≤ 0.10 w-% dry basis
- S0.20 ≤ 0.20 w-% dry basis
- S0.20+ > 0.20 w-% dry basis, and maximum value to be stated

Analyzer for S, C According to method prEN 15289

Normative / informative for pellets (Part 1)

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Nitrogen (N)

- Nitrogen is normative only for chemically treated biomass (1.2.2, 1.3.2, 2.2.2,3.2.2)

- N0.3 ≤ 0.3 w-% dry basis
- N0.5 ≤ 0.5 w-% dry basis
- N1.0 ≤ 1.0 w-% dry basis
- N2.0 ≤ 2.0 w-% dry basis
- N3.0 ≤ 3.0 w-% dry basis
- N3.0+ >3.0 % w-% dry basis and maximum value to be stated

CHN-analyzer
According to method prEN 15104

Normative/informative for pellets (Part 1)

Chlorine (Cl)

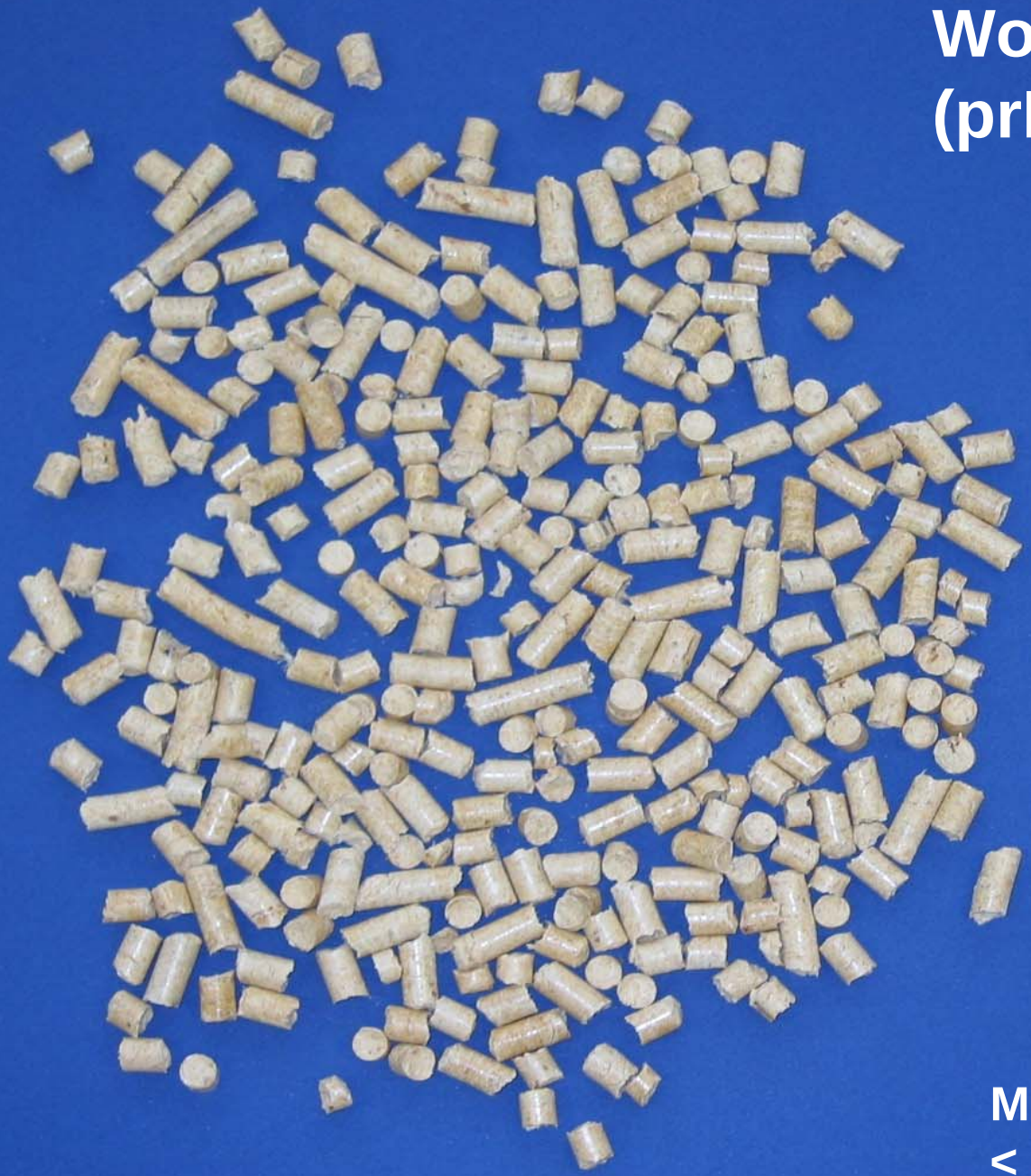
- Chlorine is normative only for chemically treated biomass (1.2.2, 1.3.2, 2.2.2,3.2.2)

- Cl 0.02 ≤ 0.02 w-% dry basis
- Cl 0.03 ≤ 0.03 w-% dry basis
- Cl 0.07 ≤ 0.07 w-% dry basis
- Cl 0.10 ≤ 0.10 w-% dry basis
- Cl 0.10+ > 0.10 w-% dry basis
  the maximum value to be stated

Analysis according to method prEN 15289 (total S, Cl)

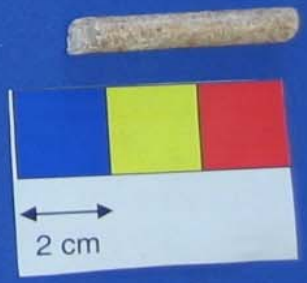
Photos: ofi & ENAS Oy

Wood pellets (prEN 14961-1)



Amount of fines (< 3,15mm)
≤ 1 w-%

Pellet length, 3,15– 40 mm
≥ 95 w-%



Maximum length, 45 mm
< 5 w-%

Photo: VTT

Product standard - Non-industrial wood pellets (Part 2)
Properties agreed in November 2009 (draft)

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Property	A1	A2	B
Origin	1.1 and 1.2.1	1.1 and 1.2.1	1.1, 1.2, 1.3
Dimensions	D06, D08 (± 1 mm) 3,15≤ L ≤40 mm Max. 45 mm (1w-%)	D06, D08(± 1 mm) 3,15≤ L ≤40 mm Max. 45 mm (1w-%)	D06, D08(± 1 mm) 3,15≤ L ≤40 mm Max. 45 mm (1w-%)
Moisture, M	≤ 10 w-%	≤ 10 w-%	≤ 10 w-%
Ash content, A dry basis	0.7 w-%	1.5 w-%	3.0 w-%
Bulk density, BD	≥ 600 kg/m^3	≥ 600 kg/m^3	≥ 600 kg/m^3
Mechanical durability, DU	≥ 97.5 w-%	≥ 97.5 w-%	≥ 96.5 w-%
Net calorific value as received, Q	≥ 16.5 MJ/kg [4.6 kWh/kg]	≥ 16.5 MJ/kg [4.6 kWh/kg]	≥ 16.0 MJ/kg [4.4 kWh/kg]
Fines, F (< 3,15 mm)	The amount of fines shall be ≤ 1% leaving the final point of loading for delivery to the end-user. i.e leaving the final storage point or the factory if delivering directly to the end-user. The amount of fines leaving the factory gate shall also be ≤ 1% (unless there is a different agreement between the producer and their customer).		

Additives ≤ 2w-% of pressing mass dry basis, type (e.g. starch, corn flour, vegetable oil) and amount to be stated.

Product standard – Non-industrial wood pellets and briquettes (Part 2, 3) – Properties agreed in November 2009 (draft)

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Property	A1	A2	B
Sulphur, S dry basis	S0.05	S0.05	S0.05
Nitrogen, N dry basis	N0.3	N0.5	N1.0
Chlorine, Cl, dry basis	Cl0.02	Cl0.03	Cl0.03
Ash melting behaviour, DT °C*	≥ 1 200	≥ 1 100	≥ 1 100
Arsenic, As mg/kg dry	≤ 1	≤ 1	≤ 1
Cadmium, Cd, mg/kg dry**	≤ 0.5	≤ 0.5	≤ 0.5
Chromium, Cr mg/kg dry**	≤ 10	≤ 10	≤ 10
Copper, Cu, mg/kg dry**	≤ 10	≤ 10	≤ 10
Lead, Pb, mg/kg dry**	≤ 10	≤ 10	≤ 10
Mercury, Hg, mg/kg dry**	≤ 0.05	≤ 0.05	≤ 0.05
Nickel, Ni, mg/kg dry**	≤ 10	≤ 10	≤ 10
Zinc, Zn, mg/kg dry**	≤ 100	≤ 100	≤ 100

* Not for briquettes, DT = deformation temperature *(Analysis EN15370-1)*

** 1 000 mg/kg = 1 000 ppm = 0,1%, *Analysis prEN 15297 – Minor elements*

values with red colour not yet agreed, to be agreed in March 2010

How to use classification

- Boiler/burner manufacturer can select the property classes for the product
- Classification can be marked on the product

Manufacturer	**RIKA**
Output	**12 kW** **EN 14785**
Fuel	**Wood pellets** **EN 14961-2 (A1)**

Photo: Martin Englisch, ofi

- For packages information has to be marked on the packages
- For bulk material: Product Declaration to be used

Example of product declaration according to Part 1 – Bulk delivery

	EN 14961 – Part 1	
	Producer	EAA Biofuels
	Pellet factory	Jyväskylä, Finland
	Origin	1.2.1.2 (Sawdust, pine)
	Traded form	Pellets
Normative	Dimensions	D08
	Moisture, w-%	M 10
	Ash, w-% dry	A0.5
	Mechanical durability, w-% pellets after testing	DU97.5
	Amount of fines, w-% (< 3,15 mm)	F1.0
	Additives, w-% of pressing mass	0,5 w-% starch
	Bulk density, kg/m^3	BD 650
	Net calorific value as received, kWh/kg	Q4.7
Informative	Sulphur, w-% dry basis	0.05
	Nitrogen, w-% dry basis	N0.3
	Chlorine, w-% dry basis	Cl0.03

Example of product declaration of wood pellets – packaged pellets – Part 2

PHYDADES
EACI

Wood pellets

Producer	EAA Biofuels P.O. Box 1603, FI-40101 Jyväskylä Tel. +358 20722 2550
Origin:	1.2.1.2 Coniferous wood without bark
Traded Form:	Pellets – Class A1 (A0.5)
Country of origin	Jyväskylä, Finland

Normative (EN 14961- 2)

Dimensions Diameter (D), lenght (L)	D08 (D= 8±1 mm, and 3,15 ≤ L ≤ 40 (95%) Maximum 45 mm
Moisture (w-% as received)	M10 (≤ 10 %)
Ash (w-% of dry basis)	A0.5 ≤ 0,5%
Mechanical durability (w-% of pellets after testing)	DU97.5 ≤ 97,5%
Amount of fines (w-%, < 3.15 mm)	F1.0 ≤ 1%
Net calorific value, Q	Q ≥ 4,7 kWh/kg
Additives (w-% of pressing mass)	Starch < 1 w-%
Bulk density as received (kg/m^3)	DB600 ≥ 600 kg/m^3
Chemical composition (w-% dry basis)	N0,3, S0,05, Cl0,02
Ash melting behaviour, (DT °C)	≥ 1200
Minor elements (mg/kg dry basis)	As 1, Cd 0,5, Cr 10, Cu 10, Pb 10, Hg 0.05, Ni 10, Zn 100

Phydades project

- **www.phydades.info**
- Training material and on-job training of CEN methods
- Database **Biodat** of solid biofuels and ash properties
- Workshops and lectures

Trainees from Estonia and Latvia participating in on-job training of CEN analysis methods at ENAS Oy, Jyväskylä, Finland

BIODAT Database (www.biodat.eu)

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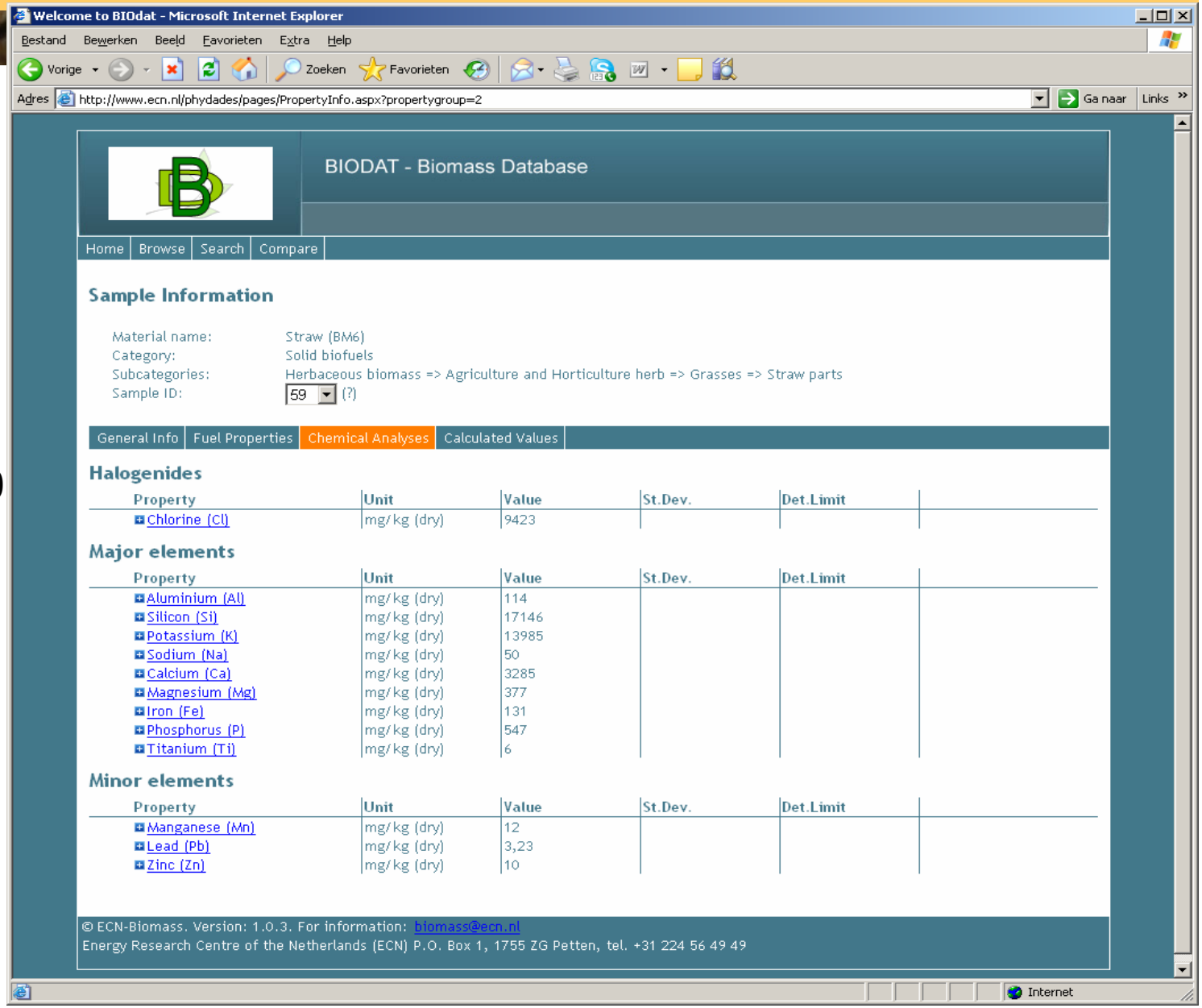
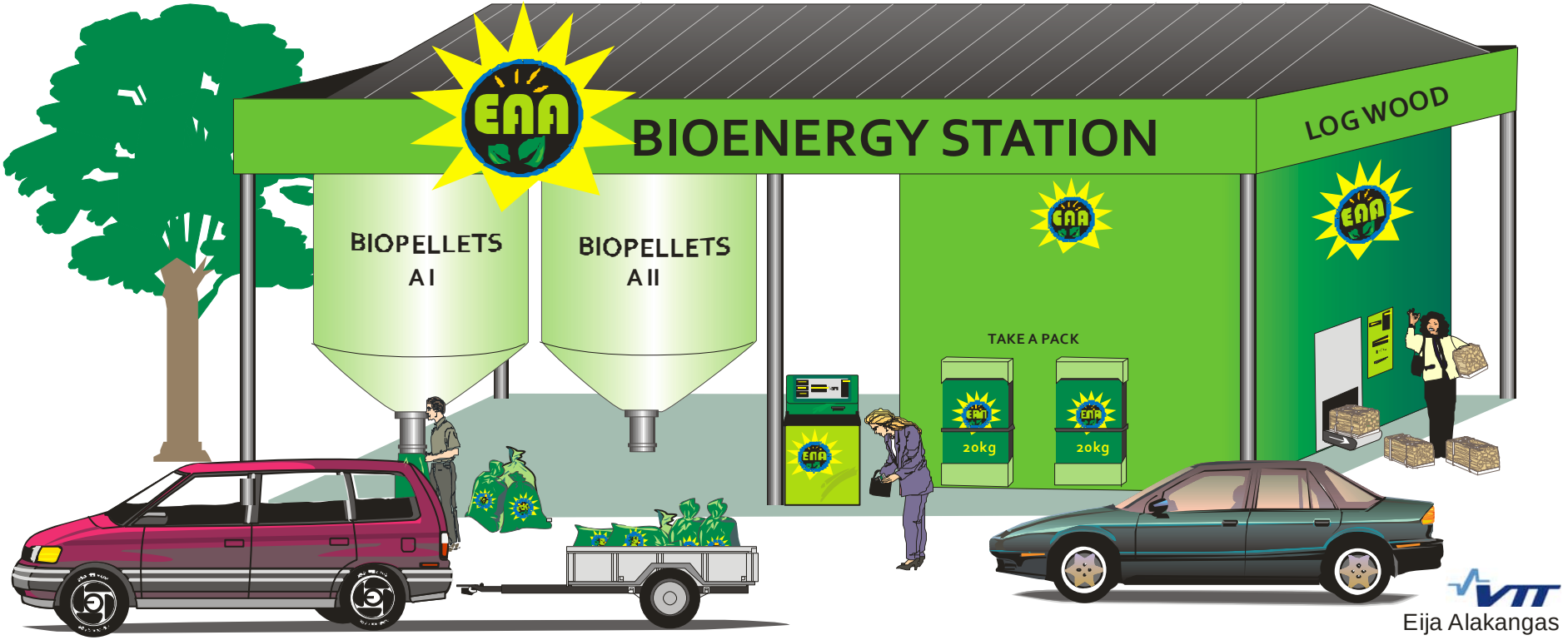
- Data of solid biofuels now available
- Data analysed by CEN methods
- Calculation tools
- Bio ashes end of 2009
- Liquid biofuels in 2010



More information



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