SMALL TREE CHIPPING EXPERIMENTS

The chipping parameters have a great influence on the type of material entering the biomass conversion processes. The tree species, tree size and chip's lengths affects the chipper power consumption, the chip size distribution and the degree of cracks on the surface of chips. An experiment of chipping small logs of spruce, pine and birch with an electrically driven chipper was conducted at the Biofuel Technology Center of Umeå. The experiment evaluated the energy consumption and chip quality as a function of species and tree size when chips of 2 lengths (8 and 12 mm) were produced. The result of the experiment will provide knowledge about the characteristics of chips to be used in

THE RELEVANCE OF SMALL TREE CHIPPING PROCESSES

Small diameter trees from early thinnings are a great resource of biomass for refinery purposes in the Botnia-Atlantica region. The main tree species in the region are Scots pine, Norway spruce and birch. In many biomass conversion processes like combustion and fermentation the characteristics of the raw material entering the process are of great importance, e.g. the size distribution of the chips. Depending on the growth rate of the trees and specie the wood shows different density / hardness which, together with trees size and chipping length (sizes produced) influences chipping power consumption.

For these reasons, chipping experiments were set up at the BTC (Biofuel Technology Centre) in Umeå. The objectives of the experiments were to evaluate the effects of trees species, trees size and chipping length on the chipping power consumption, the size distribution of the produced chips, and the degree of macro and micro cracks on the surfaces of chips.

DESIGN OF THE CHIPPING EXPERIMENTS

Delimbed stemwood from pine, spruce and birch was sampled from a thinning site in Västerbottens costal area. The sampled stand contained 3200 trees/ha with average diameter at breast height of 8.1 cm and 8.3 m height. The harvested biomass was transported to the experimental site in Umeå few days after cutting and was stored in three piles (by species) on open asphalted ground (uncovered) for 3 weeks before trials. The trials were carried out for five days in October 2012 by personnel from SLU and Metla.

Figure 1. Manual feeding of a small log during the chipping experiment.

The chipper used in the experiments was Edsbyhuggen 250H, powered by an electrical engine, presenting a disc of 825 mm diameter with 4 knives rotating at 540 rpm, a 15 liters hydraulic system driving a vertical pair of feed rollers. A total of 185 logs of pine, spruce and birch were chipped, their diameters at butt end ranged between 5.6 and 14.4 cm and the masses from 3.5 to 43.5 kg, for a total mass of 4189 kg. The logs were sorted by the butt diameter in five diameter classes: below 9 cm, 9-11 cm, 11-12 cm, 12-13 cm and 13-14 cm. For each combination of species and diameter class at least three logs were chipped. The whole experiment was repeated in two batches for production of two chips lengths respectively of 8 and 12mm.

Each log was manually fed from the butt end into the chipper and the power used by the engine was instantly measured with a Fluke Power Log data logger. The weight of each log was scaled before chipping to determine the production and the time taken to chip each log was measured with a chronometer. Three sub-samples were collected from a running stream of chips for each treatment and collected in 5 liters buckets, in total 90 samples (30 liters) were obtained and used for determination of moisture content and for analyses of the degree of macro- and micro cracks on the surfaces of chips. A supplementary sample of 200 kg per specie for each chips length was taken for analyses of the chips size distribution. The experimental results are under compilation and soon new information will be provided to be used for designing refinery processes based on small tree chipping.

KEYWORDS
Comminution, small trees, efficiency, chips

AUTHORS

Fulvio Di Fulvio
Swedish University of Agricultural Sciences
Department of Forest Biomaterials and Technology
fulvio.di.fulvio@slu.se

Gunnar Eriksson
Swedish University of Agricultural Sciences
Department of Forest Biomaterials and Technology
gunnar.eriksson@slu.se

Raul Fernandez Lacruz
Swedish University of Agricultural Sciences
Department of Forest Biomaterials and Technology
raul.fernandez@slu.se

Otto Läspä
Finnish Forest Research Institute, METLA
otto.laspa@metla.fi

25.02.2013

European Union
European Regional Development Fund
Botnia-Atlantica
Cross-border cooperation over mountain and sea
REGION VÄSTERBOTTEN
Länsstyrelsen Västernorrland
Österbottens förbund Pohjanmaan liitto
REGIONAL COUNCIL OF CENTRAL OSTROBOTHNIA