ROSS
Technology Report
Mixing, Blending, Dispersion & Process Control

November 1997

A New Recipe for High-Speed Oleoresin Extraction

This is an excerpt from an article that appeared recently in Food Processing magazine. For a copy of the complete story, or to discuss the application in greater detail, call Ross Product Manager Ron Hoage: 1-800-243-ROSS.

When Givaudan-Roure recently expanded its flavor production facility in East Hanover, New Jersey, the company streamlined its manufacturing and dramatically increased production. "But our goal was evolution, not just expansion," says Gerry Ferrara, Givaudan-Roure VP. "For decisive gains in product quality and consistency, we also looked for creative ways to reinvent our process technology."

One of the plant's most important functions is large-volume oleoresin extraction, the starting point for many varieties of flavor development. For many years, virtually all flavor manufacturers – including Givaudan-Roure – have followed the same costly and time-consuming recipe for oleoresin extraction. In a labor-intensive operation lasting eight hours or more, botanicals are loaded into a jacketed percolator, in which they rest on a perforated plate. Solvent is then added, and the tank is heated. The batch percolates for 8-24 hours – usually

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These giant 2,500-gal Cone Screw Mixers have revolutionized oleoresin extraction at Givaudan-Roure's high tech flavor production facility. Equipped for vacuum and heat transfer, they have boosted product yields and consistency, and shortened the process cycle.

What's In This Issue

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(Globe)

High Tech Strategy for Hot Melt Production

The complete text of this story, which is excerpted from a recent article in Adhesives and Sealants Industry magazine, explains the operation of the Ross Kneader Extruder in greater detail. For a copy, call Ross Product Manager Ron Hoage: 1-800-243-ROSS.

At Ato-Findley Adhesives' new flagship plant outside of Louisville, Kentucky, production is rising fast. The world's fourth largest adhesives manufacturer, Ato-Findley is proving that big gains in production volume and cost-efficiency can be achieved while the company also improves plant safety, reduces environmental risk, and offers its customers more "special" products than ever before. "The new plant gave us an ideal opportunity to create an integrated, state-of-the-art hot melt processing facility from the ground up," says Scott Klinko, who led the design effort at Ato-Findley.

Three giant Ross/AMK Kneader Extruders provide a solid cornerstone for the plant. With one designed for 250-gallon operating capacity and the other two for 500-gallon capacity, these are the largest ever installed in North America. Each of the 500-gallon Kneader Extruders in the new Ato-Findley plant weighs in at 50,000 pounds.

When the Louisville plant was conceived, the company already owned two of these Kneader Extruders. A third was needed, and Mr. Klinko called Ross to develop a design customized for Ato-Findley. Working closely with Mike Morse, Ross's regional sales manager, Mr. Klinko defined such design parameters as projected throughput, thermal jacketing and the location of probes, sensors and ports in the vacuum hood.

He then began collaborating with Ross/AMK engineers in New York and Germany. Together they modified the 500-gallon Kneader Extruder to match the layout and maintenance requirements of the new plant. Motors, packings, and other wearing parts were all specified to ensure that replacement parts would be immediately available locally in Louisville.

Since AMK introduced the original Kneader Extruder, the mixer has been used in plants worldwide for processing high-viscosity products in many industries. In hot melt production, these high-powered mixers have replaced traditional paddle mixers, because they shorten batch cycles and improve product quality.

"We have seen cycle times cut from 18 hours to 4 hours or less," says Mr. Klinko. "With a 100-horsepower drive on the blades, they have the power to tear the high-viscosity material apart and blend it much faster than a paddle mixer."

Inside each Kneader Extruder, two Z-shaped "Sigma" blades fold and compress the dense material, generating

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A New Recipe for Oleoresin Extraction

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overnight – until the discharge process is finally ready to begin.

Once the flavor has been extracted, the solvent is drained off. This leaves the residual botanical material to be discharged from the percolator. Because the material virtually solidifies during prolonged percolation, the discharge process is difficult – generally consuming at least 16 man-hours.

"We wanted to become more productive and deliver a more consistent product," says Mr. Ferrara. "So, we started looking for new equipment alternatives."

Engineers at Ross and Givaudan-Roure began a collaborative R&D effort, which eventually led them to retire all of Givaudan-Roure's traditional percolators. They replaced the percolators with four specially designed 2,500-gallon Cone Screw Mixers equipped for heat transfer and vacuum processing.

A new design – and a new role for Cone Screw Mixers in food processing.

Cone Screw Mixers have been used for years in many food processing facilities, because they offer an excellent combination of low shear blending, positive agitation and overall process efficiency. To put the Cone Screw Mixer's inherent efficiency to work in oleoresin extraction, Ross engineers had to contend with the difficulty of discharging waste botanicals.

1. Considering the tendency of the botanicals to solidify during the process, the Ross engineering team recommended truncating the lower portion of the blender cone – which normally narrows to the diameter of the mixing screw – to leave an unusually large-diameter bottom.

2. The bottom section also drops and swings away from the upper cone to facilitate discharge of the botanical solids, and for easy cleaning.

3. The swing-away section supports the solid material with a platform comprised of a screen reinforced with a perforated plate.

The mixing screw inside the blender gently lifts material upward as it revolves around the periphery of the cone. When the material reaches the top, it material cascades back into the middle of the vessel. The mixer's conical geometry promotes efficient heat transfer and quick discharge once the cycle is finished.

An unsupported mixing screw speeds discharge.

The mixer's basic cone-screw geometry makes it extremely efficient. But in this case, conventional cone-screw design also presented a difficult engineering challenge. The mixing screw in an ordinary cone-screw mixer is supported at the bottom of the cone by a bearing that centers the screw and prevents collisions with the vessel wall. In this application, a bearing in this position would have presented terrible problems in discharging botanical solids – driving up labor costs and equipment downtime between batches.

Ross had designed many Cone Screw Mixers with an "unsupported screw" – with an overhead drive assembly strong enough to maintain correct alignment as the screw orbits the cone, without any support at the lower end – but never in a size this large.

"In the engineering community, a cone-screw blender with an unsupported screw is generally considered impractical in sizes over 200 cubic feet – a little more than half the size of the blenders we were designing for Givaudan-Roure," says David Hathaway, Ross director of engineering in the company's plant in Savannah, Georgia. "But in this case the benefits that an unsupported screw could deliver simply made it a design necessity."

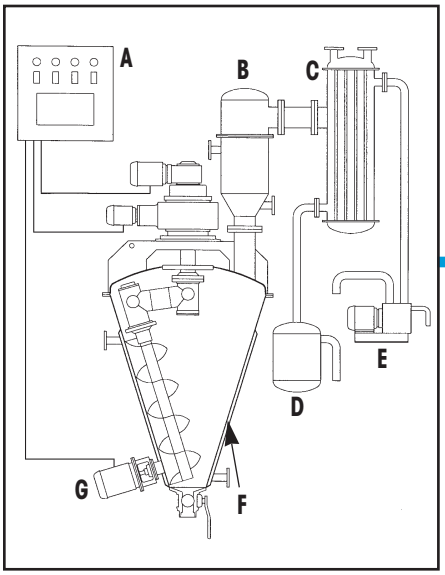
The Ross engineering team designed a special drive system which eliminated the lower bearing, and the results have been worth the effort. The cone opens fully, with no obstruction to interfere with discharge. Residual botanicals discharge easily, and labor is reduced significantly.

Process and product improvements.

The four giant Cone Screw Mixers are now fully integrated in Givaudan-Roure's process line, where a Distributed Control System monitors and controls temperature, pressure/vacuum, screw speed and flow rates, 24 hours a day. Mr. Ferrara measures the efficiency of the system in several dimensions.

"The loading and unloading process, which used to take eight and sixteen man-hours respectively, now take only about four man-hours for each operation.

"But even more important, we're seeing much better product yields and consistency. We're extracting everything the botanicals have to offer. The bottom line is this: we're delivering a higher quality product in volumes high enough to meet the needs of all of our customers."

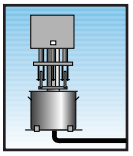


Anatomy of a Vacuum Drying/Extraction System

- A Control system monitors and controls all process variables.
- B Filter excludes powders from the piping system.
- C Condenser, in which vapor is chilled and returned to a liquid state.
- D Receiver, where condensed liquids are collected.
- E Vacuum pump.
- F Heat applied to the jacketed vessel combines with the lowered vapor pressure under vacuum to drive off liquids.
- G High speed lump breaker, which accelerates drying in many applications.

ON THE PROCESS LINE

by Ron Hoage, Manager of Technical Services



Vacuum processing – fine-tuning for improved production.

Vacuum processing has often been in the news lately, because vacuum can supercharge the mixing process and improve end-product quality. But most of the articles I've seen have told only half of the story. There's more to applying vacuum than just turning on a vacuum pump. The possible production gains are tremendous, but they are available only if you optimize your technique for combining vacuum with the mixing process.

Once you have selected the right mixer for your application, your next step is to test with vacuum while monitoring all the parameters that are critical for your formulation. This is accomplished most efficiently in a well-equipped laboratory. During a typical process test in the Ross Test & Development Center, we monitor such variables as vacuum level, batch volume and temperature, individual agitator speeds and input horsepower. We often find that mixing under vacuum requires a complex sequence during which we increase vacuum incrementally and adjust the other variables as the process develops.

For example, with a 50-gallon batch of a thick polymer blend, we recently applied vacuum at 10"Hg (10 inches of mercury) and observed the volume increase to 100 gallons – as air entrapped in the material expanded.

We then held the vacuum level constant and began slow agitation. Thirty minutes later, the volume had fallen back to 50 gallons. We increased vacuum to 18" Hg, and again the batch expanded to 100 gallons. We resumed agitation, this time for 45 minutes.

After several of these steps, we reached 27.5"Hg, but this time we did not follow agitation with another increase in vacuum. We were approaching the vapor pressure of a solvent-constituent in the mix, and with additional vacuum we would have begun removing the solvent – and ruined the formulation.

When we returned the batch to atmospheric pressure, the color of the material had turned perfectly clear and the final volume was 44 gallons. This "densification" resulted from mixing under vacuum and removing entrapped air. The removal of oxygen was also crucial to the quality of the end-product in this case, since reduced oxidation extended the shelf life of this product considerably.

This example is unique – as every formulation is – but it illustrates a fundamental rule for applying vacuum in mixing. Once you've identified the right vacuum/mixing equipment, testing is essential to determine the best technique for applying vacuum to maximize efficiency and end-product quality.

Your next challenge will be to transfer this technique to your process line. Whether the process is simple or complex, all of these process steps can be programmed into a control system that will reproduce the mix precisely. A flexible control system will both ensure batch-to-batch consistency and allow you to switch formulations without delay.

High tech strategy for hot melt production.

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intense shear. Because of its power and close tolerances, the mixer requires minimal heat to soften the material and process the batch. According to Mr. Klinko, other types of high shear mixers can also mix this material, but not within a safe temperature range. The Kneader Extruder operates well below the threshold at which the polymer and resins degrade.

These two powerful Sigma blades are able to fold and compress dense material at lower temperatures than other mixers require. The extrusion screw beneath the Sigma blades increases shear during mixing, then turns in reverse to accelerate discharge.

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INPUT/OUTPUT

Control System News

By Rob Lanham, General Manager

Ross SysCon expands again, increases capacity and shortens lead times!

We're thrilled to announce that our facility expansion is rolling ahead on schedule. Soon we'll be adding new faces, new equipment, and a lot more capacity. The new plant should be ready for operation in late 1997 – just in time for a big New Years' celebration.

Our customers will have plenty to celebrate, too. Our attention to detail and broad expertise in process control has attracted so much business that we're working at full capacity. Our new plant will enable us to produce more control systems and deliver them even faster.

Of course, we will continue to design and build quality motor control centers and distribution systems. But we will also be equipped to manufacture control systems that offer even greater value to our customers – controls that integrate upstream and downstream processing equipment into one system.

That's where our experience really shines – and really pays off for our customers. Because we can handle anything from a small starter panel to a complete control room, many of our clients have stopped bidding projects in pieces. Instead, they have asked us to provide a proposal for the entire process line, including control system design, specification, programming and start-up. They've discovered that with Ross serving as a single source for equipment and engineering, they can save time and money. The project will be easier to track. The start-up will occur on schedule. And best of all, we can eliminate the scheduling headache that comes when you work with multiple suppliers.

WORLDWIDE NEWS BRIEFS

Mixing, Blending and Dispersion

Savannah, Georgia: **Ross Engineering expands, speeds delivery.** Ross's fabrication division in Savannah, Georgia, has completed a plant expansion that will both increase capacity and shorten delivery schedules for many customers. In addition to the mixers and blenders built in the Savannah plant, Ross Engineering builds custom fabricated vessels and storage tanks for customers worldwide. According to Plant Manager David Hathaway, one of the most important benefits of the extension is that it doubles the division's production capacity for large tank work. "Our extended fabrication bays also allow the plant to handle longer vessels," says Mr. Hathaway. "We can build vessels in any size that can be shipped over the road." Ross Engineering regularly builds vessels to meet ASME and API specifications, in a wide variety of steels and special alloys...*Contact (NAME, TITLE, TELEPHONE)*

Atlanta, Georgia: **Coatings manufacturers applaud new Ross PreMax unveiled at International Coatings Exhibition.** The new PreMax created a sensation at the show by giving processors a new high-speed alternative for pre-mixing. With an ingenious rotor/stator design (patent pending), the PreMax disperses pigments like pthalo blue and burnt umber much faster than ordinary pre-mixers. "The quality of these pigment dispersions is just as impressive as the mixer?s fast cycle times," says John Paterson, manager of the Florida plant where the PreMax is manufactured. "With pre-mix results regularly measuring between five and seven on the Hegman Gauge, the PreMax can eliminate one to two passes through the media mill ? for a big savings in time and energy." A high-energy vortex above and below the rotor/stator draws solids into the high-shear zone quickly. The material is subjected to intense mechanical and hydraulic shear, then ejected at high speed to create vigorous flow... *Contact (NAME, TITLE, TELEPHONE)*

High tech strategy for hot melt production.

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Extrusion screw accelerates mixing, improves safety.

During the mixing cycle, an extrusion screw located beneath the two Sigma blades intensifies the shearing action of the mixer and accelerates the process cycle. The screw carries material across the trough, compressing and tearing it against the rotating Sigma blades above. After the cycle is finished, the screw reverses direction to discharge material from the mixer.

"Without an extrusion screw, a conventional kneader would have to be tilted and discharged by hand," says Mr. Klinko. "The process can take several man-hours with material this viscous. Overall, by intensifying the mixing process and accelerating the discharge of the final material, the extrusion screw is cutting the cycle time in half." It's also improving plant safety. Since the system is totally enclosed, it eliminates unnecessary exposure to the material as well as the hazardous physical work of digging it out of the mixer.

A 20-year collaboration aims at the future.

Findley Adhesives bought its first Ross/AMK Kneader Extruder nearly 20 years ago. Today, that 15-gallon mixer plays an important role in the company's hot melt production strategy. Together with a new 1-gallon unit, the two mixers allow Ato-Findley to concentrate on developing robust formulations to address new customer needs, test each formulation extensively, and produce low-volume formulations quickly and efficiently.

"Our goal is to anticipate what the market will need down the road, and to answer those needs with steady growth in our product selection and the capabilities they offer. Our Louisville plant is a giant step in that direction."

For more, ask for **the story reprint!** 800-243-ROSS

THE MAINTENANCE Advisor

By Jinny West, Parts Manager

Ross-Lube, a new universal lubricant for mixing and blending equipment.

Working with a leading formulator of high-tech synthetic lubricants, Ross has developed a new lubricant that is ideal for nearly all mixing and blending applications. Compared to ordinary lubricants, Ross-Lube can reduce wear by 50-100% in equipment built by Ross or any other manufacturer. This can help extend the service life of your equipment significantly. Since Ross Lube can serve as your standard lubricant, it can also make ordering and inventory control easier and less expensive.

Ross-Lube is a Teflon®-based grease compounded to handle all but the most severe operating conditions. It is certified for continuous duty at temperatures from -45°F to 450°F (-43° to 232°C), and it is immune to attack from most solvents. Its adhesion to gears, shafts and bushings is excellent. Ross-Lube is also 100% compatible with all other lubricants.

Ross-Lube is rated H-1 for food processing equipment. It is clear, non-toxic, and non-staining – an ideal choice for food, pharmaceutical and cosmetic processing equipment.

For ordering information, call Jinny West. For more on Ross-Lube's technical specifications, call Senior Engineer Bill Purse.

For more **INFORMATION** call Jinny West at 800-243-ROSS

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