Effect of sieve size and assortment on chipped woody biofuels qualities

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• “The quality of fuel wood depends on several factors including its moisture content, ash content (AC), and particle size distribution (PSD).

  – *For optimal combustion, the fuel should have a low content of fine particles.*”

• “With growing numbers of different wood fuel assortments entering the market, it is increasingly important to determine their quality in terms of their PSD and AC.

  – *Information on these quantities facilitates the identification of shortcomings in supply chains, feeding systems and combustion processes....”*
Objectives

• “To analyze and compare the qualities of wood chips obtained from five different fuel wood assortments produced using two different chipper sieve settings.”
Study design

• Collection of different biomass assortments
• Time study of chipping work
• Sampling of chips
• Lab work
• Calculations...
Assortments

Bundled tree parts from thinnings (B)  Energy wood (EW)

Tree parts from marginal lands (TP)  Logging residues, fresh (LRF) & stored (LRS)
Chipping system

- Doppstadt DH910 drum chipper with a 450 kW engine, five 219 mm chipping knives having cutting lengths of 35 mm.
- Two different sieve sizes were used: “standard,” i.e. 100 × 100 mm; and “large,” i.e. 100 × 200 mm.
- The chipper was fed using a truck-mounted Epsilon Q170 crane and Hultdins SuperGrip II 360A grapple with a grabbing area of 0.36 m².
Time study

- Each assortment chipped with each sieve size
- Knife sharpness were controlled
- Each run took ca 1 hour of productive time
- Monitoring of main work elements
- Sampling of biomass from piles
Analysis

- Mass (weight bridge)
- MC
- AC
- PSD
Results

• Productivity & quality:
  – No differences between sieve sizes

>>Data were pooled!
Mass vs. size distribution
AC per size class
Effects of sieving (bundles)
Effects of sieving (stored LR)
Conclusions

• Sieve size:
  – sieve’s main role in a large drum chipper is to recirculate oversized particles....
  >> chip size is primarily determined by the knife configuration and settings.
Conclusions

• Key finding:
  – post-comminution screening could potentially significantly increase the fuel quality of the comminuted material.
  >> beneficial when dealing with assortments such as logging residues for which the fines in the comminuted material are largely derived from needles, bark, twigs and soil.

• This nutrient-rich material could be gravimetrically separated from sand and used to produce valuable chemicals in biorefineries....
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