

Small Molecule Manufacturer

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References

- F Harrison et al., "A 1,000-Year-Old Antimicrobial Remedy with Antistaphylococcal Activity," MBio (2015).
- C Lee, "A Blast from Potions Past," The Medicine Maker (2015). Available at https://bit.ly/3aRmayC
- J Furner-Pardoe et al., "Anti-biofilm efficacy of a medieval treatment for bacterial infection requires the combination of multiple ingredients," Scientific Reports 10 (2020).

ive years ago, a group of academics at the University of Nottingham, UK, faithfully recreated a recipe from "Bald's Leechbook" – an ancient medical text – to see what would happen. Bald's eyesalve combines only four main ingredients – wine, garlic, bile from a cow's gallbladder, and cropleac (an Old English word that ambiguously refers to members of the Allium genus, including onion and leek) – in a method with several specific steps, including letting the mixture stand for nine days (1, 2). In the experiment, rather than applying the concoction to a volunteer's eye with a feather (as per the original recipe), the group tested the potion against cultures of MRSA bacteria.

And it worked.

The research captured imaginations and sent a shockwave through the scientific community. Could it be a coincidence that the ancient remedy worked?

Since that initial dip into Bald's world, other researchers have sought to uncover the secrets of the eyesalve, with some attributing its antimicrobial effect to allicin – a compound found in garlic. Now, scientists from the University of Warwick have teamed up with some of the original research team to dig into the science behind the combination of ingredients (3).

Notably, no single ingredient in the recipe was responsible for the antibacterial effect. And no ingredient could be omitted – not even the wine, which is known to have limited antimicrobial activity on its own. They also tested the eyesalve in host-mimicking models – and, yes indeed, Bald's eyesalve is effective against five bacteria that cause modern-day biofilm infections.

Were such ancient remedies built on science and understanding or simply the result of trial and error – or a little of both? We may never know, but it appears that combinations of natural products deserve more attention. As for Bald's Leechbook, what other antimicrobial secrets lie within its pages? When it comes to the rise of the superbug, it would be wise to leave no stone unturned.

Stephanie Sutton

Editor

Stephanie Sitten

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Biologically Active Excipients?

Uncovering the truth about "inert" ingredients

Are APIs the only drug ingredients with biological activity? That's certainly the case for the vast majority of formulations, but new research suggests that a notable minority of excipients aren't quite as inert as previously thought (1). Brian Shoichet, a professor at the University of California, San Francisco (UCSF), explains that his study identified 38 ingredients with potent activity against specific receptors and enzymes in vitro. A surprising result – but not entirely unexpected; Shoichet says he realized several years ago that something was amiss with the "inactive" ingredients included in many drugs.

"In 2016, my colleague Kathy Giacomini received FDA funding for a Center of Excellence in Regulatory Sciences and Innovation and was looking for projects to support. She knew that the agency was interested in excipients so she suggested that I take a look at them," he says. "I thought she was joking. Why would excipients be of interest? But



the more we looked at these 'inactive' ingredients, the more we wondered how they got their designations."

Soon after, Shoichet set up a collaborative team with Laszlo Urban, Global Head of Preclinical Safety Profiling at the Novartis Institutes for BioMedical Research (NIBR), who had already begun to investigate "active" excipients. Using computational techniques to screen a curated database of biologically active molecules, the USCF team examined excipients that resembled molecules known to bind to over 3,000 different human proteins. Meanwhile, their NIBR colleagues screened various inactive ingredients against a panel of protein targets used to test drugs for safety and toxicity. Their results showed that most excipients weren't bioactive – but the ones that were interacted with more than 100 important enzymes and receptors.

"Fortunately, most active excipients do not reach substantial concentrations systemically – they either get stuck in the gut or are rapidly metabolized," Shoichet says. "However, several do get to meaningful concentrations, with some of the most important found in injected formulations, so further investigation is needed to understand how and why this happens."

Reference 1. J Pottel et al., Science, 369, 403 (2020).

FIMELINE

Small Molecules Versus COVID-19

A timeline of just some of the small molecule interventions against COVID-19

MARCH

- Early studies suggest potential of hydroxychloroquine (1,2)
- Gilead receives orphan drug designation for remdesivir in the US
- FDA issues Emergency Use Authorization for hydroxychloroquine

APRIL

 Concerns raised about efficacy of hydroxychloroquine
 Gilead highlights results from phase III

remdesivir trial



- FDA issues
 Emergency Use
 Authorization for
 remdesivir
- Japan approves remdesivir

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BUSINESS IN BRIEF

Two new forays into the pharma space and a billion-dollar discovery deal... What's new in business?

- Jnana Therapeutics has signed a multi-target collaboration and licensing agreement with Roche for the discovery of small molecule drugs. The deal, worth over \$1 billion, will focus on immune-mediated and neurological diseases specifically small molecules targeting the solute carrier family (SLC) of metabolite transporters for regulating cellular metabolism. The collaboration will use Inana's RAPID platform, which screens small molecule libraries for novel modulators of SLC transporters.
- Precision diagnostics developer Invivoscribe is making the leap into drug development, with plans to develop and commercialize small molecules for blood cancers, licensed from Domainex. In a press release, Invivoscribe CEO Jeffrey Miller said that the company will seek to make use of its regulatory experience and network of clinical laboratories with access to



oncology patients. A new drug development division will oversee the project.

Kodak was set to enter the pharma space after receiving a \$765 million federal loan from the US International **Development Finance** Corporation (DFC) to manufacture APIs for key generic medicines. But, after the US Securities and Exchange Commission launched a probe into the deal following allegations of suspicious trading, the DFC tweeted that it would not be proceeding with the deal because "recent allegations of wrongdoing raise serious concerns". A group of House Democrats had also questioned why the government would choose a camera maker with little experience in pharma manufacturing.

The Key to Competition

Researchers identify several factors associated with shorter marketing exclusivity periods

A study of 264 small molecule drugs facing generic competition from 2012–2018 (1) found that exclusivity periods were shorter compared with four biologics (14.2 vs 16.6 years). The research team from Brigham and Women's Hospital also found that exclusivity periods were shorter in cases where the first generic was granted 180 days of exclusivity (14.1 vs 15.9 years) – an incentive designed to expedite generic competition.

Modified versions of existing products, including those with novel routes of administration, therapeutic areas, or use of expedited approval pathways, also had shorter exclusives than new drugs (9.9 vs 14.5 years). But, in contrast to some previous estimates, the team did not find that exclusivity periods for small molecules were lengthening.

The authors hope the findings will inform policymakers as they consider options to encourage timely competition. Most importantly, they warned in their paper that "Unnecessarily long exclusivity periods delay patient access to lower-priced medications."

Reference

1. BN Rome et al., Clin Pharmacol Ther, 858, 23 (2020).

JUNE

- FDA revokes authorization for chloroquine and hydroxychloroquine
- UK authorizes dexamethasone
- US secures 5,000,000 treatment courses of remdesivir through Sept

JULY

- Remdesivir receives conditional marketing
- approval from EMA
 Japan approves dexamethasone
- European Commission signs contract for remdesivir supplies from Aug onwards

AUGUST

- Gilead says it has shortened manufacturing timeline for remdesivir to 6 months
- Scientists say hydroxychloroquine should not be ruled out completely (3)
 Gilead submits NDA to
- FDA for remdesivir

References

(2020).

- J Liu et al., Cell Discovery 6 (2020).
 S Sagrane, MA El Mhannedi, New
- Microbes New Infect 35 (2020). 3. Nuffield Department of Medicine Centre for Tropical Medicine and Global Health, "Hydroxychloroquine is being discarded prematurely in COVID-19 prevention,"

Sayonara, Serendipity

Researchers discover rational strategy for finding molecular glue degraders – small molecules that can tap into hitherto undruggable proteins

More than three-quarters of all human proteins are beyond the reach of small molecule developers – at least with traditional (antagonistic/agonistic) pharmacologic approaches. An alternative involves using small molecule "degraders" to destabilize undruggable disease-causing proteins. But, so far, the field has lacked rational strategies for discovering these drugs, relying instead on serendipity.

But now, researchers – mainly from the CeMM Research Center for Molecular Medicine of the Austrian Academy of Sciences – have identified mutations in a gene called UBE2M that cause resistance to all known "glue degraders," a seemingly rare degrader subset. "We surmised that we could find novel glue degraders by screening compounds with unknown mechanisms of action in these cells," says Georg Winter, corresponding



author of a new paper setting out how to rationally discover molecular glue degraders (1).

How do these degraders work? The compounds redirect E3 ubiquitin ligases toward proteins, which are earmarked for destruction via a process called "ubiquitination" and then degraded by the proteasome. To screen for novel glue degraders, the team engineered cells impaired in E3 activity ("hyponeddylated"). By comparing hyponeddylated cells with E3-proficient cells, the team identified compounds that depend on active E3s – potential molecular glue degraders.

"We were most excited when we identified novel chemical matter that acts via undescribed mechanisms," says Winter. These compounds were found to induce degradation of the cyclin K protein, which is essential in many different cancer types. Because the molecular mechanism was hitherto unknown, it has yet to be explored therapeutically. "We were surprised to find that our new compounds can degrade CCNK in the absence of a dedicated substrate receptor – a component of cullin–RING ligases," says Winter.

The researchers are confident that the approach can be scaled – so much so that they've founded a new spinout called Proxygen, dedicated to the scalable discovery of novel glue degraders.

Reference

 C Mayor-Ruiz et al., "Rational discovery of molecular glue degraders via scalable chemical profiling" (2020). Available at: https://go.nature.com/3ibB3hw.

New Options in Pain Management

Recently developed compounds aim to make pain relief less of a headache for patients

Is there such a thing as pain relief without side effects? Recently developed

acetaminophen analogs may offer just that. These alternatives to common pain management medications (1), developed by a team from the US and Spain, were found to relieve pain and reduce fever in mice. Importantly, unlike many readily available OTC nonsteroidal anti-inflammatory drugs, they weren't shown to cause addiction or to damage the liver or kidneys of the animal models used. The positive results prompted the



collaborators to license the technology they used to develop the new compounds to Sun Rampart Pharma, a biotech company committed to the development of drugs for chronic, acute postoperative, and neuropathic pain.

Reference

HA Bazan et al., Eur J Med Chem, 202, 112600 (2020).

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a blossoming MARKET

By Maryam Mahdi

India is emerging as an economic powerhouse. The growth of its pharmaceutical sector – particularly small molecule APIs – has certainly contributed to its domestic and international success, but what opportunities and barriers does the flourishing sector face? ith an estimated value of US\$41 billion per year and a CAGR of eight percent (1), India is the world's largest supplier of generics. The country – dubbed "the pharmacy to the world" – provides medicines to over 200 countries (2), but the market dominance it now enjoys is relatively recent. Prior to 1970 (3), there was little pharmaceutical infrastructure in place, which made the country reliant on foreign imports.

"Though India has a long history of traditional medicine use, its journey with allopathic drugs is fairly new," says Selwyn Noronha, CEO at ACG Capsules. "Almost all drug patents held in India in the 1950s and 1960s were held by foreign companies. And domestic drug prices were among the highest in the world, meaning that only a privileged minority could afford them."

New attitudes began to take hold in the late 1960s (3). The nation wanted to become self-reliant, producing medicines for its own population as well as for international markets. And by the 1970s, this shift in attitude coupled with the introduction of new legislation prompted the launch of most of India's pharma companies. The Patents Act of 1970 allowed companies to develop generic versions of patented drugs so long as they were manufactured using novel approaches (4). This sparked a new trend in the industry and companies began to focus their energy on reverse-engineering the latest medicines - creating their own manufacturing processes to compete in the pharmaceutical marketplace. The FDA's Drug Price Competition and Patent Term Restoration Act, or Hatch Waxman Act, also helped generics manufacturers bring products to the US market (5). Offering companies a 180-day exclusivity period for abbreviated new drug applications (ANDAs), the law incentivized the production of cheap alternatives to common brand-name drugs.

Since then, Indian pharma has grown rapidly and cemented its place in the industry. In the US, for example, one in three drugs is reported to have been developed by an Indian generics company (1). According to Noronha, the cost of these medicines also contributes to the nation's competitive advantage. "India first began exports to the international markets in the 1980s," he says. "APIs were the first products sold abroad but the sale of formulations quickly followed. This new direction caused an upheaval in the global supply chain and the prices of myriad drugs (including NSAIDs like ibuprofen and acetaminophen) were slashed to a quarter of prevailing market prices."

The low costs of Indian products certainly contributed to their attractiveness – but that alone was not enough to secure their position in the market. Could other aspects of the manufacturing process also be improved to help India break into more highly regulated markets?

A question of equipment

Throughout the 1980s, heavy import taxes prevented Indian companies from acquiring the equipment they needed to comply with cGMP (6). As a result, many turned to local suppliers, but generally the equipment lacked the sophistication needed for high yields and efficiency.

"The growth of the export market prompted an important change in the attitude of India's equipment manufacturers. Many companies were increasingly focused on the pharmaceutical markets of the West and needed superior machinery that could enhance process control, mitigate human error, and yield products compliant with their regulations," says Richard Stedman, CEO at ACG Engineering.

Equipment manufacturers quickly responded by developing machinery with superior process control technology. Stedman says, "To be considered viable, companies needed to demonstrate their ability to mitigate the risk of human error in their operations. The mounting pressure from their Western industry partners was a clear incentive for change."

Falling import duties in the early 1990s meant that companies could finally consider purchasing foreign manufacturing equipment (6). And the increased competition forced the hand of domestic manufacturers, who began to develop machinery with equal or superior capabilities. "Though our local equipment manufacturers were able to meet industry expectations in the past, overall equipment efficiencies (OEE) is the crucial measure in manufacturers are no longer satisfied with equipment that delivers desired product quality with adequate process controls; they are looking at improved efficiencies, higher uptimes, faster cleaning, and higher OEEs. But past experience proves that our equipment manufacturers don't settle for the status quo. I'm confident that they will deliver new technologies to meet the industry's growing demands."

Clearing up misconceptions

Though India has made significant contributions to the global generics market and has the highest number of FDA-registered facilities outside the US, quality issues have led to negative perceptions. In 2019, for example, it topped the list of countries with the most FDA-issued warning letters for manufacturing quality. Of the agency's 43 letters, 20 were aimed at Indian facilities and cited control issues, lack of written procedures inside plants, insufficient laboratory records, poor sanitation, and data security as common violations (7). Although Noronha agrees that the warning letters can't be refuted, he argues that concerns about the quality of Indian facilities stem from Timeline to manufacturing success

1856 // India's first patent laws

1911 // Patent and Designs Act

The Office of the Controller of Patents, or Indian Patent Office, begins to oversee all patents

1970 // Patent Act

Manufacturers can develop patented drugs using novel processes

1984 // Hatch Waxman Act

The FDA incentivizes the manufacture of generics, providing a protected period of market exclusivity to manufacturers

1994 // General Agreement on Tariffs and Trade (GATT)

India signs GATT during the Uruguay Round Agreements, which form the basis for the launch of the World Trade Organization (WTO)

1994 // Trade Related Aspects of Intellectual Property Rights (TRIPS)

India signs TRIPS and revokes some of its intellectual property laws to comply with those introduced by the agreement. The country is granted a transition period of five years and extended patent protection to help it fulfill the new requirements.

2005 // Fulfills TRIPS requirements

Sources

- Intellectual Property India, "History of Indian patent system" (2020). Available at: https://bit.ly/39tcfOQ.
- N Zacharias, S Farias, "India: Patents and the Indian pharmaceutical industry" (2019). Available at: https://bit. ly/3g2RjRb.
- J He, "Indian patent law and its impact on the pharmaceutical industry: What can China learn from India?", Innovation, Economic Development, and Intellectual Property in India and China (2019).

"Bolte of lies: The Inside Story of the Generic Drug Boom" by Katherine Eban. In his opinion, the book made broad generalizations about Indian generic products, depicting them as "cheap ripoffs" and products of gross process violations.

"Bad press always attracts more attention than good," he says. "The industry is now working to lay these misperceptions to rest. One example is that several recently launched contract research and clinical research laboratories have established global partnerships – testament to the credibility of the industry."

Crisis management

According to ACG's Noronha, the COVID-19 pandemic has provided Indian pharma with an unusual opportunity to prove itself on the global stage. The pharmaceutical industry is facing an unprecedented challenge – and Indian pharmaceutical companies now have the opportunity to reassess their operations and work with international partners to deliver therapeutic solutions. "Indian companies have quickly been identified as partners to manufacture potential oral and vaccine-based solutions – palpable proof of India's relationship with companies and organizations worldwide," Noronha says. "I hope that our response to the crisis will have lasting effects on our global perception."

Though COVID-19 may be driving a shift in how India is perceived, it also raises a new challenge: India receives 60-70 percent of some of its API requirements from China, but the pandemic has significantly disrupted the flow of supply (1). Noronha

explains that several Indian companies have reported interruptions in production schedules, partial shutdowns, and supply chain disturbances as a result of China's border closures. Such logistical challenges have prompted many to evaluate whether a single API source is still a viable option for drug manufacturing. "The availability of raw materials has been uncertain. Many businesses have reported an exponential increase in operational costs and service prices," says Noronha. "The COVID-19 outbreak is bound to spark a change

bound to spark a change in mindset across India's pharmaceutical community as the need for self-reliance in manufacturing bulk drug ingredients becomes increasingly obvious."

Small Molecule Manufacturer "I hope that our response to the crisis will have lasting effects on our global perception."

Sudarshan Jain, Secretary-General of the Indian Pharmaceutical Alliance opined that the Indian government and Indian pharmaceutical industry have risen to the challenge, continuing to supply medicines to patients across the country. "COVID-19 has given us the opportunity to usher in a new era for the country's healthcare and pharma ecosystems. We're already seeing how well industry and government can collaborate to find solutions," he says. "When the pandemic began, many companies across the country were able to maintain an inventory of critical APIs and key starting materials despite the shutdown of China's borders."

The Indian government also recently passed the Bulk Drug and Medical Devices policy, which focuses on increasing domestic manufacturing of APIs and key starting materials (8). The policy will give India the chance to scale up its ingredient manufacturing capabilities and challenge China's position in the market. The country has already identified a key opportunity to reduce manufacturing costs and reduce its "dependency on other countries for bulk drugs" (8). Drug manufacturers will receive incentives for manufacturing 53 critical bulk drugs prioritized for development by the government.

Beyond bolstering its manufacturing capacity, India is embracing new practices to ensure business continuity and employee safety amid the crisis. Pharmaceutical manufacturers were exempt from the country's stringent lockdown, so employers had to explore new ways to prioritize the health of their workforce. Under legislation issued in May (9), the government required companies to encourage remote working wherever possible and urged employers to enforce social distancing practices on their premises (10). Noronha anticipates that the implementation

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"This will redefine the way the pharma industry carries out marketing activities for decades."

of social distancing will drive digitization and automation in all manufacturing processes. "The severe restrictions on movements will

usher in different ways to connect, engage, and serve global customers using the latest digital platforms," he says. "This will redefine the way the pharma industry carries out marketing activities for decades."

For the future

Though COVID-19 will have a lasting impact on pharma, the industry had already begun to change to meet the needs of its stakeholders. Vision 2030, India's plan for cross-sector growth, outlines four key areas of development for the pharmaceutical industry (1):

- improved accessibility and affordability of drugs in the domestic market
- investment in the development of breakthrough drugs continued growth in the US
- increased presence in large, unpenetrated markets like Japan and Latin America

Jain believes these targets are achievable for Indian companies that are keen to prove they can offer more than generics to their customers. "Until now, the Indian pharmaceutical industry's success has largely been in generics – but India was one of the first markets in the world to initiate biosimilar development and has seen the launch of many biologic products," he says. "Though this a positive step, the sector has had limited success in developing other product classes, such as gene therapy and specialty drugs. Spurring innovation in these types of complex drugs can usher in the next leg of growth for pharma in India." But, for ACG, the industry's growth will be defined by its ability to embrace technologies that offer improved process and data control. "Technologies that improve overall efficiency need to be given more attention. As the world begins to embrace Industry 4.0 concepts, continuous manufacturing, and additive technologies, we must also consider their benefits for our continued success. We have to keep an ear to the ground to keep up with

changing times," says Stedman.

Whatever strategies they use to increase their market presence,

Indian companies are proving their ability to adapt to market needs and reliably partner with companies worldwide. And it's this "can-do" attitude that will underpin India's future success.

References

- The Indian Pharmaceutical Alliance, "The Indian pharma industry

 contributions to global health outcomes" (2019).
 Available at: https://bit.ly/3jM0zvF.
- Government of India: Department of Pharmaceuticals, "Annual report 2019-20" (2020). Available at: https://bit.ly/30TyfhZ.
- GT Haley, UCV Haley, "The effects of patent-law changes on innovation: The case of India's pharmaceutical industry," Technol Forecast Soc Change, 79,607 (2012).
- N Zacharias, S Farias, "India: Patents and the Indian pharmaceutical industry" (2019). Available at: https://bit.ly/3g2RjRb.
- FDA, "Hatch-Waxman Letters" (2018). Available at: https://bit.ly/39xAR9n.
- DK Das, "Manufacturing productivity under varying trade regimes: India in the 1980s and 1990s," Indian Council for Research on International Economic Relations (ICRIER), Working Paper, No. 107, (2003).
- FDA, "Warning Letters 2019" (2020). Available at: https://bit.ly/39KG8ut.
- 8Press Information Bureau India, "Cabinet approves promotion of domestic manufacturing of critical key starting materials/drug intermediates and active pharmaceutical ingredients in the country" (2020). Available at: https://bit.ly/39zQBc3.
- National Law Review, "India Update: Indian government institutes community and workplace safety guidelines for phased re-opening following the COVID-19 lockdown" (2020). Available at: https://bit.ly/2WYOpFK.
- Government of India: Ministry of Health & Family Welfare, "SOP on preventive measures to contain spread of COVID-19 in offices" (2020). Available at: https://bit.ly/2DeoAdG.



\$1 BILLION FUND TO ENABLE COMPANIES TO MANUFACTURE PHARMACEUTICAL INGREDIENTS DOMESTICALLY BY **2023**

Sources

Sources IBEF, "Pharmaceutical Exports From India" (2020). Available at: https://bit.ly/30UwEIJ. The Indian Pharmaceutical Alliance, "The Indian pharma industry – contributions to global health outcomes" (2019). Available at: https://bit.ly/3jM0zvF.

A Year of Challenge and Opportunity

The COVID-19 pandemic has caused widespread disruption. And though pharma has had to overcome hurdles to manage the fallout, opportunities to show the industry's commitment to its most important stakeholders – patients and employees – have emerged. As has the chance to implement new processes and technologies to maintain the continued development of the sector. Here, Deepak Sapra, Global Head of PSAI (Custom Pharma Services and Active Ingredients) at Dr. Reddy's Laboratories, explains the company's approach to dealing with the ongoing crisis.

What has been Dr. Reddy's main priority during the pandemic? The past few months have been very intense. The COVID-19 pandemic is affecting lives, so we must find ways to support as many people as possible.

One of our first steps was to ensure that our workforce and their families were in good health. We have taken a host of measures in this regard so that we can continue to provide much-needed medicines to patients through this period of uncertainty. For our colleagues who work at our manufacturing sites, laboratories, and distribution centers, we have put in place additional layers of health and safety procedures to provide them with a safe working environment. These include significantly enhancing capacity of our buses for social distancing, temperature checks at all entry and exit points, providing PPE to employees and contractors, disinfecting machines to spray outer garments and shoes, as well as social distancing measures. In addition, some plants were used to make disinfectants and hand sanitizer. We are also closely following and complying with the advice from our local

authorities, and have issued guidance for remote working for all our colleagues who can do so.

How else is the company addressing the crisis?

The pandemic has raised questions on the reliability of global supply chains and companies are now trying to ensure its resilience and reliability. A strong supply chain network with reliable partners is key to addressing the problem. Fortunately, we had already started to implement initiatives to help mitigate risks well before the COVID-19 outbreak began. In recent years, we have formed strategic sourcing and logistic partnerships, reassessed our capacity management systems for our manufacturing units, and included the backward integration of key starting materials into our production processes. We are also continuing to mitigate geographical risks by leveraging our manufacturing set up across three continents, for both our APIs and for our formulations.

Do you think COVID-19 will affect how the industry operates in the long term?

efficiency and work practices.

In our industry, most companies quickly moved to working remotely through digitized processes and video conferencing. I think we all saw how COVID-19 accelerated the adoption of digitalization. I hope we can keep this agility and speed for continued improvement in

eepak Sapra, Global Head of PSAI ustom Pharma Services and Active gredients) at Dr. Reddy's Laboratory

governments and health



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The trends behind the tech

Richard Stedman, CEO, ACG Engineering, highlights the trends influencing the Indian pharmaceutical equipment industry

What are the most significant emerging trends?

Though the global demand for generics is on the rise, so too is the domestic need for medicines in India. Price pressures are forcing producers to consider more efficient processes. In turn, equipment developers are now working in a more integrated manner with pharma companies to better understand their manufacturing processes and find opportunities for optimization.

As well as generic products manufactured using conventional technologies, there is a growing need to produce more advanced medicines, which has resulted in a demand for equipment with high containment capabilities to meet overall exposure limits (OEL) norms as stringent as OEL IV and V.

Who is influencing these trends?

Everyone from patients to regulators to pharmaceutical companies themselves. They are all stakeholders in the industry and, as such, their opinions shape how machinery manufacturers respond. In recent years, concepts like digitization, the Internet of Things, and Industry 4.0 have influenced the equipment being developed. As new trends emerge, India's equipment manufacturers must meet the industry's expectations to maintain their competitive edge.

What challenges are associated with meeting industry expectations? The previously mentioned trends have contrasting equipment needs. Whereas generics require high output, high efficiency, and large batches, advanced medicines are manufactured in smaller, contained batches with highly automated cleaning capabilities. Equipment manufacturers will have to work closely with their clients to create solutions for these varied needs.

Irrespective of the product, equipment providers must continue to meet the industry's high standards for manufacturing. The Code of Federal regulations recently introduced electronic validation for the manufacture of pharmaceutical machinery. And that means companies must integrate powerful computer- and programmable logic controller-driven processes into their protocols to reduce human intervention in the drug development process to drive a higher level of quality and efficiency in pharmaceutical manufacturing technologies.

What's next for India's equipment manufacturers? Stakeholders' needs are rapidly changing and many emerging technologies have attractive cost benefits. Continuous manufacturing, for example, offers companies an alternative to conventional processes, as well as the opportunity to cost-effectively produce large volumes of product. Traceability technologies must also be prioritized to help secure products in the supply chain.

Though it's important to address customer requirements, equipment manufacturers must also assess the benefits of developing new machinery for their own operations. They must ask themselves what the long-term value of producing new equipment is and

> how it will affect their perception among customers. Simply put, companies must weigh up the pros and cons before developing equipment for trends that may be short-lived.

CEO at ACG Engineerin

Precious Metals

Edelmetale Metale te cmuar Qiymətli Metallar Metal preziatuak Metalls preciosos Bililhon nga Mga Metals Zitsulo Zamtengo Wapatali 贵金属 Metalli Preziosi Dragocjeni metali Drahé kovy Værdifulde metaller Kostbare metalen Altvaloraj Metaloj Väärismetallid Mahalagang Metals Jalometallit Métaux Précieux Edelmetalen Metais preciosos Edelmetalle Metali presve Karfe mai daraja Nā Metala kūpono Lub Neej Zoo Nkauj Nemesfémek Dýrmæt málm Alsdi ola di oké onu ahia Logam Berharga Metalli preziosi 貴金属 Metals Logam 귀금속 Metayên hêja nobilis metalli Dārgmetāli Taurieji metalai Metaly sarobidy Logam Berharga Metalli prezziużi Metara Raraemi Edelmetaller Drogocenne metale Metais preciosos Metale pretioase O Metotia Taua Meatailtean luachmhor Metali ea Bohlokoa Metals anokosha Drahé kovy Plemenite kovine Birta Qaaliga ah Metales preciosos Logam lumayan Vyuma vya Thamani



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Breaking With Tradition

Before adopting continuous manufacturing practices, companies need to assess the potential pros and cons for their operations

By Mark Muldowney

Continuous manufacturing is the norm in many industries, but for pharma – despite the well-documented cost and quality benefits associated with continuous – batch manufacturing remains king. The availability of standard batch reactors and the simplicity of their use means that old habits die hard.

With many continuous processes relatively untested and with regulatory guidance somewhat lacking, the industry's hesitance to embrace continuous is understandable. For continuous manufacturing to be more widely adopted, companies must be aware of its operational advantages, as well as the challenges posed by its use. Armed with this knowledge, companies can fully assess whether continuous processes are appropriate for their business needs.

Mitigating risks

There are many reasons for pharma companies to embrace continuous manufacturing. A continuous manufacturing process can run consistently until a project is complete, minimizing the labor and cost associated with starting up and shutting down production between batches – and slashing manufacturing times. Throughput can also be maximized using continuous processes. Importantly,



The

Next Big

Thing?

a continuous process avoids batch dumping. In batch processing, if something goes wrong then the entire batch will often need to be discarded - a waste of precious time and raw material; in other words, highly undesirable. In a continuous chemical process, reactions take place on a much smaller scale so even if there was a pipe failure, only a small amount of product would be lost. Not only can manufacturers reduce quantities of material used - saving money and unnecessary interactions with hazardous products - the automated nature of the technique means that fluctuations in reaction conditions can be minimized, and the possibility of human error reduced. Additionally, it's possible to immediately quench reactive agents as soon as they've been used rather than waiting until the end of a cycle.

A continuous process is very different to batch manufacture – and so it requires a different set of skills. The equipment is also expensive – even small-scale equipment can cost companies in excess of £30,000. Yes, continuous manufacturing offers many benefits, but the business case for implementation will often come down to economic viability.

If you can make the investment, rewards can follow; however, continuous manufacturing should not be implemented just for the sake of it; the process needs to be carefully evaluated for the product. The success and scale-up of any project relies on suitable product selection. Plug flow reactor pipes are only appropriate for certain types of API reaction; for example, they work well for homogenous solutions. Literature also suggests alkyl lithium reactions are renowned for generating solids that build up and block reactors during this type of processing. Solids can often cause blockages because a narrow network of pipes is used to ensure adequate mixing. Should a solution precipitate out (as happens frequently with processes involving concentrated solutions) then the operators must dismantle the kit, which is time consuming. Continuous equipment with wider pipes designed for solids manufacture does exist and uses oscillating baffle reactors to ensure the material inside continues to move. Though this type of equipment provides a pertinent alternative for solid API production, it is more complicated to use than ordinary kit (and more expensive!).

> "Continuous manufacturing offers many benefits, but the business case for implementation will often come down to economic viability."

It goes without saying that you should buy your equipment from a reputable supplier – a company that understands the continuous process and its challenges. Ever since the early days of continuous implementation, finding the right equipment has been its own challenge. It is best to use commercial equipment made from the same material as your proof-of-concept (POC) equipment to avoid affecting any of the reaction parameters, but this can make sourcing commercial equipment more complicated. One solution to this problem is silicon carbide, which has anti-corrosive properties (particularly useful for acidic reactions), but not all suppliers make small-scale versions in this material.

With this in mind when it comes to making decisions about the equipment most appropriate for your project, buying in is not the only option. Third party suppliers can design and build equipment to fit the specific chemistry needs of customers. Engaging with CDMOs can be a good way to begin to explore the viability of continuous processing.

Making the final decision

Continuous manufacturing is still in its infancy in the pharma industry, but many organizations are showing high interest because of the potential for increased manufacturing efficiencies and reduced costs. But be warned: continuous can only be successful when the correct equipment is supported by robust scalable chemistry and systematic process design, along with suitable process analytical technology.

Expertise is vital – and so I also recommend collaborations. Some companies, for example, have partnered with academic institutes to learn more about continuous manufacturing. Other companies embark on strategic collaborations with the aim of sharing resources and costs, and mitigating risks.

If used correctly, continuous manufacturing allows companies to more efficiently develop APIs and broaden the safe operating range of chemical processes. Just remember to do your homework and consider the suitability of continuous processing for your specific product before taking the plunge.

Mark Muldowney is Head of Innovation and Technology at Sterling Pharma Solutions

The Crystal Maze

Unexpected hydrates of an API can cause a frustrating detour in the drug development pathway – the right analysis (and expertise) can help manufacturers find their way

By David Pearson

Despite having modern modeling software, cloud-based computing, and an arsenal of analytical protocols at their disposal, predicting the crystalline nature of an API in its solid state remains a trying task for pharmaceutical manufacturers. This is particularly true of hydrates – APIs whose crystal structure contains water molecules. Up to 75 percent of all pharmaceutical compounds form hydrates during the manufacturing process, affecting many of the physicochemical properties of an active ingredient (1).

This is a sticking point for companies wanting to move their API through the clinical pipeline as quickly as possible as it challenges their ability to discern the overall bioavailability, physicochemical properties and intellectual property position of their material early in the development process. To help overcome these hurdles, larger pharmaceutical companies are increasingly turning to CDMOs to perform solid-state analyses in expert laboratories. Valued in excess of \$150 million, CDMOs represent over 50 percent of the total market share for solid-state services (2).

Companies should perform comprehensive experimental screening of materials using a variety of solvents, experimental conditions, and processes, along with all the associated analytical techniques. Ultimately, you are looking for a robust solid form of a molecule that allows high-quality materials to be consistently delivered.



Figure 1. Different structures of API – different dehydration rates.

But inadvertent changes to the solid form of an API between batches can still occur. So how can companies effectively manage the variability in their manufacturing processes? Identifying and understanding the formation of

"Ultimately, you are looking for a robust solid form of a molecule that allows high-quality materials to be consistently delivered." alternative structures early on can reduce potential risks.

Hydrates: putting development at risk Unlike solvated forms of an API, which contain organic molecules (such as ethanol) in their crystal lattice structure, hydrate formation relies on water and is not easily recognized during screening. As the vapor pressure of water is above zero, hydration and rehydration can occur in ambient conditions such as storage. If a drug were dosed in an anhydrous form that converts during storage or in the body to a lowersolubility hydrated form, for example, it may affect the observed solubility and dissolution of the API, making in vitro/ in vivo correlation more difficult.

If the potential to form hydrates is flagged to the development team early on, they can take steps to mitigate the risk. What does this look like in practice? We used polymorph screening to examine the difference in four different crystal forms of an API obtained from organic solvent and solvent/water mixtures. The various solid forms included:

- Form 1 anhydrous racemate and the desired form of the API
- Form 2 a hydrated racemate
- Form 3 anhydrous conglomerate
- Form 4 a hydrated conglomerate

The rate at which these hydrated forms dehydrated varied massively – from several minutes under ambient conditions, to several days at 40°C in a stability oven (Figure 1).

Initial data indicated that there were two anhydrous and two hydrated forms (with the same amount of water observed in the two hydrated forms). Only detailed analysis by X-ray powder diffraction (XRPD), single-crystal X-ray diffraction, dynamic vapor sorption (DVS), and thermal analysis showed that the two hydrated forms were not true polymorphs of each other. This allowed the targeting of the desired form.

Hydrate mapping, in which the water activity in organic solvent systems is systematically altered using varying volumes of water, is a powerful technique to understand the hydrate formulation in solvent-based systems. While DVS and variable humidity XRPD can provide a wealth of information on critical water activities and kinetics, a more practical method is solvent-based and closely related to real-world scale-up. Table 1 shows the results from the hydrate mapping for this particular API and its four forms.

Optimizing the crystal form

If an undesired hydrate is isolated, there are a number of ways to attempt to convert it back to a preferred form. Reducing the relative humidity – for example, by storing the material over a desiccant or heating it in a vacuum in a

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Table 1. Hydrate mapping of the four API forms.

tray dryer – can often force a hydrate to dehydrate. Slurrying or crystallization in solvent systems that have low water activity can also help recover unwanted hydrate formation; however, this process must be guided by a deep understanding of the relationship between the anhydrous and the hydrated forms.

In our case study, Form 1 was chosen as the best solid form to move forward with, and the data gathered was used to develop a crystallization protocol to produce it in a reliable manner. Accurate solubility measurements in a variety of solvents - with quantification by ultra-performance liquid chromatography - can also help guide the choice for further crystallization optimization.

While water is a great antisolvent for many APIs, in this case, the potential for an undesired hydrate form posed a potential risk. The ICH class 3 alcohols (which are defined as solvents with low toxic potential) showed high solubility. Class 2 (restricted) solvent methanol also showed good solubility but is more toxic and less thermally stable compared with ethanol and isopropyl alcohol (IPA, propan-2-ol). Heptane and methyl tert-butyl ether (MTBE) were identified as antisolvents, with heptane being preferred as a class 3 solvent with a higher boiling point than MTBE.

We recognized that there were a variety of ways of obtaining metastable zone width measurements, or solubility data, using tools such as focused beam reflectance measurement (FBRM), turbidity probes, Crystal16 and the recent BlazeMetrics probes. In this case, a cooling crystallization was used and the metastable zone width measured in a variety of different solvent systems. This data was also used to give an early indication of particle size, morphology, and other properties. The ethanol-heptane system gave the widest metastable zone width, which allowed greater flexibility over the seeding point and de-supersaturation rates. The crystal form produced from these experiments was also checked and found to be the desired form 1, even without the use of seeds.

Once the solvent system was identified – and in this case, ethanol:heptane looked ideal – crystallization was optimized with an in situ, real-time analysis of the process. Using a BlazeMetrics probe, particles were monitored as they were produced and this provided a wealth of information on the formation, growth, morphology, and size distribution. The large particles obtained filtered very rapidly, dried easily, and ultimately gave a high-quality product and a process that could easily scale to a vessel size in excess of 1,000 liters.

Online Raman spectroscopy was not required in this case because the use of a non-aqueous solvent system reduced the risk of hydrate formation. However, it can be used to observe the formation of an undesired crystal form or, more importantly, confirm that there is no change in form occurring within the vessel during the crystallization process.

Importantly, our work shows how an understanding of the different crystal forms informs the selection of appropriate protocols. This will ultimately help accelerate the development of an API, reduce risk in the development and manufacture of both the drug substance and drug product, as well as adding intellectual property to the portfolio.

David Pearson is Chief Scientific Officer at Cambrex Edinburgh, UK

References

- J Chisholm at al., CrystalEngComm, 8, 11–28 (2006).
- 2. Cambrex Marketing & Intelligence (2019).

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Creating Value at All Levels

Sitting Down With... JoyL Silva, General Manager, Pfizer CentreOne, New York, USA

Why pharma?

From an early age, I was able to observe my dad's approach to business. He ran a franchise of a popular department store and taught me the ingredients for successful operations. While I had a keen interest in the world of business, I also had a love for the sciences. My high school curriculum was rigorous and made me want to pursue a science degree at college. When I discovered that a career in the pharmaceutical industry would combine these passions, the choice was easy.

When I graduated in the late 1990s, pharma's product pipeline was thriving. A new blockbuster was launched to acclaim almost every year, and I wanted to join a company that was a forerunner in innovation. I interviewed with several companies, but what set Pfizer apart was the questions they asked. They were genuinely interested in my passions and what I wanted to gain from the job. It made me realize that it wasn't a one-sided relationship; they wanted to invest in me. I took the healthcare representative role offered without hesitation and my journey with the company began...

Have there been challenges working as a female leader in pharma?

When I joined Pfizer, there was a push to create a more diverse workforce. Because of this, I faced some backlash from those who felt that I was a "diversity hire" and only got the role because I was a woman. My response was always: "I am a woman, and I got the job. But you won't really know the reasons why I was hired until we work together." And once they saw my dedication to the business and contributions to the team, most realized that I was hired on my own merit, and bringing a diverse perspective to the table was a bonus.

That said, women in science and pharma do face ongoing challenges.

Throughout our academic careers, we've been trained to deliver results and we don't give up easily. But in the professional world, our hard work and achievements will only allow us entry. If we want to progress, we have to build and manage alliances. We all need a strong network around us that will champion our ideas and a group of advisors to support our success as we gain new experiences. I've chosen to surround myself with people with different points of view, who aren't afraid to challenge me and, as a result, I've been able to stay focused on achieving my goals.

How did you get involved with the Pharma & Biopharma Outsourcing Association (PBOA)?

When I became the General Manager role at Pfizer CentreOne, the contract manufacturing sector was new to me. I became aware of the PBOA through our existing membership. What I have found has been a community to advocate for common goals, a network of experience in the industry, and a forum to discuss the role of CDMOs in our complex, highly regulated environments. Being a trustee within the PBOA has afforded me the opportunity to help educate others about the value contract manufacturers bring to pharma.

What is your top advice for those wanting to move into leadership? You have to know and understand your personal strengths and goals – or what I would call your "value proposition". It's easy when asked about your career to respond with your job title but I encourage people to celebrate their successes and speak about what value you bring and what you enjoy. We all bring value to others through our roles, and we shouldn't be shy to let others know!

If you know your brand, then

you'll also be confident enough to acknowledge your weaknesses or areas where you may not be experienced. Early on in my career, I went for a job interview and tried hard to twist my experience to match the job criteria. I left knowing that I wouldn't be hired. But in a follow-up call, the interviewer told me that if I had just been myself, I probably would have got the job. I didn't have the experiences listed on the job advertisement but I had a willingness to learn. I used that experience to inform how I have approached my career since then.

I've also come to realize that caring for yourself is not optional. To show up and be a great leader at work, you need a healthy body and mind. Because of the COVID-19 pandemic, everyone is spending more time at home and there is a tendency to want to work round the clock. I make an effort to engage in activities that bring clarity and balance to my life, whether taking a walk with my dog or practicing yoga.

What factors have contributed to your success?

Throughout my career, I've always strived to build a strong network and have been fortunate to work in so many facets of the industry. From my early days in pharma sales, to becoming a commercial business leader, and now leading a contract development manufacturing organization, I've had the opportunity to work with a considerable number of people, and the experiences that they have shared with me has truly been a huge factor to my success. The value of these connections can't be measured. Working with someone on a project or gaining a better understanding of how they approach problems has taught me important lessons and added valuable skills that can't necessarily be learned from a textbook.



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