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The Comminution of Dried Spruce Bark with a Cone Crusher

Spruce bark is an underutilized side product from forest industries and it is available in huge amount in Scandinavia. Bark, is typically used in energy production. Spruce bark contains high amount of extractives, which instead of burning should be utilized as specialty chemicals and ingredients. To recover chemicals from bark, particle size has to be reduced. In this study, size reduction of dried spruce bark by cone crusher was studied.

BACKGROUND

Spruce bark is an underutilized renewable material available in huge amount in Scandinavia. Bark, formed as a side product from forest industries, is typically used in energy production and only minor amounts are used in other applications, such as, in mulch. Loose bark is stored outside in non-covered piles where it is exposed to wind, insolation, mould and pests which decay the bark.

Spruce bark contains structural components such as cellulose, hemicellulose and lignin but also high amount of non-structural components, extractives, which instead of burning should be utilized as specialty chemicals and ingredients in food, cosmetics and medicine, for example. When removed from the tree the decomposition of bark begins – the amount of extractives is halved in few weeks in summertime due to respiration of living cells, decay caused by bacteria and fungus, and chemical oxidation. Drying is a good way to increase bark preservability because reducing the water content also reduces the viability of bark degrading mould.

To recover chemicals from bark, particle size has to be reduced to increase the accessible surface area. In this study, size reduction of dried spruce bark by cone crusher was studied.

MATERIALS AND METHODS

Bark used in the study was collected from a Finnish saw mill in March 2017. Time from debarking was two days; average outside temperature in this two day period was -3°C (max 2.9°C, min -9.3°C) and thus bark degradation was negligible. Bark was dried in an oven at 65 °C for 16 hours to get bone dry bark.

Bark was crushed using Morgådshammars cone crusher (Type B-90) (see Fig 1). Particle size distribution was determined by sieving according to CEN/TS 15149-1:2006 for feed and CEN/TS 15149-2:2006 (with exception that sieves of 8, 3.15, 2, 1, 0.63 and 0.2 mm were used) for crushed bark.

Figure 1. The cone crusher used in the study.

RESULTS

Figure 2 presents the dried uncomminuted bark and figure 3 presents the comminuted bark. The longest pale particles seen in figure 2 are wood flakes having length of 15 cm. The biggest particles in the comminuted sample are pale wood flakes having length of five centimetres. The comminuted bark contained a high content of powdery material.

The particle size distributions of dried feed and ground bark are presented in Fig 4.

Figure 2. Dried, uncomminuted, bark used in the study. The scale in the figure is 40 cm long.

Figure 3. Comminuted spruce bark.

It can be seen that particle size decreased markedly in comminution: d50 decreased from 11 mm to 1 mm and d80 from 31 mm to 4 mm. However, the smooth surface of the cone wasn't designed for bark processing and work was time consuming. The crusher used is not suitable for large scale use and different cone structure or different crusher type for industrial bark comminution is needed.

AUTHOR

Mikko Karjalainen
Natural Resources Institute Finland (LUKE)
mikko.karjalainen@luke.fi
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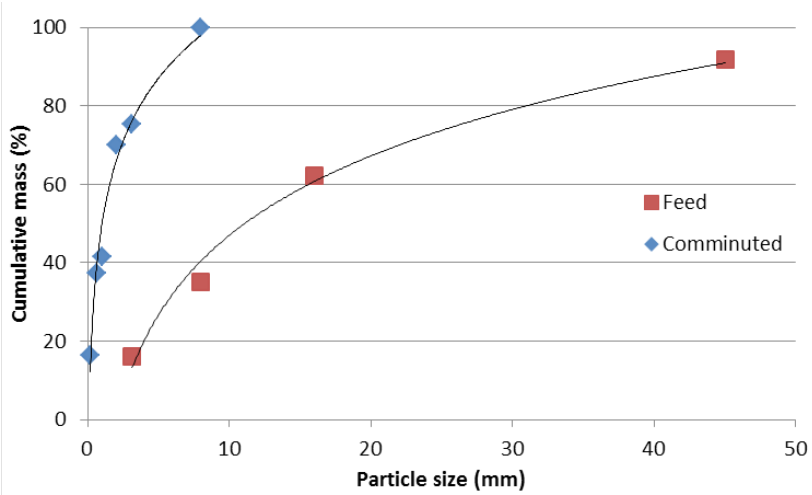

Figure 4. Cumulative particle size distributions of feed and comminuted material.

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