This document is part of a series of case studies from Oregon State University, Wood Science and Engineering, describing different technologies for converting forest-derived woody biomass into boiler fuel or higher-value products, and the characteristics of the processed material. The work is sponsored by a USDA Wood Utilization Research grant.

WOODY BIOMASS

BLITZ GRINDER

Processing logging slash generated from partial thinning.

Sample Date: Summer 2010

Partially thinned stand to increase individual tree vigor and reduce hazard fuel loads

Diamond Z-4000 processing logging slash

Physical Characteristics

Fraction	% Dry Solids	% Green Wt	Bulk Density (lb/ft^3) dry
Overs	68	9.5	-
Mids	68	68.8	7.5
Fines	67	21.7	13.0
Aggregate	68	-	9.2

Site Description

This particular Central Oregon site investigation took place in the Deschutes National Forest on a prescribed harvest stand of 65 acres. The stand was treated to reduce tree density in order to increase individual tree vigor. Treatment consisted of removing any Lodgepole pine within 15 feet of a larger, healthy, Lodgepole pine.

Logging operations occurred during the early Spring, consisting of mechanized felling and ground skidding to the landing. A processor piled branches, tops, and un-merchantable logs. Harvested biomass was sold as boiler fuel to two different mills.

Recovery Operation

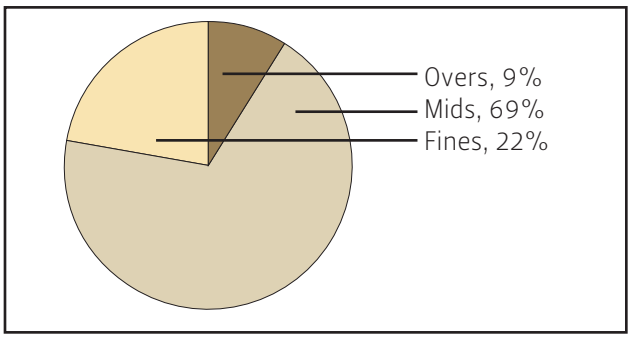
Recovered material included tops, limbs and non-merchantable timber. Biomass was coated with a visible dust layer generated from outgoing trucks and other vehicles. In the weeks leading up to recovery activities the weather was hot and dry. A 780 horsepower Diamond Z-4000 horizontal grinder equipped with four inch screens processed the biomass, while loading material into awaiting chip vans. A Hyundai 210 excavator with rotating brush grapple was used to feed the grinder. Combined fuel consumption between the grinder and excavator averaged 260 gallons per day or about 37 gallons per hour of grinding time.

Processed material was directly loaded into 20 unit chip vans, averaging 37 minutes per truck. Numerous slash piles were generated from logging and spaced approximately 700 feet apart. Production from each pile was five to six, 20 unit truckloads of material. Transitioning between piles took 30 minutes with empty awaiting trucks standing-by. In a typical 13 hour workday, total grinding time was around 7 hours, generating 13 truckloads of ground biomass.

Physical Characteristics

Processed woody biomass physical characteristics of interest where size distribution, percent dry solids, and bulk density. Reported values for this study are the average of tests conducted on 20 gallon samples taken from three different trucks. Gross size distribution was determined by screening material on an oscillating screener with 2" and 3/8" round hole screen decks. Material retained on the 2" screen was considered Overs, material retained on the 3/8" screen was considered Mids, and anything that passed through the 3/8" screen was considered Fines.

Gross Size Distribution



Processed material

Smaller portions of each gross size fraction were further measured by hand and standard sieves to determine detailed size distribution.

Material Size Distribution

Material Size	% of wet weight
>6"	5.6
-6 + 3"	21.9
-3" + 3/8"	50.5
-3/8" + 1/16"	14.7
-1/16"	7.3

Fuel Value Characteristics

Reported heat value and ash content are the averages of three samples taken from three different trucks.

Fuel Value Characteristics

Fraction	% Ash	HHV Btu/ dry lb.	LHV Btu/ green lb.
Aggregate	4.7	8520	5720
Overs	1.8	8600	5860
Mids	1.4	8600	5690
Fines	14.8	8240	4830

HHV, Higher Heating Value is measured on oven dry samples. LHV, Lower Heating Value is net recoverable heat at original moisture content.

Sample	% dry solids measured by customer	% dry solids measured by OSU
1	75	69
2	66	68
3	88	66

Moisture content data for the three different trucks that were sampled in this study was provided by each of the mills receiving material from this site.

Visible dust contamination in material

As the picture shows, piles were heavily contamnated with dust. Analyzing the percent ash content of these samples shows that non-combustible debris settles to the Fines fraction. Assuming that the visible dust on the piles came from road traffic, non-combustible material content could have been decreased by re-routing traffic flow away from the individual piles. As pile size dwindled and brush grapple use was no longer feasible, the remaining debris were loaded into the grinder with a front end loader. Through this process, excess amounts of visible dirt were put through the grinder, ultimately ending up in the finished product. To decrease contamination, spreading the remaining material around the site for natural decomposition would likely eliminate unnecessary debris ending up in the merchantable material.

Loader reclaiming small amount of slash that is left after bulk of slash pile is processed

The data shows, a simple measurement such as moisture content is highly variable within each individual sample. A suggestion to consumers would be to collect data from each sample that comes from a particular site and use the average of these moisture content determinations to develop a more accurate number for each site.

Observation

1. Dust and other contaminates settle into the Fines fraction leaving cleaner material in the Mids and Overs fractions.
2. Biomass purchasers should consider a more representative method for determining sample moisture content.

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