REVIEW OF TECHNIQUES AND PRINCIPLES FOR COMMINUTION AND SORTING OF FOREST BIOMASS

The purpose of this work was to identify suitable types of equipment and methods for processing raw materials for biorefineries. These were to be used as a basis for selection of suitable alternatives to study at harvesting sites, landings and terminals. Descriptions of commercial equipment on the Swedish, Finnish and Italian markets, found in literature and on the Internet, were used in this review. These data were combined with information from equipment manufacturer and from pulp- and saw mills.

THE CATEGORIZATION OF EQUIPMENT

The processing of the wood after harvesting can be divided into three phases: debarking, comminution and screening. In the debarking phase the bark (and sometimes also branches) are separated from the stem wood. In the comminution phase the stem wood (or bark/branch material) is usually cut/chipped or crushed into smaller pieces. In the screening phase impurities are removed and size of the pieces is homogenized.

DEBARKING EQUIPMENT

Chain flail machines (stand-alone or integrated with chippers) can be used for initial separation of foliage, limbs and bark at landings. Ring debarkers are more productive for a given amount of power, but require straight logs to operate with high efficiency. Like rosser-head debarkers (with rotating heads pressed against the stem), their productivities depends strongly on stem diameter, in contrast to drum debarkers and cradle debarkers, which rub the stems against each other. Mobile models of drum debarkers are also manufactured.

COMMINUTION EQUIPMENT

There are at least 85 manufacturers of comminution equipment.

These machines can be divided in three main categories:

- Tractor-mounted chippers (three-point hitch, PTO powered), mostly disc chippers;
- Diesel-powered, trailed or self-propelled drum chippers, crushers and shredders;
- Stationary, industrial electric chippers.

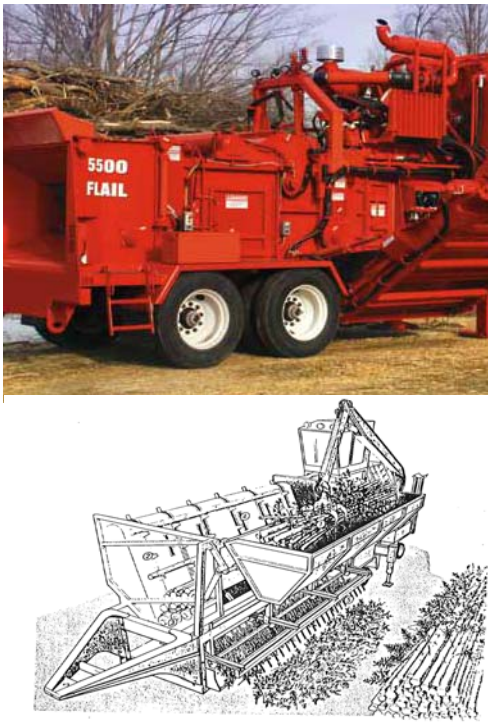

Figure 1. Chail flail debarker (top) and cradle debarker (bottom).

Electrically powered drum chippers, shredders and crushers are available from very low to very high powers. About 40 models found were self-propelled with tracks, mostly drum chippers but also some crushers and grinders (useful for movement along piles of raw material).

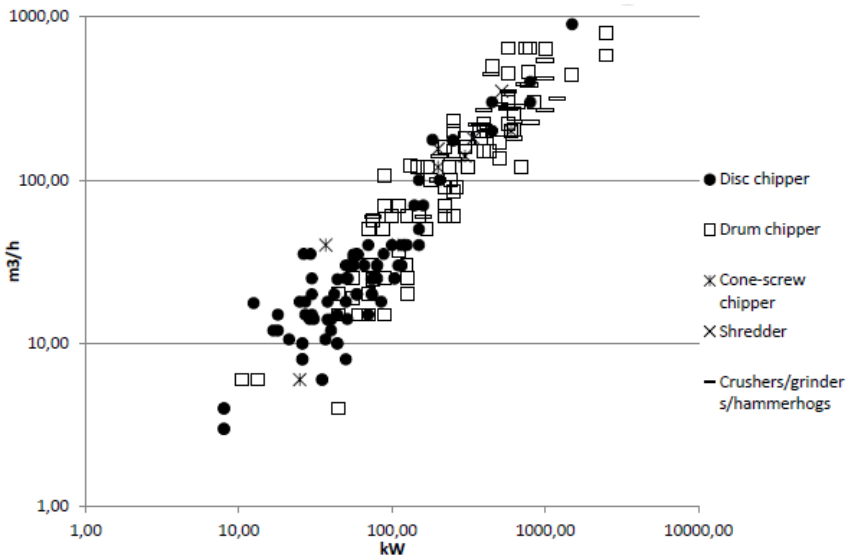

Figure 2. Comminution capacity as a function of power and type of technology used.

SCREENING EQUIPMENT

Typical capacities for deck screens are 10 m^3/h of material for each m^2 of screen area. Typical cut-off sizes are 10 to 90 mm. Disc screens and star screens can process about 2 m^3/h for each m^2 at capacities from 50 to 500 m^3/h. Drum screens (rotating cylinders with perforated mantle surfaces) can process 1-2 m^3/h for each m^2 of mantle surface area. Air is often used to: 1) transport the accepts past a stone trap, 2) to remove light material (plastic bags in waste processing, but needle separation is an option) or 3) for separating the lighter fraction in an entrained flow. One manufacturer has a zig-zag shape of the chamber, presumably to break up lumps of material on impact. The Finnish company Allu produces blades for excavators or front loaders which can be fitted either with crushers or disc screens, driven by the vehicle hydraulics.

LITERATURE

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