

JM

Johnson Matthey
Inspiring science, enhancing life

Informally speaking

A formaldehyde magazine from Johnson Matthey

- Formaldehyde Asia returns to Bali
- Meet Astachem, Dover and Intanwijaya
- How catalysts are created
- Formaldehyde and modern fertilizers
- Getting started with UFC



SPRING/SUMMER 2023

Three conferences, six months and tonnes of experiences

During the second half of 2022 and the first quarter of 2023, we conducted three conferences within six months, something we have never done before. Of course, there was a very good reason for it, since we had not been able to meet in person this way since March 2020. And we did learn, as you can see in both the previous editions and on pages 6-7 in this one, that these conferences are here to stay. Not only because they improve communication and allow building new networks for people, but also since the information shared is highly valuable. We also took the opportunity to interview a few of our customers attending the latest conference in Bali, and you can read about them and their experiences on pages 8-11.

One area that we have not written about for a while, however, is agriculture. This is something that has gotten a lot more attention in Europe ever since the war in Ukraine began, which has had a big impact on Europe's farmable lands and fertilizer situation. On page 14 you will find an article about two types of modern fertilizers that can be made with urea/formaldehyde, and what these mean from both a sustainability and an ecological perspective.

Other articles in this edition have been included in response to questions we have received from several of you. One is about how new catalysts are created, which our R&D department explains on pages 12-13.

Another is for those of you who have been asking about how to extend into UFC production. And with safety always an important topic, we start out this edition with an article on performing a HAZOP study and how we can be of help. Later we offer some tips on condenser cleaning and the quality of your boiler feed water that can help you to extend the lifetime of your equipment. There is also an update on the molybdenum situation following the wildly fluctuating price development of last year.

As we move forward, we take with us all the rewarding interactions that we experienced with you during our recent conferences and, as always, look forward to future meetings between our teams to support you in any way we can.



Lars Andersson and Ronnie Ljungbäck
Global Market Managers Formaldehyde

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This document is printed on Essential silk paper, which contains material sourced from responsibly managed forests and is Elementary Chlorine Free (ECF). We are helping The Woodland Trust and The Woodland Carbon scheme, which aims to improve the landscape of Britain by planting more trees and protecting our national heritage of precious ancient woodland.

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Embedding sustainability into everything we do

Johnson Matthey (JM) is a global leader in sustainable technologies. Through inspiring science and continued innovation, we are catalysing the net zero transition for millions of people every day. Our skills and technologies are important today as businesses and communities adapt to the challenges of climate change. But advancing sustainability isn't just about our portfolio of technologies, it's also about our own operations, how we work together and hold ourselves accountable for our impacts on society.

Our products and services are where we believe we can have most positive impact on society and we have aligned our strategy with four of the UN Sustainable Development Goals (SDGs).

Good health and wellbeing

- **Emission control technologies** that reduce harmful oxides of nitrogen (NO₂) and particulates from vehicle tailpipes and stationary engines
- **Purification technologies** that reduce harmful contaminants, such as mercury, from industrial processes
- **Refinery additives** to mitigate NO, and oxides of sulphur (SO₃) emissions
- **Catalysts** used to make pharmaceutical ingredients

Responsible consumption and production

- **PGM recycling** to recover and reuse scarce resources
- **Chloride guards** to prevent corrosion
- **PURACARE™ services** to reduce maintenance lifetime and end-of-life recovery
- **CAT-AID™ products** to extend catalyst life

Climate action

- **Technologies** that turn high sources of carbon, such as household waste, into sustainable aviation fuels
- **Fuel cell components** for low-carbon transportation and distributed power units
- **Nitrous oxide (N₂O) abatement systems**

Affordable and clean energy

- **Renewable (green) hydrogen technologies** that will support the drive to zero carbon hydrogen production using renewable energy and electrolysis
- **Low-carbon (blue) hydrogen technologies** that are available today to help make low-carbon hydrogen at scale

BY



Nicole Watson
Marketing Communications
Representative

On the front page:

Formaldehyde Asia, March 2023

Read more about this event on page 6-7



Conferences coming up...

We are planning formaldehyde conferences in both China and South America during 2023/24, details to be confirmed.





What is a HAZOP and how can we help?

In recent years there has been a lot of attention placed on the importance of doing a HAZOP study, and some of you have asked if this is something we can help you with. In this article we take a brief look at what a HAZOP is, how we do them at JM, and how we can be of assistance to you if you need it.

HAZOP in a nutshell

A HAZOP, or Hazard and Operability study, is a systematic assessment tool used to identify and address potential hazards in industrial processes right at the design phase to avoid the occurrence of an incident that could affect the safety of people or assets while hindering productivity. For **FORMOX™** plants, a HAZOP is done once every three years for our standard plant design. In addition, whenever a change is made to the design stage, a HAZOP is done for that particular change.

How is HAZOP done at JM?

JM has its own EHS Risk Matrix and Procedure designed to bring more clarity to, and a better understanding of, critical EHS/Process Safety risks. Worst case scenarios are developed as a part of hazard review, and assessment of consequences are done based on the JM EHS Risk Matrix. The HAZOP study is directed at minimising

the probability of any of these scenarios actually occurring. Several operating and procedural recommendations that arise from the HAZOP study are then implemented to the standard plant design. Note that scenarios that arise outside battery limit (OBL) are generally not considered during a JM HAZOP study, but are to be included in your own HAZOP study.

How can we help you with your HAZOP?

Customers are responsible for doing a complete HAZOP study of the plant based on the Process Engineering documents sent by JM. This should include both IBL and OBL scenarios, as well as any other added pipelines likely to enter the plant at a later stage that we are not aware of. JM always assists with specific queries related to customers' HAZOP studies and we can also take part in your study if you need more assistance. Furthermore, we provide approval for any actions to be taken based on recommendations generated by your study. If the recommendations suggest a major change to the safety controls, you are always welcome to ask us for our feedback.

If you would like to know more about how we can assist you with a HAZOP study, please contact me at Debopriya.Das@matthey.com

Node	1	DWG. No.	ID-01-01	Rev 0				
System	HTF	Equipment	HTF vapor from reactor to condenser					
Lines	10011	Attendees	Aaa, Bbb, Ccc					
Nodes	Guideword	Deviation	Causes	Consequences	CC Type	CC	Protection	Recommendation
1.01.a	Flow	High	Line/Bellows rupture	Major HTF release to atmosphere due to boil-off of HTF when HTF system pressure is lost, formation of flammable vapor cloud. Environmental hazard	S E	4 3	Pipe code Hazardous area classified Zone 2.	5.Piping integrity program

Table 1: Extract from a HAZOP Study done for JM for Standard Plants that lists, among other things, consequences and recommendations

BY



Debopriya Das
Senior Process Engineer

JM-LEVO tips and reminders

As mentioned in our previous issue of *Informally speaking* as well as at our latest Formaldehyde conferences

(Helsingborg 2022, Houston 2022 and Bali 2023), our FPC (FORMOX Process Control) system was to be decommissioned earlier this year. Now that that has happened, we would like to remind you that the most efficient way to get timely feedback is via the JM-LEVO™ Formaldehyde Portal. Of course, you can provide data by other means, but the manual handling will unfortunately significantly impact the response time.

We are glad to see that many of you that have been recently onboarded are sharing data much more frequently. We believe that it is a sign that you see additional value in this new way of interacting with us for technical support.

We are glad that so many of you have begun using the JM-LEVO Formaldehyde Portal. To help you get the most out of it, we will continue to bring you some useful tips in the coming issues of *Informally speaking*, for example:

BY



Dr Philippe Thevenin
Global Technical Services Leader –
Formaldehyde



Follow JM on LinkedIn for further updates or contact Philippe or your Regional Sales Manager or Technical Service representative if you have any questions.

Did you know that...

As part of our latest release a few months ago, we introduced a new area under the Document page. Beside the Generic area, where you can find all our Technical Information documents, you have at your disposal a My Doc library. This is replacing the former Customer Center that was decommissioned a little more than a year ago. Here, we can store on your behalf any document that is strictly related to your own operations.

For this purpose, we have created the following categories:

- Technical Documents
- Analysis reports
- Invoices – Orders
- Loading service
- Operation
- Plant Details
- Spent catalyst
- Technical study
- Other

For instance, as part of the Analysis report, we will store the reports from catalyst characterization (e.g. XRF analysis on formaldehyde catalyst, Activity tests on ECS catalysts, etc.).

Another example is the Loading service folder where, for instance, the loading reports can be made available. Likewise, under the Spent catalyst, we can store any information regarding the recovery of the spent material that you have returned to us.

Formaldehyde Asia 2023

13 - 16th March 2023, Uluwatu, Bali

After the unforgettable 9th Asian conference in Kota Kinabalu in 2019 just before the pandemic started, we have finally returned to Southeast Asia to gather on this beautiful island paradise for our 10th Asian conference. We were 65 in Bali altogether, coming from 13 countries and representing 23 companies. The conference was well presented by JM's formaldehyde team and appreciated by very responsive and enthusiastic participants.

Day 1

After a nice reception Monday evening with sunset and a beautiful view at our feet, Eddy Lee kicked off the conference Tuesday morning with a welcome address and introduction, followed by the safety briefing from the hotel officer and a safety experience sharing with Peter Karlsson, Technical Service Engineer.

Alberto Giovanzana, Managing Director for Catalyst Technologies at Johnson Matthey then officially opened the conference by delivering an update on JM's business and sustainability efforts. Lars Andersson and Ronnie Ljungbäck, Global Market Managers Formaldehyde presented our portfolio of **FORMOX** plants and catalysts respectively, and Peter Karlsson explained what our technical support offering is all about.

After a coffee break, Philippe Thevenin, Global Technical Services Leader – Formaldehyde, demonstrated several valuable features of the **JM-LEVO** Formaldehyde Portal, followed by Ola Erlandsson, Senior Process Specialist, and Philippe providing our latest updates on **FORMOX 2.0** high pressure plants and catalysts. Claes Lundström, Senior Consultant - Plant & Revamp Sales, gave a flavour of our different options to upgrade existing formaldehyde and UFC plants, before group photo taking and lunch break.



After lunch, our invited speaker, Mark Berggren from MMSA presented a methanol market update, followed by Ronnie Ljungbäck with our latest view on the formaldehyde market. Claes Lundström then continued along Alberto's path of sustainability by talking about formaldehyde decarbonization. Lars, Ola, and Ronnie came back in the afternoon to talk about the future development of formaldehyde technology, which provided us with great insight and reaffirmation of our efforts to improve our product portfolio. That evening we enjoyed dinner with typical Balinese entertainment at the hotel's beach club facing a beautiful sunset over the Indian Ocean.



Day 2

On Wednesday Regional Sales Manager Van Fu Shen welcomed everyone to the General presentations and Vendor stations. Ola and Lars talked about process description and critical equipment in formaldehyde plants respectively, followed by Peter introducing the next interesting activities: Visit to the vendor stations. The participants were first briefed on Heat transfer fluids by Sagar Raghunath from Eastman, TurboPac Generation 2.0 by PBST's Ragnar Olafsson, and on Piller by Chih Khiam Hoe.

During the coffee break participants visited the informative vendor stations provided by our partner suppliers Aerzen, Continental Disc, Eastman, PBST, Piller, PT Dover Chemical and our own **FORMOX** tools. After lunch we departed for our excursion activities visiting the new icon of Bali: the GWK Cultural Park – devoted to the Hindu god Wisnu and his mount Garuda – followed by the Uluwatu temple, continuing with dinner on the beach of Jimbaran and ending with karaoke (singing) back at the hotel.

Day 3

Peter Karlsson started off the final day by introducing the Operational presentations. A customer speaker, Aizaq Syazwan from Polyplastics, shared the company's improvement history for reducing paraformaldehyde formation. Ola, Philippe, and Peter talked about deflagrations, process hazard awareness, instrument errors, gas analysis, yield calculations, and catalyst usage and ageing.

After lunch Ronnie, Ola and Philippe elaborated on how and when to use hotspots, absorber theory and operation and optimisation of plant and catalyst operation. The conference concluded with a Slido quiz and was wrapped up by Ronnie and Lars. Eddy closed the conference and bade farewell to the participants.

Thanks for all your enthusiasm and feedback

We could tell that there was a pent-up desire to meet in person again, just like we had experienced at our recent conferences in Helsingborg and Houston, and it was really great to meet so many nice people face-to-face again. Listening to participants, and also reading their feedback, it seemed to have been a very appreciated event, informative, good experiences shared and the high ratings on the presentations, backed up the comment: "JM's **FORMOX** team is excellent".

We look forward to next event in the region, when and where yet too soon to be decided, but Thailand is a hot candidate...and you can count on carrying on the karaoke tradition!

BY



Eddy Lee
Regional Sales Manager

Astachem committed to reducing emissions and energy waste

Asta Chemicals Sdn Bhd in Malaysia provides toll manufacturing services that enable other chemical companies to produce and distribute their products in Southeast Asia without having to build their own manufacturing plants in the region.

Established nearly 50 years ago as a formaldehyde-based resin manufacturing company then known as Borden Chemicals, it later became Hexion (2005) and Momentive Specialty Chemicals (2010) before becoming Asta Chemicals in 2012. The company has operations in both Perai and Kuantan with total capacities of 67,000 tpa formalin, 160,000 tpa resins and 12,000 tpa powders.

Over the years Astachem has received numerous awards and in 2014 it became the first chemical manufacturer in Malaysia to be awarded a "MYCarbon Award" by Malaysia's Ministry of Environment & Natural Resources for its commitment to reducing carbon emissions. The company fully utilises its steam for heating in its processes to reduce energy waste and its reliance on natural resources like natural gas, and is currently looking to invest more in sustainable energy solutions such as solar and steam-generated power.

Long history with JM

"We have a rich history with JM dating back to the installation of the first load of **FORMOX** catalyst in our Borden-designed formaldehyde plant in 1996," says Plant Manager Mr. Andy Tan. "Since that time, we have never looked back, relying consistently on the proven performance and reliability of **FORMOX** technology to power our plant operations. Last year, we installed the 19th load of **FORMOX** catalyst, a testament to our



Mr. Kevin Looi, Deputy CEO (left) and Mr. Andy Tan, Plant Manager (right) with Eddy Lee and Polly Murray during the Formaldehyde Asia conference in Bali.

continued confidence in this trusted technology and our ongoing partnership with Johnson Matthey."

Value of the conferences

"As the Plant Manager at Astachem for the past seven years, I am honoured to have attended four JM Formaldehyde Conferences: Formaldehyde China 2017 in Chengdu, China; Formaldehyde Asia 2019 in Kota Kinabalu, Malaysia; Formaldehyde China 2019 in Zhuhai, China; and Formaldehyde Asia 2023 in Bali, Indonesia. Attending these conferences feels like a reunion with the JM family, where we come together to learn, share, discuss, brainstorm, and laugh before parting with the anticipation of the next conference."



Product lines

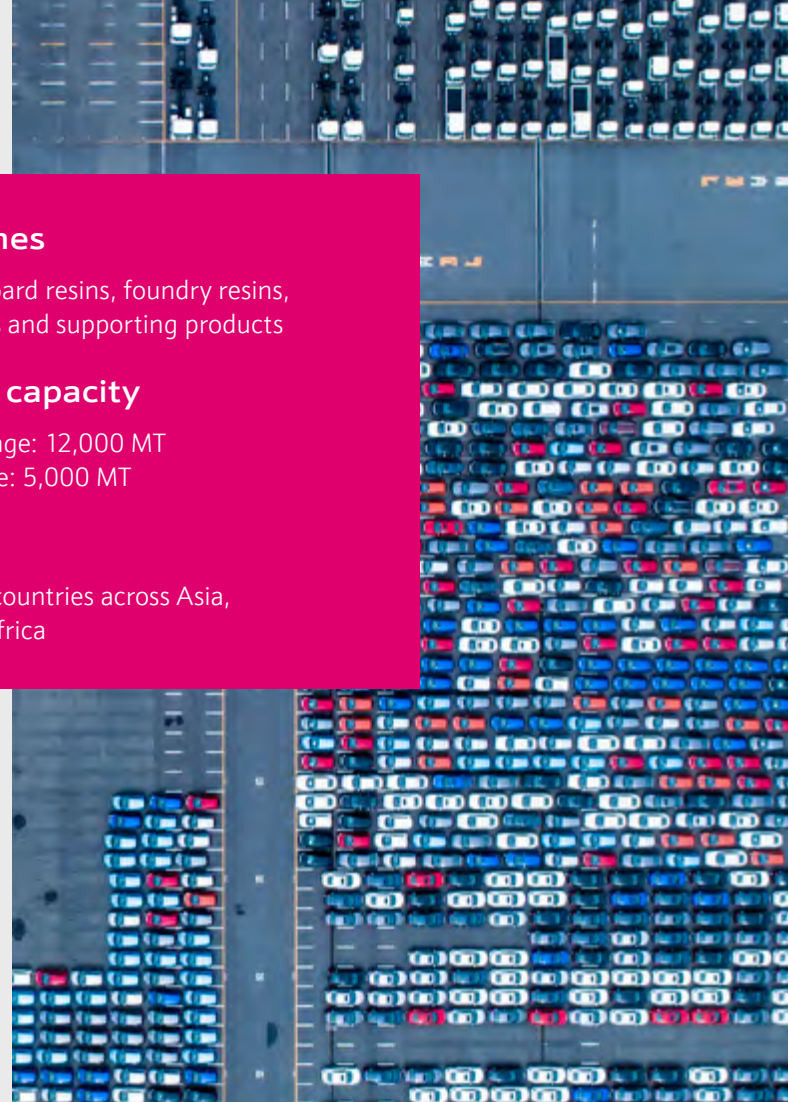
Wood panel board resins, foundry resins, specialty resins and supporting products

Tank farm capacity

Methanol storage: 12,000 MT
Coal tar storage: 5,000 MT

Markets

Exports to 24 countries across Asia, Oceania and Africa



“The vendor stations with practical sessions have provided valuable insights into state-of-the-art equipment and further learning opportunities”

“The JM conferences have provided an excellent opportunity to learn about the latest developments and updates from Johnson Matthey’s experienced formaldehyde team. It’s a great platform for meeting peers and sharing knowledge and experience. On several occasions, we’ve found answers and solutions to the challenges we face through these conferences. We’ve been able to speak directly to the JM experts about various matters pertaining to catalyst and plant operation, such as **JM-LEVO** and catalyst performance, which we discussed with Dr. Philippe Thevenin during the conference in Bali.”

“The vendor stations with practical sessions have provided valuable insights into state-of-the-art equipment and further learning opportunities. Additionally, the presentations on operational topics such as critical plant and process equipment, plant performance optimization, and absorber theory and operation have been particularly valuable for me and my team of Manager and engineers. Overall, attending the JM Formaldehyde Conferences has been a great learning experience for all of us at Astachem.”

BY



Eddy Lee
Regional Sales Manager

**Astachem on JM-LEVO Formaldehyde Portal:
“An invaluable resource for formaldehyde plant operation”**

“JM-LEVO is a powerful tool that provides instant data upload and analytical capabilities, making it an invaluable resource for formaldehyde plant operation,” says Mr. Andy Tan, Plant Manager at Astachem. “Prior to having this Portal, plant operation data was sent periodically to JM experts via email, which could take anywhere from one to a few days for analysis before being emailed back to us. With the implementation of **JM-LEVO**, the data analysis process has been significantly streamlined, providing us with real-time insights into plant operation and enabling us to make timely decisions based on the most up-to-date information.”

“We are constantly striving to learn and explore the various functions available in the Portal to fully leverage its potential. Through regular experimentation with new features and capabilities, we can gain a deeper understanding of the Portal’s capabilities and uncover innovative ways to enhance our plant operations.”

Intanwijaya finds added value in recycled catalyst

During the recent Formaldehyde Asia conference we sat down with two delegates from PT. Intanwijaya Internasional Tbk in Indonesia, who kindly shared with us some of their experiences and insights.

Formerly known as PT. Intan Wijaya Chemical Industry, the company was first established in 1982 as a producer of formaldehyde and formaldehyde resin products. It was listed on the Jakarta Stock Exchange on July 24, 1990 under the initials INCI.

Intanwijaya's facility was established in Banjarmasin, South Kalimantan, Indonesia. The chemical complex was constructed in 1986 equipped with world-renowned European technologies including the **FORMOX** formaldehyde technology from Perstorp AB of Sweden and Thermosetting Adhesive Resin technology from FORESA of Spain. In 2013 the company built a second facility in Semarang, Central Java to broaden its reach toward Java's expanding wood industry.



Products

Formalin, urea formaldehyde resin, melamine formaldehyde resin, phenol formaldehyde resin, urea formaldehyde powder resin and melamine formaldehyde powder resin

Production capacity

110,000 tpa formaldehyde 37% – 55%
120,000 tpa formaldehyde-based resin
9,000 tpa urea formaldehyde glue powder

Markets

Primarily domestic with some exports to Hongkong, India, Sri Lanka, Myanmar and Africa

“Innovation on catalyst, in particular on the recycled catalyst, has given us added value”

“We have enjoyed 37 years of excellent cooperation with JM,” said Mr. Sonly Ardy, Director of Intanwijaya. “The conferences have been very helpful, giving us the opportunities to broaden our business relations network, update the understanding of the formaldehyde technical operation and market, and awareness of technology improvements. Innovation on catalyst, in particular on the recycled catalyst, has given us added value.”

BY



Eddy Lee
Regional Sales Manager



Mr. Sonly Ardy, Director (left) and Mr. Sul Moo Yong, General Manager (back right) sat down for an interview with JM's Polly Murray and Eddy Lee during the Formaldehyde Asia conference in Bali

Dover helps Southeast Asia to store more carbon

PT. Dover Chemical was established in 1980 as part of Dovechem Group with a local partner in Indonesia. The company is in the formaldehyde, paraformaldehyde and adhesive business for manufacturing, and has been using JM's **FORMOX** technology for about seven years.

"Our first business contact with JM was when we bought our first metal oxide plant in 2016 as part of our paraformaldehyde industry," said Mr. Ng Sheng Cheng Director. "Before that, we have known Mr. Eddy for quite some time since he has been around since the industry began to boom in Southeast Asia."

Region's only producer of paraformaldehyde

Mr. Ng says that Dover Chemical is currently the only producer of paraformaldehyde in Southeast Asia and hopes to provide competitive products to the wood panel industry so that more people will store carbon inside wood-based materials. Looking ahead he says the company plans to produce more specialty chemicals in the catalyst/hardener sector of the chemical industry. When asked about the importance of the conference, he replied:

"Aside from the China melamine conferences, the JM conference is one of the very few events where the formaldehyde resin producers are gathered. And many suppliers to the formaldehyde resin industry would like to join."

Products

Formaldehyde, paraformaldehyde, formaldehyde resin, construction chemicals, preservatives chemicals, crosslinking chemicals, synthetic resins (non-formaldehyde)

Production capacity

200,000 tpa formaldehyde 37%
180,000 tpa formaldehyde resin
20,000 tpa paraformaldehyde

Markets

Primarily Indonesia with exports to Asia regions



Mr. Ng Sheng Cheng, Director, spoke with Polly Murray during the Formaldehyde Asia conference in Bali

BY



Eddy Lee
Regional Sales Manager



How new catalysts are developed at JM's formaldehyde R&D facility

Developing a new catalyst is an extensive undertaking. In this article we want to share with you some of the many considerations and steps required in order for our R&D department to turn customer pain into customer gain.

A new catalyst can be made either in forward or reverse. By this, we mean that a new catalyst formulation or modification can be generated purely from an idea – taking a new, original idea and developing it forward to the customer. Or in reverse – wherein the customer experiences an issue (pain) and requires a new catalyst solution (gain) that R&D and other functions work on.

Typically, Commercial and Marketing & Innovation are the direct point of call with the customers, who can then pass on issues or ideas directly to Perstorp R&D and aim to form a new offering. So typically for an idea generated from the customer (or be it internal idea), it is clear what is needed to be done, but not how. R&D would then work to expand the idea into something that could be tested out on a small scale.

Regardless of the starting point for the idea, JM always does its due diligence when it comes to the Freedom-To-Operate (FTO). It is important when a new idea for a product is conceived that the inventor follows up with our Legal team to check that JM is open to pursue the idea, and not infringe on any active patent.

Good to go!

Once we have checked the FTO, we can then look at how to place the idea. Is it something which could be integrated into an existing offering by some modification? Then we can write a project charter for a PIM project (Product In Market), or a Continuous Improvement (CI) project. The quality control team will also be on hand to check that any modifications of a current product still adhere to the high standards of our catalysts. On the other hand, if the idea requires a new product to fulfil the goal, then an NPI (New Product Introduction) project must be started.

Figure 1 shows the process from the initial idea to the start of an NPI project. Important milestones include understanding the chemistry behind the idea – will it work? Is it feasible? What kind of catalyst do we need to create?

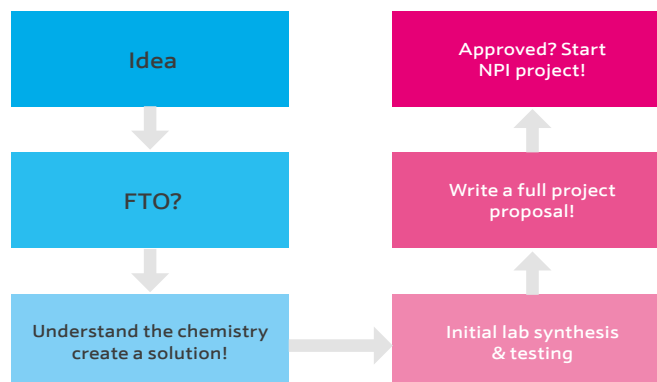


Figure 1: Development of an idea in R&D

All these and many more questions will need to be answered before a solution can even be synthesized. Once we have synthesized the new catalyst, we begin lab scale tests – including performance and characterisation – all of which are done within JM's sites both in Perstorp and around the world. JM's Perstorp site has the ability to tap into other JM Technology Centres around the globe that not only offer world-leading advanced characterisation, but also have the workforce to ensure the analysis and understanding is there too.

Entering the pipeline

Now the project enters the NPI pipeline at the Evaluate stage (see Figure 2). This stage aims to screen through samples and ideas and 'evaluate' which is best to 'develop'. The main scale here is lab scale (grams of catalyst) and checking whether the performance of the candidates is good enough to carry forward.

After evaluation, we can begin to really develop the product for market release, and this is where the crossover from powder to pellets begins. The pellets that JM make today are carefully designed with decades of experience to ensure maximum efficiency. Not just in terms of catalytic performance, but also in terms of production facility yield, physical strength/hardness, and long-term robustness.

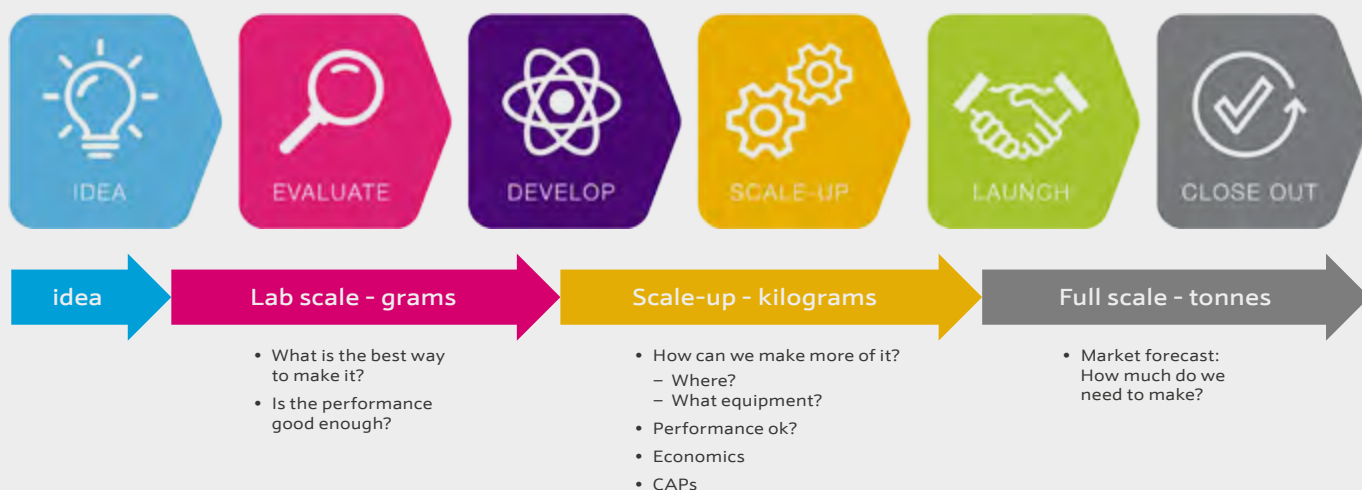


Figure 2: NPI (New Product Introduction) timeline

Most difficult part of the process

Whenever we make a new powder formulation, it is important that the tablet we produce meets all the high specifications and demands of its predecessor. This is one of the most difficult parts of the whole process and requires expertise from all over JM – from engineers and scientists to operators and project managers, etc. – to come together and collaborate. At Perstorp R&D, we have the capability to carry out small scale trials for taking a powder feed all the way to pellets, from gram to kilogram scale, including all kinds of physical stress tests to be sure the pellets are as good as expected.

Reaching the finish line

Having reached the kg scale, we can now think about full-scale pilot testing, loading plan development, and how and where will we make this new product. Perstorp R&D has the facilities to run simultaneous full-scale pilot plants, which give excellent comparisons to full-scale plants in terms of catalyst performance. Each pilot can be run for a short period of time (days-weeks), or if needed, for elongated periods of time (months-years), to mimic real world formaldehyde producers. We can then feedback this data from the pilot the production method of the new catalyst, and constantly improve our offering.

At this stage, the new product is nearly finished, and whilst much remains to be done, it will enter the launch phase and finally be closed out. Aftermarket services provided by JM will then support integration of the new product for customers and provide all necessary follow up, including possibly starting another PIM or CI project to make the product even better!

BY



Dr. David James Martin,
Senior Scientist,
Catalyst R&D

Everything we leverage to develop a better catalyst, faster:

- CI, PIM, NPI and quality control.
- 6 x full-scale pilot reactors that simulate a single tube on a real formaldehyde reactor. More being built!
- ECS pilot reactor for customer sample testing
- 2 x micropilot reactors to screen up to 5 samples at a time (e.g. 1 layer within the reactor)
- In-house characterisation (Elemental analysis: XRF, surface area: BET, microscopy, etc.)
- Access to alternative on-site characterisation (FTIR, AAS, ICP, etc.)
- Ability to tap into other JM sites' expertise (for characterisation, synthesis, scale-up, testing, etc.)

Current R&D progress

There are several new products in the pipeline to address current customer pains – meaning improving performance – and we hope to be able to tell you more about them in a near future, either in this magazine or at an upcoming conference somewhere around the globe.



Fertilizers that make farming more sustainable

In modern agriculture, the search for sustainable and efficient farming practices has led to the development of controlled-release (CRFs) and slow-release fertilizers (SRFs). These innovative fertilizers have revolutionised the way nutrients are supplied to plants, promoting optimal growth while minimising environmental impact.

Unlike traditional fertilizers, which deliver nutrients rapidly and are prone to leaching, CRFs and SRFs are engineered to minimise nutrient losses and optimise plant uptake by providing a controlled and gradual release of essential nutrients over an extended period. This controlled-release mechanism not only reduces fertilizer application frequency but also enhances nutrient use efficiency, leading to improved crop yields and reduced environmental pollution. Such delay or extended time availability is created in different ways, such as controlled water solubility of the material by semipermeable coatings, occlusion, protein materials, or other chemical forms.

What are they used for?

Applications vary across several sectors, including agriculture, horticulture, landscaping, and turf management (the work needed to keep a sporting pitch ready for use). They are particularly beneficial for crops with longer growth cycles or in regions with high rainfall or sandy soils prone to leaching. They also support sustained nutrient availability, ensuring that plants receive a continuous supply of nutrients throughout their growth stages, which improves plant health, root development, and overall crop quality. Moreover, they can be applied in different agricultural practices such as broadcasting (kind of seeding), side-dressing, and fertigation (injection), providing flexibility and convenience to farmers.

Quantity and Availability

The fertilizers are produced in various forms such as granules, prills, and powders. They are commercially available in different nutrient compositions, including nitrogen (N), phosphorus (P), and potassium (K), with varying ratios suitable for different crops and soil types. The growing popularity of SRFs has led to increased availability in many agricultural markets worldwide. Additionally, advancements in manufacturing technologies have improved production efficiency, making them more accessible to farmers globally.

How are they manufactured?

The manufacturing process involves coating granules of conventional fertilizers with materials that control the release of nutrients. Coating materials can be organic or inorganic polymers, resins, or sulphur. These coatings regulate nutrient release by controlling the diffusion rate, solubility, or microbial activity surrounding the granules. By providing a barrier around the fertilizer granules, the coatings slow down the release of nutrients, allowing plants to access them gradually over time as needed, reducing nutrient losses to the environment.

Manufacturers employ different techniques to coat the fertilizer granules. One common method is fluidised bed coating, where the granules are suspended in a chamber and sprayed with the coating material. Another method is the encapsulation of the fertilizer granules within a polymer matrix. This encapsulation provides a prolonged release of nutrients, as the polymer slowly breaks down over time, gradually releasing the enclosed nutrients. Manufacturing processes continue to evolve, driven by advancements in coating materials and equipment, ensuring higher quality fertilizers with improved efficiency.

Of special interest to formaldehyde producers are liquid UF concentrates (UFCs). These are urea/formaldehyde intermediate products used in the manufacture of granulated (chemically mixed) CRFs as well as a few liquid UF fertilizer products. UFCs are characterised by high formaldehyde-to-urea molar ratios and analyse at 12% nitrogen. To increase end-product nitrogen content and achieve the desired degree of polymerisation, extra urea is added during the production of granulated fertilizer.

Current Market Situation and Outlook

The market for SRFs has witnessed significant growth in recent years due to increased awareness of sustainable farming practices and the need for environmentally friendly agricultural inputs. The market has experienced a surge in demand, driven by factors such as the growing global population, shrinking arable land, and the need for enhanced crop productivity. The trend toward increasing use of CRFs is expected to continue. Coated fertilizers are the fastest-growing segment of the CRF and SRF market.

The market outlook for these fertilizers remains promising, fuelled by several key factors. First, the increasing emphasis on sustainable agriculture practices and the need to minimise environmental impacts are expected to drive the adoption. Secondly, technological advancements in coating materials and manufacturing processes are likely to result in more efficient and cost-effective CRFs and SRFs, further boosting their demand. Thirdly, the growing global population and the need to achieve food security will continue to drive the demand for enhanced crop yields, creating opportunities for these products.



For these reasons, global demand for CRFs and SRFs is expected to grow around 3% annually during 2020-25. However, due to the high price of CRFs and SRFs relative to conventional fertilizers, their application is still limited to ornamental, horticultural, and turf applications. When larger production is achieved costs will decline, making them more attractive for commodity/open-field/broad-acre crops like wheat and potatoes. Another factor that will drive demand is future regulations encouraging growers to minimise fertilizer run-off in water streams.

It's important to note that CRFs and SRFs can cost anywhere between 2.5 and 10 times that of conventional fertilizers, which is why they are still primarily used in niche markets such as golf courses, landscaping, greenhouses and nurseries.

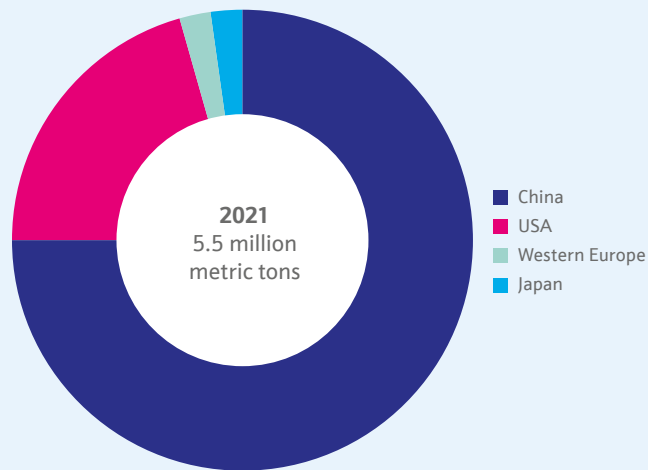


Figure 1 - Present demand CRF's and SRF's by major regions

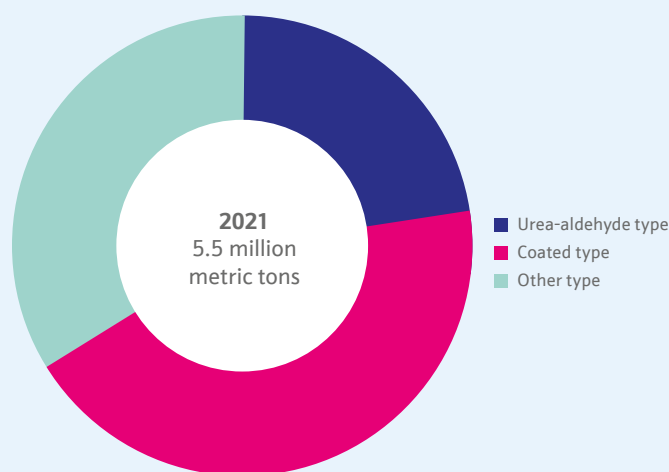


Figure 2 - Present demand CRF's and SRF's by product type

Conclusion

CRFs and SRFs have emerged as a sustainable solution for enhancing crop productivity while minimising environmental pollution. The availability of SRFs varies regionally, but advancements in manufacturing technologies have improved their accessibility to farmers worldwide and the market has witnessed significant growth due to increased demand for sustainable agricultural inputs. The market outlook is positive, with projections indicating continued growth over the next five to ten years. As farmers and growers continue to prioritize sustainable farming practices, CRFs and SRFs are poised to play an increasingly vital role in enhancing crop growth sustainably, ensuring food security and environmental protection.

BY



Lars Andersson
Global Market Manager
Formaldehyde - Plants



Considering UFC production?

Wood panel resins account for almost 50% of the world's consumption of formaldehyde (FA) and for some types of wood panel resins, it is possible to start your resin production from either a FA solution or from urea formaldehyde condensate (UFC). The choice of starting material depends on several factors, but the resulting wood panel resin will be equally useful. UFC is a pre-condensate of urea and FA and can be produced in a continuous manner by adding a urea solution instead of process water to an absorber, see figure 1 below.

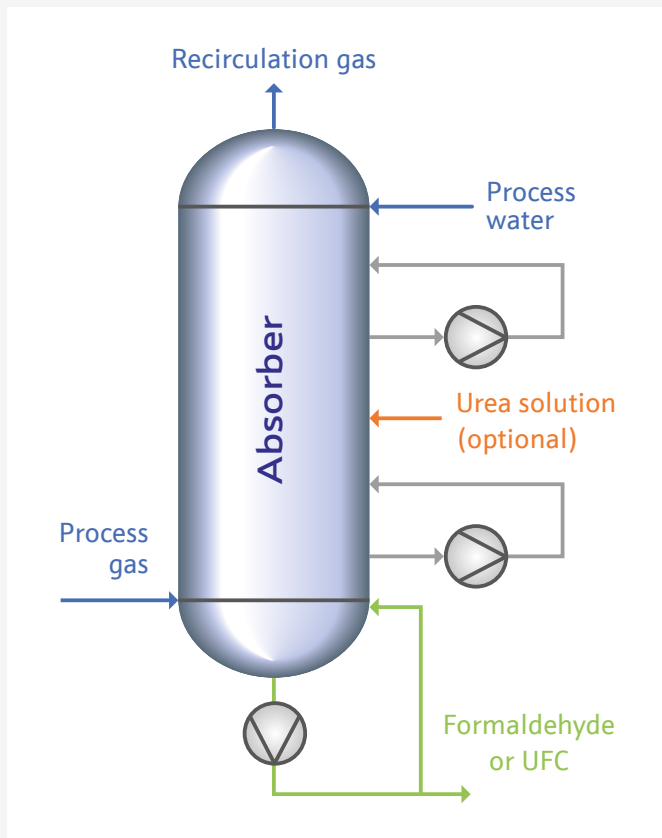


Figure 1: Absorber sketch with optional urea solution feeding

If your **FORMOX** plant has been designed for FA and UFC from the start, the **FORMOX** process offers you great flexibility and reliability in producing the two products. However, if your plant is designed for FA only, there are a few options for you to choose from if you want to add UFC production capabilities:

- Make the UFC in a batch process using an ordinary resin reactor
- Convert your existing FA absorber to a combined UFC and FA absorber
- Invest in an additional absorber designed for UFC production in parallel with your existing FA plant

Making UFC in a batch process can be an option if smaller quantities are required, but for larger volumes a continuous process is required to make it efficient and to get a consistent product.

Conversion can in some cases be an alternative if the absorber has the right prerequisites. In most cases, however, the absorbers are not very suitable to upgrade as this often involves a complete make-over of the absorber internals and perhaps also additional equipment to improve the process gas cooling capabilities. And above all, this option involves a significant amount of downtime with lost production.

By far the best alternative is to add a UFC absorber, and JM has the required experience and expertise to make a bespoke solution for your needs, figure 2 shows an example.

Storage and handling of urea

Urea should be stored in a cool, dry, and well-ventilated area. It is important to protect it from moisture as urea is hygroscopic and can absorb water, leading to caking or decomposition. Ideally, the storage temperature should be below 30°C to prevent degradation.

Urea is typically available in granular or prilled form and is normally delivered in bulk or in moisture-resistant bags made of plastic or paper. The urea is stable if stored properly, but the granules or prills need to be handled with care to avoid breakdown and it is

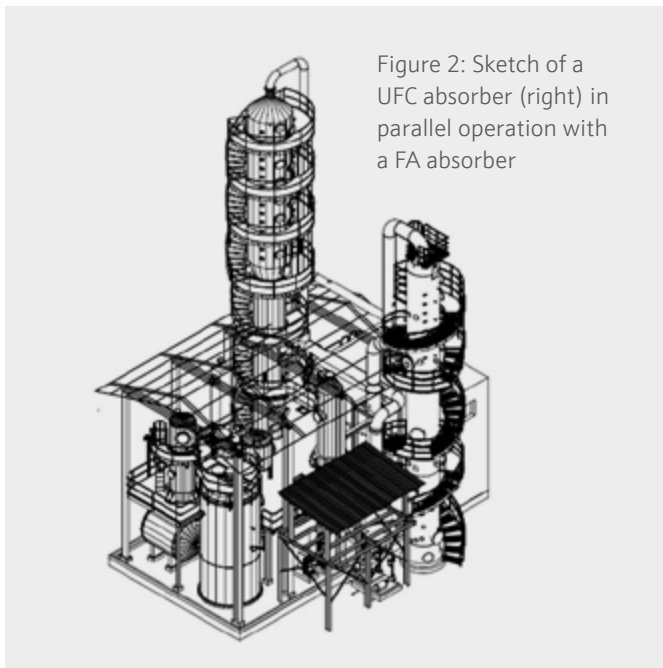


Figure 2: Sketch of a UFC absorber (right) in parallel operation with a FA absorber

Producing UFC adds to the requirements on site and there are several additional aspects to consider apart from your production unit:

- Urea storage and handling
- Process condensate storage
- Urea solution mixing and storage
- Caustic solution preparation
- Off-spec product storage
- UFC product storage

recommended to use transportation systems that are designed for urea. When handling urea, always refer to the manufacturer's guidelines and safety data sheets (SDS) for specific instructions regarding the storage and handling of the urea.

Making and storing the urea solution

The process condensate is produced in the UFC plant when cooling the process gas exiting the UFC absorber. The condensate is mainly water but will also contain formaldehyde and methanol (usually <1 wt%), and traces of UFC. This condensate is often used to make the required urea solution but can also be used as process water in the FA production if traces of UFC are permitted in the formaldehyde. The size of storage tank should be matched with the production of urea solution.

As mentioned above, the process condensate is often mixed with urea to make a 50 wt% urea solution. A resin reactor is normally used to make the mix and after mixing it is pumped to a storage tank. The urea solution is not stable for longer periods so the storage must not be too large but still large enough to make the production efficient. In most cases, one to two days storage is sufficient.

If the concentration is high, >50 wt%, the urea solution tank should be heated and piping to be traced. If not, the urea will crystallize. More detailed information about concentration versus temperature can be obtained via your JM representative, but as an example, the tank should be kept at minimum 50°C if the urea concentration is >60 wt%. Mild agitation is

also required, either by a circulation pump or an agitator, as otherwise layers with different concentration will be formed. The tank should be made in the same material as for FA tanks.

Caustic solution preparation

To make the required 20 wt% caustic solution used for process pH adjustment, inline blending with commercial grade caustic soda (50 wt%) is recommended.

Off-spec production

The amount of off-spec production largely depends on the UFC demand and how often the UFC production is down. As the UFC absorber is designed for UFC production only, the off-spec production is not dependent on product purity demands as no switching from FA to UFC mode or vice versa is necessary. Normally the off-spec material is blended in with the UFC product to avoid waste material. The size of the off-spec tank will depend on the capacity of the plant.

Stability and storage of high solid content UFC

UFC of high solid content, 80-85 wt%, is stable for reasonable storage periods, at least 6 months, if it is maintained within recommended storage conditions (10-30°C). At temperatures higher than 40°C, the stability of UFC is greatly reduced, resulting in a lower pH and increased viscosity. An extended storage period at low temperatures (as low as -20°C) is not a problem, but to maintain the UFC in an adequate viscosity range, the recommended storage temperatures should be kept. The UFC storage tank should therefore be insulated and equipped with suitable heating and cooling system depending on location; heating to be used in the winter and cooling in the summer to keep constant temperature in the tank when the storage is affected by the ambient temperature and direct sunlight.

The pH in the UFC tank decreases with time due to continued bond formation. Caustic should be added if the pH drops below 7.5, otherwise the UFC will start to gel. A higher pH will give a higher buffer capacity which means longer storage stability, but if a high pH (8.5), is not desired by the customer, there are ways of increasing the buffer capacity without increasing the pH. More detailed information about this can be obtained via your JM representative.

The design of the UFC storage tank should be the same as for FA storage tanks, but if the tank will be used for UFC only the material of the tank can be of carbon steel or mild steel coated with phenolic resins or polyethylene as UFC is less corrosive than FA.

Conclusion

To summarise, JM has a long and solid history in providing customers with flexible and reliable solutions for UFC production and the **FORMOX** process technology offered is well proven in many plants around the globe. If you are interested in learning more about how to get started with UFC production at your existing plant, please contact your local JM representative.

BY



Claes Lundström
Senior Consultant - Plant & Revamp Sales

MAINTENANCE

Boiler feed water quality and condenser cleaning



It is well known how much Johnson Matthey has always emphasised the importance of a good boiler feed water quality to be used in formaldehyde plants. The quality recommended is specified and is generally intended to keep corrosive compounds as low as possible. This is key for a good maintenance of vessels like the HTF condenser and the ECS steam generator, as well as to keep the plant in good condition.

It is also very important to maintain routines to be performed on the above-mentioned vessels, particularly blowdowns. There are two types of these: continuous and shock blowdowns. Continuous blowdowns need to be performed uninterruptedly so that the impurity-rich surface boiler water is removed from the vessel. Shock blowdowns, which consist of creating turbulence, should be performed to prevent sediments and scaling from accumulating. The frequency of the shock blowdowns will depend on the boiler feed water quality, but usually two to three times a day is a good standard to be followed.



However, even when following these routines consistently plants do get old and it becomes harder to keep them well maintained. Therefore, JM also recommends regularly cleaning these vessels. Failure to do so can lead to very bad consequences, even to the

point of not being able to save the vessel by repairing it. The only option then is to replace it. The pictures clearly show just how bad things can become.



Be on the lookout for leakage

A clear sign of the HTF condenser beginning to deteriorate is steam leakage. This can be usually identified through a pressure build-up, resulting in increased temperature at the top of the vessel and, potentially, a lower level of boiler feed water. Also, it might be possible to see more condensate than usual venting from the HTF tank. When any of these things are observed it is a good time to stop the plant and perform a pressure test to confirm the suspected leakage. Hopefully then it will still be possible to save the condenser by welding the affected tubes.

BY



Alejandro Perez
Principal Technical Service
Engineer

Considerations when sizing Safety Relief Valves

The Safety Relief Valves (SRVs) in the formaldehyde plant are there to protect the vessels from overpressure. They have been sized during the engineering of the plant, based on the expected conditions during operation. In this article we look briefly at their function, some instances when resizing might be necessary, and what to consider when replacing them.

Let's take the HTF and steam SRVs on the HTF condenser as an example. They are both there to cover the loss of cooling scenario for the reactor. The HTF SRV will open if the HTF vapor is not condensed, and the steam SRV will open if the heat is not leaving the condenser with the formed steam. The sizing of both valves is based on the heat formed in the reactor from the oxidation of methanol to formaldehyde. Generally, the SRVs in a formaldehyde plant are functioning well and there are no known incidents of an SRV failure having caused any vessel damage.

When to check the sizing

The original sizing should be sufficient for the original operating conditions. There are however instances when it might be a good idea to check the sizing calculations:

1. If the production capacity for the plant has been increased,
2. If the vessel has been changed or if an SRV nozzle has been modified,
3. The original SRV has been changed,
4. Or if a new safety scenario has been identified in a safety review, e.g. fire scenarios, new pump capacity, equipment failure, etc.

Increasing maximum production means more methanol is reacting in the reactor and more heat is formed. A new SRV sizing M&E (mass and energy) balance for the new maximum methanol flow will give the required relief capacity for the SRVs. A first check could be to simply scale the required SRV capacities from the original process engineering to the maximum methanol flows.



Important when replacing

The rated relief flows for the SRVs are based on a specific pressure drop in the vessel's outlet nozzles and in the SRVs' outlet pipes. It is important that any replacements do not have higher pressure drops from sharp edges, smaller dimensions, etc. Replacement of rupture discs before SRVs often requires special attention.

Any replacement SRV needs to meet the required relief capacity. A replacement with a larger SRV can also cause problems if the higher flow will create too high a pressure drop in the vessel outlet nozzle and in the outlet pipe. A balanced bellow SRV must only be replaced with another balanced bellow SRV.

Please contact your Technical Service representative if you have more questions about SRV sizing.

BY



Ola Erlandsson
Senior Process Specialist

Price spikes and connection to copper stress importance of recycling catalyst

The price of Molybdenum has fluctuated rather dramatically over the last year. Will this continue? Well, very much comes down to the demand-supply balance, and here I will try to explain a few of the reasons for this.

In my previous update (Spring 2021 issue) my prediction for rising prices in the second half of 2021 came true, sort of. I had estimated they would rise to 12-14 USD/lb, but in fact they reached 16-19 USD/lb. That level lasted until late 2022, before rising as high as to 38 USD/lb this past February. Since then they have dropped back to a level just above 20 USD/lb from early April.

Related to copper production

The increase at the end of 2022 was very much influenced by the economic recovery and high demand for steel in China in particular. At the same time, molybdenum output outside China was reduced, mainly due to its relation to copper.

Roughly 80% of all molybdenum comes as a by-product from copper mines. So when the Cu price sank due to lower demand in the second half of 2022, both Mo and Cu output was lowered. New projects for both combined and Mo-only mines are in the pipeline, but there have been delays due to uncertainties in the global economy.

Bright outlook

As already indicated two years ago, the outlook for molybdenum is still very bright, with growth in demand expected to be well above 3% over the next 5 years according to different sources. One indicator they base this on is the major shift towards electric vehicles, which we now see happening. And because molybdenum, like formaldehyde, is quite versatile, its usage in lubricants, fertilizers, electronics, inks and of course, catalysts, provides plenty of options. The portion of recycled molybdenum is also expected to increase, which is best from a sustainability point of view and in line with how we at JM have been working with spent catalyst for decades.

Your efforts play a big role

Since I mention it, I would like to remind about the importance of returning spent catalyst to us in good condition – meaning keeping it dry by storing it in agreed containers, drums or bigbags, and protecting it from rain. Your spent catalyst is a valuable raw material for us, and the ceramic rings can also be reused, so just a kind reminder of the importance of this process.

What to expect for the near future

Due to the supply situation and the impact of Cu pricing on the availability of Mo, price levels for the coming years are a bit difficult to predict. Depending on whom one listens to, anywhere from 15 to 30 USD/lb is to be expected. For the year ahead, 20-30 USD/lb is more likely depending on how quickly new capacity is added and how Cu pricing develops. Personally, I believe we will see a level of 18-22 USD/lb. But I may be too optimistic.

As always we do our best to keep net prices as stable as possible no matter what market fluctuations occur. But we have all become aware, especially over the last two years, of the impact of inflation, rising energy costs, and more on just about everything. So please remember that you play an important role in keeping catalyst prices stable by returning spent catalyst – in good condition and according to our specifications – to our catalyst recycling facility!

BY



Ronnie Ljungbäck
Global Market Manager
Formaldehyde – Catalysts

Projects and start-ups



Two projects were started up this spring; Markor V (left) for Xinjiang Markor Chemical Co., Ltd, and an FS3 plant (right) for Xinjiang Guoye New Material Technology Ltd.

New Projects

Agreements have been signed with customers in:

- South America for a pre-study for an FS1 plant
- Germany for supply of an ECS reactor/preheater
- Mexico for supply of an HTF condenser
- Yumen, Gansu, China for three FT3 plants

Ongoing projects

The following nine projects are in the design phase:

- Qingtongxia, China for two FT3 plants
- Nantong City, Jiangsu province, China for one FT3 plant
- Chuzhou City, Anhui Province, China for one FT3 plant
- Egypt for an FS2 UFC plant with SMD as the end user
- Wujiaqu City, Xinjiang, China for two FT3 plants
- Jingzhou City, Hubei Province, China for two FT3 plants
- Changji, China for one FT3 plant
- Korla, China for one FT3 plant
- Nanchong, China for two FT3 plants

In the shipping or construction phase:

- The project with one FS3 and one FT3 plant for a customer in Nantong, Jiangsu Province, China is in the shipping phase.
- The project with an FS1 High Pressure plant for a customer in United Kingdom is in the shipping phase.
- The project with two FT3 plants for a customer in Shanxi Province, China is in the construction phase.
- The FS3 plant for a customer in Europe is in the construction phase.
- The project with Inner Mongolia Jiutai New Material Co., Ltd. in China is in the construction phase. The formaldehyde plant will have an annual capacity of 1,500,000 tonnes per annum and will be among the largest single site facilities for formaldehyde production in the world.
- The project with two FT3 plants for a customer in Dalian, Liaoning, China in in the construction phase with scheduled start-up in late 2023.
- The project with a customer in Wuhai, China, for three FT3 plants is in the construction phase with scheduled start-up in late 2023.
- The project with three FT3 plants for a customer in Wuhai, Inner Mongolia, China, is proceeding well with planned start-up in late 2023.

- The project with **Foresa, Industrias Químicas Del Noroeste, SA** to double the capacity of their plant in Caldas de Reis, Pontevedra, Spain to an FT2 plant is in the construction phase, with planned start-up this autumn.
- The project with a customer in Xinjiang, China, for three FT3 plants is in the construction phase with planned start-up this summer.
- The project with an FT3 plant to a customer in Hebi, China, is proceeding well with scheduled commissioning this summer.

Start-ups

- The project with one FT3 plant and one FE3 plant for a customer in Xinjiang, went on stream in March 2023.
- The FS3 plant to a customer in Xinjiang, China, was successfully started in June 2023.

Training



JM conducted onsite training in March of 2023 for Xinjiang Markor Chemical Co., Ltd in connection with the startup of their new FT3 plant in the city of Korla, Xinjiang province, China.



Operator training was conducted in May for Xinjiang Guoye New Material Technology Ltd. in Xinjiang province, China. Representatives from JM were Marvin Su, Shaoze Yang and Caleb Chen.

New faces

Perstorp



Achin Mishra
Electrical Engineer



Ahmad Hameed
Process Engineer



Saga Vesterbacka
Process Engineer

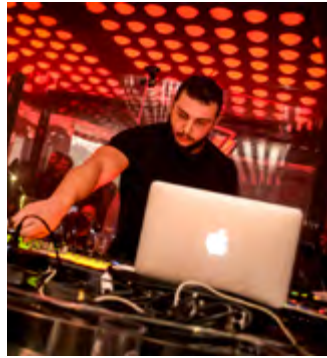
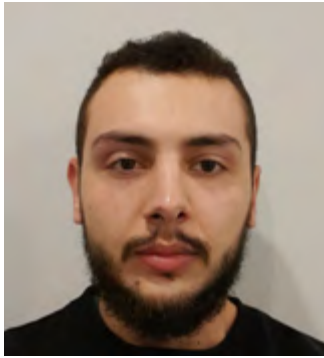


Melita Roex (Mulabdic)
Laboratory Technician



Anna Unkuri
Supply Chain Coordinator

New site supervisor



Rogério Sampaio is from Brazil and began his career as an engineer designing steel structures, pressure vessels and machines. More recently he worked as an Industrial Inspector for TÜV.

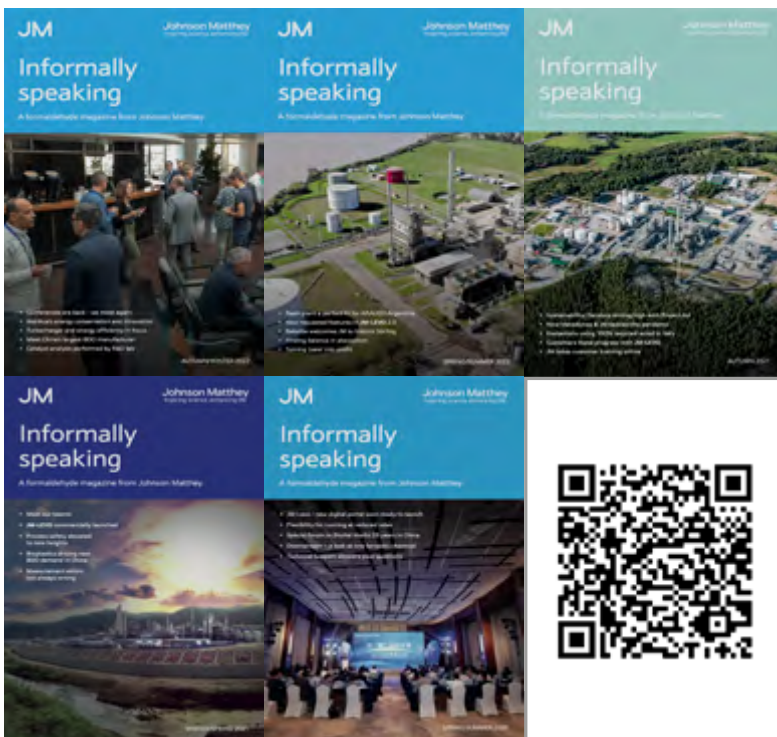
"My area of expertise is inspecting industrial installations, pressure vessels, piping, etc. both during fabrication for quality control and in working equipment to evaluate structural integrity and ways to safely extend lifetime. At JM I will be assisting our customers on the commissioning of new plants and visiting suppliers to assure quality. Outside of work I like to play guitar, play with synthesizers and make music, also for audiences."

New sales representative for Europe



Marion Kugler originally joined JM's Clean Air division in Royston in 2006 where she has held various technical and customer facing roles.

"In 2021 I moved into the Chemical Catalysts section of the JM Catalyst Technology business as a Sales Manager. In 2022 I expanded into Formaldehyde and am now responsible for some of the European **FORMOX** customers. In my free time I enjoy travelling, being in nature, cooking, baking, and dancing. With my recent move to Sweden I have had the opportunity to try ice skating and cross-country skiing as well as spending time at a husky kennel in Lapland."



A formaldehyde magazine from Johnson Matthey

The newsletter Informally speaking aims to provide information about formaldehyde in an informal forum and is published twice annually by Johnson Matthey for its customers and contacts in the formaldehyde business. The information included herein is part of our customer service and in no way entails or implies any undertakings, legal responsibilities or liabilities.

Johnson Matthey Formox AB
SE-284 80 Perstorp, Sweden.
Phone: +46 435 380 40
e-mail: formox@matthey.com
www.matthey.com



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JM



Sustainability is at the heart of what we do

At Johnson Matthey we are committed to minimising our environmental footprint and conserving scarce mineral resources.

We helped create one of the world's first circular economies and our increasing use of secondary or recycled PGMs reduces the environmental impact mining for these minerals has.

In our chemicals division, great care is taken throughout the production process with used catalysts being recycled for metals wherever possible.

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