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# INITIAL EVALUATION OF THE SIMCO/RAMIC CHIP SORTER

## BACKGROUND

In recent years, the Canadian forest industry has been using in-woods delimbing, debarking, and chipping to convert small-diameter stems to chips for pulp mills. The unscreened chips generally arrive at the pulp mill with bark contents ranging from 1-4%. The mill accepts these chips because they represent a small portion of the total chip furnish to the mill. However, as the proportion of chips from in-woods operations becomes larger, the chip quality will become increasingly critical. In September of 1993, the Forest Engineering Research Institute of Canada (FERIC) conducted a short evaluation of a chip sorter developed by Simco/Ramic Corporation of Medford, Oregon. The objective of the trial was to assess the machine's ability to sort sample batches of chips with known bark contents.

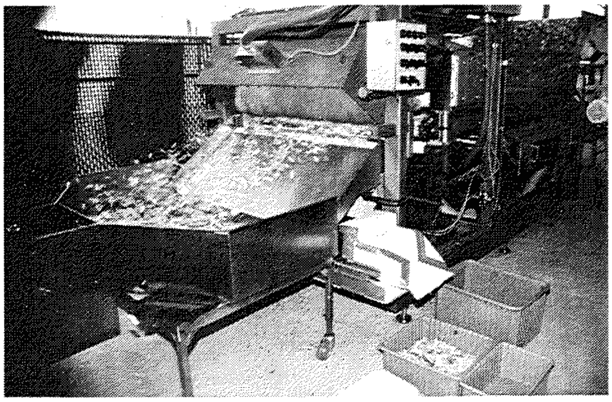

*Figure 1. The Simco/Ramic chip sorter.*

## DESCRIPTION

The Simco/Ramic Corporation (SRC) initially developed a computer-assisted optical scanning system that detects and removes off-coloured and imperfect french fries for the food-processing industry. The corporation has now expanded this sorting technology to handle other products such as glass, plastics, other vegetables, and pulp chips. To date they have two sorters operational; one is located at Homer, Alaska, where it is used to upgrade wood chips produced for export sales by a Peterson Pacific DDC5000, and the other is at VTT Technical Institute of Finland.

The chip sorter viewed by FERIC (Figure 1) was a test model which was set up for small batches of chips at SRC's Medford manufacturing plant. The sorter, approximately 6.6-m long and 2.5-m wide, weighs 2700 kg and is of stainless steel construction. The SRC chip sorter requires an air compressor with a capacity of 2.83 $m^3$/min at 690 kPa and a 440-volt 60-Hz 3-phase source of power. The price of a single unit capable of sorting 18 tonnes of wet chips per hour is US$350 000. Simco/Ramic estimated the yearly operating cost to be approximately US$90 000, which includes setup, labour, maintenance, and utility usage.

To begin the sorting procedure, samples of chips are spread over an elevated infeed shaker and fed down an acceleration chute onto a 1.2-m wide belt travelling at 6 m/s. After falling onto the belt, the chips are further accelerated, separated, and stabilized by an airflow system. The chips are propelled over a separation gap where high-intensity lights illuminate the chips for two computer-controlled video cameras located above and below the gap. When the cameras detect an off-colour fragment (bark, rot, or stain) they activate one of the 128 solenoid-controlled air nozzles located above the separation gap to blow the undesirable fragment into a reject conveyer. Clean chips pass over the separation gap and continue onto the accept chute. Each camera can differentiate 262 shades of black and white images down to a 1.18-mm lineal length across the width of the belt. SRC claims their machine can remove 70-80% of the undesirable contaminates from the product stream.

## OBSERVATIONS

FERIC took six small samples of unscreened chips with known bark contents to Medford to test the chip sorter's ability to remove the bark. Approximately 30 kg of chips were used in each test. The bark-detection sensitivity of the cameras was set at two different pixel-size categories (3 or 4) to compare the resulting proportion of accepted and rejected material (Table 1). Two samples of rejected material were put through the sorter a second time. The total accept chips for the samples 2 and 3 were 94% and 90% respectively. The prorated dry bark percentages were calculated to be 0.5% and 1.1% for the two samples. Table 2 is a summary of the percentages of accept chips that were lost during the sorting.

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*Table 1. Summary of Chip Separation Trial*

| Before separation | | | After separation | | | Second separation | | |
|---|---|---|---|---|---|---|---|---|
| Sample | Dry bark (%) | Pixel | Accept (%) | Reject (%) | Dry bark (%) | Accept (%) | Reject (%) | Prorated dry bark (%) |
| 1 | 1.8 | 4 | 83 | 17 | 0.5 | | | |
| 2 | 1.8 | 3 | 80 | 20 | 0.3 | 94 | 6 | 0.5* |
| 3 | 2.3 | 4 | 73 | 27 | 1.1 | 90 | 10 | 1.1* |
| 4 | 2.3 | 3 | 66 | 34 | 0.6 | | | |
| 5 | 4.5 | 3 | 84 | 16 | 1.6 | | | |
| 6 | 7.4 | 3 | 74 | 26 | 2.9 | | | |

* small sample error.

*Table 2. Analysis of Reject Chips*

| Sample | Dry bark (%) | Pixel | Accept (%) | Pins (%) | Fines (%) | Bark (%) |
|---|---|---|---|---|---|---|
| 1 | 1.8 | 4 | 84 | 6 | 1 | 9 |
| 2 | 1.8 | 3 | 71 | 6 | 1 | 22 |
| 3 | 2.3 | 4 | 79 | 10 | 3 | 8 |
| 4 | 2.3 | 3 | 74 | 7 | 2 | 17 |
| 5 | 4.5 | 3 | 76 | 7 | 2 | 15 |
| 6 | 7.4 | 3 | 67 | 10 | 2 | 21 |

The chips in sample 6, derived from stems that were neither delimbed nor debarked prior to chipping, had a dry bark content of 7.4%. Although it was a very small sample, indications are that a second sorting of both the accept and reject chips could result in a minimum of 75% recovery of accept chips with bark content less than 1%.

Although the results illustrated in this report are based on a small sample, the initial results are encouraging. If chips are screened prior to sorting, and if the sorter can be calibrated more accurately to suit specific chip furnishes, chip recovery should be improved. Simco/Ramic indicated that colour imagery is also an option available for sorting.

## CONCLUSION

The SRC chip sorter designed by Simco/Ramic Corporation appears to be able to upgrade chips derived from in-woods chipping operations. Each unit has been designed to handle approximately 20 tonnes/h of wet chips. A single unit can be used to remove the bark from in-woods chipping operations, or a multi-unit installation can upgrade all of the chips delivered to a pulp mill. Large-scale studies are needed to fully investigate the potential impact of this new technology to the Canadian forest industry.

## INFORMATION

The information contained in this report is based on limited field observation and discussions with the manufacturer. It is published solely to disseminate information to FERIC members. It is not intended as an endorsement or approval by FERIC of any product or service to the exclusion of others that may be suitable. More information can be obtained from:

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