



A formaldehyde magazine from Johnson Matthey

Informally Speaking

Summer 2017

Johnson Matthey
200 years:
- Inspiring science,
enhancing life

Formaldehyde conferences:
Americas & Russia

Safe operations

Honeycomb

Formaldehyde for the 3rd century

This year Johnson Matthey is celebrating its first 200 years of existence. At the same time, we are kick starting a third century of business with the bold motto, “inspiring science, enhancing life”. I strongly believe that these words are representative for our Formaldehyde business and **FORMOX™** technology as well, which will be turning 60 next year. Over these past six decades, the use of formaldehyde has experienced remarkable development. Its unique and versatile properties have made formaldehyde an integral part of our everyday lives, greatly impacting modern society. Originally used mainly as a chemical for resins, formaldehyde is fast becoming a key building block in polymers for the automotive industry, fibers for the manufacture of sportswear, applications within the health care industry, and much more.

In addition to finding new uses for formaldehyde, the technology itself is also developing. Later this year we plan to introduce a higher pressurization process as a further step towards increased efficiency and reduced energy consumption of the **FORMOX™** process. This advancement is the result of our unique turbocharger concept and enhanced catalyst development. And it is well in line with the JM’s aspiration to be a global leader in sustainable technologies and creating solutions with our customers that make a difference.

I almost forgot to tell you that JM this year is also rolling out a fresh new look as part of our goal to unify and strengthen the brand. Thus, you will notice that our logo has received a makeover, and that our visual identity features a refreshed color palette along with a new, unique typeface. We are still the same company, but with a more modern image aimed at building an even stronger presence in the global marketplace.



Lars-Olle Andersson,
Business Manager,
Johnson Matthey

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Contributing writer: Charles Hodgdon
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200 years of inspiring science

As well as being the year JM was founded, 1817 was the year that the bicycle and butterscotch were invented! In the US, it was also the year the states of Mississippi and Alabama were created and the 5th President James Monroe was sworn in.

In the UK, George III was King, Lord Liverpool was Prime Minister, the first Waterloo Bridge was completed and it was three years before Charles Darwin set sail on HMS Beagle to hatch his theory of evolution.

In China it was the midpoint of the Qing Dynasty, the tea trade experienced a surge in demand and in South East Asia it was two years before the founding of modern Singapore.

The world has changed a lot in two hundred years! JM is now a global company with operations on all continents, 13,000 employees and annual sales of more than £3 billion, with more than 90% of sales coming from technologies that make the world cleaner and healthier.

It’s unlikely that Percival Norton Johnson thought that the business he was founding would have such longevity. Through the constant application of new ideas and new processes, JM has grown for 200 years.

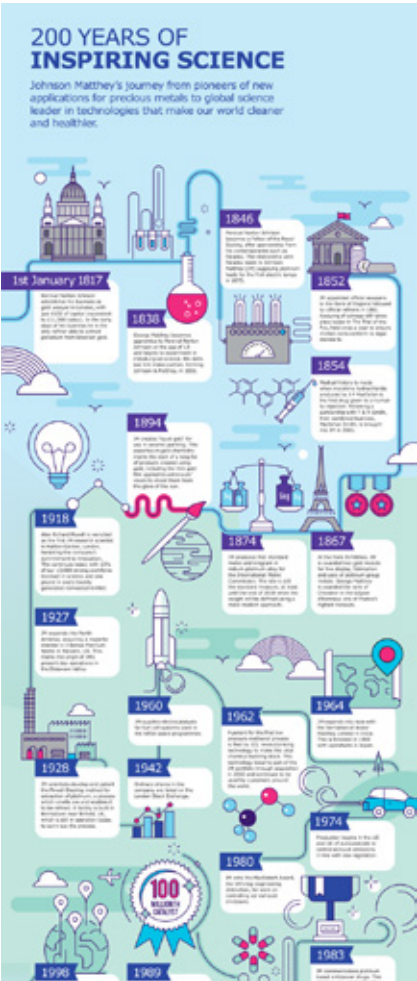
Turning 200 is a fantastic accomplishment and one that makes it difficult to select the events and milestones that should be highlighted. Our newest infographic helps us navigate JM’s rich history of inspiring science, from pioneers of new applications for precious metals to global science leader in technologies that make our world cleaner and healthier.

Source: www.matthey.com

BY



Anna Rundblad,
Communications Manager,
Johnson Matthey



See the infographic in full scale:
Our journey across two centuries:
<http://www.matthey.com>



Johnson Matthey & FORMOX™: “Inspiring R&D, enhancing Technical support”

The marriage between **FORMOX** and Johnson Matthey a couple of years ago was, from an R&D perspective, a perfect match. It has opened up several new opportunities to gain further understanding of the catalysis taking place in the **FORMOX™** process and to develop improved products. Our already skilled team has become a part of a world-leading R&D community that gives access to more and deeper knowledge within areas such as catalyst synthesis, characterization, and modelling. For us this means that more can be done, and it can be done faster.

Advancing our capabilities

In addition, teaming up with Johnson Matthey has also enabled us to extend our technical support capabilities so that we can now perform tailor-made investigations into deviating catalyst performance. For standard analyses such

as chemical analysis and catalytic performance, we have acquired dedicated equipment that allows us to quickly get a good picture of the cause of the problem. In most cases, poisoning of the catalyst surface is the root cause for poor performance. By identifying what components are present on the catalyst we can find the source of the poisoning and take actions to prevent it from happening again. Due to physical limitations, however, standard techniques may in some cases fail to detect or locate the elements that may or may not be on the catalyst. When this happens, we contact our colleagues at other laboratories who can assist us in performing analyses using complementary techniques. These techniques may also be more surface sensitive and can provide information about not only what is present in the catalyst, but also where the poisons are located.

New possibilities with Emission Control pilot

We are also constantly upgrading our pilots. The latest member to join our pilot family is a new Emission Control pilot. The building of a new pilot highlights yet another advantage of belonging to a larger R&D community: the possibility to benefit from the experiences of colleagues working with similar projects. Our new pilot, for example, has been designed in collaboration with colleagues in the Clean Air sector who are world-lea-

Collaboration and Customer focus are two of Johnson Matthey's core values, both of which are perfectly exemplified in the technical support services we have developed to assist you when needed.

ing in emission control catalysis. The pilot is designed to be operated at reaction conditions typically seen in a **FORMOX** Emission Control System (ECS), but it also enables testing on other components not normally found in our plants. This opens up the possibility to investigate whether various side streams of interest could be led to the **FORMOX** ECS.

Currently, the pilot is used to test and evaluate monolith-type emission control catalysts, which are products we can offer to those customers most sensitive to pressure drop. Within a short time, the pilot will also be part of our technical support services. Since it can be operated at realistic reaction conditions with respect to temperature, gas composition, gas velocity and bed height, more accurate performance tests than can be offered today will be possible on our customers' spent catalyst. The output from the pilot includes information regarding recommended inlet temperature and emissions escaping the reactor at realistic operating conditions. By combining the pilot with chemical analysis, it will be possible not only to reveal the cause of a deactivation, but also to quantify the extent of it and provide recommendations for appropriate actions.

Collaboration and Customer focus are two of Johnson Matthey's core values, both of which are perfectly exemplified in the technical support services we have developed to assist you when needed. If you have any specific requests or want to know more, please contact your Regional Technical Support Manager.

BY



Robert Häggblad,
Manager R&D Catalysts,
Johnson Matthey



New absorber model

Johnson Matthey has developed a non-equilibrium mass transfer absorber model, with pH dependency, that has accurately predicted different absorber configurations and operating conditions. This tool can now be used for technical support and further development of the current absorber design.

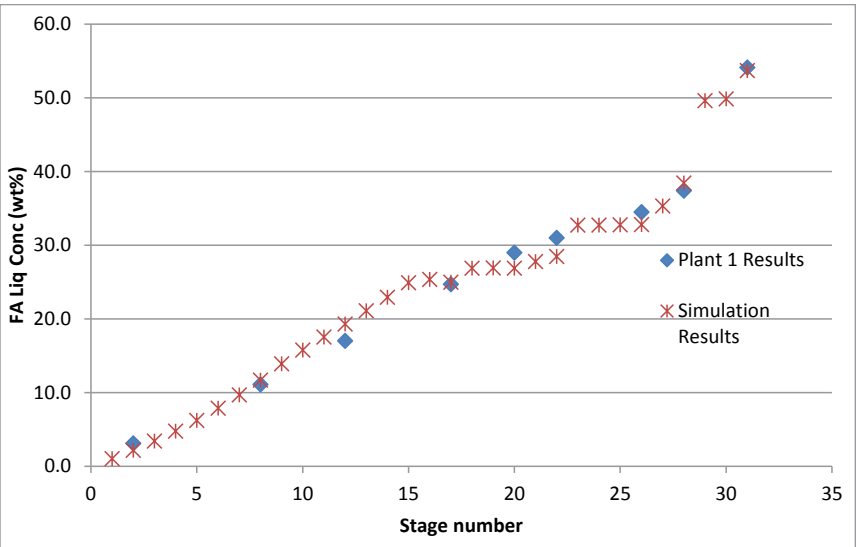


Figure 1 - A simulated formaldehyde profile vs. sample point data at an existing absorber.

Absorbers are an expensive equipment item in the formaldehyde technology. They can also be the root cause of many issues seen on-site. There are two conflicting goals when optimising absorbers; one is to maximise the formaldehyde in the formalin product and the other is to minimise the formaldehyde lost in the tail gas at the top of the column. It is difficult to achieve both these goals at the same time. To discover ways in which one could optimise the absorber design whilst achieving the goals mentioned above, an 18-month investigation was conducted to improve our own understanding of the

intricacies of formaldehyde absorption and the heat and mass transfer effects in the absorber itself. To achieve this we have developed, using Aspen Plus, a rate-based model (also referred to as a non-equilibrium mass transfer (NEMT) model) that has been proven to be very reliable and robust when simulating existing absorbers and comparing to their measured performance. Reactive absorption is the absorption of gases in liquid solutions accompanied by chemical reaction. For formaldehyde, the process is highly complex with many reactions, and occurs far from thermodynamic

equilibrium. Formaldehyde rarely exists in its singular form in the liquid phase. It undergoes reactions with water and methanol to form a variety of formaldehyde chains (referred to as oligomers and hemi-formals) that contribute to the overall formalin product. The rate of these reactions increase with caustic addition i.e. at higher pH, and thus one can get improved separation operating in this way. Whilst developing the model all these effects were taken into account. The result is a model that is much more sophisticated than a typical equilibrium-stage model.

FORMOX™ absorbers have taken on many different faces over the years. Configurations have continued to change in order to improve the performance and to bring down costs for the customer. The model has in-built correlations for different column internals and therefore one can simulate different column configurations (types of tray/packing) with an aim of bringing down capital costs yet improve or at least maintain column performance.

We have already had some early successes with the model, especially in technical support and revamp projects. Some customers have asked to see how their absorber might handle addi-

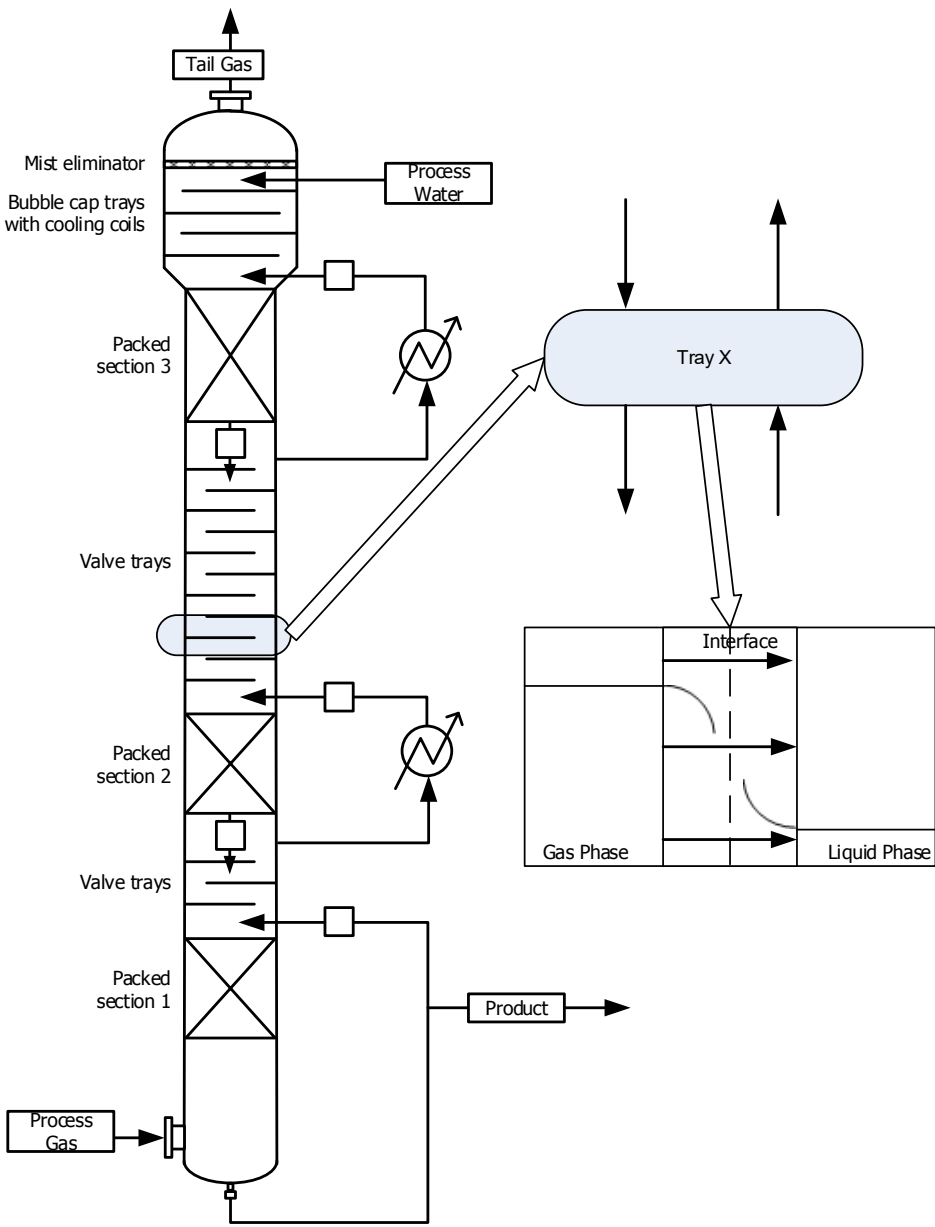


Figure 2 - The model takes into account the mass transfer at the gas and liquid interface on each stage using the two-film model.

tional capacity and others have asked to see how their absorbers might cope with an internal change (for example random packing to structured packing). With both the operational experience that Johnson Matthey holds and the additional use of this model we can give answers to these questions with even more confidence.

In the future, we would ultimately like to improve on the two optimisation goals referred to in the introduction, whilst developing a design that reduces costs.

This is obviously a difficult task (absorber designs have historically not changed dramatically for very good reasons) and one that we will hope to deliver with plenty of contingency in place. We are currently looking at ways we can sustain plant yield whilst increasing the product concentration above 55wt%. The advantage of having a NEMT model as opposed to an equilibrium-stage model allows us to deliver advice and designs with superior conviction.

If there are any questions about what the model can do and be used for we would be happy to hear them. In addition, we would like to continue to cooperate with our customers to further improve the performance of their absorbers.

BY



Ben Hancox,
Process Engineer,
Johnson Matthey



The conference was well attended with delegates from Akzo Nobel, American Chemistry Council (ACC), Arclin, Celanese, Continental Disc, DuPont, Eastman, Egger, Georgia Pacific, GPC Quimica, Hexion, Methanol Market Services Asia (MMSA), Perstorp Polyols, Praxair, Solenis and Tracerco.

Formaldehyde Americas 2017

– a great happening

We succeeded in nailing the right weather conditions when we arranged the Formaldehyde Americas 2017 conference March 20-22. Houston was at its finest when we met for the conference at the Hilton Houston NASA Clear Lake Hotel.

This year's conference was well attended, with representatives from all the major formaldehyde producers in North America present. Forty-four people took part in the full 2-day conference packed with the latest information and trends related to the formaldehyde business. Whether their focus was on market outlooks related to the formaldehyde business, legislative matters, manufacturing optimization or safety, I'm sure there was something for everyone to bring home as a valuable piece in the day-to-day business puzzle.

The conference focused mainly on safety-related topics and we were very happy to see so many customers presenting cases from their own plants. This was something highly appreciated by all delegates and I personally hope we can look forward to see more of this in upcoming formaldehyde conferences.

Many also showed a big interest in Kimberly White's (ACC) presentation where the regulatory, legislative and science landscape for formaldehyde was discussed. It is clear there will be an altogether more stringent environment for formaldehyde producers looking forward.

We heard William Mixon from Tracerco, a subsidiary of Johnson Matthey, present the many possibilities for process equip-

ment inspection in "impossible places" through the use of radioisotopes. This technique makes it possible to do performance evaluations of process equipment during operation that normally is impossible to do. Interesting examples are absorber scans, HTF levels inside a converter, gas flow distribution, etc.

A welcome break from the traditional classroom presentations was when the participants were divided into groups to visit an exhibition hosted by four vendors serving many formaldehyde producers all over the world. We received interesting information from Continental Disc, Eastman, Solenis and Tracerco, and everyone had the chance to discuss with the representatives and the other delegates.

Johnson Matthey's unique position as a formaldehyde technology provider were highlighted in presentations covering plants, catalysts and technical support. Of particular interest were the new catalyst for high-pressure operation and two new plant sizes – our smallest, FC1 and biggest, FT4!

As background to where Johnson Matthey and the **FORMOX™** brand stand today as well as to the news presented, Ola Erlandsson gave a fantastic history lesson describing the development of formaldehyde process technology. Ola's presentation took us from the birth of **FORMOX** in the 1950's up to modern times.

Of course, during these two days there was also time for informal discussions and networking, as well as for individual discussions with team members from Johnson Matthey. I believe we also had time for some fun. Perhaps the most valuable experiences during a conference like this are the informal ones.

Great weather made the boat trip to Wednesday evening's dinner very pleasant and memorable.

Verdicts from the delegates were overall very positive, which is of course really encouraging for us at Johnson Matthey. We will for sure continue to arrange these conferences and can hopefully, with help from our partners and customers, continue to develop them into even better events in the future.

Thank you all for your contributions and see you next time in 2020!

BY



Lars Andersson,
Regional Manager Technical
Support, Johnson Matthey





Formaldehyde Russia 2017

This year Johnson Matthey arranged a conference in Moscow, Russia, with the ambition to repeat the success from the first conference held in Moscow back in December of 2014. And we did!

The conference was held 24-26th of April at the Ibis Moscow Dynamo Hotel located in Moscow's urban environment. Seventeen people from the following ten customers participated in the seminar: Achema, Acron, Kronospan Russia, Metadynea, Metafrax, Nizhnekamskneftekhim, Shchekinoazot, Sibmetakhim, Togliattiazot and Uralchimplast.

The main topics presented and discussed at the conference were the latest **FORMOX™** catalysts and CAPs and how the correct usage of these can save you money, along with plant developments such as the 1 bar pressure plant and the FT4 plant with a production of more than 1 000 MTPD! Other subjects presented included how to boost your plant capacity further, safety philosophy and optimal and trouble-free plant operation. A lot of examples of incorrect plant operations were presented and opportu-

nities were given for the participants to ask questions and to join discussions in workshops.

The conference was very much appreciated by the participants who enjoyed the conference themes and all the opportunities provided for informal networking. The customers valued the chance to meet others within the same industry sharing experiences, successes and challenges of formalin and UFC production. A lot of opportunities for discussions were given throughout the conference, and especially during the informal evening dinner events, as well as for private sessions with JM representatives. There were several private sessions where technical questions were discussed upon customers' requests.

But most importantly, it was a gathering of friendly and open-minded people sharing knowledge in a welcoming and joyful atmosphere, and enjoying a bit of fun during the informal evening dinner activities.

The event will surely be repeated in the

future, with the next conference in Russia most likely taking place in St. Petersburg in 2019. Johnson Matthey would like to wish you all most welcome the next time around!

BY



Simon Smrtnik,
Regional Manager
Technical Support,
Johnson Matthey





Safe operation fire prevention

We all want the plants to operate safely for as long as possible. To achieve this, we must take a number of precautions to minimize the different risks associated with production of formaldehyde.

One of the risks for major damage to the plant is an internal fire in either the methanol vaporizer or the main reactor. A fire here could reduce the yield, cause a deflagration and potentially even destroy the vessel. There are several known ways that a fire in the system could start. There are also several known actions that can prevent the start of a fire.

Catalytic methanol fire in the vaporizer

There is usually some rust (iron oxide) particles in the methanol feed that will stick to the metal surfaces in the vapor-

izer when the methanol is evaporated. There are examples in which the methanol has oxidized on a coat of iron oxide formed on the pall rings in the demister section¹ after the methanol spray header. The heat from the oxidation subsequently melted the steel pall rings in a small area (~diam. 100-200 mm) of the demister. In some cases the heat caused a deflagration.

To avoid this we recommend using a water jet or brushes to remove any formed iron oxide film upon each catalyst reloading.

Heat transfer oil (HTF) fire in the reactor

Tube leaks in the reactor increases the risk of an HTF fire. The start of a leak is typically very small, with only a drop of HTF leaking through in a day. It is possible to find and weld these small leaks if the reactor is inspected during the catalyst reloading. The HTF system is pressurized during the inspection and the reactor is checked for any HTF smell after a few hours. If any smell is detected, all reactor tubes must be visually inspected to find the leak.



A large, burning HTF leak in one tube can spread to adjacent tubes and eventually cause several tube ruptures. The fire can be extinguished by injecting nitrogen or CO₂ through the firefighting system once the plant has been stopped. It is important that the blowers are not running in order to prevent the nitrogen/CO₂ from being swept out of the reactor. This is more critical if the rupture discs have opened.

Paraformaldehyde fire

Paraformaldehyde can typically form in the vaporizer if the hot formaldehyde gas from the reactor is cooled too much. There is also a risk that a malfunctioning absorber or a leaking prevaporizer will cause paraformaldehyde formation prior to the reactor. Under some conditions, the paraformaldehyde may begin to burn, typically during start up with higher oxygen concentrations. Paraformaldehyde fires before the reactor have in some cases caused deflagrations. Vaporizer fires after the reactor will normally only result in tubes exposed to heat; a deflagration is not expected due to the lower oxygen concentration.

We recommend that all para prior to the reactor be removed with steam as soon as it is found. Paraformaldehyde in the vaporizer that is affecting performance should be washed out with hot water or caustic solution when convenient.



Over-oxidation on exposed, uncooled catalyst

It is important that all the catalyst is in the reactor tubes below the top ceramic ring layer. Catalyst lying on the tube sheet, or that has been spilled in the top void, could react with the incoming concentrated methanol gas and overheat due to insufficient cooling. We recommend that the tube sheet be vacuum cleaned and that the top void, if there is any, is visually inspected to ensure there is no spill and that all tubes have been filled after the catalyst reloading.

Foreign materials

There are known examples of how piec-

es of wood, metal parts, etc. left in the reactor have caused fires and deflagrations. Always inspect the reactor before closing the manholes to make sure that nothing has accidentally been left.

Conclusion: Safe operation is dependent on a clean system!

BY



Ola Erlandsson,
Senior Process Specialist,
Johnson Matthey

Global customer survey 2017

We always strive to help our customers making better business. An effective tool to 'help us help you', is our global customer survey. With start during this summer, we are conducting our survey. Just as last time in 2014, we are using an outside independent company called

TradeWell, to make these interviews. Representatives from TradeWell will contact a selection of you by phone, and for your convenience this short interview will be in your preferred language. We are very grateful for your participation!



UPCOMING CONFERENCES

- Tentative plans for a conference in China later this year (October – November), dates and location not finally decided.
- Formaldehyde Europe 2018, May 2018 in Sweden (exact dates and location is to be decided)

HTF leakage and subsequent reactor fire



An HTF leakage is a serious reactor problem that in a worst-case scenario can result in a reactor fire when HTF oil from the shell side leaks into the hot catalyst on the tube side and ignites. A reactor fire is a serious threat to the safety of personnel and also results in further damage to adjacent reactor tubes. Such damage in turn means a longer shut-down period for repair work and, most likely, additional and tedious administrative work due to authority regulations. All of this combined results in a substantial loss in production and revenues. Therefore, to guarantee personnel safety, and as a preventive measure, it is highly recommended to leakage test the reactor on a regular basis as a standard procedure in the preventive maintenance routine.

There are several reasons for a tube break to occur. The most common cause is too low HTF level during a prolonged period of time resulting in metal fatigue. This is due to abnormally high tube wall temperatures – above the reactor tube design temperature – and insufficient cooling for a maintained reaction in the

top section of the catalyst layer. Eventually a tube will break due to severe heat stresses, and flammable HTF oil will leak into the catalyst reaction area and catch fire. Adjacent reactor tubes will most likely also break and the intensity of the fire will gradually increase, resulting in a higher pressure. Eventually the higher pressure causes the rupture discs to open, providing a continuous flow of fresh air to a rapidly growing fire that puts personnel

The most common cause is too low HTF level during a prolonged period of time resulting in metal fatigue.

and other equipment at great risk. Elevated temperatures can also occur when the mixed catalyst layer has mistakenly been loaded higher than intended. This increases the risk of the HTF oil level not being able to fully cover the catalyst section, resulting in insufficient cooling. Yet another possible cause for a reactor tube wall break can be corrosion, which is more common in older reactors.

In spite of these risks, having full control of the HTF level in the reactor is a simple way to prevent insufficient HTF cooling. Also, high hotspots may be a sign that something is going on, especially when found in the upper parts of the tubes. Therefore, temperatures should be continuously monitored to ensure that they remain stable.

It is thus recommended to always have as high an HTF level as possible in the HTF condenser to ensure good cooling of the reactor tube wall!

BY

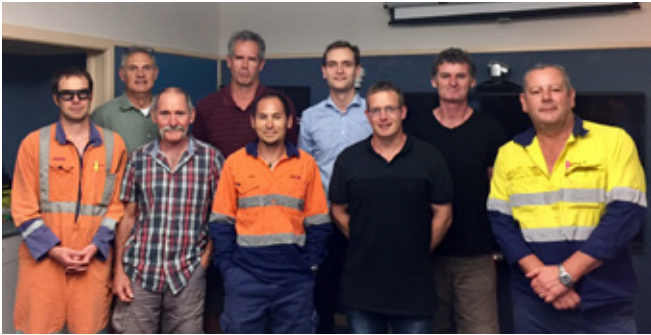


Simon Smrtnik,
Regional Technical
Support Manager,
Johnson Matthey

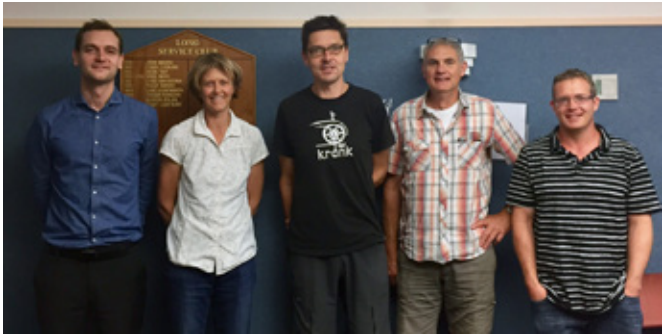


Alejandro Pérez Navarro,
Regional Technical
Support Manager,
Johnson Matthey

Trainings - Spring 2017



We went to New Zealand and held a Training for AICA during March.



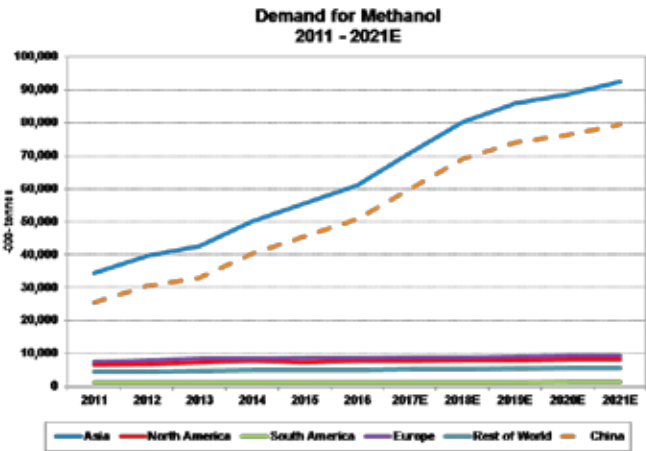
Dover came to Perstorp, Sweden, for Training and some winter activities in February.



Kanoria II had their Training in Perstorp, Sweden, in the end of April.

Global methanol

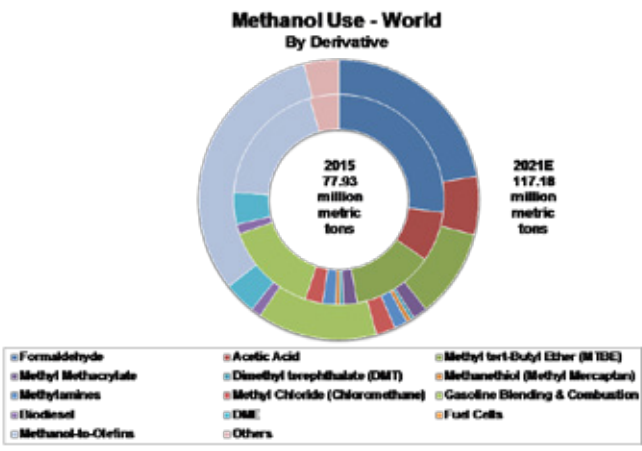
– RISING AND CONSTRAINED MARGINS



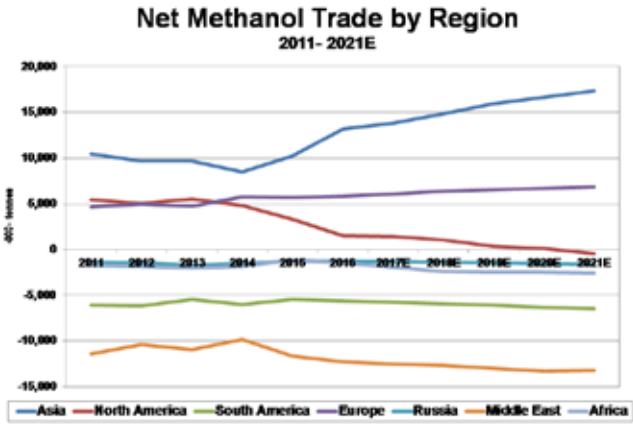
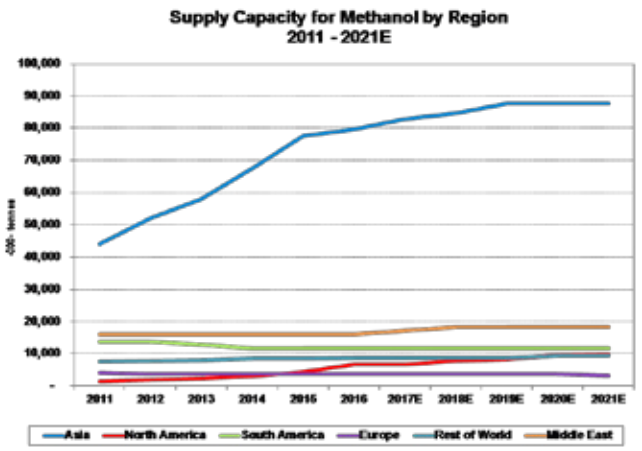
Methanol markets around the world have witnessed price volatility over the past year. New applications in China have helped sop up methanol molecules sending market prices to a peak this March. Yet the MTO industry now has a limited ability to afford methanol, and is intolerant of quickly rising methanol prices. Their resistance to the March peak set off a price decline which is only now ending. For formaldehyde producers, these developments will be a mixed blessing: on one hand, the larger scale use will help keep overall methanol prices competitive in the near term. However, as MTO economics improve, MTO manufacturers will be able to afford higher methanol pricing.

As the chart to the left shows, China is driving methanol demand growth as it develops the use of methanol in applications like MTO.

The trend of increasing methanol demand driven by energy applications will continue, led by refined product replacement, in the form of methanol to olefins (MTO), gasoline blends and direct combustion. The strongest growth in methanol demand will come from MTO use. In fact, in 2017, MTO is on pace to surpass formaldehyde's use of methanol globally. MTO will consume 39.2 million metric tons of methanol by the end of 2022. With such substantial volume, China demand dwarfs rest of world. China is, and will be a methanol price dictator.



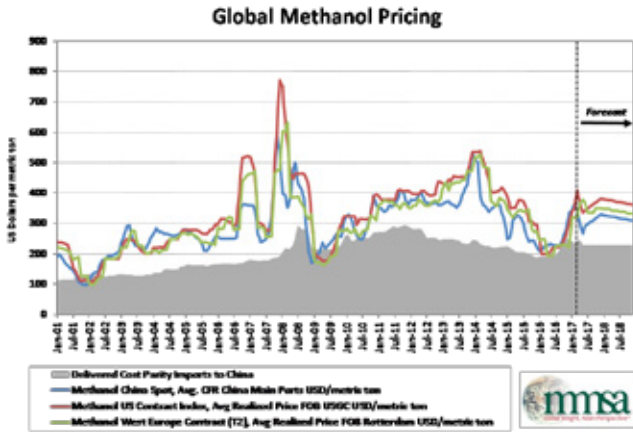
Future methanol supply additions (see chart, left) are below future demand growth expectations, despite US capacity plans using low cost natural gas. While margins for methanol producers have improved, the cost to build remains high, adding risk. Iranian projects to issue are on a less predictable schedule, restrained by many needed upstream investments.



As US production increased, and coastal China demand grows, global trade flow patterns will be altered. The chart to the right shows MMSA expectations of North America becoming a net exporter, and Asia (China and India) increasing their intake.

Global prices and margins bounded by affordability in China energy applications, as well as the economic feasibility of China production. Current methanol cash margins have peaked, yet MTO demand continues to grow. Methanol prices and margins will waver between narrowed floors and ceilings as MTO

demand and spot supply to China ebbs and flows. The chart to the left shows MMSA expectations going forward (grey area is a proxy for cost). Margins stay positive, but remain limited.



BY

Mark Berggren,
Managing Director,
Methanol Market Services Asia
(MMSA)

Mo update

In my previous update, I estimated the Mo price would remain fairly stable until the end of 2016, as well as during 2017, ranging from 5 to 8 USD/lb. So far this has been accurate, although recent trends indicate further increase. The price has been very stable since the autumn of 2016, increasing only in the second quarter of 2017. So what will happen going forward? Should we expect it to remain at the present level, or has anything happened to change the previous view?

Reviews by several experts and analysts indicate that the future is a bit more uncertain. Some suggest the price will increase to 9-11 (or even 12-14) USD/lb during 2017-2018, citing continued increase in demand by the steel industry and continued disruptions in supply from some producers. Others suggest that the release

of stockpiled material could slow the rate of any increase in prices, though it is unlikely that such release would cause prices to fall significantly or for a prolonged period. Based on second quarter development, however, which shows positive outlooks in many markets, that scenario does not seem likely.

Looking further ahead, the introduction of new primary and by-product operations, as well as increased output from existing producers, will be required in 2018-2019 to meet the strong growth in molybdenum demand from special steel and chemical applications. This is also expected to support further price increases, although this as well could lead to increased output from 'swing' primary molybdenum producers, which should slow price rises. On top of that, local economies and other factors (e.g. changes in trade within and with EU, USA, Russia and China), could influence global development and market price.

Based on this year's development and the different views from various analysts, I believe we will see slightly higher price levels (8-12 USD/lb) in the coming year, but that the available output on the market will keep the prices from increasing more during 2018-2019, and instead return to around 10 USD/lb in 2019.

As always, we strive to keep reasonably stable net prices regardless of the market changes. Your efforts to return spent catalyst in good condition to our catalyst recycling system are a strong contribution. By treating it as a valuable raw material and according to our specifications, you help keep prices stable!

BY

Ronnie Ljungbäck,
Commercial Manager Catalysts,
Johnson Matthey

BY



Jonas Lindborg,
Chief of Projects,
Johnson Matthey

Projects & start-ups

New Projects

- An agreement for an FS3 plant to Eastern Europe has been signed.
- A client in China has signed an agreement for an FT3 plant.
- A client in Asia has signed an agreement for expansion of its existing plant with UFC production.
- Another client in the Middle East has ordered an FS1 plant.
- An agreement for an FS1 plant to a client in Southeast Asia has been signed.

Ongoing projects

- The project for supply of an upgraded reactor to South America is in the shipping phase.
- The FT3 plant to KOLON BASF innoPOM, INC (joint venture between KOLON PLASTICS and BASF) is in the shipping phase. The plant will be located in Gimcheon-Si, South Korea.
- Works on an FS3 plant for a client in Asia are in the construction phase.
- The new FT3 plant to be supplied to Wanhua Chemicals Group Co. Ltd., in Yantai China, is proceeding well with construction. This will be their second **FORMOX™** plant on this site.
- The FT3 plant for a client in Eastern Europe is in the installation phase.
- The FS3 plant for Xinjiang Xinye Energy Chemical Co., Ltd, located in China, is in the installation phase.

Start-ups

- The project with an FS3 plant for a client in Eastern Europe is approaching start-up in June.
- The new FS2 UFC plant to PT Dover Chemicals, in Merak, Indonesia, is in the commissioning phase with start-up scheduled for June.
- The project with two FT3 plants located in China is proceeding with scheduled start-up this spring.
- The FT2 plant in the Middle East is scheduled for start-up after publication of this issue of Informally Speaking.
- The new FS3 plant for SI Group Crios Resinas S.A., in Rio Claro, Brazil, was successfully started in April.
- The FS1 plant for Masisa Mexico, in Durango, successfully went on stream in September.

Plant upgrade – why and how?

Johnson Matthey has long experience of executing upgrades and is now offering upgrades to all customers operating oxide plants.

Reasons for upgrading a plant are probably as numerous as there are plants, but we have identified a few of the more common problems, as well as ways to solve them:

- Capacity – increased gas flow, higher inlet, pressurization or higher pressurization pressure, de-bottlenecking of certain equipment
- Product quality – new absorption column for UFC
- Environmental issues – installation of an ECS unit
- Energy usage – higher inlet, steam turbine solutions, turbocharger
- Energy recovery – ECS with steam generator, methanol pre-vaporizer
- Out-of-date equipment – new DCS system, replace re-circulation blowers with fans
- Used equipment – replacement of equipment, preferably updated to the latest standards
- Monitoring plant operation - Performance package with infrared instrument for on-line measuring of DME, CO & MeOH losses

A plant upgrade project typically begins with a discussion between the customer and one of JM's regional sales managers. If the problem is found to be within JM's area of expertise, the next step is for JM to perform a feasibility study. The feasibility study typically includes an assessment of the existing equipment to determine which equipment can be kept, and what will need to be exchanged. Normally the study will look at a few different cases, e.g. various increases in capacity where more equipment will need to be replaced the higher the increase becomes. Based on the findings of the study, JM can then provide budget quotations for the various options. Next, a discussion between JM and the customer takes place to agree upon the most viable option, for which JM will subsequently provide a binding quotation including a catalyst agreement.

Should the customer decide to go ahead with the project, JM will carry it out like any standard plant project and supply the engineering, hardware, site supervision and commissioning according to the agreed scope.

We have been working with upgrades/revamps for a long time and the types of projects have been strongly connected to new innovations implemented in our standard range, changes in legislation, or other developments. The pressurization projects of the early and mid 00's, for example, were a response to sudden increases in demand. Currently, several prospects are looking into updating performance follow-up or changing their production and replacing/upgrading outdated equipment.

BY

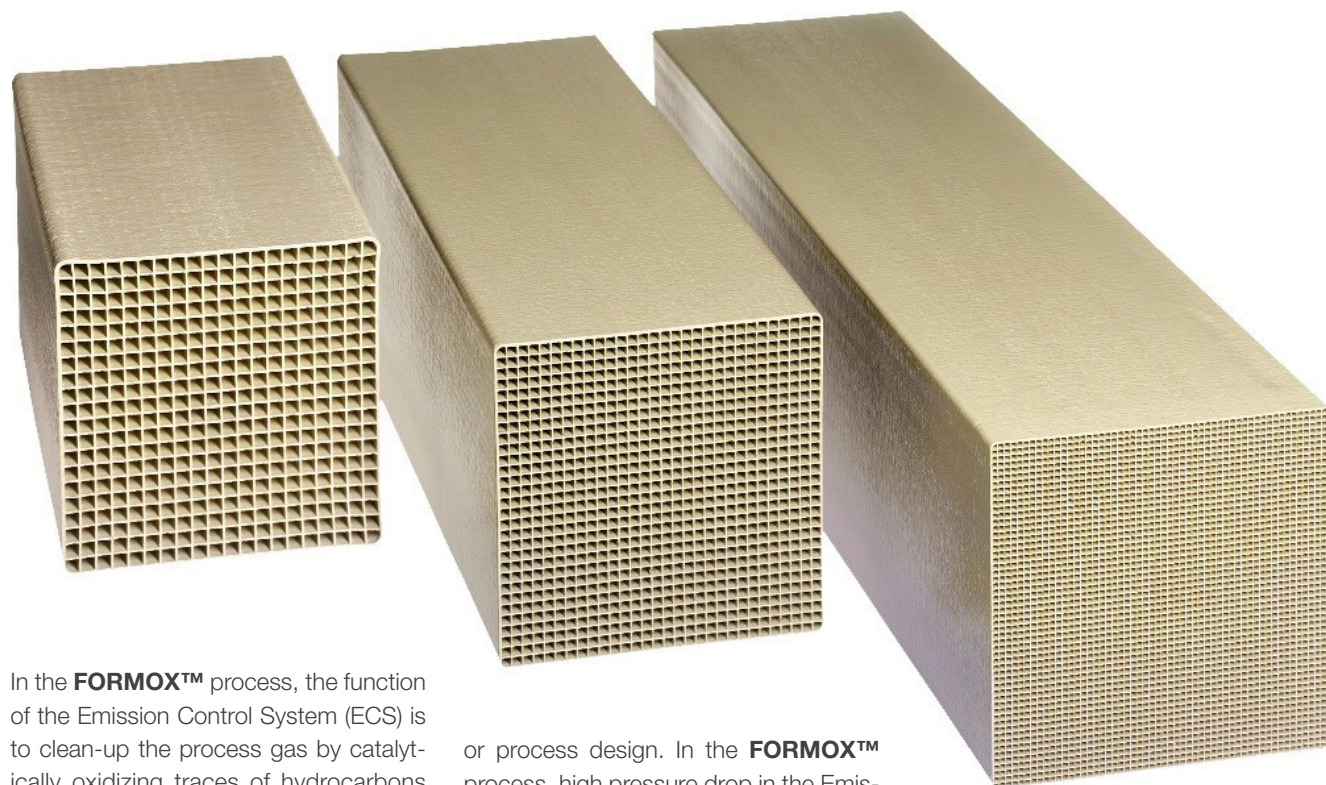


Andreas Magnusson,
Product Manager Plants,
Johnson Matthey



Honeycomb catalyst

for clean-up of emissions in the FORMOX™ Formaldehyde process

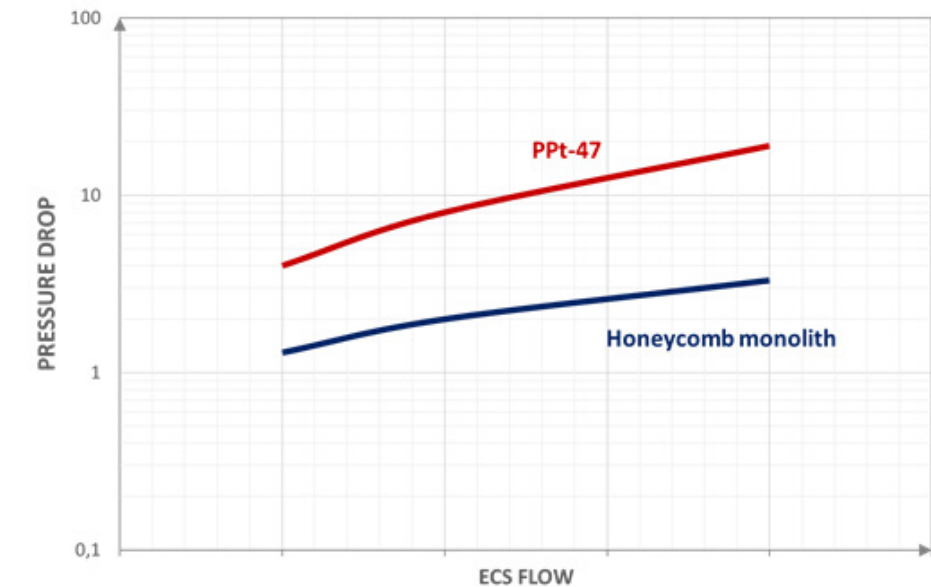


In the **FORMOX™** process, the function of the Emission Control System (ECS) is to clean-up the process gas by catalytically oxidizing traces of hydrocarbons (e.g. methanol, dimethyl ether, formaldehyde) and carbon monoxide into carbon dioxide and water. In the present configuration, the packed bed technology is used, the catalyst is made of spherical alumina pellets with platinum or palladium as active material. However, there are a number of FA-plants, “non-**FORMOX** design”, that include an ECS based on the honeycomb technology.

Conventional fixed-bed catalytic reactors present some shortcomings, depending on the operating conditions and/

or process design. In the **FORMOX™** process, high pressure drop in the Emission Control System (ECS) bed, and to a lower extent mal-distribution, would be the main concerns. Because of the nature of the process, contamination by dust is not an issue. Honeycomb monolith catalytic systems have found many applications in combustion and environmental uses, afterburners of engine exhaust and for removal of harmful compounds from industrial off-gases. Each type of substrate has its strength and weakness; the pellets promote a turbulent flow, which improves the contact of reactant with the active catalyst surface but it generates a significantly high-

er back pressure, especially when high gas flows are concerned. For the honeycomb substrates the pressure drop, in straight narrow channels through which the reactants move, can be smaller by up to 2 or 3 order of magnitude when compared to conventional packed-bed reactors; the higher the gas flow, the higher the difference. However, the arrangement of the blocks in the reactor is more complicated and critical as an imperfect installation may cause leaks over the bed.



The development of the turbocharger and its installation in the **FORMOX** plants offers significant reduction of the specific power consumption, ca 30%. It conveys however a new constraint in terms of pressure drop requirement. The pressure drop over the ECS catalytic system should be reduced to take full advantage of the energy saving potential. When it comes to design, this hurdle has been circumvented by enlarging the ECS reactor. As the space velocity is kept constant to ensure the same high degree of conversion (and so the very low emission levels), the height of the catalyst bed is lowered. The on-going development of the High Pressure Formaldehyde technology, with an increased system pressure, intensifies the demand on managing pressure-drop.

A number of activities concentrating on development of the honeycomb monolith technology (for the formaldehyde business) have therefore been recently initiated.

When it comes to the honeycomb products itself, these have already been developed and commercialized by JM's Emission Control Technology division, although not for **FORMOX** technolo-

gy. Such products can be metallic or in ceramic material, the choice being governed by the application and environment (e.g. corrosive atmosphere, high temperature, etc.). In the case of the formaldehyde process, ceramic substrates are generally favored for their superior resistance to corrosion. Platinum and palladium remain the preferred choice for the active phase. They are in a way similar to the **FORMOX** PPd-47 and **FORMOX** PPt-47. These honeycomb monolith products, **FORMOX** PHC, are now fully integrated in our product portfolio dedicated to formaldehyde application.

Since this technology is already used and the products commercialized, the next step is to develop a method that will allow us to provide the same type of technical support as the one we offer for the other catalysts and more specifically the **FORMOX** P-catalysts (PPt-47 and PPd-47) used in the ECS units. A dedicated new test rig has been constructed for this purpose and allows evaluation of the performance of honeycomb test-samples, like we do for P-catalysts.

In the case of the application in the **FORMOX™** process, the first results from our development work show that

the DP can be improved significantly by replacing the packed bed with the honeycomb concept (see graph below).

We have already been offering honeycomb catalysts for about two years now and expect to further broaden the offering with a dedicated technical support for this specific types of ECS catalyst. Eventually, the next significant step will be the design of a **FORMOX** ECS reactor based on honeycomb technology for the high pressure Formaldehyde technology.

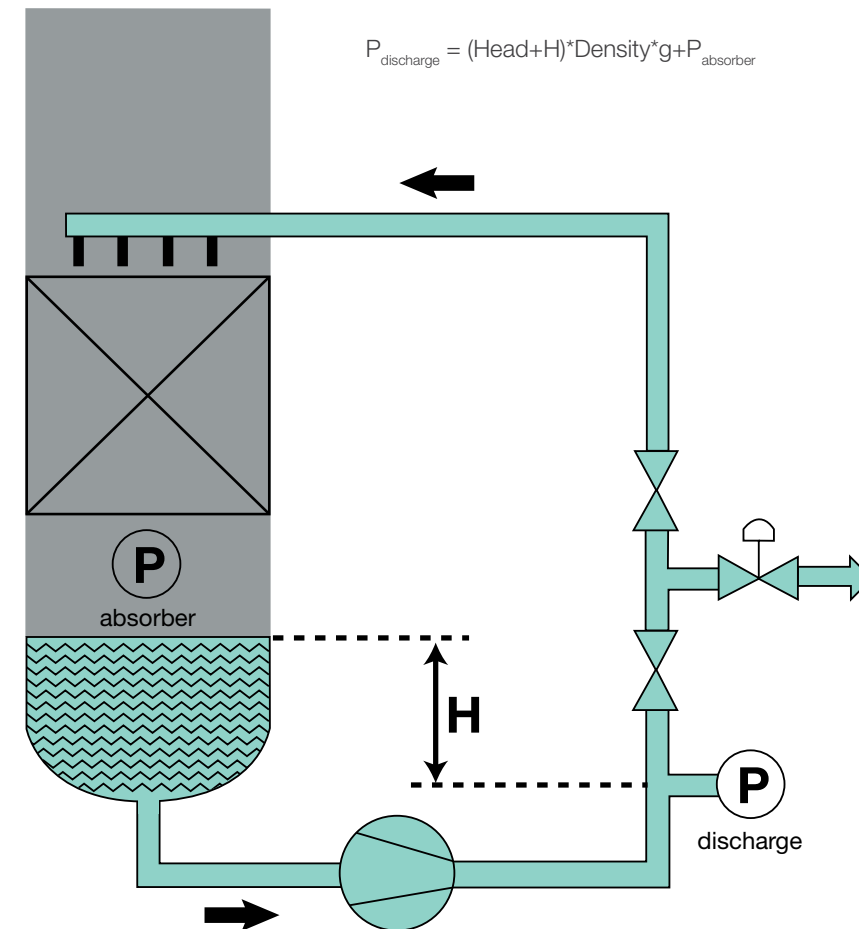
In the meantime, if you have any request or questions regarding these products, you are welcome to contact your Johnson Matthey representative to discuss your specific situation.

BY



Philippe Thevenin,
Product Manager Catalysts,
Johnson Matthey

Check your absorber pump flows!



Low flow can result in:

- Dry spots in the packing (causes paraformaldehyde formation)
- Poor absorption due to insufficient wetting
- Low methanol evaporation (if a prevaporiser is installed)

High flow can result in:

- Flooding in the absorber and high pressure drop
- Increased entrainment, giving poor absorption
- Movement of the packing material

A good working absorber will maximize the absorption of formaldehyde and minimize maintenance requirements. The absorber pump flows to the packed sections is one parameter that has a high impact on absorber performance. It is important to maintain the correct circulation flow over the packed section in the absorbers – neither too low nor too high!

The correct flow is determined by the cross-sectional area of the absorber, regardless of plant load. The correct flow can be found in the plant documentation or operating manual. There are mainly three methods for determining the circulation flow:

- Flow meter
- Calculating the flow with the discharge pressure of the pump and pump curve

- From the power (amps) used by the motor to the pump, together with the pump curve

Using a flow meter is the best method for verifying that you are always operating with the correct flow. Flow meters are standard equipment in today's **FORMOX™** plants, but for older plants it may be a good investment to install one, at least in the bottom packed section where the risk of paraformaldehyde build-up is highest.

Using the discharge pressure of the pump, or power from the motor, together with the pump curve, is also good way to determine the flow. But remember to verify the flow on a regular basis in order to make sure that you are always operating with the correct flow. Also, if the manometer is broken at the pump dis-

charge, you could be getting wrong data for the calculation.

We also recommend that you check the liquid level in the distributor every shift. But remember that if paraformaldehyde is already blocking the distributor holes, flooding may occur even if you are operating at the correct flow.

If you have any questions about how to operate the absorber, please contact your Johnson Matthey representative.

BY



Tomas Nelander,
Global Manager
Technical Support,
Johnson Matthey

New faces...



Gustav Nyberg
Process operator



Filip Lantz
Process operator



Hubert Koffi
Sr Process engineer



Alina Moscu
Catalyst specialist



Stefan Möllerström
EHS Manager



Amir Jahangiri
Process engineer



Erland retires

Erland Andersson decided to retire as Project Manager at Johnson Matthey and **FORMOX** after 22 years. Erland has managed several formaldehyde projects worldwide and we wish Erland all the best and relaxing days at home.