Physical Analysis of Woodchip

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Objective

- To describe wood chip assortments to CEN/TS 14961 Solid biofuels – Fuel specifications and classes

Parameters of Physical Analysis

- Moisture Content
- Bulk Density
- Net Calorific Value
- Energy Density
- Particle Size Classification

Bulk Density

- CEN Standard – CEN/TS 15103: Methods for the determination of bulk density
- Sampled with moisture content
- Bulk Density (as received) includes moisture content
- Bulk Density (dry matter) excludes moisture content

- Conversion of bulk density (as received) to bulk density (dry weight) as follows:

BD (wd) = BD (ar) * [(100 – MC)/100]

Bulk Density by Assortment & Site

Assortment	Condition	Bulk Density (ar)	Mean MC	Bulk Density (wd)
		kg/m^3	%	kg/m^3
Energywood	Covered	310	52.5	145
Energywood	Uncovered	341	57.8	143
Roundwood	Covered	274	47.9	141
Roundwood	Uncovered	296	53.0	138
Wholetree	2007	269	47.4	140
Wholetree	2006	235	39.0	140

Site	Bulk Density (ar)	Mean MC	Bulk Density (wd)
	kg/m^3	%	kg/m^3
Abbeyfeale	279	51.3	135
Ballybofey	296	54.1	134
Bweeng	280	47	147
Kilbrin	201	32.3	135
Swan	269	45.6	145
Woodberry	305	49.5	150

Energy Content

- Energy content is the basis for wood fuel trade
- No specification – acceptable range should be stated in contract

Recommended methods:

1. Net Calorific Value (Giga joules per tonne)
2. Energy Density (kilowatt hours per cubic metre loose volume)

NCV & Energy Density by Assortment & Site

Assortment	Condition	Mean MC	NCV	Bulk Density (ar)	Energy Density
		%	GJ/t	kg/m^3	kWh/m^3 lv
Energywood	Covered	52.5	7.8	310	675
Energywood	Uncovered	57.8	6.7	341	634
Roundwood	Covered	47.9	8.8	274	672
Roundwood	Uncovered	53.0	7.7	296	636
Wholetree	2007	47.4	8.9	269	668
Wholetree	2006	39.0	10.8	235	702

Site	Mean MC	NCV	Bulk Density (ar)	Energy Density
	%	GJ/t	kg/m^3	kWh/m^3 lv
Abbeyfeale	51.3	8.1	279	628
Ballybofey	54.1	7.5	296	616
Bweeng	47.0	9.0	280	702
Kilbrin	32.3	12.2	201	682
Swan	45.6	9.3	269	697
Woodberry	49.5	8.5	305	719

Particle Size Classification

- Using methodologies described in:

  IS EN 15149-1 Oscillating Screen Method for particles greater than 3.15mm

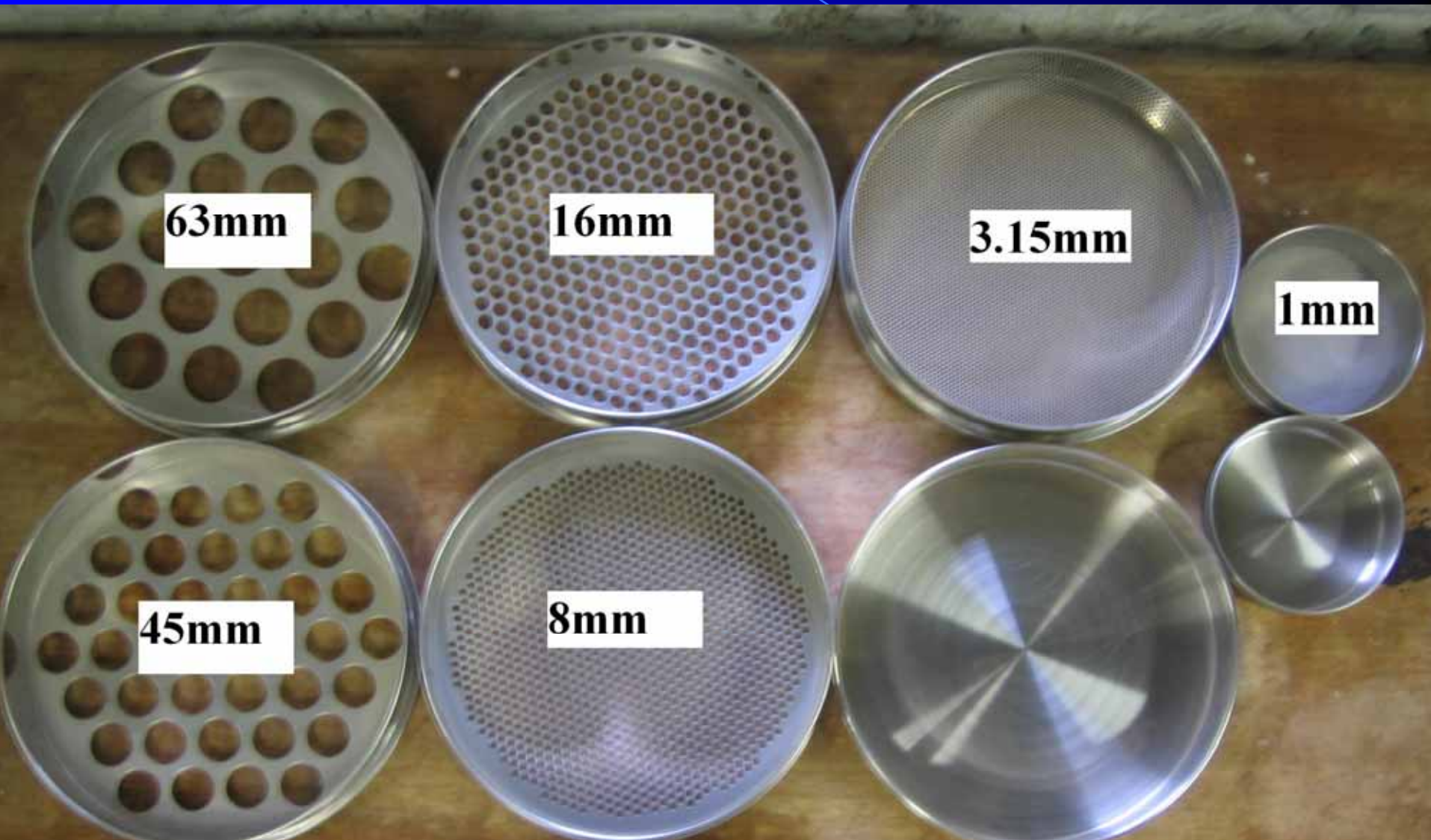
  and

  IS EN 15149-2 Vibrating Screen Method for particles less than 3.15mm

Particle Size Classes

	Main Fraction > 80% of weight	Fine fraction < 5%	Coarse fraction Max. length of particle
P 16	3.15 mm ≤ P ≤ 16 mm	< 1mm	Max 1% > 45mm, < *All 85 mm*
P 45	3.15 mm ≤ P ≤ 45 mm	< 1mm	Max 1% > 63 mm
P 63	3.15 mm ≤ P ≤ 63 mm	< 1mm	Max 1% > 100mm
P 100	3.15 mm ≤ P ≤ 100mm	< 1mm	Max 1% > 200mm

Sieve Screens



FE2007 Chippers & Woodchip

Silvatec
Wholetree

MusMax
Roundwood

TP Greenline
Wholetree

Standard P16 Woodchip

Standard P45 Woodchip

Wholetree chip produced by TP Greenline

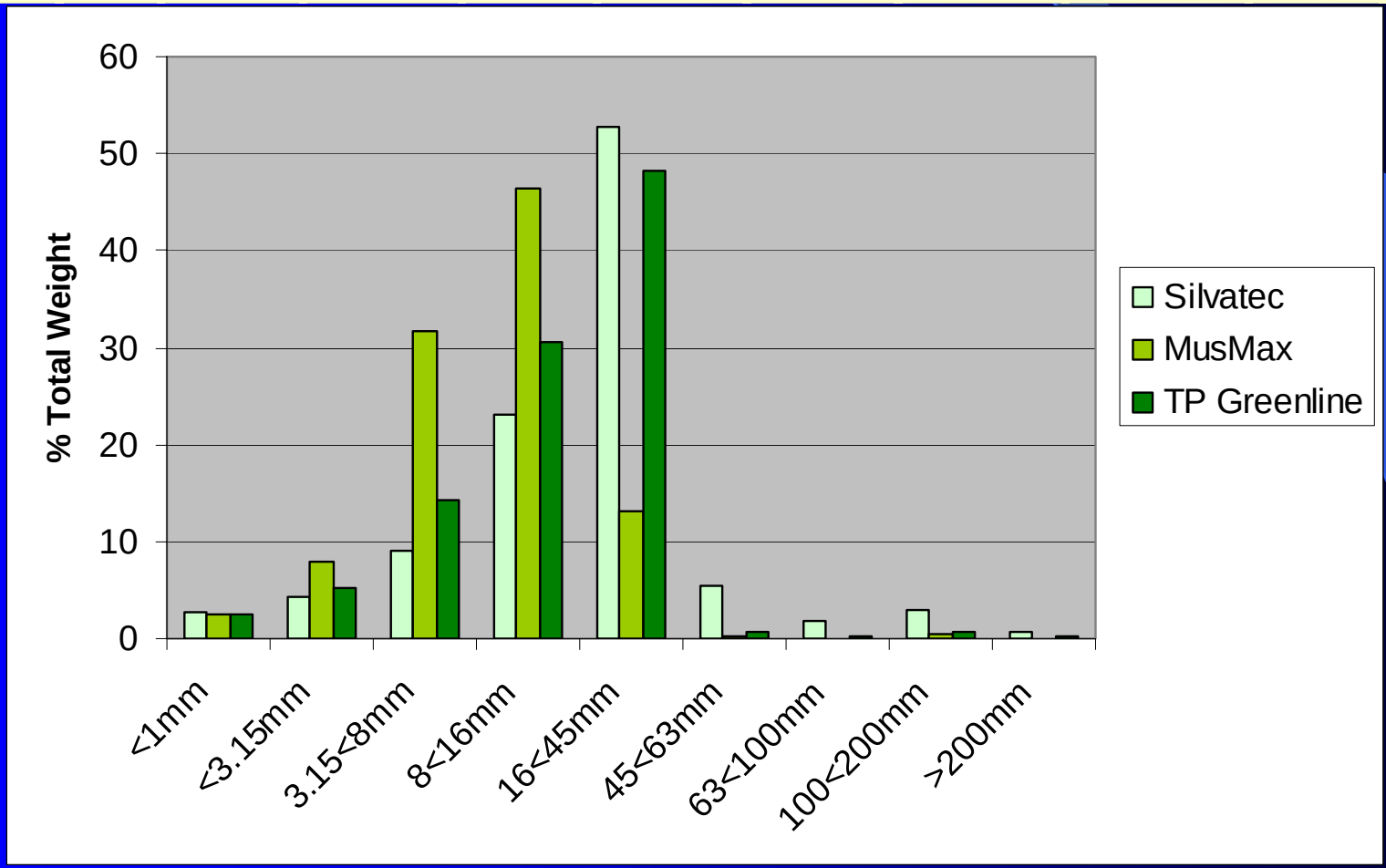
Wholetree chip produced by Silvatec

Roundwood chip produced by MusMax

Energywood chip produced by MusMax

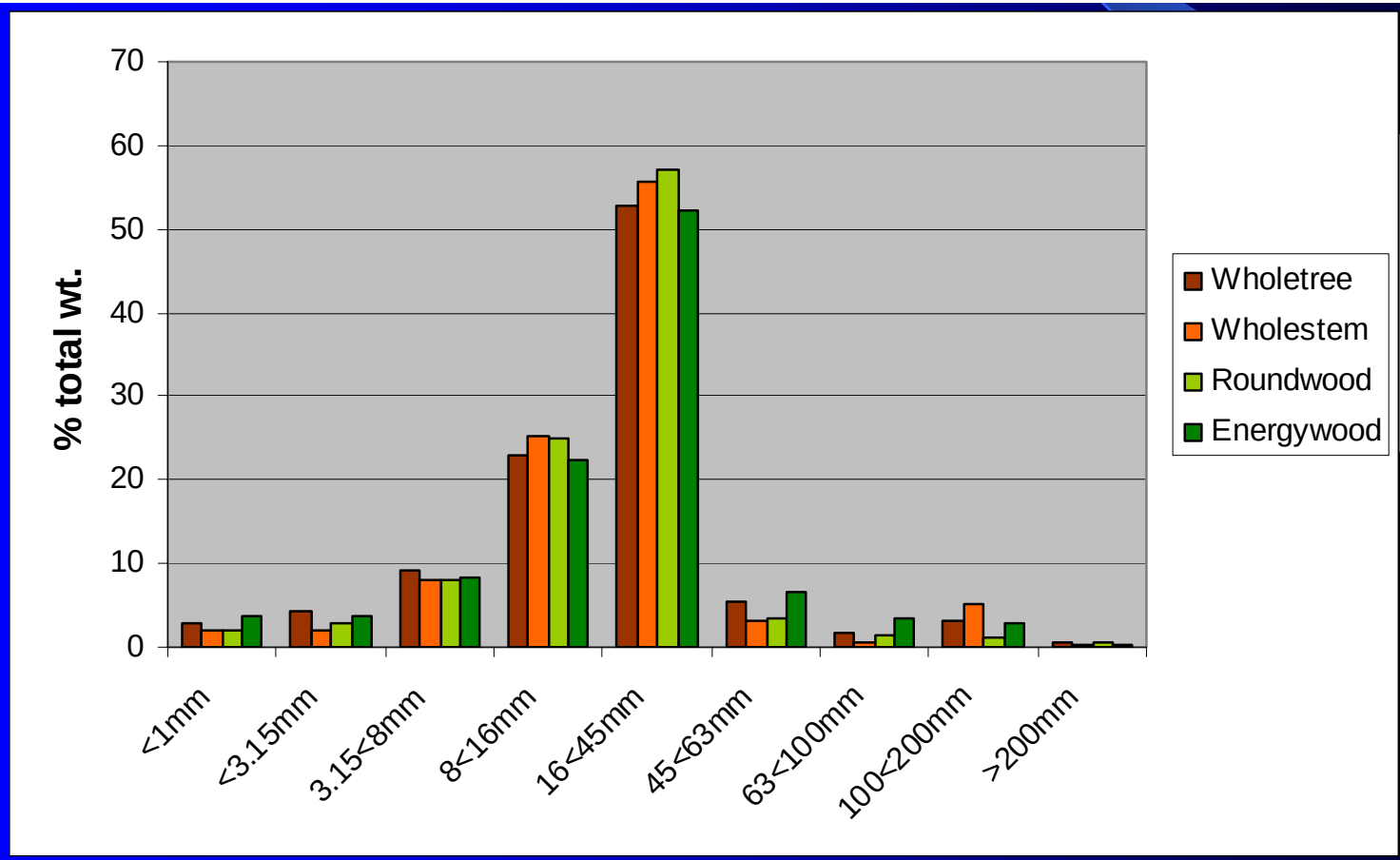
Mean Particle Size Classification by Chipper

Chipper	<1mm	<3.15mm	3.15<8mm	8<16mm	16<45mm	45<63mm	63<100mm	100<200mm	>200mm	Classification
Silvatec	2.8	4.3	9.1	23.1	52.7	5.4	1.7	3.0	0.6	**P100**
MusMax	2.5	7.9	31.6	46.4	13.2	0.3	0.1	0.5	0.0	**P45**
TP Greenline	2.5	5.3	14.2	30.6	48.2	0.8	0.1	0.6	0.1	**P45**



Particle Size Classification by Assortment (Silvatec Chipper)

Assortment	<1mm	<3.15mm	3.15<8mm	8<16mm	16<45mm	45<63mm	63<100mm	100<200mm	>200mm	Classification
Wholetree	2.9	5.1	9.7	22.2	50.8	6.2	1.7	3.6	0.7	P100
Wholestem	2.1	2.1	8.1	25.2	55.6	3.0	0.5	5.3	0.3	P100
Roundwood	2.1	2.9	8.1	25.0	57.2	3.5	1.3	1.2	0.7	P100
Energywood	3.8	3.8	8.2	22.4	52.3	6.6	3.6	2.8	0.3	P100



Summary Particle Size Classification

- CEN classification is not effective at accurately classifying woodchip
- 85mm cutoff for P16 is not described in methodology
- Limitations on oversize particles are too restrictive and not sufficiently described
- All woodchip produced was commercially acceptable
- Roundwood assortment produces fewer overlong particles than wholetree or energywood assortments