FIBRE PILE MANAGEMENT FOR PELLET PLANTS

Best Practices for Safety, Efficiency and Quality

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The Biomass and Bioenergy Research Group (BBRG) is a world-class research group of engineers and scientists based at the University of British Columbia. This fact sheet provides the latest information based on the centre's research related to best practices on the safe handling and storage of pellets, part of a four-year research project involving WPAC and BioFuelNet Canada, and funded through the federal Canadian Agricultural Partnership.

The Wood Pellet Association of Canada (WPAC) and the British Columbia Forest Safety Council (BCFSC) have partnered to pursue a process known as Critical Control Management (CCM) that already is or will be underway at every WPAC member plant in 2021.

GENERAL INFORMATION

When fresh biomass is reduced in size by chipping or hogging and stored in large piles outdoors, a number of biological, physical and chemical processes take place that can lead to deterioration or safety risks. While all biomass is susceptible, the greatest biological activities take place with smaller particle sizes—so sawdust with high moisture content is more reactive because it has less surface areas than wood chips.

Respiration of plant cells and microbial growth lead to the generation of heat deep inside the pile. The heat can reach around 60°C as a result of limited air passage inside the pile and the low conductivity of woody biomass. If the pile is wider, there is slower heat transfer from inside to the outside.

At 80°C and higher, most of the biological activities cease and further heat development results from subsequent physical and chemical processes such as water transport and adsorption, hydrolysis, chemical oxidation and charring.

The risk of spontaneous ignition increases if the raw material or solid biofuel is initially moist, the stored volume is large and the ambient temperature is high.

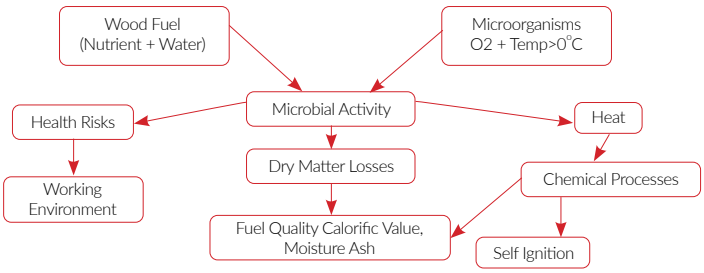

Figure 1. Processes involved in deterioration of feedstock during storage

Dry-matter loss (the degradation of lignin, cellulose and hemicellulose), deterioration of fuel quality (loss of BTUs); and heat accumulation may ultimately lead to spontaneous ignition. Moist wood chips and sawdust also lead to high concentrations of bacterial particles and fungal spores, creating an unacceptable working environment.

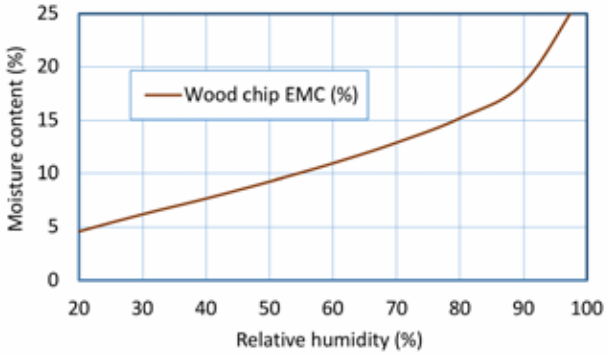

Figure 2. Relationship between the relative humidity of the air and moisture content of wood chips/sawdust and pellets.

This figure shows how the higher relative humidity of the air increases the moisture content of the wood chips/sawdust. For example, when the relative humidity is at 80%, the moisture content of biomass is expected to be 15%.

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FIBRE PILE SELF-HEATING

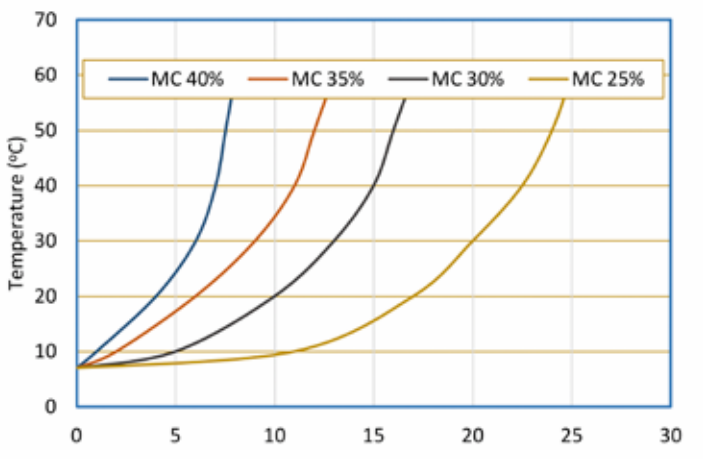
When fibre is stored in piles, self-heating and combustion can occur over time. The smouldering can continue for months, and can produce caverns that collapse when weight is put on the pile. These gaps are like a furnace and can reach extreme temperatures.

It is important to monitor fibre pile temperatures in several locations with temperature probes or an FLIR (infrared) camera. A sticky, irritating smell or steam rising from the pile in winter are also signs of self-heating.

Other ways to detect activity in the fuel bed are to measure the carbon monoxide concentration in the air above the fuel surface, or use multi-gas detectors and sensitive electronic nose type of detectors.

If you suspect a pile is self-heating, follow safe work procedures or ask your supervisor for advice. Never go on top of a pile if you suspect it is self-heating, and always have a trained fire brigade or local fire department expose and extinguish fibre pile smoulders or fires.

Figure 3. Biomass pile temperature versus number of days for safe storage



This figure shows how the moisture content of biomass can affect the storage stability of piles. For example, a biomass pile with a 35% moisture content can be stored safely for 13 days when the pile temperature is 30°C.

IGNITION SOURCES

Any of the following situations or circumstances can lead to a fire in the pile:

- hot points or fire pockets in fuel or raw material delivery
- receiving operations (screening, crushing) connected with spark forming impurities of fuel or raw material
- hot work in conjunction with inadequate cleaning and preparations
- equipment having a surface temperature above 100°C for continuous operation
- electric motor overload
- friction in handling and conveyor system
- temperature rise in gears and/or bearings

Table 1. Bulk density of various feedstocks that may enter or be produced in a wood pellet plant. Knowing the volume of a load of biomass, the weight of the load is estimated from multiplying volume by density. This is important when blending biomass to produce pellets with the desired composition.

IN-FEED FEEDSTOCK	BULK DENSITY (KG/M^3)
Wood chip	250
Bark	180
Sawdust	160
Shavings	90
Pellets	650

BEST PRACTICES FOR MANAGING FIBRE PILES

Fibre piles should be kept small—typical heights are six metres for sawdust; seven metres for bark; and 15 metres for chipped forest residue and clean wood chips without bark.

Raise piles in elongated stacks, with the base width twice the height of the stack. If the pile is wide, the heat stays in and this can cause problems. If it is narrow, the heat can escape.

Keep the material as dry as possible. If it is outside, it should be covered for protection.

Fibre piles should be located close to the road for easier access, but higher than the road surface so water does not flow into them.

Place fibre piles on dry, level ground free of stumps and stones; preferably an asphalt or concrete surface.

Store the product for as short a time as possible – with the first in, first out.

Store fuels that are dry with less than 20% moisture content to avoid microbial growth.

Never mix fuels of different qualities when they are stored.

Avoid running heavy equipment on the material, which will compact it.

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