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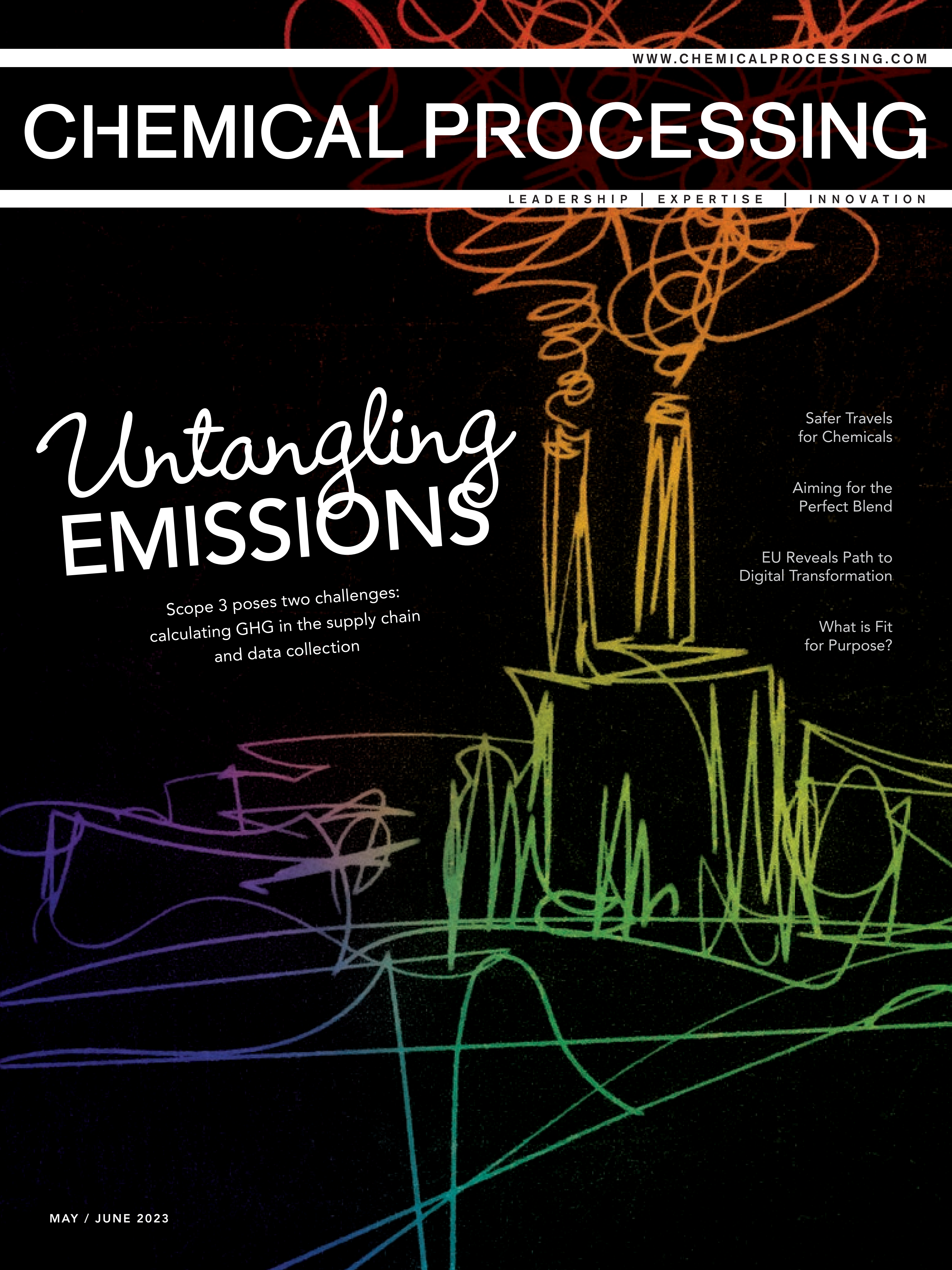

Untangling EMISSIONS

Scope 3 poses two challenges: calculating GHG in the supply chain and data collection

MAY / JUNE 2023

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Calling Out Scope 3 Hang-Ups

Confusion comes as companies implement different strategies

HAVE YOU ever played the "telephone game?" It's where you get a chain of people together, and the first person whispers a phrase or tidbit of news into the next player's ear. That person then relays the message to the next participant, and so on. This goes on until it reaches the last person, who then blurts out what they've just heard. The first person lets everyone know if the original message made it down the chain intact or changed meaning along the way.

Ideally, the message moves along word-for-word, but the way one person recalls the phrase may be different from the previous participant. A lot rides on how the missive gets delivered and interpreted. We often see something similar play out in the real world. Create a complicated message, and confusion will ensue. You must calculate how easily people will understand instructions and relay that information to others clearly and accurately. And you also must consider spoilsports who will purposely change the message.

After reading this month's cover story, "Untangling Emissions" (page 18) by Seán Ottewell, Scope 3 certification now reminds me of the telephone game.

The CliffsNotes version of all the scopes: Scope 1 is emissions from your plant; Scope 2 is from energy sources; and Scope 3 relates to emissions from downstream and upstream activities involving assets the reporting organization doesn't own or control but directly impacts its supply chain. This is one of the sticking points because it puts companies on the hook even if they didn't directly create Scope 3 emissions. (See "Develop Your Decarbonization Roadmap" on page 14 for a more thorough analysis.)

Oftentimes, when organizations set climate-change goals, they seek emissions information from their supply chain. For our audience, the "telephone game" starts when a chemical facility reports its certified emissions.

As the emissions message moves through the chain, it becomes apparent that there's no consistent way to interpret and relay the information. And, along the way, it's important that companies don't exaggerate the message or they could be accused of greenwashing.

As Ottewell writes, much of the emissions reporting occurs over email or through supplier questionnaires, processes that are reactive and prone to error. (A lot of my telephone-game pals were equally reactive and prone to error.)

"The result is confusion, with companies implementing different strategies to address Scope 3 emissions, and activists saying many organizations are falling short of their commitments," he says.

By the way, this article evolved from a conversation with our editorial board members, many of whom are in the thick of the Scope 3 reporting process. Members said Scope 3 reporting felt like the Wild West because there is no consistent way to estimate emissions. While they agreed that meeting these goals is a major challenge, they also noted that it's important that they address them.

As Mesbah Sabur, founder of Netherlands-based supply chain traceability solutions company Circularise says in the cover story, "We believe that one of the biggest barriers to the shift to a more circular economy is the lack of information flow between supply-chain actors."

It's time to perfect this version of the telephone game and get all the players on board with the same message-delivery system because there's a lot more riding on sustainability targets than just bragging rights. ●

Scope 3 certification reminds me of the telephone game.

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Folio Editorial Excellence Award Winner

AWARDS

VIE FOR VAALER 2023

Nominations are open for *Chemical Processing*'s biennial Vaaler Awards, which honor products and services that have dramatically improved the operations and economics of plants in the chemical industry. To be considered for a 2023 Vaaler Award, the product or service must have been commercialized in the United States between May 2021 and June 2023.
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WEB-EXCLUSIVE FEATURES

HOW OSHA'S PROCESS SAFETY MANAGEMENT UPDATES IMPACT THE CHEMICAL INDUSTRY

Regulatory changes could impact the way chemical manufacturers handle highly hazardous chemicals.
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BARRY ON BATTERIES: BRINGING PROCESS SAFETY TO LITHIUM-ION MATERIALS

New technologies and evolving operating safety practices reduce risks for battery production.
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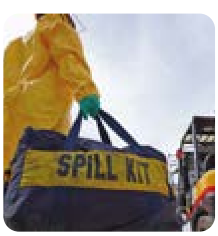
PROCESS SAFETY: AVOID BIG TROUBLE FROM LITTLE CHANGES, PART 2

Selecting the process hazard review method, explaining the rationale, and resetting past thinking and presumptions.

https://chemicalprocessing.com/33002488



DID A NORFOLK SOUTHERN TRAIN TAKE A 'SPILL'?

Words matter, especially when an industry's reputation is at stake.
https://chemicalprocessing.com/33002389

COMICAL PROCESSING

Our cartoon gallery houses all the chemical-processing-inspired drawings by award-winning cartoonist Jerry King. He creates the images and we rely on readers to provide the captions. Think you've got what it takes to create a winning caption? Visit the site and prove it!
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PODCASTS

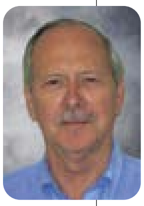
LESSONS LEARNED FROM 1988 SHELL PLANT EXPLOSION

A corroded vapor line caused the deadly incident. This episode talks about ways to stay ahead of corrosion concerns and how to better protect workers in case of unthinkable catastrophe.

https://chemicalprocessing.com/33004331

Tips to Troubleshoot Solids

Expect unexpected characteristics of solids to alter process outcomes dramatically



When troubleshooting a solids process, first consider the type of chemical and unit operation involved.

DRYING IS a fertile area for problems, especially when working with organic chemicals. It's a process that requires a delicate balance between heat input and mixing of the solids.

The first thing I consider when troubleshooting a solids process is the type of chemical or chemicals and unit operation involved. That's because each one is unique. For example, when I hear a problem involving organics, I think "phase change." Likewise, a problem with a screener shouts "particle size" or "particle shape" issues.

Why do these come to mind? Every device has fundamental operating parameters. When you go outside these boundaries, bad things happen. For a drying operation, there is a delicate balance between keeping the particulate solids suspended and the generation of fine particles. For example, fluid beds do a fine job of suspending the solids but can overheat the particles, especially if they are organic chemicals. Often we would select a freeze dryer to limit the excess heat. However, pulling the solvent out too quickly can fluidize the solids or, worse, shear the solids in the capillaries.

While heat may be the enemy of organics in a fluid bed, the shear in a freeze dryer may degrade the organic to the same extent. Shear imparts excess energy into the particles to a similar extent as thermal energy. We had a sticky material and a low melting point. Freeze-drying sounded like a perfect fit. However, in trials, the particles melted, apparently due to the shear caused by the vapor flow. A flash dryer followed by a fluid bed that used low-humidity gas solved the problem.

Remember, it's not temperature that drives drying but vapor pressure difference. So, when you plot your drying curve, always include tests that cover a wide range of humidity.

Crystals offer a whole new landscape for solids processing as they influence so many parameters downstream, such as dustiness and dissolution rate. At the heart of control is a good understanding of solubility and the mechanisms involved.

EXPLORE ISSUES POSED BY SOLIDS

Check out previous Solid Advice columns online at www.ChemicalProcessing.com/voices/solid-advice/.

The chemical you are trying to crystallize will dissolve given the right conditions, which can be a blessing when trying to minimize fine particles in the final product or a curse when trying to reduce dustiness.

As I mentioned in my previous column ("Vital Data for Solids Scale-Up," https://chemicalprocessing.com/33001446), solubility curves are required to troubleshoot crystallizers. It's insufficient to have one curve but one for each of the polymorphs or solvates involved in the process. It's not unusual to see the curves cross, as in the case I cited. In addition, some chemicals decrease in solubility as the temperature increases. The curve can even be flat.

One of the complications with solids, in general, is particle size because the physical properties change with a mixture of particle sizes. Fine particles dissolve faster, dry faster, filter slower and interact more with other particles than large particles (think hindered settling). One of the important properties to consider when diagnosing operating problems is the particle size distribution.

Many years ago, the best you could do to determine size distribution was a screen analysis. Unfortunately, particle behavior on a screen is not what happens in a fluid bed, crystallizer or pneumatic conveyor.

For example, plant managers once called me to help them after a customer rejected their product due to too many fine particles. The plant used screens to check the particle size, and it met the specifications. However, the customer used pneumatic conveying to unload the product, which generated excess fines, but we still had more fines in the product after transport.

Under a microscope, we observed the fines clinging to the larger particles at our plant. They were held together by a static charge that dissipated during transport to the customer releasing fine particles. Adding ionized air to the loading operation helped release the fines to the local dust control system, solving the problem. Also, the plant replaced its screen sizing with a laser-based system.

These short examples highlight unexpected characteristics of solids that can dramatically alter process outcomes, but maybe for solids, should be expected. ●

TOM BLACKWOOD, Powder & Solids Columnist

What is Fit for Purpose?

Consider how changes impact the system and process safety

When you make changes, ensure that different circumstances are considered.

I recently visited South America. I spent a few days in Santiago, Chile, so I planned a small hike in the Andes. This was an ambitious goal, as I am not known for hiking. I had been planning this for a while, so I worked up a gym routine twice a week for over an hour each session. Lots of cardio exercise and every gym session included a vigorous leg workout. I was preparing well for the hike … or so I thought. Everything was going to plan, except my gym sessions were all at sea level. I had not factored in that I would be walking from around 7,555 ft. to 8,530 ft. Only 975 ft. up, but the starting altitude blew me away. I was fit, but not fit for purpose.

Many years ago, I learned the difference between something being on specification and something being fit for purpose. In 1999, I worked at a refinery that manufactured several batches of aviation gas. The batches passed every inspection, but they were not fit for purpose. They had a contaminant that was not detected in testing. This contaminant caused deposits to form on the fuel systems of the engines, resulting in engines losing power. No aircraft crashed, but around 5,000 were grounded until they could be cleaned. This was a huge lesson in understanding fit for purpose.

A hike in the Andes Mountains tested whether I was truly fit for purpose.

As I struggled walking up the track with my body receiving 25% less oxygen than I was used to, I noted that while I was on specification (I was fit), I was certainly not fit for purpose. So how did I manage to keep going? My guide offered advice on how to adjust, and he helped me manage the change. Like any other management of change, I needed to consider the risks and implement controls: Slow, deep breathing from my diaphragm with my head held high to keep my airway open. Small steps to avoid overusing my leg muscles, so they did not need as much oxygen. A steady, slow rhythm that allowed me to maintain deep breathing. These controls addressed the risk of not getting enough oxygen into my body.

Some days later, on the same vacation, I visited Iguazu Falls in Argentina. The adventure boat ride had a 500-ft. steep stairway to climb. I was back in familiar territory now, much closer to sea level. That climb was easier, no rest stops were needed, just a constant pace up the stairs as I ascended from the riverbank. This helped confirm I was fit, as I had doubted myself after the Andes trip.

In any facility, we always need to consider the risks and ensure we are managing them with appropriate controls. Especially when we make changes, we need to ensure that different circumstances are considered. So, the next time you consider changing something in your facility, think about the change and how it impacts the system. Are their circumstances that make the change more or less risky? Was the system fit for purpose at the start? What additional or different controls are needed? How would you know the system remained fit for purpose? Have you considered all the necessary factors? How will the processes around the change interact with each other? Then make sure you implement the necessary controls.

I was so proud of myself for making it to the top of my hike. Once I reached the top, I continued the hike for another two hours at that altitude, before descending. Truly an amazing experience and an important reminder of what is fit for purpose. ●

TRISH KERIN, Safety Columnist

Synthesis Method Speeds Sugar Selectivity

Reaction could improve the sustainability of chemical feedstock production

RESEARCHERS FROM Osaka University, Japan, have used microwave radiation and a calcium hydroxide catalyst to selectively produce sugars from formaldehyde.

Known as the formose reaction, this classic chemical synthesis follows two steps, eventually forming a complex mixture of sugars and sugar alcohols. However, these need separating for further industrial use.

The new Osaka work both speeds up and improves the selectivity of the formose reaction. It produces just two sugars — a hexose and a heptose — with a reaction yield of nearly 100%.

Their version of the reaction involves irradiating a 5mL aqueous solution of formaldehyde containing calcium hydroxide catalyst with 2.45 GHz microwaves for one minute at 150°C.

With the two products being readily purified and the straightforward reaction design reported in a recent issue of *RSC Advances*, the Osaka researchers believe the new reaction will help improve the sustainability of chemical feedstock production and prove invaluable if scaling up to larger reaction volumes can be achieved.

"We hypothesize that the formose reaction in our system proceeds substantially on the surface of calcium hydroxide crystallites in the reaction mixture," says Akihito Hashidzume, a professor with the Department of Macromolecular Science at Osaka University and lead author of the study. "Given that the formose reaction can also proceed on mineral or meteorite surfaces, our work also has intriguing possible implications for understanding the prebiotic synthesis of sugars," he adds.

Hashidzume's team will continue to focus on the formose reaction, with two priorities.

"First is to improve the yield with the calcium hydroxide catalyst using different, higher-power microwave reactors and by optimizing the purification procedure. Second, is to obtain sugars using other catalysts. Our preliminary data indicated that the products are somehow dependent on the catalyst. If we get a grant, we will continue this project," he explains.

Hashidzume is particularly keen to pursue the microwave reactor technology. "It's one of the most important parameters, but we could not choose the wavelength used freely because of regulations under the [Japanese] Radio Act. So, after getting a grant, we would like to collaborate with some company that produces or designs microwave reactors," he explains.

"The chemicals industry has a sustainability problem, and using formaldehyde as a chemical synthesis precursor can help solve this problem. Our updates to the formose reaction add substantial value to its utility in subsequent chemical syntheses," Hashidzume concludes.

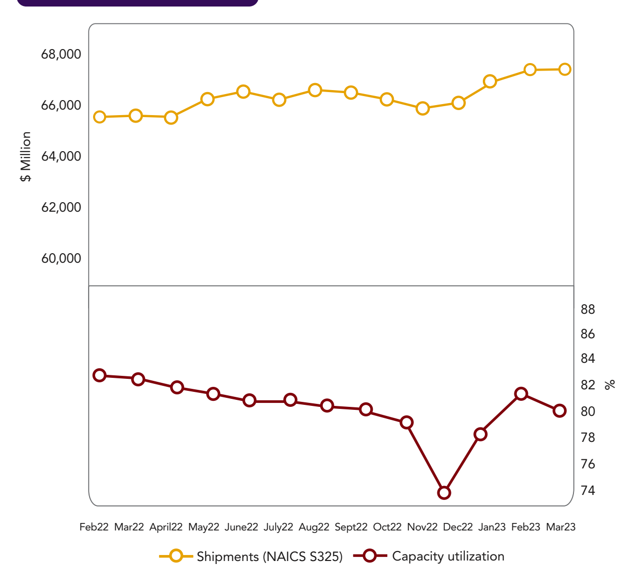
Ball Mills Produce Photochemical Reactions

A NOVEL process developed by researchers in Germany has overcome solubility and light penetration issues generally associated with photochemical reactions and allowed the regioselective solid-state photo-mechanochemical synthesis of nanographenes. This, they believe, opens the door to the discovery of completely new reactivities.

Based at Ruhr-Universität, Bochum, Germany, the researchers replaced the large volume of toxic solvents usually needed for light-driven chemical reactions with the mechanical energy in ball mills.

"This provides a sustainable alternative to established synthesis methods," says team leader and chair of inorganic chemistry, Lars Borchardt.

ECONOMIC SNAPSHOT



Both shipments and capacity utilization increased slightly. *Source: American Chemistry Council.*

Essentially, the researchers used ball mills as reactors. Starting materials were placed in vessels with milling balls and shaken at high frequencies. The high energy impacts provided the mechanical energy for the reaction and thoroughly mixed the substances. Using a specially adapted photoreactor, the researchers conducted the ball milling process under UV irradiation. This led to the solid-state photomechanochemical synthesis of nanographenes.

The vessel consists of a quartz tube containing two polytetrafluoroethylene (PTFE) balls with a perfluoroalkoxy alkane (PFA) cap at either end. UV lights were mounted on an aluminum frame around the tube.

In the first experiments, triphenylene was synthesized by two routes, the Mallory photochemical-cyclization-elimination reaction and cyclodehydrochlorination (CDHC), resulting in yields of 81% and 92%, respectively.

On investigation, the researchers determined the driving force of the reaction is a mechanically assisted photochemical reaction, while mechanical grinding is critical for mixing the substrates.

In the next step, the researchers successfully scaled up the reaction to gram scale and demonstrated the robustness of the method by applying it to a wide range of substrates, including substituted triphenylenes, a heterocycle, a five-membered ring and larger systems.

“This shows that our method is well suited for the synthesis of triphenylene derivatives, a substance class that has hardly been accessible by mechanochemical methods so far,” they wrote in a recent issue of *Angewandte Chemie*.

Finally, using the larger compounds, the researchers showed that nanographenes could be formed regioselectively for the first time via mechanochemistry.

“This new process enabled us to carry out specific reactions and synthesize chemical substances in a much more sustainable way,” says Borchardt. “We reduced reaction times by up to 56% while using 98% less solvent than in equivalent syntheses done with conventional methods. Last but not least, the new photoreactor consumes almost 80% less energy than conventional equipment,” he concludes. ●

Sponsored Content

ARE CHEMICAL MANUFACTURERS READY TO TUNE INTO PROCESS HEALTH?

How would you rate your company's ability to see and understand process-related issues? And how much does that matter? We asked those and other questions of key players in the chemical industry in November and December of 2022. Survey results suggest that chemical facilities are just starting to trust technologies like AI and IoT sensing to predict when — and even how — production lines can be optimized.

Read the full report to see how your organization compares: chemicalprocessing.com/33004007

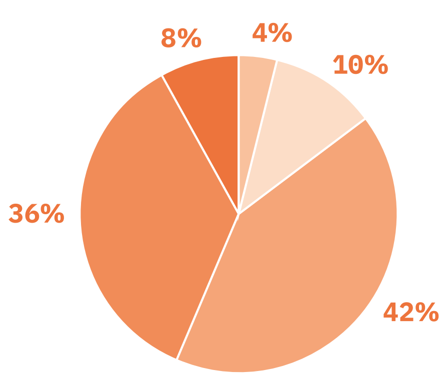
Process Inefficiencies Hurt Manufacturing at Every Level

How do process inefficiencies negatively impact your company?

They hurt our bottom line	50%
They damage our ability to meet regulatory requirements	33%
They damage our brand reputation	31%
They cause operational disruptions	56%
They negatively impact productivity	66%
They negatively impact product quality	52%
They negatively impact investor confidence	13%
They negatively impact training and onboarding	9%
They do not negatively impact my company	5%

Confidence in Process Visibility Is Fairly High, But ...

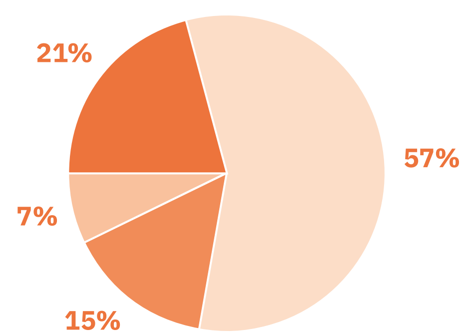
How would you rate your company's ability to see and understand process-related issues?



- **VERY POOR** — We don't have any insight
- **POOR** — We have some insight
- **FAIR** — We have insight but still struggle
- **GOOD** — We have valuable insight
- **VERY GOOD** — We have excellent insight

... In Reality, Most Lack Sufficient Visualization

Does your company have the ability to visualize process issues in real time across all sites?



- **NO,** we have zero process insight
- **YES,** we have some insight
- **YES,** we have deep insight
- Don't know

Manufacturers See Process Insights as the Remedy for Inefficiencies

How do you think deep insight into process-related issues would positively impact your company?

Don't know	4%
Would improve our bottom line	52%
Would improve our ability to meet regulatory requirements	29%
Would enhance our brand reputation	30%
Would help to optimize our operational practices	64%
Would positively impact investor confidence	21%
Would positively impact product quality	54%
Would positively impact productivity	55%
Would impact training and onboarding	23%
They would not positively impact my company	6%

The Journey to Process Health Matters a Lot

Fixes for the chemical industry's process-insight gaps are out there, and signs point to a growing embrace of AI-driven solutions to improve quality, productivity, regulatory, operational, and bottom-line outcomes. For many, the journey needs to start with a full understanding of where they stand now, where they'd like to be, and what's possible with process health insights.

Develop Your Decarbonization Roadmap

Follow these steps to achieving net-zero emissions

Compared to Scope 1, reducing Scope 2 emissions is more straightforward.

TO ACHIEVE net zero, chemical companies must first develop a roadmap that implements Scope 1 and Scope 2 emission reduction projects. These include energy-efficiency improvements, carbon capture and storage or utilization and importing low-carbon energy sources.

In a previous column, I discussed various decarbonization opportunities. When attempting to reduce carbon emissions, consider three possible methods: Scope 1 emissions reduction (reducing emissions from operations), Scope 2 emissions reduction (importing low-carbon fuel sources) and Scope 3 emissions reduction (producing net-zero products by importing green feedstock sources). To reach net zero, a typical strategy starts by reducing Scope 1 and Scope 2 emissions before attacking Scope 3 reductions separately. Scope 3 reductions depend on market demands, regulations and government subsidies (see my article explaining the Inflation Reduction Act, https://chemicalprocessing.com/21536329).

The first step is saving energy. Based on my experience working in oil refineries and petrochemical plants, chemical manufacturers can achieve energy savings via several initiatives. Table 1 shows the typical order in which tasks are executed.

Other projects to cut Scope 1 emissions emerge from furnaces, boilers, gas turbines and any additional fuel engines. Flue gasses from these units contain varying amounts and concentrations of CO_2. The current approach to reducing emissions, often seen in Europe and Asia, is to implement a carbon capture unit (CCU) and use it as a feedstock for certain products, or store or export the CO_2 recovered (carbon capture storage (CCS).

While future columns will explore opportunities for CCS and CCU, building and operating these processes using current technologies is cost-prohibitive. However, placing a cost on CO_2 emissions (like in Europe or California) may incentivize companies to improve the situation. Furthermore, subsidies for emission reductions or a price-per-ton of CO_2 stored underground will eventually make these processes profitable. Another example includes oil-producing areas, such as the Permian Basin in Texas, where reinjecting CO_2 in oil wells can generate more oil for enhanced oil recovery.

To select the best carbon-capture (CC) processes, consider the parameters in Table 2 (see, https://chemicalprocessing.com/33005104). Future columns will focus on the latest CC technologies.

Compared to Scope 1, reducing Scope 2 emissions is more straightforward. Scope 2 emissions are attributed to imported energy sources, such as renewable power or green or blue hydrogen. Recent declines in renewable energy prices and solar and wind farm installation costs typically accelerate the ability to meet emission-reduction targets.

This all depends on whether renewable energy is available at the plant location. When the plant is in an industrial complex that can share costs and benefits with other factories, developing a large-scale renewable energy facility that supplies the whole area may be advantageous. An example is a plan by the Port of Rotterdam in the Netherlands to install a 1-GW electrolyzer to produce green hydrogen for that area.

Collectively, these projects in Scopes 1 and 2 can potentially slash emissions from 30%–50% in 10–15 years, putting us on track to realize 100% reduction by the year 2050. ●

MICHIEL SPOOR, Energy Columnist

Energy Improvement Area	Typical Benefits Realized
Energy efficiency improvements: Operational improvements and “quick wins” with no capital expenses	3%–5% of energy cost (and emissions)
Debottlenecking of the plant after implementation of the quick wins	2%–3% production increase
Capital projects (payback less than 3 years)	10%–15% of energy cost (and emissions)
Optimization technology: Implement utility digital twin and real-time optimizer. This is often referred to as a digital energy management system.	2%–5% of energy cost (and emissions)
Operations focus: Develop real-time metrics and performance indicators for energy efficiency and emissions	1%–2% of energy cost (and emissions)
Carbon emissions overall impact	15%–25% CO_2 reduction

Table 1. Scope 1 energy efficiency projects could reduce CO_2 emissions by 15–25%.

EPA Targets Methylene Chloride

Agency proposes ban on carcinogenic solvent, insisting safer alternatives exist

It may well become the standard for regulating other solvents under EPA review.

ON MAY 3, 2023, the U.S. Environmental Protection Agency (EPA) proposed under Section 6(a) of the Toxic Substances Control Act (TSCA) to prohibit most uses of methylene chloride. This column summarizes this important initiative.

Risks associated with workers, occupational nonusers (ONU), consumers and those in proximity to consumer use, drove the EPA's unreasonable risk determination for this widely used solvent. The EPA identified risks for adverse human health effects, including neurotoxicity, liver effects and cancer from inhalation and dermal exposures to methylene chloride.

The proposed risk-management rule would "rapidly phase down" methylene chloride manufacturing, processing and distribution, most of which would be fully implemented in 15 months. For uses the EPA proposes to prohibit, the agency found alternative products with similar costs and efficacy to methylene chloride are generally available.

The EPA determined methylene chloride presents an unreasonable risk of injury to health, without consideration of costs or other non-risk factors, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant to the 2020 methylene chloride risk evaluation, under the conditions of use (COU). To address these risks, the EPA proposes:

- Prohibiting the manufacture, processing and distribution of methylene chloride for all consumer use;
- Prohibiting most industrial and commercial use;
- Requiring a workplace chemical protection program (WCPP), including inhalation exposure concentration limits and related workplace exposure monitoring and exposure controls, for 10 COUs;
- Requiring recordkeeping and downstream notification requirements for manufacturing, processing and distribution in commerce;
- Providing a 10-year, time-limited exemption for civilian aviation from the prohibition, addressing the use of methylene chloride for paint and coating removal to avoid significant disruptions to critical infrastructure, with conditions for this exemption to include compliance with the WCPP; and
- Providing a 10-year, time-limited exemption for emergency use of methylene chloride in furtherance of NASA's mission for critical or essential specific conditions and for which no technically and economically feasible safer alternative is available, with conditions for this exemption to include compliance with the WCPP.

All TSCA COUs (other than consumer paint and coating removers, which were subject to separate action under TSCA Section 6 in 2019) will be subject to this proposal. The EPA requests public comment by July 3, 2023.

The EPA states that proposed risk-based limits are based on recent data and meet the TSCA requirement to eliminate unreasonable risk. After the agency issues the final risk-management rule, employers would have one year to comply with the WCPP and must monitor their workplaces periodically to ensure workers are not exposed to methylene chloride levels that would lead to unreasonable risk.

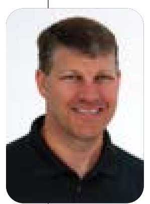
The EPA's approach is likely a template for regulating other priority industrial solvents like 1,4-dioxane, N-methylpyrrolidone (NMP) and carbon tetrachloride. Comment on the proposal is thus essential. The agency requested comment on specific aspects of the proposed rule that readers are encouraged to consider. For example, the EPA discussed its authority under TSCA Section 6(g) to grant a time-limited exemption for specific conditions of use (e.g., civilian aviation), where the EPA finds compliance with the proposed requirement would "significantly disrupt … critical infrastructure." This exemption would include compliance with the WCPP. If the WCPP is protective and facilities can comply with the WCPP, the time limit seems to go beyond what's required to protect health and the environment.

TSCA Section 26(h) requires the EPA to make decisions under TSCA Sections 4, 5 and 6 consistent with the best available science, which includes protocols and methodologies like systematic review. The EPA's use of its 2018 Systematic Review Document in the final risk evaluation also casts doubt on whether it met the requirements for weight of scientific evidence under TSCA Section 26(i), which the agency codified to mean a "systematic review method, applied in a manner suited to the nature of the evidence or decision …." ●

LYNN L. BERGESON, Regulatory Columnist

Lynn is a lawyer specializing in chemical industry regulations.
The views expressed herein are solely her own. This column is not intended to provide, nor should be construed as, legal advice.

Proper Communication Devices Are the Key to Safety



RYAN BROWNLEE
Product Manager - MCC Americas / Hazardous Locations SME, Pepperl+Fuchs

"Make sure that the equipment you're picking is appropriate for the hazardous area but is also useful."

KEEPING WORKERS safe in hazardous environments requires constant communication. Add to the equation that many locations are also harsh industrial settings means ensuring the right communication equipment is appropriately rated while providing the needed functionality is paramount.

To better understand how to select the right equipment, *Chemical Processing* spoke with Ryan Brownlee, product manager and hazardous locations expert at Pepperl+Fuchs.

Q: How is the landscape of communications in industrial locations changing, and what additional challenges does operating in a hazardous location bring?

A: If you go back far enough, people were carrying basic phones and standard land mobile radios (LMR) — your push-to-talk walkie-talkie. Now, we're seeing a move to people wanting to be connected through more office-friendly platforms like Microsoft Teams or Zoom, something that allows them to connect with anyone.

If they need to get hold of a certain expert or a supervisor, they don't have to rely on making sure that the individual on the other end has the specific platform. They can work across a variety of different platforms.

The challenge that you might have with going into a hazardous area is that you have limited choices on what you can use. Obviously, in a non-hazardous environment, there are a lot of different products, but when you're going into a hazardous area, the equipment needs to be rated to be in that hazardous area because of the increased risk of ignition and the resulting fire and hazards. The challenge is making sure that the equipment that you're picking is appropriate for the hazardous area but is also useful for what it is that you're trying to do.

Q: Compared to legacy systems, what are some of the benefits of newer systems and the methods that they offer?

A: One of the nice benefits of the new systems is that communication is happening through a standard data channel. Zoom, Teams or even Skype, they're all voice-over-IP protocols. You don't necessarily need to have somebody that's in a radio network. If I was doing something like a traditional LMR, I could only talk with people on the same radio network. So, the new systems give me connectivity across the globe. It also gives me the ability to have that connectivity through a multifunction device like a cell phone or a tablet. Now, I have the connectivity and the communications I need in the hazardous area as well as the ability to do other data-related and communications-related functionality with a single device.

It gives a lot of flexibility to the user in the field while also giving them connectivity at a global level. Platforms are available to give you push-to-talk functionality that you would have with LMR. But it's doing it over a data channel, so you can do it with a tablet or a phone. You don't need the dedicated LMR, but they'll integrate with those LMRs so that you can have people with traditional LMRs talking with people, doing a push to talk over cellular on a cellular device.

Q: What are the cons?

A: Some cons can be connectivity, especially if you're trying to do a video. They're obviously going to be a little data-heavy. Depending on the data throughput of the network that you're trying to connect to or even the ability to get that signal, that certainly can be a challenge.

Other challenges might be some of the latency. If you're trying to work with a land mobile radio system, the nice thing about those systems is that whoever developed it, usually when it was deployed in an area, the manufacturer of that LMR system did all of it. They did the radios, they did the base stations, they did all of it. And so they had obviously very tight control of the performance. When you're moving to a push-to-talk over cellular, especially if it's something that isn't tied to a carrier, you're going to have the mismatch of the device, the network, the push-to-talk application, and so you potentially end up adding some latency that you wouldn't have with a dedicated LMR.

However, that latency is getting shorter and closer to a traditional LMR experience. As more companies are deploying private LTE and private 5G networks across their facilities, they're seeing a lot of benefits. They're seeing increased security. They're seeing increased data throughput and availability, and it's much easier to deploy a 4G LTE or 5G network across a plant than having all these hotspots and all these things for repeating a Wi-Fi signal. My anticipation is that as more companies deploy private 5G and private LTE networks in their own plants, some of the latency issues due to data throughput and traffic that's on a commercial signal will go away within their plant.

Certainly, security is a concern as well. And the nice thing about moving to a private LTE or a private 5G network is that it's a much more secure method of providing cross-plant connectivity because the security within an LTE or private 5G network is inherently much more robust. So, there's going to be a lot of benefits certainly moving forward. And depending on where a particular company is, the types of scenarios that you might have today will largely be solved three years from now.

In addition to 5G technology, the new Smart-Ex 03 is equipped with support for B48/n48 to meet industrial requirements—from Voice over IP, programmable keys, Wi-Fi only mode, remote diagnostics and remote support, to the implementation of Industry 4.0 applications.

Q: Can we circle back to cybersecurity? How does that play into these new systems?

A: Cybersecurity is always a concern with plants. Some of these PTT systems are encrypting their communications over the internet. Some of them will use AES 256. This is kind of a moving target, but the companies that are putting the equipment and software together are certainly aware of cybersecurity.

And there's a variety of different platforms and systems that can be leveraged within these kinds of data-centric things because whether you're talking communication or talking data, once you get it into that environment, the computers and stuff don't care. It's just another set of ones and zeros. So, there are different ways to protect that, to secure that, to safeguard that. There are technologies coming out all the time because vulnerabilities are found, and then they're patched. Like any chain, it's only going to be as strong as your weakest link. And so, making sure that you're paying attention to all the access points into your network and making sure that everything is secure and having a plan for your security at your facility is key, and making sure that all of the different pieces are part of that, not just the communication pieces, but all of it.

Another big piece of this is the industrial Internet of Things or IIoT. People may not necessarily think about a simple little sensor to detect room temperature, but if that's connected to your network, it is a possible way for somebody to get into your network and pull data and hack into your system. So being aware of any time that you're hooking onto your network, that's another place where somebody can get in and do something nefarious if that's what you're concerned about. Having a holistic plan is certainly important.

Q: Anything you'd like to add?

A: There are many things that are available from an industrial standpoint, from a commercial or consumer grade standpoint, that would support interfacing to any one of these systems. Teams, Zoom, pick one of your push-to-talk applications, all these kinds of things. But when it comes to hazardous areas, these environments are going to be harsher and will have specific safety requirements.

You need to make sure that you have the equipment that is appropriately rated for that hazardous area. Make sure that you're doing your due diligence and that the people who are specifying the equipment to work with these systems and go into these hazardous areas understand the need and requirements for products. Be sure IT or OT or operations are saying, "Okay, these are the types of devices we're looking for. Please help us find appropriate equipment to go into the hazardous areas to keep our people safe, but still provide the functionality we're after."

It's understanding all the different pieces that come together and making sure that you're selecting equipment to check all the boxes, not check most of the boxes, and understanding the risks that go along with that.

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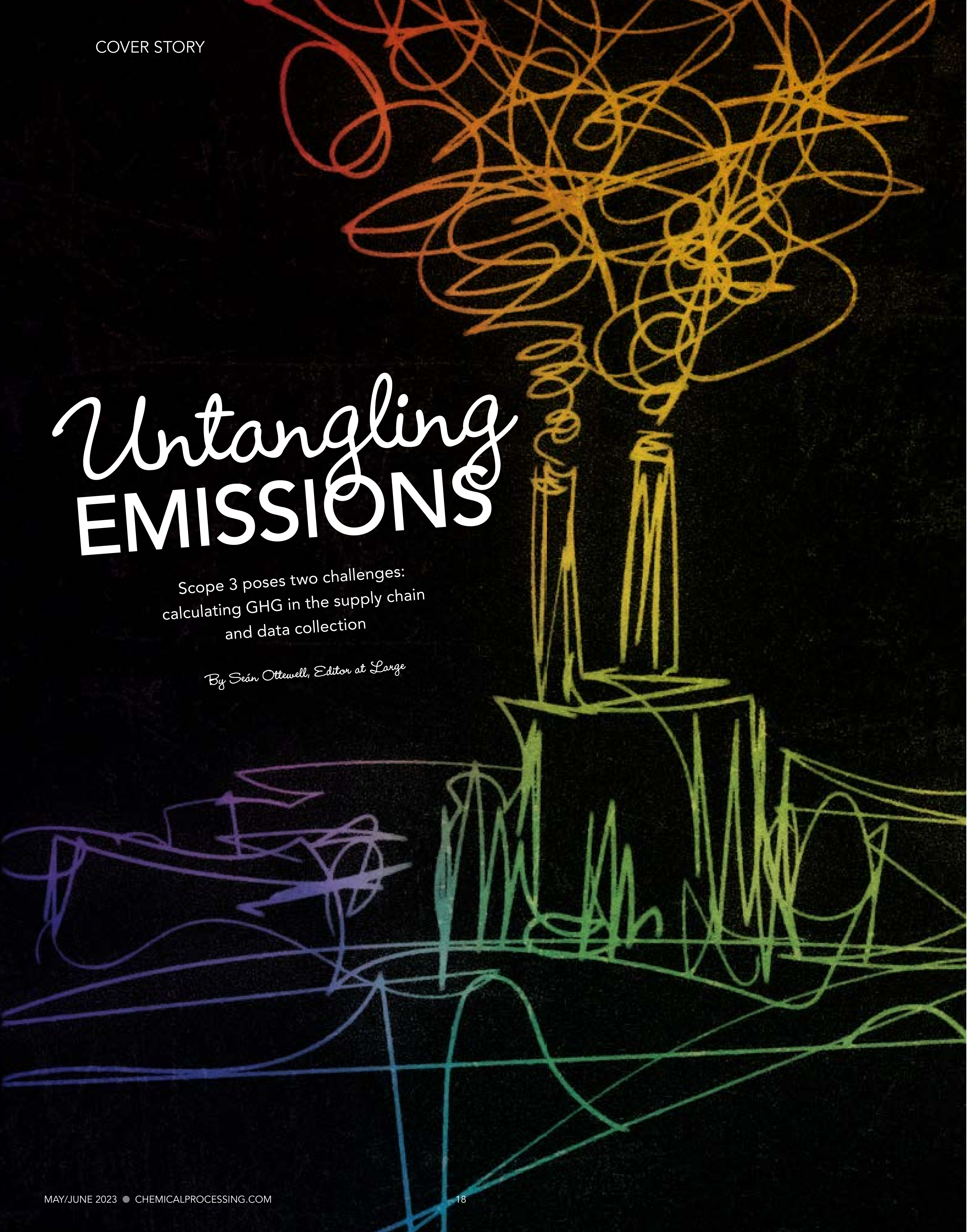


Untangling EMISSIONS

Scope 3 poses two challenges: calculating GHG in the supply chain and data collection

By Seán Ottewell, Editor at Large

TO KEEP global warming from exceeding 1.5°C, as called for in the Paris Agreement, global emissions must drop 45% by 2030 and reach net zero by 2050.

For chemical manufacturers, one of the most contentious issues of the agreement is how to deal with Scope 3 emissions, those that the industry is indirectly responsible for across the value chain.

The challenges here are twofold: Deciding on the best ways to calculate greenhouse gas (GHG) emissions from upstream value chains and how to gather this data in the first place, says Mesbah Sabur, founder of Netherlands-based Circularise, which specializes in improving transparency and traceability across complex supply chains.

"Currently, there are slightly different frameworks and approaches to calculate Scope 3 emissions — ISO 14064, ISO 14067 for carbon footprint, GHG Protocol, etc. — and there are ongoing discussions on how to harmonize them," he explains. "Furthermore, chemical companies need to gather data on the emissions factors and footprint of their upstream supply chain to determine their Scope 3 emissions. Today, much of this is done over email or through supplier questionnaires, which is very reactive and prone to error."

The result is confusion, with companies implementing different strategies to address Scope 3 emissions, and activists saying many organizations are falling short of their commitments.

AMBIGUITY ABOUNDS

Multinational oil and gas company BP is almost a case study in this regard. In February, the company said it plans to scale back oil and gas production by 25% by 2030. However, a year earlier, BP committed to cutting oil and gas production by 40% by 2030 as part of its strategy to reduce emissions and move to alternative energy sources. BP maintains that, if taken collectively, its climate targets are still Paris-agreement compliant.

It's an argument that raises concerns with investors and environmental organizations.

For example, Brunel Pension Partnership in Bristol, U.K., is one of eight local government pension pools across the country and brings together £35 billion ($44 billion) of investments from 10 different funds.

Shell's approach as an energy provider is to set a target to reduce the net carbon intensity of the energy products it sells. *Source: Shell.*

On April 20, Brunel announced it would be voting against the reappointment of BP's chair Helge Lund at the company's April 27 annual general meeting (AGM).

Explaining the decision, Brunel's chief responsible investment officer, Faith Ward says, "We acknowledge BP's ambition to be net-zero by 2050 or before and the increased commitment to invest in solutions, but we are using our votes at the AGM to flag our concerns about the changes in strategy. There was no shareholder engagement regarding the reductions in commitments relating to oil and gas production — a material change to the plan presented to shareholders in 2022, and one that seriously imperils BP's credibility as a company that will deliver on its promises."

Another British pension fund to vote against Lund's reappointment was Nest.

Explaining its decision, Diandra Soobiah, head of responsible investment, notes in a blog post that well-run organizations with sustainable environmental practices have a higher chance of long-term success and are more likely, over the long term, to provide good investment returns.

"But what happens when a company you invest in isn't on the same page or, even worse, sets targets to commit to be environmentally sustainable and doesn't follow through on their promise?" she asks.

"By engaging with oil and gas companies, especially in collaboration with other investors, we have a better chance to help those that are progressing too slowly in their transition to a low-carbon economy," Soobiah adds. "After all, as investors, we need to remember that the emissions of our investee companies are by default our emissions too."


Part of the Next Generation Evonik strategy involves intensive cooperation with partners along the value chain. *Source: Evonik Industries.*

The two organizations were especially riled that BP's altered production targets weren't up for discussion at the April shareholder meeting, despite the earlier ones being approved at the 2022 AGM.

The Financial Times described this behavior as confusing at best and urged BP to "eschew slipperiness and try for clarity and transparency instead."

At the same time, Dutch environmental group Follow This urged other shareholders to consider several factors before casting their votes on its resolution, which called for BP to align its 2030 Scope 3 emissions reduction aims with the goal of the Paris Agreement.

Follow This pointed out that BP says it "anticipates" its absolute Scope 3 emissions of marketed products to increase by 2030 with its current strategy. It also remains unclear whether BP's absolute total Scope 3 emissions — marketed and traded — will increase by 2030.

Shell is experiencing similar issues.

"We believe our climate targets are aligned with the more ambitious goal of the UN Paris Agreement on climate change: to limit the increase in the average global temperature to 1.5°C above pre-industrial levels," a spokesperson told *Chemical Processing*.

In 2021, the company set a new target to reduce absolute emissions from activities under its operational control 50% by 2030, compared with 2016 on a net basis. This covers Scope 1 and 2, where Shell is a user of energy.

Shell believes a dramatic change in demand for energy is just as critical as the required changes to supply for the energy transition to take place. Hence, it says, an essential part of its strategy is working with customers across different sectors, combined with advocating progressive government policies, to transform demand and assist customers in reducing their Scope 3 emissions.

"We have made good progress in reducing carbon emissions from our oil and gas operations, with a 30% reduction by the end of 2022, compared with 2016 on a net basis," adds the spokesperson. "That puts us more than halfway toward our target to reduce them by 50% by 2030. We have also continued to change the energy mix of our portfolio. By the end of 2022, the net carbon intensity of the energy products we sell had fallen by 3.8%, compared with 2016."

Shell's approach as an energy provider is to set a target to reduce the net carbon intensity of the energy products it sells 20% by 2030, with a goal to become net zero by 2050, i.e., have zero absolute emissions by 2050.

"We believe that this target is in line with estimates based on the IPCC [Intergovernmental Panel on Climate

Change] scenarios, which show that the net carbon intensity of the energy mix will need to fall by around 15% to 35% by 2030," the spokesperson says. "We also believe this target takes into account the time needed for energy users to invest in large-scale equipment and the energy infrastructure changes needed for Shell to deliver more low- and zero-carbon energy."

Still, a resolution at Shell's May shareholder meeting urged the company to set more ambitious Scope 3 emissions reduction targets.

"Doing so, without changing demand and the way in which customers use energy, would effectively mean handing over retail and commercial customers to competitors," claims the spokesperson. "This would materially affect Shell's financial strength and limits its ability to generate value for shareholders. It would also reduce Shell's ability to play an important role in the energy transition by working with its customers to reduce their emissions."

Follow This has tabled similar resolutions at the AGMs of TotalEnergies, Exxon Mobil and Chevron.

Circularise's Sabur believes that by using traceability technologies to create digital product passports, chemical companies will be able to gather the information required for Scope 3 emissions much more effectively.

"These solutions also follow and keep up to date all the different standards, so companies won't need to worry about whether they are complying with the latest standards and frameworks," he explains.

The other issue Sabur raises is the incentivization of a shift toward circular economy models.

"We believe that one of the biggest barriers to the shift to a more circular economy is the lack of information flow between supply-chain actors," he says. "If chemical companies can track and trace how their products flow through the supply chain and end up in final products, and moreover how these final products reach their end-of-life and are disposed of, they can design and develop better polymers and compounds that can be more easily recovered and recycled. It can also allow chemical companies to examine new business models like take-back schemes or closed-loop approaches to minimize waste."

TACKLING THE VALUE CHAINS

One company embracing this approach is Evonik Industries.

As part of its Next Generation Evonik strategy, the company, based in Essen Germany, says it is committed to being "well below the 2°C target" of the Science Based Targets Initiative (SBTi) – a joint enterprise involving CDP, United Nations Global Compact, and the World Resources Institute.

"Reducing Scope 3 emissions is challenging for the entire value chain because these emissions are outside their direct sphere of influence and are affected by many external factors," says Evonik's external communications manager Bernd Kaltwasser. "That necessitates intensive cooperation with partners along the value chain [Figure 2]. We aim to reduce our Scope 3 emissions in all upstream categories and in the category 'downstream transportation and distribution' by 11% between 2021 and 2030."

To begin with, the company is analyzing which raw materials and suppliers offer the greatest potential for reduction. The starting point here comprises secondary data from databases but also, increasingly, primary data.

"To increase the proportion of primary data, we contact our key suppliers once a year. In this context, we discuss, among other things, the main ways we can leverage emissions reduction with our suppliers. That may be renewable energies, improved processes or alternative raw materials. Taking the overview of all factors, we then discuss specific targets with our suppliers," says Kaltwasser.

As an example of this reform in action, he cites the 2022 letter of intent signed on a strategic alliance with engineering contractor Pörner Group, Vienna, Austria, and Phichit Bio Power, Phichit, Thailand, to offer the global tire industry a bio-based silica made from rice husk ash. "This allows us to reduce the CO_2 footprint by 30% compared to our standard silica. Thus, we support our customers' focus on reducing carbon emissions and circularity," explains Kaltwasser.

While the short-term availability of low-carbon raw materials remains limited, Evonik uses detailed mid- and long-term scenario analyses to align its procurement strategies.

For example, green hydrogen is expected to drive the energy transition in the area of raw materials. That opens opportunities for the production of green ammonia and green methanol. In the methanol process, CO_2 removal is possible, so the product would have a negative carbon footprint.

"Evonik is monitoring these developments and is in close contact with potential suppliers. Since ammonia can be used as a transport medium for hydrogen and as a substitute for marine diesel, we assume that the development here will be faster than for other raw materials," he adds.

One step toward reducing its Scope 3 emissions is using green C4 fraction produced from green naphtha in Marl, Germany. There are signs of a significant increase in volumes, notes Kaltwasser, especially biomethanol, which is used to produce MTBE (Methyl tert-butyl ether). In addition, green acetone is being used to make sustainable isophorone products.

"We have also extended certification under the mass balance standard of the Roundtable on Sustainable Palm Oil. For the first time, we are able to report process improvements on the supplier side as a Scope 3 measure thanks to the improved data transparency resulting from various supplier commitments," he adds.

Meanwhile, Circularise has carried out projects with companies including Shell, Neste, Borealis and Trinseo, focused on how digital traceability can support the ISCC Plus certification scheme by using mass balance accounting for bio-based and recycled feedstock. This certification covers food, feed, bio-based products, energy and biofuel.

"Such certifications provide oil and gas and chemical companies with a way to transition away from the use of fossil fuels and increase their production of bio-based and recycled feedstock. Perhaps this can be the 'happy medium' that allows these companies to maintain some of their existing operations and more smoothly transition towards net zero," suggests Mesbah. ●

BY JONATHAN KATZ, EXECUTIVE EDITOR

SAFER TRAVELS FOR CHEMICALS

Can the chemical industry do more to prevent the next East Palestine disaster?

ON MARCH 9, senators on the Environment and Public Works Committee grilled Norfolk Southern CEO Alan Shaw over his company's involvement in the East Palestine, Ohio, Feb. 3 train derailment and chemical release. During his testimony, Shaw discussed steps Norfolk Southern would take to improve safety, including improvements to early-warning sensors and the development of a digital train inspection program. He also talked about partnering with other railroads to review best practices.

Absent from his testimony was reference to chemical suppliers and efforts to partner with the industry to safely distribute chemicals. The suppliers are not subject to liability because transportation providers accept responsibility for ensuring the materials arrive at their destination safely, says attorney Mark Steger, senior counsel with Clark Hill, an international law firm covering numerous industries, including oil and gas and pharmaceuticals.

"It's really the railroad's liability; the railroad's fault," he says. The only exception would be if the chemical suppliers were grossly negligent, he adds.

Still, the chemical industry has committed to safely delivering materials by working with suppliers, distributors and transportation companies through the American Chemistry Council's (ACC) Responsible Care initiative. ACC issued a statement following the Senate testimony saying, "Rail safety is a shared responsibility. Safety initiatives and regulations must address the entire safety equation, which includes preventing derailments, avoiding releases and supporting emergency response."

ACC President and CEO Chris Jahn added that the organization wants to work with policymakers and transportation partners to apply the lessons learned from the incident. What those efforts entail remains to be seen. Some green-chemistry advocates say the industry can avoid future public health and environmental disasters by developing safer products. But even proponents of material substitution acknowledge that new formulations can take decades to develop and mass produce.

Portions of a Norfolk Southern freight train that derailed Feb. 3 in East Palestine, Ohio, burning the following day. *Source: AP Photo/Gene J. Puskar.*

More practical solutions in the near term may include closer oversight of logistics partners' safety practices and new supply chain strategies that minimize shipping distances for hazardous materials.

AUDIT TRANSPORTATION PARTNERS

The rail industry has faced harsh criticism for fighting various safety regulations, including modern braking systems and stronger tank cars for explosives. The chemical industry needs to fill the gaps when standards are lacking, says Trish Kerin, director of IChemE Safety Centre.

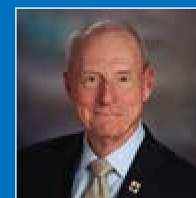
"While Responsible Care is a voluntary program, it is in place to help industry manage their hazards, especially where the legislative framework may not have kept up," says Kerin, who also co-hosts *Chemical Processing*'s "Process Safety With Trish & Traci" podcast. "[While] the legislative requirements may have decreased, as owners of the products being transported, industry should be ensuring the risk has not increased and demanding suitable controls are implemented because they have ownership of the risk from cradle to grave."

This includes auditing logistics providers and their vehicles to ensure they meet safety requirements for moving hazardous materials, she says. In addition, the transportation company needs to understand the unique characteristics of the chemicals they're carrying and their reactive properties while in transit, Kerin says.

"For example, a product that is static in a tank at a site may not pose a high risk, but once it starts sloshing in a moving vessel, the agitation may present different risks," she explains.

Chemical suppliers also should know the maintenance practices of their logistics partners and be familiar with key safety features on the vehicle, such as a train's braking system, to understand whether it can handle an emergency situation, Kerin adds. A National Transportation Safety Board (NTSB) investigation revealed that an overheated bearing played a role in the East Palestine derailment. NTSB also is investigating aluminum protective housing covers used on three of the vinyl chloride tank cars that derailed in East Palestine.

FINDING A VIABLE REPLACEMENT



Swapping one chemical for another comes with inherent challenges. William Carroll, an adjunct professor in the chemistry department at Indiana University, shared his thoughts on the topic with *Chemical Processing*. Carroll retired from Occidental Chemical Corp. in 2015 after 37 years and now leads his own company, Carroll Applied Science. Here is an abbreviated version of that conversation, which has been edited for space and clarity.

CAN AN ALTERNATIVE MATERIAL MEET WIDE-SCALE USE?

Let's say you wanted to try to replace ethylene in its various uses. Well, there are very few, two-carbon hydrocarbons with a double bond other than ethylene. That's a basic chemical property that allows you to make polyethylene and turn it into virtually every other polymer. There's just nothing you can grab off the shelf to drop in for it. And that's where it gets to be difficult.

IS IT SAFER, MORE EFFECTIVE?

I was chair of the Green Chemistry Institute Advisory Board at ACS for three years, and our mantra, like the OECD (Organization for Economic Co-operation and Development) mantra, was efficient, effective, safe and benign. And if you're talking about making substitutions that don't touch those four things, then your substitute chemistry isn't going to get used. If it costs way more — and I'm not saying it has to cost less — if it doesn't do the job, if it's not markedly safer than what you're using and, also relatively safe in the environment, then it's just not going to succeed.

WHERE DOES SUBSTITUTION MAKE SENSE?

If you start at the small end of the chemistry enterprise, very specialty things (such as pharmaceuticals or fine chemicals) that have very elaborate synthesis, you have lots of choices of reagents, and you can look at those reagents and decide which of those are safer and still work for your operation. This is why, to me, the biggest [opportunity] for green chemistry is in the pharmaceutical industry, and they have embraced this in terms of solvent choices, reagent choices, [and] designing new reactions. [At] the other end of the spectrum, where you're talking about commodity chemicals, it gets extraordinarily more difficult. When you talk to these manufacturers, you discover they've taken this chemical material that also has different physical properties and handling properties and mechanical properties, and they've developed their own technology. So, the way my product handles may be totally different from the way somebody else's product handles. And as a result, [an alternate material] is not an easy drop-in for that customer.

FIND SAFER, SUSTAINABLE ALTERNATIVES

Some academics and industry experts say the East Palestine spill should encourage a shift in manufacturing practices throughout the sector. On Feb. 25, an opinion column in *Scientific American* by three sustainable chemistry advocates suggested the disastrous outcomes in East Palestine could have been avoided had the chemical industry developed safer, more eco-friendly chemicals. According to the authors, many current chemistries date back to the pre-1960s and haven't kept pace with today's safety regulations.

"We keep making dangerous chemistries and shipping them around the country and world," says Joel Tickner, a professor of environmental health at the University of Massachusetts Lowell. Tickner, one of the authors of the *Scientific American* column, leads a research institute at UMass Lowell called Sustainable Chemistry Catalyst. He says the entire value chain bears some responsibility when chemical spills occur.

"In the end, it comes back to the chemistry – if the chemistry is less hazardous, it becomes less dangerous in the event of an incident," he tells *Chemical Processing*. "We built our modern materials economy on chemicals that worked really well and were optimized for costs and performance and not low hazards. Vinyl chloride is a known human carcinogen used to make a low-cost high-demand plastic PVC."

Vinyl chloride is the primary chemical of concern in the East Palestine spill. It's the main ingredient in polyvinyl chloride (PVC) production, the plastic piping commonly found in plumbing and construction applications. Vinyl chloride exposure can cause a variety of health effects, including dizziness, drowsiness and headaches from short-term contact and more serious effects, including liver cancer, from long-term exposure.

But many of the properties that make certain chemistries hazardous are the same thing that make them useful in a variety of applications and building blocks for other materials, says Scott Jensen, ACC's director of issue communications. "For many critical uses, no suitable substitutes can provide the same measure of safety and performance," he notes.

BRING PRODUCTION CLOSER TO CUSTOMERS

Even if chemical manufacturers say product substitution isn't feasible, the fallout from the East Palestine spill could spur major changes across the industry supply chain.

Most vinyl chloride production occurs along the U.S. Gulf Coast, where producers benefit from access to cheap natural gas, which they convert to ethylene, notes Bill Bowen, senior markets editor at ICIS. Vinyl chloride producers could see their cost advantage take a hit, though, if legislators impose additional safety regulations on the rail industry. The costs to comply would likely get passed on to the company shipping the chemicals and their customers.

Also, the tank cars on rail lines are owned by the chemical company shipping the product, Bowen says. "So, we may also see further regulatory steps and costs for the shippers themselves," he adds.

To combat higher costs and safety risks, raw material producers may begin building smaller, modular plants closer to their customers as alternatives to the giant complexes along the coast, Bowen says.

"This specific incident in Ohio has highlighted the dangers of chlorine-derived chemicals, which carry particular dangers for workers at manufacturing facilities and in chemical transportation, or for residents near a chemical spill or accidental release," he explains. "Because of this, the idea of modular chlor-alkali manufacturing facilities has been popular – a small and relatively inexpensive production facility built next to the user of chlorine. Although this idea has been discussed for a long time now, so far, it has not gained traction. This could change."

However, Jensen says chemical producers serve a diverse range of product needs, so moving next door to customers isn't always practical. He notes that chemicals are needed everywhere – from farms to the businesses and communities that consume them.

BUILD FULLY INTEGRATED FACILITIES

Until safer materials are available, manufacturers that use dangerous chemicals in their products should produce them in house, say green-chemistry proponents. The primary application for vinyl chloride is PVC, so it makes sense to only produce it at sites that also manufacture PVC, says Eric Beckman, co-director of the Mascaro Center for Sustainable Innovation at the University of Pittsburgh's department of chemical engineering. This way, chemical producers would only make the amount of vinyl chloride they need and immediately convert it into PVC, he says. Beckman refers to this approach as "resilient design."

"In traditional design we try to prevent bad things from happening," he explains. "In resilient design, we assume that bad things happen, even if rarely, and we try to design the system so that havoc does not ensue. Thus, traditional design would have us spend a lot of energy creating rail cars with double walls or triple walls, while resilient design assumes failure or leaks but tries to minimize subsequent damage, hence, onsite, on-demand VC (vinyl chloride) use rather than rail shipments."

Tickner agrees, saying that integrated facilities would be a first step to lowering hazardous exposure but cautions that in the long term, the industry needs to identify new polymers that "don't rely on a carcinogenic building block."

LEARN MORE

For access to key resources cited in this article, visit https://bit.ly/3IgvhL6 or scan the QR code.

AIMING FOR THE PERFECT BLEND

A comprehensive how-to guide for boosting the performance of pin and pugmill mixers

BY CHRIS KOZICKI AND CARRIE CARLSON, FEECO INTERNATIONAL

"GOOD ENOUGH" is no longer satisfactory when it comes to solids and liquids blending. Performance issues can result in problems with product quality, maintenance and productivity. This is particularly true with continuous mixers, which many chemical processing facilities rely on to blend solid and liquid components into a homogeneous mixture.

It's a mixing step that sets the tone for subsequent processing, meaning it holds the power to streamline or hinder production, while also influencing end product quality and uniformity. As such, optimizing this step is critical for blending product to specification and doing so efficiently. The following covers fundamental but often-overlooked ways to improve the blending process in pin and pugmill mixers (Figure 1).

Note: While this article refers specifically to pin mixers and pugmill mixers, the principles of effective mixing extend beyond the type of mixer used.

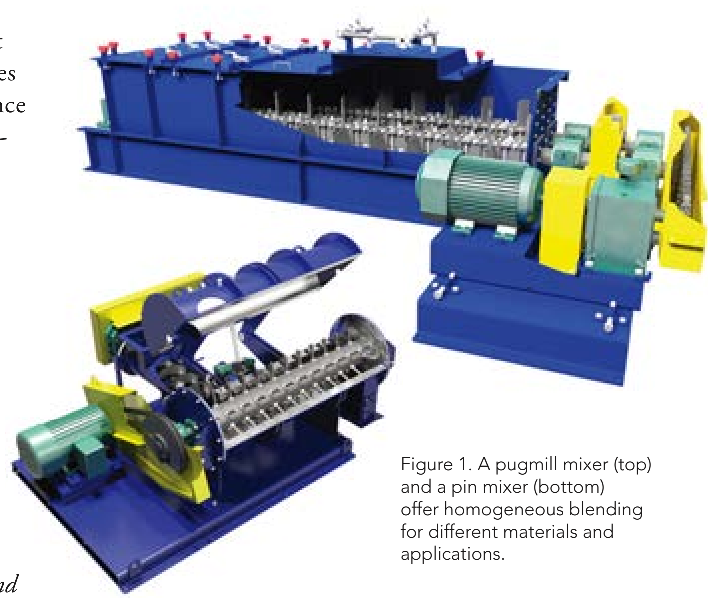


Figure 1. A pugmill mixer (top) and a pin mixer (bottom) offer homogeneous blending for different materials and applications.

PIN AND PUGMILL MIXER CAPABILITIES

The need to homogeneously combine solid and liquid feed components spans nearly every industry that handles bulk solids, starting with raw-material processing and ending with complex chemical production.

To accomplish the diverse objectives of these applications, many manufacturers rely on pin mixers and pugmill mixers — two horizontal continuous mixers with extensive capabilities in blending. While some overlap exists in their capabilities, each has its own strengths.

A pin mixer consists of a shingle shaft fitted with rods ("pins"), which rotates inside a stationary cylindrical trough. This centrifugal rotation imparts a powerful spinning action on the material, which not only thoroughly blends the solid and liquid components but can also be used to cause rapid densification and agglomeration of the material.

In contrast to the intense spinning motion employed by the pin mixer, the pugmill mixer applies a gentler folding and kneading motion, delivered through dual counter-rotating shafts fitted with paddles (for this reason the mixer is also commonly referred to as a paddle mixer).

Both mixers are highly adept at homogeneous blending, but the different action used by each can be either an advantage or a disadvantage, depending on the material characteristics and the specific objective(s) at hand.

Figure 2. De-dusted carbon black is best suited for processing using a pin mixer.

FINDING THE RIGHT BALANCE

Material characteristics have a major influence on the most appropriate blending action and the type of mixer chosen.

Material consistency. The high-speed spinning action imparted by the pin mixer is better suited to free-flowing materials, as sticky materials would bog down the mixer, making it less effective and putting additional strain on the mechanical components. Similarly, while additional wear resistance can be built into a pin mixer, the intense spinning action can encourage excessive wear when coupled with an abrasive material.

Conversely, the gentle, high-torque action of the pugmill mixer is highly effective at working through sticky or sludge-like materials and is less susceptible to wear when the material being blended is abrasive.

Particle size distribution. The particle size distribution of feedstock is also an important factor to consider in choosing between these two mixer types. Pin mixers perform better with smaller particle size ranges, as larger chunks could become lodged between pin tips and the trough interior.

Pugmill mixers have more clearance between components and can therefore handle larger particle sizes. Similarly, while the potential for tramp material to enter the mixer should always be minimized, the high torque associated with the pugmill mixer is better suited to displace any materials that might become lodged, whereas the pin mixer could experience significant damage.

Throughput. Pugmill mixers also have a much higher throughput than pin mixers, so in situations where either mixer will suit the process, producers may choose to go with the pugmill for this reason.

Blending and densification. Both mixer types yield a homogeneous blend, but pin mixers are the preferred choice when densification is the goal, particularly when it comes to ultra-fine materials like carbon black (Figure 2). Pin mixers also tend to yield a more uniform blend in terms of particle size distribution when some agglomeration is desirable, where pugmill mixers produce “rough” agglomerates. For this reason, pin mixers are the device of choice when blending material prior to a disc pelletizer or other agglomeration unit, as it produces a homogeneous mixture and can provide uniformly sized seed pellets for further growth in the secondary agglomeration device.

Ultimately, mixer selection rests on finding the right balance between process and product goals and the characteristics of the material. Pin mixers tend to be selected for blending and densifying ultra-fine materials, as well as creating smaller agglomerates, while pugmill mixers are better in tougher applications that benefit from the high torque and kneading action.

Figure 3. This pugmill mixer features a spray system consisting of multiple ports.

Figure 4. The pin mixer's visible interior shows the arrangement of pins fabricated and designed for optimal blending retention.

IMPROVING THE BLENDING PROCESS

No matter what type of mixer a processing plant chooses, there are several overarching principles that can help manufacturers optimize the blending process for efficiency and product quality based on their specific requirements. The following 10 techniques are generally applicable in most settings.

1. OPTIMIZE THE SPRAY SYSTEM

The mixer's spray system design plays an integral role in overall blending effectiveness. The number and location of spray ports, along with the nozzle types, spray pressure, height above material bed, and feed rate of the liquid component significantly influences particle wetting and the uniformity of a mixture.

It is ideal to incorporate multiple liquid injection ports (Figure 3) into the spray system design, as a wider distribution of liquid promotes more uniform blending compared to a localized or concentrated spray. Incorporating multiple injection ports, even if not all are used, also is beneficial in that it enhances operator control over liquid addition during the start-up process or in the event of changes in feedstock or process conditions.

It's important to design the spray system according to product goals and the unique specifications of the material feedstock. Different materials, as well as the same material from different sources, may exhibit variations in chemical and physical composition, causing them to respond uniquely to wetting and requiring a tailored approach.

Chemical facility operators also should customize the spray system based on how the mixture changes as it moves through the mixer; this may require nozzle type or liquid feed rate to change along the length of the mixer as well.

In some cases, it may be appropriate to locate most of the spray ports toward the feed end, adding most of the moisture near the inlet. In other cases, it may be more appropriate to spread out the spray ports along the length of the mixer for the addition of moisture in smaller increments.

2. MAINTAIN A CONSISTENT FEED

Maintaining a consistent feed seems obvious, but it is often the cause of many headaches, with even slight changes in moisture content, particle size distribution or chemical composition having the potential to throw a process off balance. This can result in over- or undermixed material, undesirable agglomerates or even process upset.

As such, carefully managing feedstock uniformity is an essential aspect of optimizing the blending process; the more uniform the material going into the mixer, the more uniform the product exiting the mixer will be and the more stable the process will be.

Managing feedstock uniformity through implementing necessary pretreatments or even changing raw-material vendors should be a top priority for those intent on optimizing their blending process.

3. OPTIMIZE PIN/PADDLE ARRANGEMENT

It's possible to engineer both pin mixers and pugmill mixers, as well as other mixer types, to adapt the agitation methods for changes in process conditions. In the case of pugmill mixers, for example, paddle arrangement, the number of paddles and the angle at which they are positioned, are adjustable.

In cases where the feed material varies in particle-size distribution or contains lumps, it's possible to adjust the unit to break up lumps for more effective mixing. In this setting, the operator can adjust the paddle angle to be closer to a vertical position to create a chopping motion. This can help break up lumps formed when moisture is added.

Also, operators may find they can achieve better results with small adjustments to the pattern arrangement, allowing them to manipulate material flow within the mixer, affecting the mixing action and in some cases retention time. They can accomplish this by adjusting the paddle angle, as well as the number of paddles, to push material back into the mixing zone and away from the discharge, increasing the retention time. Similarly, pin arrangement (Figure 4) typically encourages forward material movement through the mixer but can be modified to otherwise increase retention time.

4. MINIMIZE BUILDUP

Buildup is one of the most common and yet most easily prevented causes of issues and inconsistencies in the blending process.

Buildup can encourage accelerated corrosive or abrasive wear in mixers, which affects equipment performance and longevity, as well as process efficiency. Further, excessive buildup has the potential to break away and damage production equipment. The longer material is allowed to build up, the greater the risk to both process and equipment.

Not surprisingly, buildup can also result in contaminated or off-spec material. As such, plant managers should implement protocols for mixer cleaning as the production schedule allows to minimize buildup.

In more extreme cases, further measures may be taken to prevent buildup altogether. This might include incorporating non-stick liners and chutes, the use of alternative materials of construction, or even feedstock pretreatment.

5. AUTOMATE

Automation is a powerful tool in streamlining process and equipment efficiency, resulting in an increasing number of mixer manufacturers offering automation systems as part of their capabilities.

Automation for continuous mixers ranges from simple start-up and shutdown assistance to advanced data tracking, trending and real-time time adjustment to prevent process upsets.

These systems give operators enhanced control over the mixing process, allowing them to respond in real time to process or feedstock fluctuations, optimize the process for enhanced efficiency and circumvent potential issues by monitoring key performance indicators (KPIs).

With tracking and trending capabilities, automation systems also can give plant managers a more transparent view of their process equipment and overall production efficiency. This provides invaluable benchmarking data and opportunities for maintenance planning.

6. INCORPORATE A VARIABLE FREQUENCY DRIVE

Some types of mixers benefit from the incorporation of a variable frequency drive, or VFD, a more flexible alternative to fixed-speed motors that gives operators more control in starting up and shutting down the process, as well as fine-tuning product quality.

Figure 5. A pugmill mixer is tested in the FEECO Innovation Center.

A VFD allows for the operator to control motor speed to respond to changes in production, or to streamline start-up and shutdown. Because of this, the use of a VFD also helps to reduce stress on mechanical components.

7. CUSTOMIZE MATERIALS OF CONSTRUCTION

While most people think of materials of construction when it comes to new equipment, it may be possible to replace sections and components of an existing mixer to achieve more effective blending. This may be to reduce buildup and promote greater flowability or simply to reduce wear on the equipment.

Similarly, plant managers may be able to take advantage of trough liners, alternative pin/paddle materials and facings, and other modifications to the materials of construction for improved functionality and longevity.

8. REEVALUATE THE PROCESS

The struggle to maintain, or even reach rated capacity can be a complex endeavor. When operators can't reach production goals after troubleshooting and adjustment it may be time to reevaluate the process.

In some cases, the mixer simply may not be the most suitable option for the task at hand. In other cases, a fluctuation in feedstock characteristics may be to blame. Pinpointing the origin of an issue can be a major challenge and oftentimes requires outside expertise.

While direction and objectives may seem unclear beyond simply improving the process or resolving an issue, plant managers have several resources at their disposal.

9. CONSIDER A PROCESS AUDIT

The particulars of a process audit vary based on the provider, but in general, a process audit consists of an expert coming in and systematically evaluating the process. The auditor considers many factors, including original process design, feedstock parameters and production goals.

10. OPT FOR TESTING

Testing with an in-house R&D department (Figure 5), rental equipment or a dedicated third-party testing facility can help establish a baseline for the process, evaluate different mixer types and assess changes in process and equipment adjustments, all without affecting the live production environment.

ENSURE OPERATORS HAVE THE TOOLS THEY NEED

While mixing is a relatively straightforward objective in theory, there are many opportunities for problems to arise, particularly when efficiency or product quality are top priorities; even a slight deviation in specification is often unacceptable in many cases.

One way to keep production moving smoothly is to ensure operators have the knowledge and tools they need to be able to respond accordingly to any issues. This means thoroughly training operators on mixer operating principles and the specific challenges associated with the material being processed and the goals at hand.

It also could take the form of a readily accessible troubleshooting matrix, which lays out the problems alongside their potential causes and adjustments to make in order of priority. For these reasons, it's important to have a good working relationship with the mixer OEM for consultation, when necessary.

THE PATH FORWARD

The ability to blend materials into homogeneous mixtures is a cornerstone of modern chemical production that spans across nearly every sub-sector. With efficiency and product quality central to most operations, optimizing this mixing process is vital to meeting both process and product goals.

Plant managers and operators have many opportunities to maximize this aspect of production at their disposal, no matter what type of mixer they are working with. Optimizing spray system design, maintaining feedstock uniformity and taking advantage of automation technology are just a few of the options available to them, with the potential for small changes to have a major impact.

In settings where the path forward is unclear, plant managers can opt for a process audit or testing services to provide guidance. ●

CHRIS KOZICKI is a process sales engineer and **CARRIE CARLSON** is a technical writer for FEECO International. Email them at ckozicki@feeco.com and ccarlson@feeco.com.

Cepsa Química retrofitted this plant in Cádiz, Spain, to manufacture its Detal linear alkylbenzene, or LAB, technology for biodegradable detergents.

LAB Tested: Cleaner Detergent Catalysts

Safer linear alkylbenzene production technology can help detergent makers meet sustainability goals while boosting productivity

By Manuel Pedraza, Cepsa Química

IN THE 1970s, environmental concerns prompted the chemical industry to develop biodegradable detergents to replace earlier, highly polluting compounds. This was the birth of linear alkylbenzene (LAB), the main component in biodegradable detergent manufacturing.

Advancements in LAB technology are gaining attention in the consumer products world as manufacturers look for ways to produce safer, more environmentally friendly detergents.

For example, in 2021, Cepsa Química retrofitted its Puente Mayorga plant in Cádiz, Spain, to manufacture its LAB with the new Detal Flex 2-Phenyl technology, replacing its previous production method that relied on an acid catalyst, which posed significant health and environmental risks. In contrast, Detal uses a solid, non-corrosive catalyst.

Cepsa Química completed the transformation work in 2021, with an investment of 117 million euros. In addition to improving safety, the process helped the plant increase production by 14%, enhancing its position to meet growing global demand for biodegradable detergents. The improvements are related to lower fixed and operational costs using the Detal process over acid catalysts.

Cepsa Química also has documented lower raw material use in facilities that have converted from older processes to LAB as well as water-consumption reductions of 40% annually.

LAB YESTERDAY AND TODAY

LAB, a component of linear alkylbenzene sulphonate (LAS), is currently used as the main ingredient in the production of biodegradable detergents.

LAS has been employed in detergent production for more than 50 years. It's a biodegradable surfactant found in traditional detergent formats, such as liquid, powder or detergent bars, and more sophisticated products, including single-dose capsules or highly concentrated liquid detergents. In the early days, LAB production was carried out mainly through acid catalyst, resulting in several issues pertaining to process safety and environmental impact.

Roughly speaking, LAB production occurs in three stages. The first stage focuses on obtaining feedstock, the normal paraffins (n-paraffins) from kerosene. The second stage is the transformation of n-paraffins into alkene (monolefins), while the third and last stage is the alkylation of benzene by monolefins to obtain LAB.

Before the development of Detal technology, the final stage primarily involved acid catalysts, such as hydrofluoric acid (HF technology). This process due to the toxicity of acid catalysts, requires very strict safety protocols to eliminate risks for employees and the public. It's also a more labor-intensive process and requires specialized facilities and equipment to neutralize the acid waste.

In the late 1990s, Cepsa Química and Universal Oil Products (UOP) developed Detal and built a facility in Bécancour, Quebec, based on this technology. This new process helped mitigate the main problems that, until then, had been encountered in LAB manufacturing.

In 2009, Cepsa Química's research and development team enhanced the performance of its Detal technology by adding a transalkylation unit. The main benefit of this new process, called Detal Plus, is the need for less raw material consumption. It can increase LAB production by up to 5% without incorporating new n-paraffins, according to Cepsa Química's experience.

Further developments in the process enabled the production of two grades of LAB: the high 2-phenyl grade (typical of traditional Detal technology) and the low 2-phenyl grade (typical of hydrofluoric acid). This technology, called Detal Flex 2-Phenyl, allows LAB producers to supply both grades of LAB from a single process unit. This has efficiency and cost advantages because suppliers can sell both grades from one plant, and customers that use both types of LAB can get all their product from a single site.

SUSTAINABLE DETERGENT SOLUTIONS FOR THE FUTURE

Consumers are increasingly aware of their carbon footprint. They are demanding products that use more sustainable materials and packaging. As technologies such as Detal demonstrate, sustainable solutions can help manufacturers balance productivity needs with customer and regulatory demands for more eco-friendly products and processes.

This new way of designing, developing and implementing chemical processes is called "green "chemistry." For example, Detal meets the environmental criteria to obtain the EPD (Environmental Product Declaration) which supports environmental information through Life Cycle Analysis representing a commitment to continuous improvement in sustainability-related matters.

Detal has received various awards including the "2020 European Business Awards for the Environment" and the "ICIS Surfactants Awards", an international recognition of excellence and innovation in different areas of the chemical sector, in the category of technological innovation.

While Detal technology offers significant advantages in terms of sustainability and productivity, as with any innovation, there are still challenges to be faced and overcome. One of the key focuses in the future will be to further reduce the carbon footprint of Detal products to meet consumers' demands and align with sustainability goals.

Looking ahead, Cepsa Química plans to continue its research and development efforts on sustainable products. This includes the development of renewable and recycled raw materials, in line with its sustainability strategy, such as its NextLab product. NextLab incorporates sustainable raw materials, such as biomass of certified origin or recycled materials. ●

MANUEL PEDRAZA is head of LAB technology development for Cepsa Química. Email him at manuel.pedraza@cepsachemicals.com.

Take a Closer Look at T-Junction Mixing

For simple gas mixing applications, this method is effective and inexpensive

Many process operators and engineers make these choices without considering the basics of fluid flow.

DIFFERENT METHODS can mix two gas streams. The most common ways to mix gases include ejectors, T-junction mixers and static mixers. If it works, simple is best. In the right conditions, a straightforward T-junction mixer fits that bill.

Figure 1 shows a schematic of a T-junction. One gas goes down the mixing T, and the second is injected from a side pipe. For this example, the main flow is at velocity V1 in a pipe of diameter D1. The added flow is at velocity V2 in a pipe of diameter D2.

Multiple variations exist. Depending on their preferences, users may have the gas entering the main flow at right angles or point at some angle upstream or downstream. The mixing gas may enter either radially (aimed across the center of the pipe it enters), tangentially (aimed at a tangent to the edge of the pipe), or at some point in between. Other configurations might use multiple injection points spaced around the pipe.

Many process operators and engineers make these choices based on an idea that seems logical without considering the basics of fluid flow in mixing.

Experience and experimental work show the most rapid mixing occurs with a radial entry at right angles to the main flow. The more parallel the flows are when they join, the longer the distance and time required for full mixing.

In Figure 1, the side entering stream (from below) enters the main flow radially and at a right angle. Mixing occurs through two mechanisms. First, the vapor from the side entrains vapor into the entering jet. Second, the vapor flow entering V2 curves as it is pushed by the main flow (V1).

If the vapor velocity (V2) in the entering flow is too low, the vapor is pushed along the wall where it enters. If the vapor velocity is too high, the entering jet shoots across the main flow, hits the other side, and gets pushed down the wall opposite where it enters.

An optimum vapor velocity for V2 results in an expanding mixing zone that blends the vapors as rapidly as possible. Computational fluid dynamics has replaced smoke tracers and thermography as the primary method for analyzing T-junction mixers.

Multiple factors are involved, but for fully developed turbulent flow, the optimum velocity ratio between V1 and V2 is related to the pipe diameters. Determining the optimum design has proven difficult to quantify. However, the quickest mixing appears to occur when:

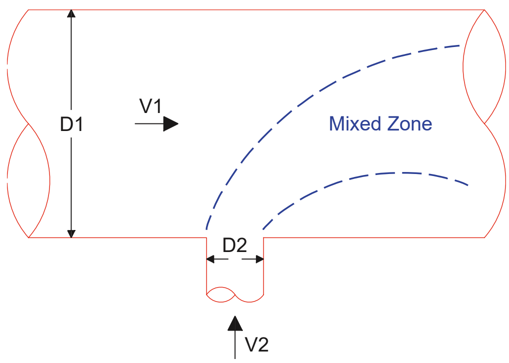


Figure 1. The optimum velocity ratio between V1 and V2 is related to the pipe diameters (D1 and D2).

$$\frac{V2}{V1} = \left(\frac{D1}{D2}\right)^{0.5}$$

This is not a perfect correlation, but works for nearly all cases with fully turbulent flow.

For example, a recent application required rapid mixing to avoid localized problems due to solids deposits. Normal operation had V2 at 54.6 ft/sec in a 4.026-in. ID pipe and V1 at 31.3 ft/sec in an 11.94-in. ID pipe. In this scenario, the velocity ratio (left side of the equation) V2/V1 is 54.6/31.4 or 1.74. This compares to $(11.94/4.026)^{0.5}$ or 1.72 for the square root of the diameter ratio (right side of the equation). The match-up of velocities and pipe sizes is nearly ideal (1.74≈1.72). In a high-rate case, V1 changes to 34.2 ft/sec, but V2 changes to 90.0 ft/sec. Under these conditions, mixing is slower because the entering velocity ratio has changed to 90.0/34.2 or 2.63, which is significantly different from 1.72. The high-velocity side inlet will have over-penetration, and it will take a longer tailpipe downstream of the T for full mixing to occur.

Changing to a 6-in. diameter side entry would help the high-rate operation but make the base case worse. This shows one weakness of T-mixing when rapid mixing is needed. They have relatively limited flow ranges for optimum operation. One attempt to get around this is to have multiple entries control the inlet velocity of the side stream. Multiple entries add complexity to the system. When operation across a large range of flow rates is required, a T-junction mixer may not be the best choice.

Still, a T-junction mixer is an effective, low-cost option for many simple gas-mixing applications. ●

ANDREW SLOLEY, Troubleshooting Columnist

Centrifuge Design Improves Separation Process

The BlueTector horizontal peeler centrifuge is designed to meet the demands and requirements of the pharmaceutical and chemical industries. The fully re-engineered design includes a new filtrate housing shape optimized to improve efficiency in liquid flow during the separation process. Its direct drive means no more belts or hydraulic systems are required. The centrifuge

basket main drive is grease lubricated, and a sliding back cover provides easy access to the mechanical section. The base plate's modular design allows for easy, low-cost shipment and installation of the machine. The peeler knife and screw conveyor also are modular designs, and all electrically driven.

Heinkel Filtering Systems, Inc.
856-467-3399
www.heinkelusa.com

Gas Filter Withstands Higher Pressures

The LE6 gas filter with a 3-in. connection and 15 µm bronze filter inserts is suited for oxygen and other gases, removing mechanical impurities in pipelines. Downstream equipment is

protected, and process performance is improved, reducing maintenance costs and expensive downtime, says the company. With an almost 12-in. diameter, nearly 3-ft. height and weighing almost 441 lb., the filter is also suitable for oxygen, meeting the stringent requirements of EIGA, AIGA and CGA. The filter features 580 psi maximum operating pressure and high volumetric flow. The filter also has connections at the gas inlet and outlet for attaching pressure gauges or electrical differential pressure transmitters.

WITT Gas Controls LP
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www.wittgas.com

Analyzer Supports Environmental Compliance

The KECO Model 205 PermaStream H_2S in liquids process analyzer offers an accurate quantification of hydrogen sulfide (H_2S) in sample streams of crude oil as part of environmental compliance, safety and quality control practices. The inline analyzer measures H_2S in light, medium and heavy crude oil; dirty or clean water; diesel; fuel oil and drilling fluid in real time. By providing accurate and continuous monitoring of H_2S levels in liquid streams, the analyzer helps companies demonstrate compliance with air permits promoting the reduction of environmental impacts. The analyzer

fully separates H_2S from the liquid sample for measurement in the gas phase, eliminating false positives.

Analytical Systems Keco
281-516-3950
www.liquidgasanalyzers.com

Enclosure Protects Against Contamination

This containment control system is engineered to safely contain and control airborne particulate from sampling procedures. Dispensing from drums and weighing operations are typical ap-

plications. Drums or equipment can be easily rolled into the enclosure through the strip curtain entrance. Both the process and surrounding environment are protected from contamination. A downward flow of HEPA-filtered air maintains a cleanliness level at drum or working height while all exhaust air exits out through HEPA filters in the rear wall. The interior is under slight negative pressure to ensure no contaminant escapes out of the enclosure.

HEMCO Corporation
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www.hemcocorp.com

Blender Develops High-Accuracy Mixtures

The Model VCB-50 v-cone tumble blender is designed for atmospheric operation and features a stainless-steel type 316 intensifier bar fitted with high-speed 19-in. chopper blades operating at 475 rpm to reduce the size of agglomerates. The intensifier bar doubles as a spray bar equipped with fan-style nozzles for minor liquid additions. The vessel is driven by a 30-hp motor to approximately 12 rpm, while a 15-hp motor drives the intensifier bar. Sanitary tri-clamp connections and mirror finish on the product-wetted parts promote easy cleaning inside and out. The control panel includes a 7-in. color touch-screen display with individual start/stop and speed controls, jog function, cycle timer and recipe system.

Charles Ross & Son Company
800-243-7677
www.mixers.com

System Supports Sustainability Goals

The Seeq Solution for Microsoft Sustainability Manager enables sustainability teams to integrate time series process data preparation, analysis and continuous improvement, reducing the environmental impact of process industry operations. Analyzing time series data from equipment sensors is critical for measuring sustainability impact at process manufacturing companies. Seeq incorporates the Microsoft Cloud for Sustainability data model into its workflow for consistency of emissions data.

Live data connectivity and auditable data cleansing and contextualization capabilities enrich time series emissions data, reducing manual data preparation time by up to 80%, the company reports. Sustainability teams can access this data within Microsoft Sustainability Manager to track Scope 1 and Scope 2 emissions for reports and to set and track accurate emissions reduction goals.
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EU Reveals Path to Digital Transformation

Report outlines how to scale up technologies to achieve more sustainable processes

The chemical industry must become more active in the development of EU digital policies and regulations.

TECHNOLOGIES SUCH as the industrial internet of things (IIoT), automation and blockchain provide the digitalization backbone to transform the European Union (EU) chemical sector into a circular, more sustainable economy.

So says the European Chemical Industry Council (Cefic) and management consulting firm Arthur D. Little in a 52-page report called "Digital Technologies for Sustainability in the European Chemical Industry."

"Digitalization in the chemical industry is not new with multiple players already applying digital technologies in their fields," says Daniel Witthaut, Cefic's executive director for innovation. "However, enormous opportunities exist for the industry to reach its sustainability goals faster through the application of the latest digital technologies — a journey that is just beginning for most players."

The report's authors outline how the chemical sector currently uses technologies and ways to scale their use to enable more sustainable processes and products.

One example is Eastman Chemical Co.'s use of blockchain technology to trace certified recycled content across its value chain. The blockchain-based platform provides visibility into the specialty plastics produced with the company's certified molecular recycling technologies.

The report also highlights Evonik Industries' IIoT platform, which the company uses to rapidly develop applications and securely scale them from the edge to the cloud. The platform also allows the company to extend the applications across the enterprise, so multiple sites can benefit from them and easily tailor the tools to meet their specific needs. One of the company's first developments using the platform was a digital plant-inspection checklist that it combined with process information systems and current plant data to help identify trends and deviations faster.

Another example is BASF's use of its supercomputer by R&D staff to conduct complex simulations of processes and materials once deemed impossible. "For instance, intricate modeling of molecular processes and materials with specific properties and functionalities that help increase their sustainability performance can now be performed within a few minutes, while covering a range of simulation parameters without the need for crude approximations," the report states. The company also is applying supercomputing to research more efficient and sustainable industrial catalysts.

Based on interviews with senior digital and sustainability experts within and beyond the EU chemical industry and covering more than 50 companies, the authors identified five priority areas they believe digital technologies could have the largest impact. These are process design and production for climate and circularity objectives; sustainability assessment; enabling materials and chemicals circularity through tracking and tracing; sustainable product design; and safe and efficient logistics and distribution.

The report then expands on the need for industry to address the challenges restricting the adoption of digital transformation. These include data availability, interoperability, standardization and cybersecurity. Also cited is the reluctance among companies to share data, financial costs, organizational issues, and a need for more digital skills in the workforce.

Addressing these bottlenecks calls for greater collaboration between EU institutions and the chemical industry, the report notes, such as collectively investigating scalable solutions for broader and more intensive implementation toward a sustainable future. There is also a need to establish common data and technology standards, including data sharing standards.

The report also urges industry to explore new business models, target investment into digital technologies to achieve circularity and sustainability targets, and train and attract talents with advanced digital skills. Here, the authors advise collaboration with universities to facilitate curricula and educational content development that links digitalization and sustainability aspects.

Finally, the authors urge the chemical industry to be more active in the development of EU digital policies and regulations.

The report's final recommendations concern EU institutions — most notably, aligning the regulatory framework. This, it says, should allow for applying digital technologies and speeding up existing processes for deploying digital technologies that effectively contribute to sustainability objectives, including through new business models.

"The success of digital solutions that are in their development phase (e.g., AI applications) strongly depends on an innovation-friendly policy and regulatory framework," the report concludes. ●

SEÁN OTTEWELL, Editor at Large


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