



Sources of different biomass resources

Biomass for use as a biofuel for heat comes in many forms and from many sources. As plant species each have different chemical composition they will each combust differently. Some species are high in oils and resins while others are high in sugars. Each have different fibre characteristics.

Boilers are designed for combustion of fuels with specific characteristics. If fuels don't have those design characteristics then the boiler will not operate efficiently.

To assist boiler owners and fuel suppliers to know the characteristics of the fuel required and offered international standards have been prepared. The ISO 17225 standard series is to provide unambiguous and clear classification principles for solid biofuels and to serve as a tool to enable efficient trading of biofuels and to enable good understanding between seller and buyer as well as a tool for communication with equipment manufacturers. It will also facilitate authority permission procedures and reporting.

Solid biomass covers organic, non-fossil material of biological origin which may be used as fuel for heat and electrical generation.

ISO 17225-1 determines the fuel quality classes and specifications for solid biofuels of raw and processed materials originating from:

- a. forestry and arboriculture;
- b. agriculture and horticulture;
- c. aquaculture.

Chemically treated material may not include halogenated organic compounds or heavy metals at levels higher than those in typical virgin material values (see Annex B) or higher than typical values of the country of origin.

NOTE Raw and processed material includes woody, herbaceous, fruit, aquatic biomass and biodegradable waste originating from above sectors.

1. Classification of origin and sources of solid biofuels

The classification set out in ISO17225-1 is based on the biofuel origin and source. In the hierarchical classification system (Table 1) the main origin-based solid biofuel groups are:

- a. woody biomass;
- b. herbaceous biomass;
- c. fruit biomass;
- d. aquatic biomass;
- e. blends and mixtures.

Woody biomass is biomass from trees, bushes and shrubs.

Herbaceous biomass is from plants that have a non-woody stem and which die back at the end of the growing season. It includes grains and their by-products such as cereals.

Fruit biomass is biomass from those parts of a plant which are from or hold seeds.

Aquatic biomass is from so called hydrophytic plants or hydrophytes, which are plants that have adapted to living in or on aquatic environments.

Blends are intentionally mixed biofuels, whereas mixtures are unintentionally mixed biofuels. The origin of the blend and mixture shall be described using Table 1. If a solid biofuel blend or mixture contains chemically treated material it shall be stated.

The second level of classification in Table 1 describes fuels from different sources within the main groups, primarily stating whether the biomass is a virgin material, a by-product or a residue from the industry.

Groups in Table 1 are further divided into third and fourth level sub-groups. The purpose of Table 1 is to allow the possibility to differentiate and specify biofuel material based on origin with as much detail as needed. With the help of typical values from informative Annex B information on physical and chemical properties can be deduced.

Examples for classification according to Table 1:

- a) Whole trees without roots from birch (1.1.1.1);
- b) Blend of broad-leaf and coniferous whole trees without roots (1.1.1.1, 1.1.1.2);
- c) Oil palm stem (1.1.3.3);
- d) Logging residues (1.1.4);
- e) Oil palm branches (1.1.4.1);
- f) Logging residues from spruce stands (1.1.4.2);
- g) Sawdust from broad-leaf (1.2.1.1);
- h) Plywood from coniferous (1.2.1.2);
- i) Plywood residues (1.2.2.1);
- j) Grinding dust from furniture industry (1.2.2.1);
- k) Lignin (1.2.2.4);
- l) Unpainted and untreated construction wood (1.3.1.1);
- m) Pallets (1.3.2.1);
- n) Straw from wheat, barley, oat, rye (2.1.1.2);
- o) Rice husk (2.1.1.4);
- p) Reed canary grass (2.1.2.1);
- q) Bamboo (2.1.2.5);
- r) Grains or seeds crops from food processing industry (2.2.1.1);
- s) Palm kernel or palm shell (3.1.2.3);
- t) Oil palm fruit bunch (3.2.1.2);
- u) Olive residues from olive pressing (3.2.2.4);
- v) Kelp (4.3.2.4);
- w) Blend; 80w-% sawdust from coniferous (1.2.1.2) and 20w-% reed canary grass (2.1.2.1);
- a) Mixture; whole trees without roots from birch (1.1.1.1), whole trees without roots from spruce (1.1.1.2);
- x) Blend; 99w-% sawdust (1.2.1), 1w-% glued wood (glue content of whole mass 0,1w-%) (1.2.2).
- y) Demolition wood (1.3.2.1)

Table 1 — Classification of origin and sources of solid biofuels

1. Woody biomass	1.1 Forest, plantation and other virgin wood	1.1.1 Whole trees without roots	1.1.1.1 Broad-leaf 1.1.1.2 Coniferous 1.1.1.3 Short rotation coppice 1.1.1.4 Bushes 1.1.1.5 Blends and mixtures
		1.1.2 Whole trees with roots	1.1.2.1 Broad-leaf 1.1.2.2 Coniferous 1.1.2.3 Short rotation coppice 1.1.2.4 Bushes 1.1.2.5 Blends and mixtures
		1.1.3 Stemwood	1.1.3.1 Broad-leaf with bark 1.1.3.2 Coniferous with bark 1.1.3.3 Broad-leaf without bark 1.1.3.4 Coniferous without bark 1.1.3.5 Blends and mixtures
		1.1.4 Logging residues	1.1.4.1 Fresh/Green, Broad-leaf (including leaves) 1.1.4.2 Fresh/Green, Coniferous (including needles) 1.1.4.3 Stored, Broad-leaf 1.1.4.4 Stored, Coniferous 1.1.4.5 Blends and mixtures
		1.1.5 Stumps/roots	1.1.5.1 Broad-leaf 1.1.5.2 Coniferous 1.1.5.3 Short rotation coppice 1.1.5.4 Bushes 1.1.5.5 Blends and mixtures
		1.1.6 Bark (from forestry operations)	
		1.1.7 Segregated wood from gardens, parks, roadside maintenance, vineyards, fruit orchards and driftwood from freshwater	
		1.1.8 Blends and mixtures	
	1.2 By-products and residues from wood processing industry	1.2.1 Chemically untreated wood by-products and residues	1.2.1.1 Broad-leaf with bark 1.2.1.2 Coniferous with bark 1.2.1.3 Broad-leaf without bark 1.2.1.4 Coniferous without bark 1.2.1.5 Bark (from industry operations)
		1.2.2 Chemically treated wood by-products, residues, fibres and wood constituents	1.2.2.1 Without bark 1.2.2.2 With bark 1.2.2.3 Bark (from industry operations) 1.2.2.4 Fibres and wood constituents
		1.2.3 Blends and mixtures	
	1.3 Used wood	1.3.1 Chemically untreated used wood	1.3.1.1 Without bark 1.3.1.2 With bark 1.3.1.3 Bark
		1.3.2 Chemically treated used wood	1.3.2.1 Without bark 1.3.2.2 With bark 1.3.2.3 Bark
		1.3.3 Blends and mixtures	
1.4 Blends and mixtures			

2. Herbaceous biomass	2.1 Herbaceous biomass from agriculture and horticulture	2.1.1 Cereal crops	2.1.1.1 Whole plant 2.1.1.2 Straw parts 2.1.1.3 Grains or seeds 2.1.1.4 Husks or shells 2.1.1.5 Blends and mixtures
		2.1.2 Grasses	2.1.2.1 Whole plant 2.1.2.2 Straw parts 2.1.2.3 Seeds 2.1.2.4 Shells 2.1.2.5 Bamboo 2.1.2.6 Blends and mixtures
		2.1.3 Oil seed crops	2.1.3.1 Whole plant 2.1.3.2 Stalks and leaves 2.1.3.3 Seeds 2.1.3.4 Husks or shells 2.1.3.5 Blends and mixtures
		2.1.4 Root crops	2.1.4.1 Whole plant 2.1.4.2 Stalks and leaves 2.1.4.3 Root 2.1.4.4 Blends and mixtures
		2.1.5 Legume crops	2.1.5.1 Whole plant 2.1.5.2 Stalks and leaves 2.1.5.3 Fruit 2.1.5.4 Pods 2.1.5.5 Blends and mixtures
		2.1.6 Flowers	2.1.6.1 Whole plant 2.1.6.2 Stalks and leaves 2.1.6.3 Seeds 2.1.6.4 Blends and mixtures
		2.1.7 Segregated herbaceous biomass from gardens, parks, roadside maintenance, vineyards and fruit orchards	
	2.1.8 Blends and mixtures		
	2.2 By-products and residues from food and herbaceous processing industry	2.2.1 Chemically untreated herbaceous residues	2.2.1.1 Cereal crops and grasses 2.2.1.2 Oil seed crops 2.2.1.3 Root crops 2.2.1.4 Legume crops 2.2.1.5 Flowers 2.2.1.6 Blends and mixtures
		2.2.2 Chemically treated herbaceous residues	2.2.2.1 Cereal crops and grasses 2.2.2.2 Oil seed crops 2.2.2.3 Root crops 2.2.2.4 Legume crops 2.2.2.5 Flowers 2.2.2.6 Blends and mixtures
2.2.3 Blends and mixtures			
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3. Fruit biomass	3.1 Orchard and horticulture fruit	3.1.1 Berries	3.1.1.1 Whole berries 3.1.1.2 Flesh 3.1.1.3 Seeds 3.1.1.4 Blends and mixtures
		3.1.2 Stone/kernel fruits	3.1.2.1 Whole fruit 3.1.2.2 Flesh 3.1.2.3 Stone/kernel/fruit fibre 3.1.2.4 Blends and mixtures
		3.1.3 Nuts and acorns	3.1.3.1 Whole nuts 3.1.3.2 Shells/husks 3.1.3.3 Kernels 3.1.3.4 Blends and mixtures

		3.1.4 Blends and mixtures		
	3.2 By-products and residues from food and fruit processing industry	3.2.1 Chemically untreated fruit residues	3.2.1.1 Berries	
			3.2.1.2 Stone/kernel fruits/fruit fibre	
		3.2.1.3 Nuts and acorns		
			3.2.1.4 Crude olive cake	
			3.2.1.5 Blends and mixtures	
		3.2.2 Chemically treated fruit residues	3.2.2.1 Berries	
			3.2.2.2 Stone/kernel fruits	
			3.2.2.3 Nuts and acorns	
			3.2.2.4 Exhausted olive cake	
			3.2.2.5 Blends and mixtures	
		3.2.3 Blends and mixtures		
	3.3 Blends and mixtures			
4. Aquatic biomass	4.1 Algae	4.1.1 Micro algae (latin name to be stated)		
		4.1.2 Macro algae (latin name to be stated)		
		4.1.3 Blends and mixtures		
	4.2 Water hyacinth			
	4.3 Lake and sea weed	4.3.1 Lake weed (latin name to be stated)		
		4.3.2 Sea weed	4.3.2.1 Blue sea weed (latin name to be stated)	
			4.3.2.2 Green sea weed (latin name to be stated)	
			4.3.2.3 Blue-green sea weed (latin name to be stated)	
	4.3.2.4 Brown sea weed (latin name to be stated)			
	4.3.2.5 Red sea weed (latin name to be stated)			
	4.3.3 Blends and mixtures			
	4.4 Reeds	4.4.1 Common reed		
		4.4.2 Other reed		
4.4.3 Blends and mixtures				
4.5 Blends and mixtures				
5 Blends and mixtures	5.1 Blends			
	5.2 Mixtures			

NOTE 1 If appropriate, also the actual species (e.g. spruce, wheat) of biomass may be stated according to EN 13556, *Round and sawn timber – Nomenclature of timbers used in Europe*.^[1]

2. Sources of woody biomass

Forest, plantation and other virgin wood

Forest, plantation and other virgin wood in this group may only have been subjected to size reduction, debarking, drying or wetting. Forest, plantation and other virgin wood includes wood from forests, parks, gardens, plantations and from short rotation forests and coppice.

By-products and residues from wood processing industry

Wood by-products and wood residues from industrial production are classified in this group. These biofuels can be chemically untreated (for example residues from debarking, sawing or size reduction, shaping, pressing) or chemically treated wood residues from wood processing and the production of panels and furniture (glued, painted, coated, lacquered or otherwise treated wood), as long as they do not contain heavy metals or halogenated organic compounds as a result of treatment with wood preservatives or coating.

Used wood

This group includes post consumer/post society wood waste; natural or merely mechanically processed wood, contaminated only to an insignificant extent during use by substances that are not normally found in wood in its natural state (for example pallets, transport cases, boxes, wood packages, cable reels, construction wood). With respect to treatment the same criteria apply as with respect to “wood processing industry by-products and residues”, i.e. the used wood shall not contain heavy metals more than in virgin wood, or halogenated organic compounds as a result of treatment with wood preservatives or coating.

Blends and mixtures

This refers to blends and mixtures of woody biomass in the groups 1.1 to 1.3 in Table 1. The mixing can be either intentional (blends) or unintentional (mixtures).

3. Sources of herbaceous biomass

Herbaceous biomass from agriculture and horticulture

Material, which comes directly from the field, perhaps after a storage period, and may only have been subject to size reduction and drying is included here. It covers herbaceous material from agricultural and horticultural fields and from gardens and parks.

By-products and residues from food and herbaceous processing industry

This refers to any herbaceous biomass material that is left over after industrial handling and treatment. Examples are residues from the production of sugar from sugar beets, barley malt residues from beer production and raw vegetable residues from food processing industry.

Blends and mixtures

This refers to blends and mixtures of herbaceous biomass in the groups 2.1 to 2.2 in Table 1. The mixing can be either intentional (blends) or unintentional (mixtures).

4. Sources of fruit biomass

Orchard and horticulture fruit

Fruit from trees, bushes and fruit from herbs (e.g. tomatoes and grapes) are classified in this group.

By-products and residues from food and fruit processing industry

This refers to a fruit biomass material that is left over after industrial handling and treatment. Examples are pressing residues from olive oil or apple juice production and processed (e.g. heated, steamed, cooked, etc.) vegetable residues from food processing industry.

Blends and mixtures

This refers to blends and mixtures of fruit biomass in the groups 3.1 to 3.2 in Table 1. The mixing can be either intentional (blends) or unintentional (mixtures).