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Classification of Wood Chips Using an Air Classifier – Practical Study

Air classification is a way to upgrade wood chips. Commercial machinery is used for example to separate knotwood from green chips. In this study, researchers demonstrate the possibility to classify young Norway spruce chips according to their density. Debarked logs were chipped, shredded and screened before air classification. Screening and drying resulted six fractions having different particle size and moisture contents. This demonstration showed that wood chips can be classified according to their density by using an air classifier. However, the density difference has to be high enough that separation is possible and multi-step classification may be needed.

UPGRADING CHIPS BY SCREENING

Screening is a common unit operation used in the chip upgrading. Another possibility to upgrade wood chips is air classification. Commercial air classification machinery to separate knotwood from green chips can be found, for example.

Knots have higher density than that of the surrounding wood and chips containing knotwood are typically thicker, that makes separation by air classification possible.

The aim of this experiment was to demonstrate the possibility to classify wood chips according to their density by air classification.

EXPERIMENT ON YOUNG NORWAY SPRUCE STEM WOOD

Material

Material used in the demonstration was young Norway spruce stem wood. This kind of material was chosen because the density of a young spruce varies only small amount due to the lack of the heartwood. The formation of heartwood changes the moisture content and thus changes the green density.

The aim was to harvest straight stems from trees grown in similar conditions. This way the amount of reaction wood and variation in density between stems is minimized.

Figure 1. *Debarking trees (left) and debarked trees (right).*

Figure 2. The mobile chipper used in the study produced approximately three cubic meters of chips.

Suppressed trees have the higher density compared with dominant trees, for example, so if both suppressed and dominant trees are included in the fractionated material, then density fractionation is more challenging.

Trees were harvested manually from Innertavle, Umeå. The average age of trees was 56.4 years, counted at stump height. Approximately 80 logs having the top diameter of 5-10 cm were barked manually using barking irons and barking spud (see figure 1).

Chipping, schredding and screening

Debarked logs were chipped using the Doppstadt DH-910 SA-drum chipper (see figure 2). The chipper produced approximately three cubic meters of elongated wood chips (see figure 3).

Particle size was still too big and inhomogeneous for air classification (see figure 3) and the material was comminuted using a Lindner Micromat 2000-shredder using the sieve having round holes of 30 mm. The resulted chips are presented in figure 3.

In addition to the density, the chip size has effect on air classification. To produce chip fractions having uniform chip size, the shredded wood chips were screened using a Mogensen G-sizer vibrating screen. Screen cloths having square mesh sieve openings of 25 mm, 16 mm and 10 mm were used.

The screening resulted two fractions used in the classification: ‘big accepted chips’ and ‘small accepted chips’. These fractions divided into three parts. Two of these were dried different times to achieve chips having different moisture content and thus different densities.

Figure 3. Wood particles chipped using the mobile Doppstadt DH-910 SA-drum chipper (left) and these particles comminuted using the Lindner Micromat 2000-shredder (right).

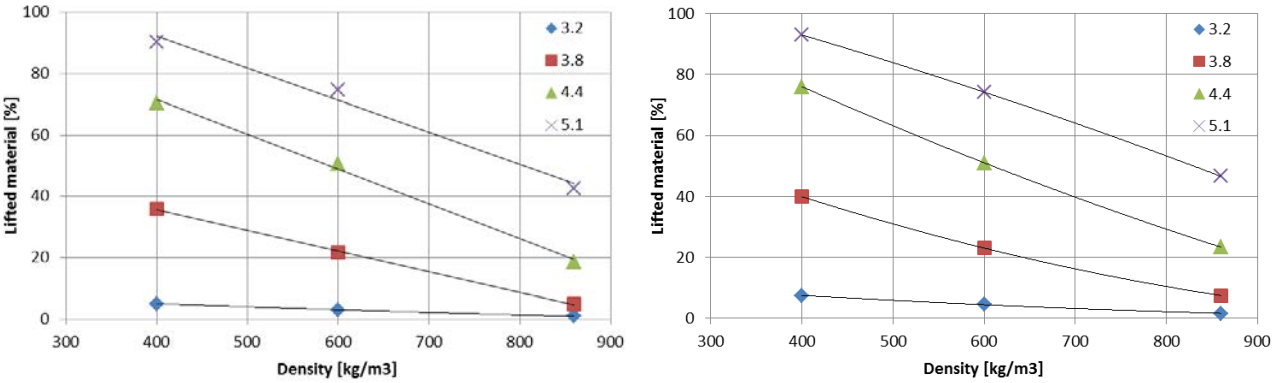

Figure 4. Air classification results for big (left) and small (right) chips. Figure presents the proportion of material lifted by air in one step classification.

Screening and drying resulted six fractions having different particle size and moisture contents. The densities of samples were calculated by their moisture content and were 400 kg/m^3, 600 kg/m^3 and 860 kg/m^3. These samples were classified using a Franssons Recycling LiftSep-air classifier. The air flow velocities of 3.2, 3.8, 4.4 and 5.1 m/s were used in the study.

AIR CLASSIFICATION RESULTS AND DISCUSSION

The results from air classification are presented in figure 4 that presents the share of particles lifted at each operational point as a function of chip density. Chip density has effect on air classification.

By using the flow velocity of 5.1 m/s, approximately half of the highest density chips and practically all low density chips were lifted, for example. Both particle sizes show similar behavior in the classification.

Particle size difference between samples was so small that it did not have significant effect on classification. It can also be seen that small difference in the air flow velocity has significant effect on the probability of the chip to be lifted.

CONCLUSIONS

This demonstration showed that wood chips can be classified according to their density by using an air classifier.

However, the density difference has to be high enough that separation is possible and multi-step classification may be needed. In addition, density difference existing between trees may cause problems in air classification.

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