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Sortyard Fines – From Forest Waste to Resource?

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Strategic Importance

For many years, much of the woody waste generated in sortyard operations has been burnt or buried in landfills. Due to increasing concern with air quality, open burning is being phased out. Landfilling is becoming less attractive as disposal costs rise and concern mounts about toxic leachate from organic material.

Sortyard residues were separated using a trommel screen. Analysis of the chemical and physical characteristics of the finer fractions revealed that this material should be suitable as a soil amendment.

Much of the wood waste generated in sortyards can be reclaimed and used for cedar shakes, wood chips or hog fuel. The rock can be used for sortyard surfacing. Increasing the use of residue material (sortyard fines) that is 5 cm or less can also have environmental benefits such as less particulate emissions from poorly controlled burning and less leachate from landfills. However, dealing with the fines is a challenge because this material is often high in ash and moisture, and therefore not suitable as fuel or as feedstock for pulp or fiberboard production.

Developing value-added uses for sortyard fines could have direct economic benefits by reducing disposal costs and generating revenue. Products could include landscaping mulches and topsoil mixes, land rehabilitation uses in logging roads, landings, and landfills, or composting with agricultural wastes and sewage sludge. Some sortyard fines might be usable as sources of specialty chemicals or fuel.

Gaining a better understanding of the organic makeup of sortyard fines is an important step for creating new opportunities for its use. Therefore, the Forest Engineering Institute of Canada (FERIC) and the Pacific Forestry Centre undertook a two-year cooperative project with the support of the ENFOR Program (ENergy from the FORest). The study characterized sortyard residues, tested equipment for separating the organic and inorganic materials under operational conditions, and determined the cost and benefits of separating techniques.

A research trial was carried out during the summer of 1996 with Tolko Industries Limited at the sortyard of its Lavington Planer Division, east of Vernon, British Columbia. The residues were classified at the field sortyard by size and type, and later analyzed in the laboratory. The types were: clean, dirty and Deal Processor residue. Clean material was

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either accumulated during the winter when the logyard surface was frozen, or directly from the log infeed to the sawmill during the summer. Sorted residues had most of the chippable wood removed.

A mechanical system for separating sortyard residue was tested to determine the productivity and unit costs of stratifying the residue by size class, organic fractions, and mineral fractions. The main components of the separation system were a 9.14 m long by 2.4 m diameter Trommel Screen, a pneumatically activated de-stoner, connecting and stockpiling conveyors, two rubber-tired front-end loaders, and a 175-kW generator.

The Trommel Screen was effective in removing a considerable amount of the fines which were not suitable for use as fuel. Unfortunately, the Trommel Screen could not separate fines completely and this caused some clogging in other components of the system. Rescreening the fines to less than 22 mm resulted in 47% wood and bark, 3% rock and 50% carried-over fines.

Characteristics of Sortyard Fines

The physical and chemical characteristics of sortyard residue determine its suitability for other uses. The characteristics of the residues, in part, reflect the type of sortyard surface, the moisture content of the wood, the source of the residue, and the proximity to processing equipment such as the log infeed deck.

Physical Characteristics

The study confirmed that residue characteristics depend to a large extent on the sortyard surface type. Dry, compacted or frozen surfaces produced clearer residues than unpaved surfaces or those not frozen.

Patrick Forrester (FERIC Project Researcher) separated each category of sortyard residue into nine size classes ranging from greater than 100 cm to less than 3 mm, and weighed each fraction. The proportions of rock, wood, slab, bark, branch, and glass in the larger size classes are available in a FERIC report.

Chemical Characteristics

The fines from residue samples collected when the unpaved sortyard surface was frozen were lower in mineral content (cleaner) than those from the wet sortyard. The cleanest fines with the lowest ash and highest carbon content came directly from the infeed deck of the sawmill. The fines in the two smallest size fractions were high in mineral matter and not suitable for fuel.

Samples were analyzed for condensed tannins to determine whether using fines for site reclamation or in landscaping would have detrimental effects on nutrient cycling or cause leaching of toxic compounds to groundwater. (Condensed tannins are phenolic compounds that occur naturally in leaves, bark and roots.) It was found that the condensed tannin content was below 0.5%, which is comparable with natural forest litter and humus. The exception was the clean, unsorted samples (3-13 mm) taken from the infeed apron at the log infeed deck. In that sample, tannin content was higher (1.6%) because of higher bark content. However, this level is still lower than that in leaves and needles on many forest floors.

Laboratory Analysis of Sortyard Fines

An analytical technique called Nuclear Magnetic Resonance spectroscopy with cross-polarization and magic-angle spinning (^{13}C CPMAS NMR) was used to get a better understanding of the organic mater. This technique provides a fingerprint of the carbon structures in the sortyard fines. It is the best available technique for dirty, complex and insoluble materials.

NMR equipment at the Pacific Forestry Centre

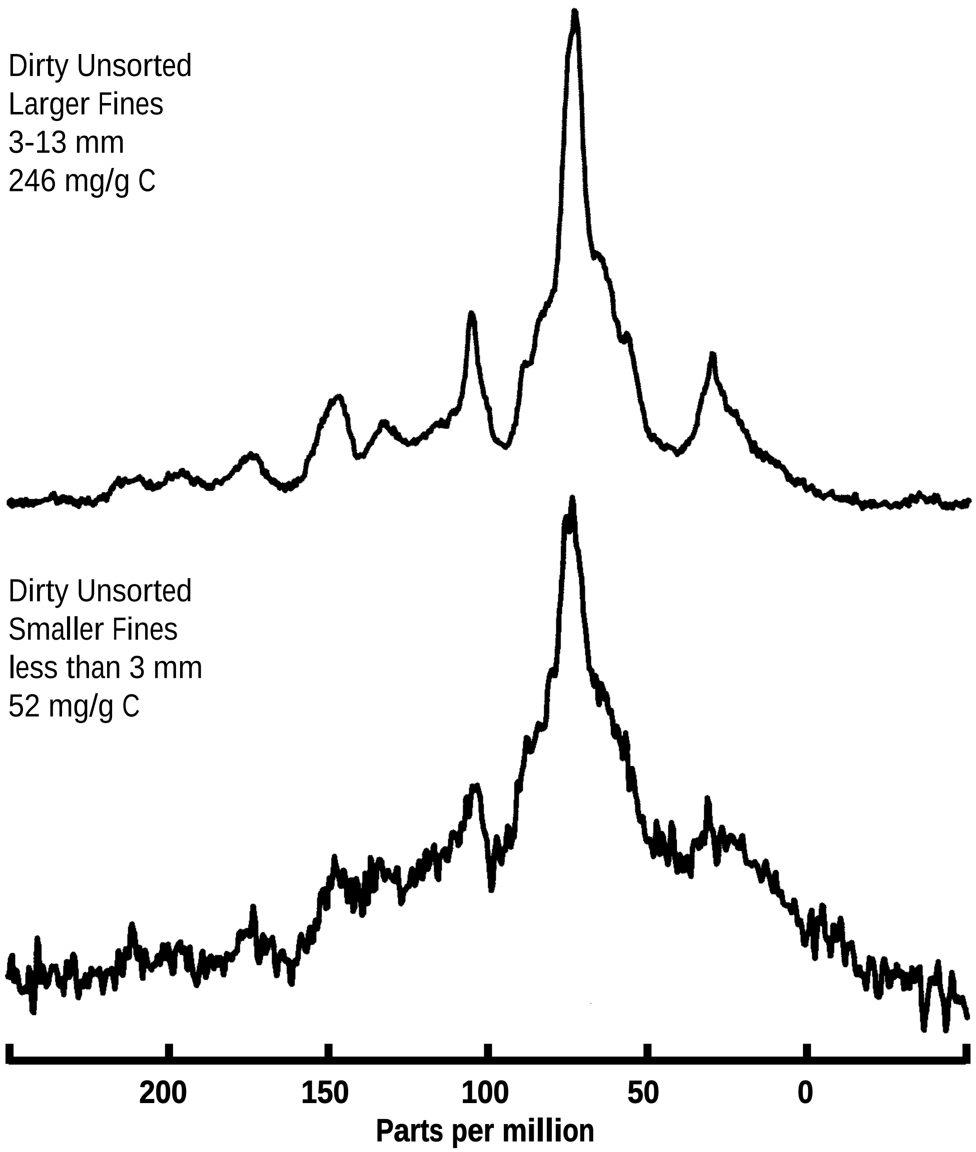

Figure 1. NMR spectrometer shows the characteristics of sortyard wastes.

The NMR spectra (figure 1) reveal that the organic composition of the larger fines (3-13 mm) are similar to wood but show some effects of decomposition, and are mixed with small amounts of bark and mineral particles. Consequently, given the absence of other contaminants such as motor oil, the properties of these larger fine fractions are quite similar to the properties of the fines from forest floors. While this material may not be suitable for burning or chemical feedstock due to its high ash content, it should be usable as a soil or compost amendment.

The NMR spectra show that the smaller fine fractions (less than 3 mm) are starting to lose the distinctive features of wood, and becoming similar to organo-mineral fractions typically found in a wide variety of soils. Again, this material should be suitable as a soil amendment or for rehabilitating roads. Results are similar for samples collected from coastal and interior British Columbia sites and for both softwood and hardwood sources. These results are also consistent with composting and decomposition data from forest ecosystems.

Using Sortyard Fines as Soil Amendments: Possible Environmental Effects

In considering these materials as soil amendments, one would expect a negative effect if large amounts were dumped into or near a stream due to high BOD (biological oxygen demand), suspended fines, and components with direct toxicity. However, effects need to be evaluated for application under operational conditions for soil amendments, and in comparison to the organic inputs that occur naturally in forest ecosystems. In the forest, the large natural inputs of foliage, wood and bark are slowly decomposed by fungi, bacteria and insects, thereby ensuring a renewal of the forest floor. The carbon components that leach out are both decomposed and adsorbed by mineral soil. These are essential processes for building soil organic matter.

If fine woody residues are applied in amounts to give a 10-30 cm depth, (either left on the surface or incorporated), their high C/N ratio should lead to slow decomposition and may cause temporary reduction of available N. This is similar to the effects caused by other high C/N residues such as straw, and can help reduce leaching loss of N on regenerated sites and build organic matter in degraded sites. Woody wastes are also a good match for high-nutrient and odorous wastes such as sewage sludge and fish wastes, either co-composted or applied together.

The results of this study show that the effects of fragmentation, leaching, microbial activity and mixing with mineral soil on sortyard fines are similar to those that occur naturally in soil and forest floor. Returning the material to the forest ecosystem as a soil amendment or road cover are options compatible with its origin and chemical properties.

Additional Reading

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