THE DEVELOPMENT OF AN AUTOMATED PITH-FIBRE SEPARATOR FOR THE CANE SUGAR INDUSTRY

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Abstract

The need to determine accurate pith-fibre ratios in cane prompted the design and development of a fully automated apparatus that separates pith, fibre and sand from a sample of shredded cane or bagasse. With the continuous introduction of new cane varieties into the sugar industry, a quick and simple method of categorising these components is useful as they impact on diffuser operations, e.g. percolation rates. The equipment has been tested on shredded cane and bagasse from various factories and on various cane varieties from the South African Sugar Association Experiment Station.

The results show that the apparatus gives excellent repeatability in terms of pith and fibre quantities for the same batch of sample. The poster describes the advantages of the new method over the old method of separation. Results include data and comments obtained from tests on 10 different cane varieties.

Introduction

The Sugar Milling Research Institute has embarked on a project to evaluate the effect of new cane varieties on diffuser performance. Australian work has indicated that the pith-fibre ratio is the best general indicator of the physical characteristics of shredded cane. New varieties recently released in Zimbabwe have resulted in poor diffuser performance in terms of flooding. One of the main reasons for this is thought to be the physical characteristics of the cane after preparation. A project was therefore started to design and evaluate equipment to determine the pith-fibre ratio of shredded cane as well as bagasse, as initial tests using the existing tumbling method of separation were not reliable. An automated pith-fibre separator has been developed and evaluated at the SMRI to separate pith, fibre and sand from different varieties of shredded cane, as well as from bagasse. Preliminary results show that the technique is reliable and repeatable.

Disadvantages of the tumbling method of pith-fibre separation

An investigation into the tumbling method of pith-fibre separation was conducted and the following problems were identified:

- The pith was being recycled into the fibre as the sample basket rotates in a trough of water where the pith is in suspension, resulting in poor separation.
- There is a significant operator component involved, as part of the separation is done manually.
- Inadequate washing of the sample may affect the results, as tumbling does not remove the sand from the sample, which would have an effect on pith-fibre ratios.

New automated pith-fibre separator

The new pith fibre separator consists of the following main components:

- PVC sample pot with a stainless steel perforated plate lid with 1.6 mm diameter holes.
- PVC cone-shaped overflow vessel.
- PVC secondary screening pot with 850 micron mesh lid.
- PVC vessel to house a fine mesh screen.
- PVC splash cover.
- Control panel.

Principle of operation

A schematic diagram of the pith-fibre separator is shown in Figure 1. The shredded cane or bagasse sample is placed on a perforated plate in the sample pot. Water flows in from the bottom of the sample pot. Compressed air is introduced, which agitates the mixture inside the sample pot. The large fibres remain in the pot and the sand settles at the bottom of the pot. The pith and the small fibres flow through the perforated lid of the sample pot into the secondary screening pot via a cone-shaped vessel. The fine fibres remain in this secondary pot. The pith flows out through the perforated lid of the secondary screening pot into a pot with three slots. The pith flows through the three slots into a cone-shaped fine mesh screen, housed in a PVC vessel. The pith collects in this fine mesh screen. The water flows through the screen, into a PVC vessel and out to drain.

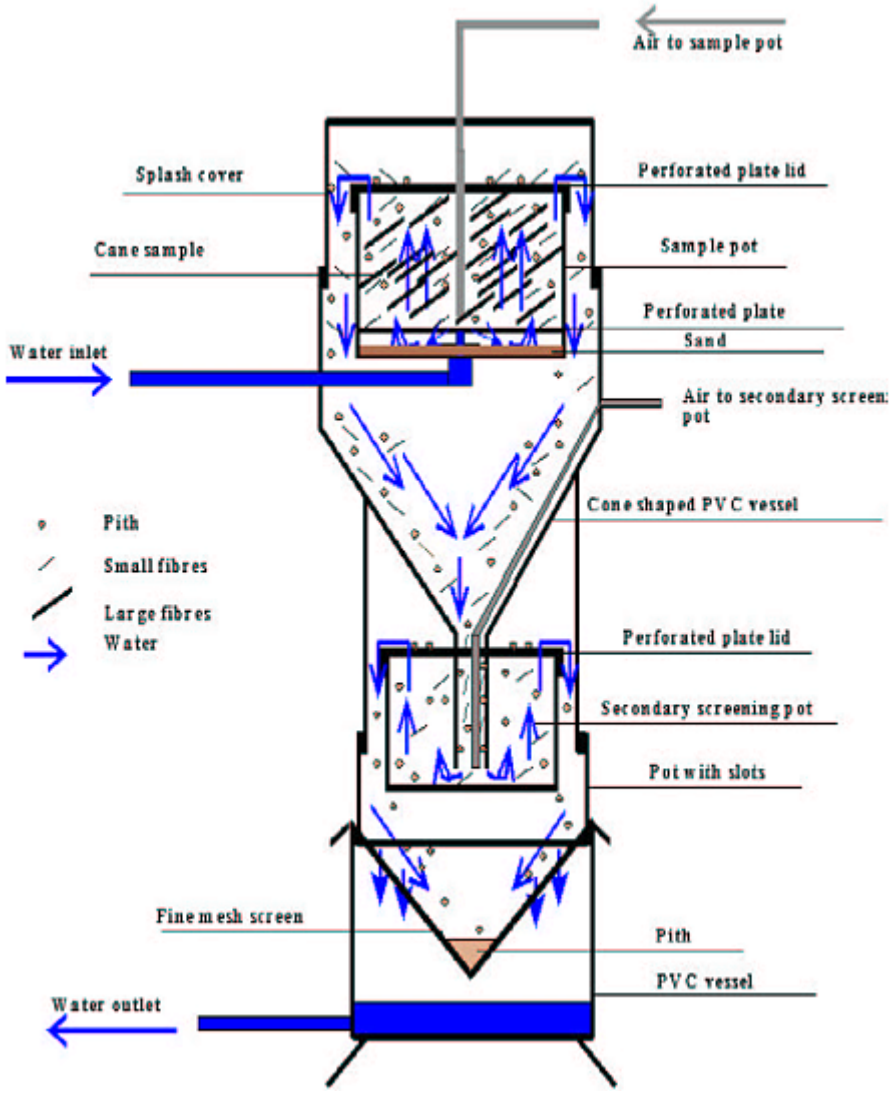

Figure 1. Schematic diagram of pith-fibre separator.

Outline of operating procedure

The tests were done as follows:

1. To 200 g of shredded cane or 100 g of bagasse sample, 1000 ml of water was added and further prepared in the cold digester for five minutes.
2. The secondary screening pot was filled with water.
3. The material was transferred into the sample pot.
4. The air to the sample pot and secondary screening pot was switched on.
5. The water was switched on.
6. The pith-fibre separator was run for five minutes.
7. The air and water were switched off at the end of the run.
8. Large fibres from the sample pot were combined with the fibres in the secondary screening pot.
9. The pith was removed from the fine mesh screen.
10. The sand was removed from the base of the sample pot.
11. The fibres, pith and sand were dried at 90°C to constant weight.

Results

To check the repeatability, three sets of tests were done using clean cane, shredded cane and bagasse. The results for shredded cane are shown in Table 1.

Table 1. Repeatability tests on shredded cane.

Sample	Pith (g)	Fibre (g)	Total fibre % cane	Pith-fibre ratio	Pith % cane	Fibre % cane	Sand % cane
1	11.31	19.07	15.19	0.59	5.66	9.54	1.42
2	10.96	18.87	14.92	0.58	5.48	9.44	1.39
3	11.18	18.93	15.06	0.59	5.59	9.47	1.45
Mean	11.15	18.96	15.05	0.59	5.58	9.48	1.42
SD	0.14	0.08	0.11	0.01	0.07	0.04	0.02
RSD %	1.26	0.42	0.73	1.70	1.25	0.42	1.41

Advantages

- The new pith-fibre separator runs for five minutes when shredded cane or bagasse from a factory is used.
- Secondary screening is not done manually.
- It separates the pith, fibre and sand.
- Repeatability is good.
- Removal of the pith, fibre and sand from the apparatus is easily done, as the apparatus is designed in a stack form.
- Wear and tear is minimal as there are no moving parts.
- There are no corrosion problems as the apparatus is manufactured from PVC and stainless steel mesh.

Conclusion

An apparatus for determining pith-fibre ratios of cane and bagasse has been developed. The apparatus gives repeatable results with less operator involvement than previous methods. The new apparatus will be useful in conducting surveys into pith-fibre ratios of different cane varieties, and determining pith-fibre ratios and sand in cane being delivered to the factories.