00-10: Properties of wood chips…

Wood chips will consist mainly of mixtures of stem wood, bark and foliage in different proportions depending on tree species, origin and handling procedures. As pointed out in section 00-02 of this handbook, there are fundamental differences between these three main categories of biomass with respect to heating value, to ash content and to ash properties.

The heating value for stem softwood in northern Europe – mainly pine and spruce – is typically about 20 MJ/kg$_{DAF}$ (Dry, Ash-Free) substance while the heating value for hardwood trees is about 5 % lower, around 19 MJ/kg. In stem wood, the ash content is low, generally less than 1 % by weight and the ash also has a high melting point.

The bark of a tree is there to protect the stem. At the same time is the innermost part of the bark also responsible for part of the water transport – and the ash content may thus be high. So bark will typically have a high heating value and relatively high ash content, relative to the stem wood, that is. Typical values for the ash content in bark may be 1-3 % by weight while the heating values is the dry, ash-free substance are about 5 % higher than those for the stem wood.

The foliage has the highest ash content of the three major fractions – up to 5 or 6 % by weight – and will typically exhibit low ash melting points, sometimes as low as 800 ºC. Hence, the production and the handling chains for wood chips should preferably be such as to avoid mixing too much foliage into the chips.

The properties of wood chips, as delivered to the energy plant, are very much determined by the design of the supply chain. Therefore, only very general aspects can be outlined and the quality control at reception is crucial.

Chips from felling sites
In case the chips are produced including open-air drying in windrows and they are delivered only a short time after chipping, they will typically exhibit moisture contents about 30-50 %, rather a high fraction of bark and a significant fraction of foliage. The amounts of bark, foliage, soil and of other ash-rich components are to a great extent determined by the handling during harvesting and at the site and are a strong function of the skill of the operating personnel. Therefore, detailed instructions to the machine drivers are one important means to provide a high-quality fuel.

Chips from industrial residues
During sawing, approximately 50 % of the material entering the mill ends up in the form of saw-dust and chips. These residues tend to fall into two different categories, namely wet chips and residues produced during debarking and sawing and dry material produced during planing and final adjustment to the desired measures. Neither fraction will be contaminated by lacquer, paint or anything else. Hence, these residues may well qualify as uncontaminated wood chips. From carpentry will the residues be composed by clean and basically dry stem wood while, from saw-mills, the residues will be a mixture of bark and stem wood. In cases may the residues be upgraded to pellets or briquettes already at the industrial site but they may also be sold off as chips on the open market.

Chips from demolition wood
Demolition wood as well as formwork timber and alike from building sites may be contaminated not only with cement but also with paints and lacquers, disqualifying the material to be accepted as a fuel. However, the interior wood structure timber is usually not impregnated and represents a source of dry low-ash stem wood well suited for fuel. Due to the risk of cement chunks, nails and other constructional remnants, is demolition wood normally chipped by crushing rather than by cutting.

Wood chips storage
Outdoor storage of wet wood chips in piles involves the risks of auto-ignition outlined in the previous chapter. In practice, a pile of wood chips does not dry during storage while there will be an internal re-distribution of moisture from the central parts to the outer parts. Hence may the outer parts of the pile become extremely wet while, only 30-50 cm below the surface, moisture content is significantly lower. Nor will precipitation penetrate a wood chips pile any further than approximately 30-50 cm.

Wood chips feeding
One major problem arising in wood chips firing is bridging in the hoppers, causing stoppages in the fuel feed. This problem is avoided by deigning the hopper expanding downwards. Chips are easily transported also at relatively steep elevations using conveyor belts, at elevations exceeding about 40 º to horizontal using pocketed conveyor belts or screws.

Wood chips are the most abundant biofuel but at the same time the least well-defined. Hence, standardisation of wood chips (see the FOREST StandardGuide) is complicated and there are several standards already in effect or upcoming. The most relevant are EN 14961-4 for general classification and EN 15234-4 for the quality assurance.