



UMEÅ UNIVERSITET

Wood Chips for Kraft and Sulfite Pulping

Evaluation of Novel Forest-Industrial Drum-Chipping Technology

Jessica Gard Timmerfors

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för
avläggande av filosofie doktorsexamen framläggs till offentligt
försvar i N360, byggnad Naturvetarhuset,
fredagen den 27 mars, kl. 10:15.
Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Professor, Sören Östlund,
Kungliga Tekniska högskolan, Stockholm, Sverige

Department of Chemistry

Organization
Umeå University
Department of Chemistry

Document type
Doctoral thesis

Date of publication
06 March 2020

Author
Jessica Gard Timmerfors

Title
Wood Chips for Kraft and Sulfite Pulping - Evaluation of Novel Forest-Industrial Drum-Chipping Technology

Abstract

Wood chipping and the supply of high-quality wood chips are of critical importance for most forest-industrial processes. The quality of wood chips affects product yield, product quality, and processability. Wood chips from a novel type of forest-industrial drum chipper, with a large drum and specially designed wood-chip channels, were evaluated with regard to wood chips for the Kraft and sulfite processes. Wood chips from a full-scale demonstration version of the drum chipper and from a conventional disc chipper at a Kraft mill were compared. The average bulk density and the fractions of oversized and overthick wood chips were similar, but the demonstration drum chipper produced 51% more large accept chips, 11% more total accept chips, and 74% less pin chips and fines. A pilot-scale drum chipper based on the new technology was used to produce short wood chips designed for acidic processes. When the drum velocity was 30-34 m/s and the average wood-chip length 21-22 mm, the fraction of pin chips and fines was 4.2% and the fraction of total accept was 89-90%. When the average wood-chip length was decreased to 17 mm, the fraction of pin chips and fines increased to 8.5% and the fraction of total accept decreased to 80-82%. The pilot drum chipper was used to investigate the influence of using different tree species (aspen, birch, pine, and spruce), processing of wood with different moisture content, and frozen wood. For hardwood (aspen and birch), the fraction of total accept reached ~90% when the average wood chip length was 17 mm. The pilot drum chipper was also used to generate wood chips of heartwood of pine for a comparison of 15 sulfite-process reaction conditions that differed with regard to impregnation and cooking procedures. The analyses included absorption of liquid in a specially designed impregnation reactor, pulp yield, reject, viscosity, kappa number, brightness, fiber properties, and chemical composition as determined using compositional analysis based on two-step hydrolysis with sulfuric acid and pyrolysis-gas chromatography/mass spectrometry. The results reveal in detail how the individual wood constituents were affected by the different treatments, and demonstrate the benefits of using a pressurized impregnation step prior to sulfite cooking.

Keywords

wood chip, drum chipper, impregnation, pulping, sulfite process, kraft process, Scots pine, Norway spruce, heartwood, frozen wood, moisture content

Language English
ISBN 978-91-7855-234-4

Number of pages
56 + 4 papers