

Screening of Crushed Spruce Stumps by a Mobile Star Screen

This study demonstrated the use of a mobile star screen in the screening of hog fuel made by crushing spruce stumps. Screening can be used to produce desired size fractions and in the removing of fines to decrease the ash content, for example. These procedures add the value of the raw material delivered to a power plant. Screens typically used in wood chip screening are gyrating screens, disc screens, roller screens and star screens. Trommel screens can also be used to remove the fine fraction containing high amount of sand. All of these screens can also be manufactured as mobile versions.

CRUSHING FRESH SPRUCE STUMPS

Stumps used in this study were lifted from firm forest land in August 2017. Trees were felled only three days earlier. The diameters of stumps at the ground level were in the range of 45-50 cm. Stumps were split to quarters and roots having diameters smaller than 25 cm were cut off in lifting. The material didn't contain big stones. The loose sand was brushed off from the surface of the stump.

Stumps were crushed right away using Vermeer HG6000TH horizontal crusher. The crushing of fresh stumps produced long narrow hog wood particles with wide size distribution (Figure 1). The particle size distribution was determined according to SCAN-CM 40:01 - with the exception that hole screens having hole diameters of 45 mm, 31.5 mm, 16 mm, 8 mm and 3 mm were used - is presented in Figure 2.



Figure 1. Crushing of fresh stumps produced elongated wood particles of many sizes.

STAR SCREEN DISC CRUSHER

Star screen utilizes decks of rotating shafts on which discs are mounted (Figure 3). The disc has the shape of a star and points of stars work as elastic screening fingers. Stars in adjacent shafts interweave and apertures are formed between adjacent discs. Material to be screened is fed to the screening deck and particles having at least two dimensions smaller than aperture dimensions pass the deck whereas bigger particles travel along the deck and are discharged at the end of the deck. Long narrow particles are able pass the screen even though their length is higher than the aperture dimensions.

The star screen used was Backers star screen 3-mal-type (Figure 4). The machine was equipped with 50 mm and 5 mm screen decks and thus screening produced oversized, medium sized and fine particle fractions. To optimize screening and to acquire different size fractions, screen decks having other dimensions are available too.

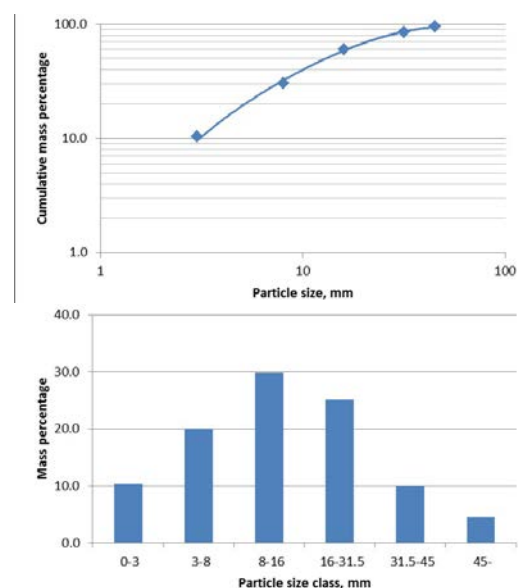


Figure 2. The particle size distribution of the crushed material used in the demonstration study.



Figure 3. The screening deck in a star screen consists of rotating shafts into star-shaped discs are mounted dry mass kg/ha/year.



Figure 4. The star screen used in the demonstration study.

GOOD PARTICLE SIZE AND LOW ASH CONTENT

The amount of sample used in screening was small and operational parameters couldn't be optimized, but parameters typically used for this kind of material, based on the experienced operator recommendations, were used. The material of which the star and screening fingers are produced, especially the elasticity of the material, has effect on screening too and star screen is a very versatile machine to fractionate wood chips. The crushed material was fed to the machine using a wheel loader.

The resulted fractions, oversized, medium and fine fractions, are presented in Figure 5. The share of oversized material was small. To produce medium sized particles, this fraction should be recirculated to the comminution stage. Approximately 10 % of the feed was segregated as fines and 85 % as a medium fraction.

The ash content of the feed, middle sized and fines fractions were analyzed using SFS-EN 14775 standard. The

ash content in feed was 2.7 % and thus it was very small for this type of biomass. The middle fraction and fines contained ash 1.5 % and 14.5 %, respectively. Over half of the ash in the feed was removed in screening to the fines fraction and only small amount of wood was lost. Thus, star screening managed to segregate bark and loose sand very well.

The smallest fraction being problematic in burning was removed and can be used in landscaping for example. Even better results can be expected when operational and machine parameters are optimized.

AUTHOR

Mikko Karjalainen

Natural Resources Institute Finland (LUKE)

mikko.karjalainen@luke.fi

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Figure 5. The oversized (left), medium (middle) and fines fractions (right) produced by the star screen.

More information on energy wood screening :

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