Case-Study:

# A Cut Above For Cinnamon

Besides being more efficient than the previous plant, the two-cutter arrangement and blending operation is essentially dust free. By Steve Knauth, general sales manager, Munson Machinery

**STARTING** up a process plant can be tricky business for any company, but when it is the first plant the company has ever built and the location is halfway around the world from equipment suppliers, the project can be daunting.

So it was with ForesTrade, when it set about building Indonesia's first organic cinnamon-processing plant, and an associated essential oils plant in Padang, West Sumatra.

The Bumilindo Project, as it is called, was beset by a variety of problems, including delays in obtaining permits, hitches in the supply of equipment, and bad weather. The two plants were officially opened in March 2007, about a year behind schedule, but the spice plant, for cinnamon and cloves, did not become fully operational until March of 2008.

## PROBLEMS AFOOT

One of the biggest problems was the procurement of equipment, particularly a cutter and blender, which are key items in the cinnamon-processing plant. The company worked with two equipment suppliers, but both deals fell through for various reasons, according to Mary Porter, formerly manager for the project and now manager of the company's Indonesian operations.

They finally received assistance with the plant design from a large local spice processor that is not a direct competitor of the Bumilindo project, because it does not work with organically grown products.

Based on their advice, the company then obtained a high-speed screen classifying cutter that cuts the cinnamon sticks to the desired length, and a rotary continuous mixer that blends various grades of material to customer specifications.

## IN THE BEGINNING...

Prior to opening the Indonesian plants, the company had contracts with various Indonesian companies to process most of its products. It started up its own spice plant for cinnamon

Jozsef Szoke, Hungary

and cloves in 2001, but since there was limited resources and know-how, it was a rudimentary operation. An old rice-hulling machine broke up cinnamon bark, and the resultant chips were separated into piles, based on their volatile oil content. Chips were selected from the piles and blended by hand to meet customer requirements for volatile oil content.

Then, in 2004, it obtained a €1 million (US$1.2 million) grant to build the plants from the Dutch Government's Agency for International Business and Cooperation (EVD). To carry out the project, the company formed a joint venture with Mitra Ayu Adi Perkasa, an Indonesian processor of essential oils.

## EXTRACTION PROCESSES

Cinnamon processing is by far the major activity in the plant, as the cinnamon, the inner bark of laurel trees, has to be cut into the appropriate lengths, dried, and blended to obtain the desired volatile oil content in accordance with customer specifications.

Cloves, on the other hand, are simply sorted and packaged by hand. Off-specification material is sent to the adjacent essential oils plant, where the cloves are crushed and ground, and oil is extracted by supercritical carbon dioxide or by distillation. The plant also extracts oil from nutmeg and vanilla. The oils are shipped to customers, who further refine them for use as flavours and fragrances.

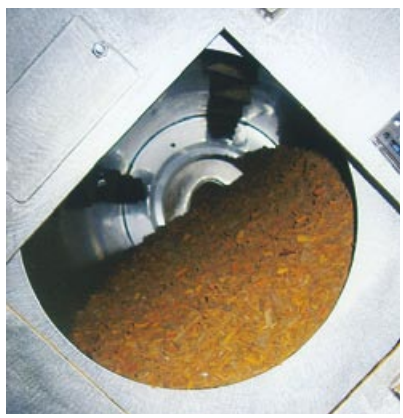
The plant replaced an existing plant that extracted oils by distillation. The new plant still uses distillation for lower-cost products, but supercritical $CO_2$ is employed for higher-purity oils.

## SIZING & DRYING OF CINNAMON

Padang might well be called the cinnamon capital of the world, located as it is in the middle of a major production area for cinnamon and other spices. The popular type of cinnamon in the region is cassia vera, which has a hot and sweet flavour. Bark from the trunk of the tree has the highest volatile oil content, which gives it a spicy flavour. The branches have less volatile oil.

Cinnamon is received at the spice plant in bags as rolled sticks, known as quills that range in length from 7.5 cm to 1 m. Samples of bark from each incoming bag are checked by distillation, and by a water-activity metre to determine the content of water and volatile oil. The bags are then manually emptied onto a belt conveyor, along which workers remove stones, and arrange the quills inline for the cutting operation. Soil and any other extraneous material are removed by a vibratory separator, and a magnet extracts ferrous metals.

From the conveyor line, the quills are discharged into a rotary knife cutter and rough-cut to a maximum length of 15 cm.

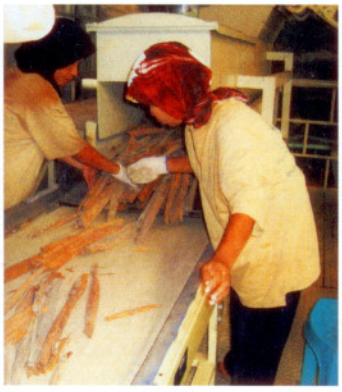



[Above] The screen classifying cutter cuts the cinnamon quills into five cm lengths.
[Left] A view of the interior of the rotary continuous mixer.

The quills are then fed via a pneumatic conveyor into a high-speed, screen classifying cutter. The unit's horizontal rotor contains dozens of cutter blades, attached to a helical array of staggered holders called 'interconnected parallelograms'. The blades are chisel-shaped, with replaceable carbon tips.

Driven by a 15 kilowatt motor, the blades rotate at 2,200 rpm and continuously shear the quills against twin, stationary bed knives, cutting them into five cm

The Munson high-speed screen classifying cutter cuts the cinnamon quills into 5cm lengths.



Workers arrange the quills inline as the conveyor takes the quills into the first cutter.

Processed cinnamon is loaded into shipping sacks through pipe magnets for last-minute removal of any ferrous metal.

rotary knife cutter and rough-cut to a maximum length of 15cm. The quills are then fed via a pneumatic conveyor into a high-speed, screen classifying cutter (Munson model SCC-15-MS). The unit's horizontal rotor contains dozens of cutter blades, attached to a helical array of staggered holders called "interconnected parallelograms." The blades are chisel-shaped, with replaceable carbon tips.

Driven by a 15-kW motor, the blades rotate at 2,200 rpm and continuously shear the quills against twin, stationary bed knives, cutting them into 5cm lengths. Despite the high rotation speed, there is little to no heat generation and minimum fines. Also, the original carbide tips have not needed replacing, says Porter, even though cinnamon is abrasive.

The cutter contributes to quality by producing more-uniform pieces and by making a cleaner cut, with less waste than under the old system. Porter points out that having a clean, uniform cut is not only important for meeting size specifications, but makes for consistency in drying.

Chopped quills fall from the screen classifying cutter into sacks which are rolled by dolly to one of two solar dryers, polycarbonate-enclosed structures located outside the plant. There, cinnamon is segregated in piles according to volatile oil content.

Fans continuously move moist air out of the structures, reducing the cinnamon's typical moisture content of 12–14% to the desired 10–11%, normally within three days. Material is then selected from various piles to meet the specifications for the next shipment and is manually loaded into a bucket elevator that feeds the mixing operation.

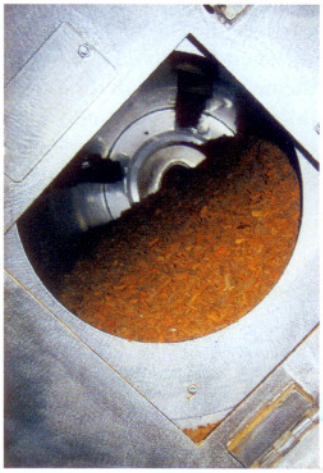
## Blending cinnamon without breakage

Bumilindo's rotary continuous mixer (Munson model 24x6-SS) consists of a horizontal cylinder 183 cm long by 61 cm diameter supported at both ends by large trunion rings that ride on heavy-duty roller assemblies. A 0.746 kW motor rotates the drum continuously while material is added through a stationary inlet at one end, flows through the mixer, and cascades over a stationary weir (dam) at the discharge end of the drum. Thorough blending is promoted by proprietary mixing flights on the cylinder wall that tumble, turn, cut and fold the material as the drum rotates.

The Munson rotary continuous mixer makes a thorough blend without breaking the brittle cinnamon.

The company operates the mixer at a speed designed to process 2 cu m/h, or 1 m.t./h of cinnamon. The mixer has a gentle action that provides two basic advantages, says Porter: it does not break the brittle product and the abrasive cinnamon does not damage the cylinder wall, which is made of stainless steel.

The discharge weir is set at 25% of the cylinder's fill level, which provides ample dwell time for thorough mixing. At the end of a product run, any residual material in the mixer is discharged by reversing the drum's rotation.



A view of the interior of the Munson rotary continuous mixer.

Blended cinnamon discharges into a two-stage vibratory screener that separates the material into two size classifications. Discharged material is loaded into shipping sacks through pipe magnets that remove any ferrous metal. Porter adds that throughout the operation there is a system of aspirators and blowers to remove dust and light trash.

The plant has a capacity of 18 m.t. for a five-day workweek, with one eight-hour shift per day. This substantially outpaces the original plant, says Porter. Even more important, she says "the quality is much better because we are getting an even blend, which we weren't able to do before."

Besides being more efficient than the previous plant, the new system has dramatically reduced dust, which had been a serious problem. The main sources of dust were the old rice hulling machine that was used to break up bark and the rudimentary blending method, in which the broken cinnamon was piled on the floor and mixed by rakes. The two-cutter arrangement, plus the installation of a pneumatic dust control system, has practically eliminated airborne dust from the cutting operation. The blending operation is essentially dust free, since the product is completely contained in the mixer.

Today, the plant is considered a model for cassia processing and has received praise from visitors, many of them customers, for its efficiency and cleanliness. "Above all, people are impressed by how clean the place is because cassia plants are notorious for dust," says Porter. Other companies have expressed interest in following ForesTrade's example, she adds, and the consultant who designed the plant has had many inquiries from companies that would like to duplicate the entire system. ■

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