

December 12, 2001

## **WOOD RESIDUE USES - Brief**

### **Animal Bedding & Litter**

Animal bedding and litter are used for animals confined to stalls, pens or cages. It should provide a cushion from the ground in stalls and pens and material for nesting or burrowing for caged animals. It must also be absorbent to help the collection and removal of feces and urates. The best wood waste material for the bedding and litter is a mixture of sawdust, planar shavings, chips and shredded wood. Wood waste used for bedding and litter should have a moisture content of 15 percent or less and should not contain non-wood materials or chemical contaminants.

### **Boiler Fuel**

Wood waste may be processed and used as fuel in residential, institutional, municipal, commercial, industrial, or utility boilers or furnaces for the production of thermal and/or electrical energy. Wood can be used alone or it can be co-fired with coal or oil. Combustion equipment is designed specifically to burn wood or is retrofitted from existing equipment to burn wood or to co-fire wood with other fuels. Combustion equipment ranges in size from very small residential or commercial energy systems to large utility-scale power plants that generate 50 to 100 megawatts (MW) of electricity.

The types of wood waste burned for fuel include: bark, sander dust, sawdust, chips, chunks, logs, and wood fuel that is processed through a hogging machine (hog fuel). It can be burned in a range of particle sizes from one-sixty-fourth of an inch in diameter to 6-inches or more in diameter. The particle size is dependent upon how the fuel is fed and the type of combustion equipment used.

Moisture content affects the energy content of wood when burned and the amount of wood fuel required to achieve desired heat or steam outputs. Harvested wood or wood from landscaping has a moisture content between 35 and 50 percent and an energy content of approximately 5,500 BTUs (British thermal units) per pound. Kiln-dried wood residue has a moisture content of 5 to 10 percent and an energy content of approximately 7,500 BTUs per pound. Wood separated from a process waste stream and used for cogeneration is typically air dried to a moisture content of 15 to 20 percent and has an energy content of approximately 6,000 to 6,500 BTUs per pound.

The use of wood as fuel has several air emission benefits compared to fossil fuels. Due to the low sulfur content of wood, significantly less sulfur dioxide, reduced sulfur compounds, and reduced sulfuric acid are emitted to the air in comparison to fossil fuel combustion emissions. Carbon dioxide and nitrogen oxide emissions will also be reduced.

## **Chunkrete**

Chunkrete is a generic term to describe concrete produced using wood residue and/or flyash as the total or partial aggregate. Using wood as the aggregate in concrete reduces its density and increases its insulating and sound absorption properties. Using a low-strength aggregate such as wood decreases the compressive strength of the concrete. However, there are many uses for lightweight, low-strength concrete products such as decking, concrete fill, and road barriers. Wood waste, from fines to long slivers to uniformly sized chips (6, 10, 12 and 20 millimeters), can be used as the chunkrete aggregate.

## **Compost Amendment**

The compost process requires that an "amendment" be added to provide a source of carbon, add porosity to the compost mixture, and increase the solids content of the mixture. Sawdust and wood chips with a low moisture content are excellent wood waste sources as amendments because they aid in achieving the desired moisture and solids content of the compost mixture. A compost mixture should also have a good balance of carbon and nitrogen. Wood waste as the primary biomass material combined with biosolids (i.e. sewage sludge, food scraps), in a 1 to 4 ratio, attains that balance and produces a marketable product that may be used as a soil conditioner or source of organic matter.

## **Erosion Control**

Erosion control refers to the placement of materials to prevent or inhibit the action of wind, precipitation, or water from displacing soil, topsoil, sand, and other groundcover materials. Wood waste, such as chips, slivers, blocks, and slabs are used for erosion control that is limited to applications where degradability is desirable, such as in establishing turf or vegetation, or temporary low-flow drainage swales. Gravel and crushed rock are better suited for erosion control along banks, roads and shorelines because they are denser, less buoyant and do not decompose like wood.

## **Ethanol**

Ethanol is a biofuel produced by or derived from biomass materials. It is a liquid fuel produced by extracting and converting starches and carbohydrates such as cellulose and hemicellulose from wood into sugars and fermenting the sugars to produce ethanol. Ethanol is concentrated prior to its use as a fuel. Wood waste must be in very small particles such as flour, sander dust, and fines in order to facilitate extraction of the cellulose and hemicellulose.

## **Firestarter Fire Logs/ Birch Log Fireplace Logs/ Quick Start Blocks/ Tiki-Lamps**

The Fire Log Company manufactures Firestarter Fire Logs (Fire Logs), Birch Log fireplace logs (Birch Logs), Quick Start blocks and Tiki-Lamps. A continuous extrusion process produces all the products from kiln-dried sawdust and wood shavings with recycled wax products as a binder. The extrusion machine has changeable heads for varying the diameter of the Fire Logs and Birch Logs. Fire logs are used to start green or wet woods and the Birch Log is a two-hour burning fireplace log. The Quick Start blocks and Tiki-Lamps are pressed and cut to size. Quick Start blocks are used to start drier woods. Tiki-Lamps are a patio decoration that burn in colored flames designed to deter insects.

## **Hardboard/ Fiberboard**

Hardboard and fiberboard are wood composites produced by separating wood fibers from lignin in wood chips, and hot pressing the mixture of fibers with adhesive resins into panels. Phenolic formaldehyde is the resin used in hardboard and urea formaldehyde is the resin used in fiberboard. Resin is an ingredient of coatings, which acts as a binder and gives the coating physical properties such as hardness and durability. Wood fibers have a relatively large length-to-cross-section ratio, so much of the strength of hardboard and fiberboard is derived from the fiber. As such, they can be made for greater strength applications than particleboard. Both were originally developed to utilize waste wood fiber generated by the paper industry and now wood recycled from pallets is also used.

## **Landfill Cover**

Sanitary landfills utilize a system of cells to dispose of solid waste. A cell is an area of a landfill in which solid waste is compacted and then covered, resulting in long-term disposal of the waste. Cover material is needed to minimize the infiltration of water into the compacted waste, prevent waste from blowing away, minimize odors, and control vectors. Large wood waste particles, such as chips or slivers are preferred for landfill cover. A mixture of various sizes of wood particles may also be used because the various sizes in the mixture can be easily compacted.

## **Landscape Mulch**

Landscape mulch is used as a ground cover material to control weeds, prevent moisture loss in the soil, and for aesthetic purposes. The best wood waste fibers for making mulch comes from pallets, wood chips, and wood that comes from cabinets, doors, furniture, trusses, mobile home builders and sawmills. These ideal fibers, however, do not yield the most aesthetically pleasing color for mulch. Pigment can be added to the shredded wood to create a variety of colored mulches. Popular colors include brown, black, and red as well as blue, green and yellow. Colored mulch decomposes more slowly than conventional wood chips, does not change soil pH, and is environmentally safe.

## **Methanol/ Syngas**

Syngas (synthesis gas) is a fuel that can be produced or derived from biomass materials. Syngas is produced from the gasification of wood and may be used as fuel for gas turbine engines or as fuel in boilers. It may also be used to produce gasoline, diesel fuel, and gasoline additives. The gasification process relies on the pyrolysis of wood or wood waste to generate syngas. Wood waste with lower moisture contents are preferred because less energy is required to evaporate the moisture prior to pyrolysis. However, high moisture content wood may also be gasified.

Methanol is a liquid fuel produced from syngas. The clean syngas is exposed to a "shift reaction" that adjusts the carbon/hydrogen ratio, is reacted through a methanol synthesis catalysis to produce crude methanol, and is further refined before used as a fuel.

## **Oriented Strandboard/ Waferboard**

Waferboard and oriented strandboard are manufactured by slicing flakes or wafers of wood from solid wood pieces. Waferboard is a mat-formed structural panel board made of wood wafers, randomly arranged and bonded together with a waterproof and boil proof binder. Oriented strandboard is made from strands with the face wafers oriented in the long direction of the panel to provide additional strength in that direction. Both are commonly used for sheathing products for roofs and walls. Wood waste should be clean and large enough to cut wafers 30 millimeters in length along the grain direction and about one millimeter in thickness.

## **Packaging Filler**

Packaging filler is used to protect items during shipping or transportation. Wood waste that can be used as filler includes sawdust and shavings

## **Particle Board**

Particleboard used in furniture cores and shelving is derived from industrial planar shavings or waste wood chips. The planar shavings and wood chips are hammermilled into small particles, coated with a phenolic resin adhesive, and pressed under heat and pressure to make flat panels or molded shapes. Particleboard is typically covered with veneers or overlays to enhance its appearance. Because the wood particles have little or no fiber length, much of the strength of particleboard comes from the adhesive.

## **Pet Litter**

Pet litter is a commercially available product used only to collect and remove feces and urates for domestic pets and typically contains an odor-masking agent. Wood waste used for pet litter is in the form of pellets or shavings with a moisture content of ten percent or less.

## **Playground/ Handicapped Access Groundcover**

Groundcover is used on playgrounds or other areas that are accessible to the handicapped, including those in wheelchairs. Wood chips is one of the materials that meet the requirements of the Americans with Disabilities Act and other impact safety laws.

## **Potting Soil**

Potting soil is a nutrient enriched soil for optimum plant nutrition that is conditioned for best root growth and superior water retention. It will provide good water holding capacity while also providing appropriate drainage. Potting soil can be made from a mixture of 60 percent wood waste product and 40 percent sand. The wood waste supplies the necessary organic matter for soil moisture and the sand provides proper drainage.

## **Pulp & Paper**

The pulp and paper industry uses wood to produce pulp and ultimately paper and paper products. Pulp may be produced from softwoods or hardwoods. The wood is traditionally supplied as roundwood or chips from harvested wood or mill residue. Typically, only forest wood waste is used to produce pulp and paper because of the concern for the quality of produced paper.

## **Road Stabilization**

Adding aggregate or an aggregate-like material may stabilize soft or muddy driving surfaces. Aggregate or aggregate-like material such as wood chips provide strength and cohesion to the driving surface, and promote the drainage of water away from the driving surface. This results in a driving surface that better supports the weight of vehicles. Wood waste used for road stabilization should be in the form of chips or slivers with a minimum of one-quarter-inch or smaller fines. Wood chips are used to stabilize dirt roads, industrial parking lots, equipment yards, utility or railroad maintenance roads, landfill access roads, and other non-paved driving surfaces.

## **Soil Amendment**

In clay or sandy soils, a soil amendment of composted wood waste may be added. For every five parts of soil, one part amendment is needed. The addition of a soil amendment of this wood waste compost is for increasing porosity to allow plant roots to more easily penetrate the soils and for drainage of surface water between particles. For quickening the wood compost process, either a nitrogen source of biosolids or grass clippings (high in nitrogen) may be added to the wood waste.

## **Topsoil**

The term topsoil refers to fertile soil with relatively high levels of nutrients, organic matter, and minerals. Topsoil aids the growth of lawns, turf, greens, gardens, trees, shrubs, and other vegetation. Wood waste may be used to provide organic matter to topsoil. The organic matter increases the water holding capacity, cation exchange capacity, resistance to compaction, and microbial activity of the soil. The wood waste is ground into small fines that are tilled into the soil. The tilled mixture should consist of one-third wood fines. The fines decompose and the topsoil absorbs the nutrients.

## **Wood Pellets**

Wood pellets are made from small particles of wood waste from either flour or sander dust, sawdust, chips, "hog fuel", chunks, and logs that are dried, compressed, and extruded into pellets. A binder material such as polyethylene may be added to help the extrusion process, increase the energy value, and protect the pellets from breaking and absorbing moisture. A high quality, low dust wood pellet does not require a binder material. The moisture content of wood pellets is typically ten percent or less. Pellets may be used as fuel in residential, institutional, municipal, commercial, industrial, or utility boilers or furnaces for the production of thermal and/or electrical energy. Markets are also increasing for pellets used as absorbents such as pet litter.

## **Wood-Plastic Composites**

Wood-plastic composites are combinations of plastics with wood fiber. Recycled wood is used as a reinforcing filler in thermoset plastics and thermoplastics. This wood-plastic composite takes advantage of the strength of wood fiber and the heat and water resistive properties of the plastic. It may be produced by either extrusion or mat-forming technologies. Wood-plastic composites may be used for a wide variety of applications. For example, dimensional lumber with increased weather and rot resistance for use in decks or playground equipment and complex molding for the automotive industry. Dry wood waste particles or fibers are usually best suited for use in wood-plastic composites.