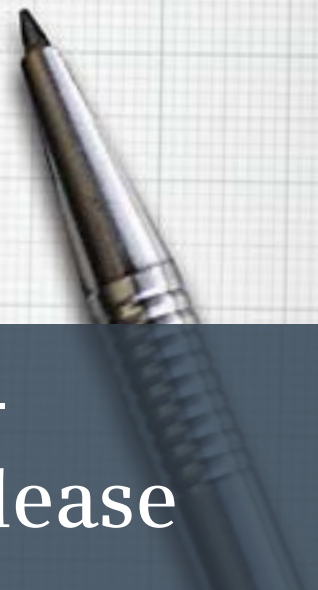


SIEMENS



reduce
TCO



Continuous manufacturing – moving towards real-time release

Creating innovations for the pharmaceutical industry



Strategic partnership

Creative ideas and industry expertise

A move to continuous manufacturing can be a big step for pharma companies. With our extensive continuous manufacturing experience and understanding of pharmaceutical industry needs, we can help you identify the continuous manufacturing potential in your operations – and bring it to life. Continuous processing can be applied to primary processes of active pharmaceutical ingredients (API) manufacturing as well as secondary manufacturing. It enables right-first-time production, improved yields, increased process safety and flexibility as well as reduced OPEX and CAPEX. Applies to secondary as well as to primary. Is valid for conti-processes in general. The term “process intensification” is often used.

Reassurance with global coverage and backup

Siemens supports customers in some 190 countries with innovative, made-to-measure solutions from a single source. Partnering with us means partnering with the reassurance of leading-edge technology backed by in-depth industry know-how and global presence to quickly respond to your market needs. Our long-term commitment to the industry is not only aimed at developing state-of-the-art technology, but also strategic, long-term concepts to benefit customers worldwide.

A new continuous manufacturing era is unfolding

Accelerated development times, tight cost controls and stringent quality and regulatory requirements – the pharmaceutical industry is an increasingly dynamic field of business, one that faces many challenges. As a result, momentum is fast developing behind the implementation of continuous manufacturing processes. Many pharmaceutical companies feel that the time is right to invest in this development. The tools now exist to manufacture pharmaceutical products with the high levels of process understanding and control needed for continuous throughput.

The race is on to be the first to apply continuous manufacturing to commercial production. The prize for companies is considerable. Small, fully enclosed processes with a high level of automation and reduced manual intervention enable companies to reduce variability, deliver high yields, increase profitability and lower operating, inventory and capital costs.



Great potential for your production

The first plants we developed in close collaboration with various pharmaceutical companies and OEMs show: continuous manufacturing holds enormous potential for releasing products in real time. For example, in the fields of oral solid dosage (OSD) and chemical API manufacturing. Now that the first plants for commercial production have been launched, real-time release will soon become a feature of pharma manufacturing.

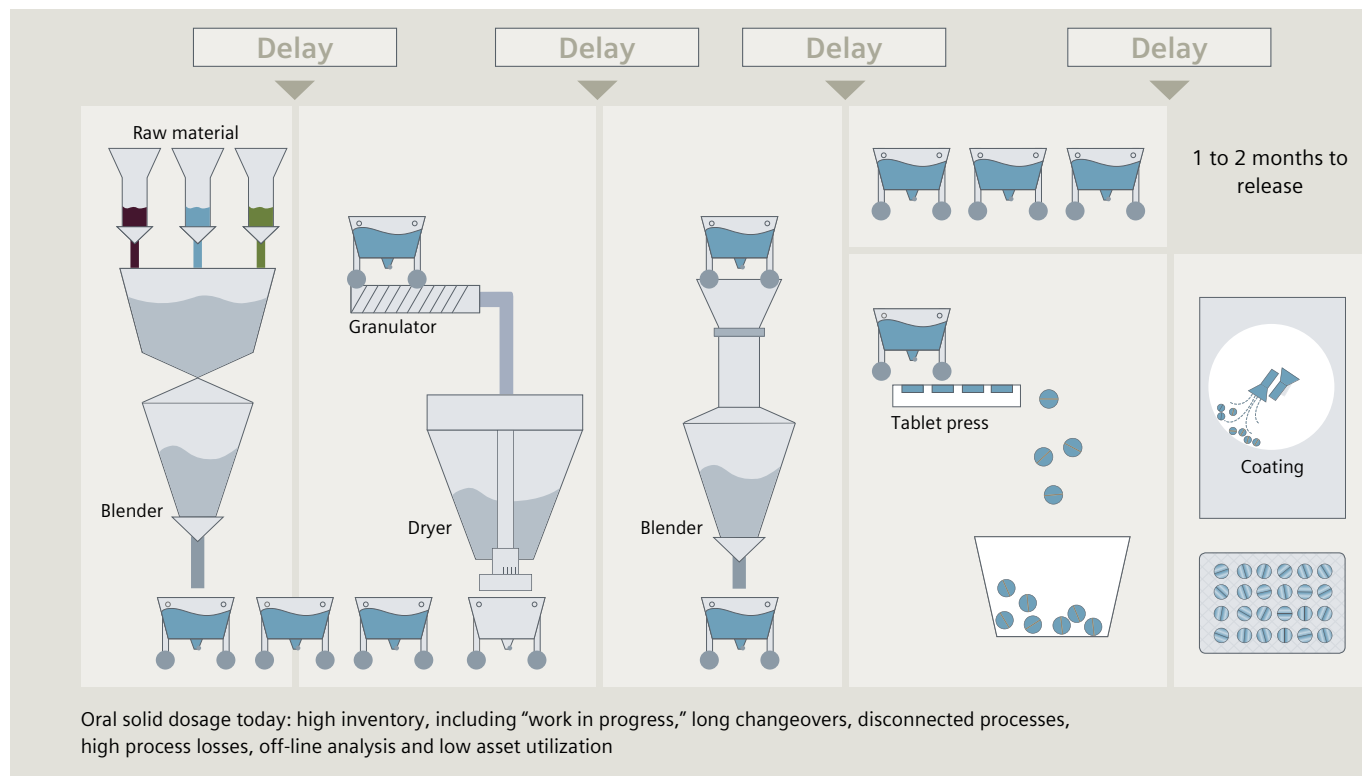
From batch to conti

The push to implement continuous manufacturing is not confined to the leading, top ten companies. A number of generic companies are also exploring deployment of the technology. Some are developing fully integrated primary and secondary manufacturing capabilities. Others are exploring the possibility of applying the technology to closed, integrated bioprocesses that combine upstream with downstream. Companies employing continuous bioprocessing are seeing promising results in record time, making batch manufacturing a thing of the past.

Moving towards real-time release of products ...

The application of process analytical technology (PAT) is key to continuous manufacturing. With PAT, quality is designed into the process, rather than checked afterwards. Introducing PAT has a considerable positive impact on reducing production costs. It speeds up decisions at the unit operation level and improves the quality and efficiency of process steps, leading to shorter batch runs and increased quality consistency.

Typically, therapeutic drug performance analysis cannot be evaluated online, limiting the possibility of controlling and optimizing processes due to relatively long laboratory

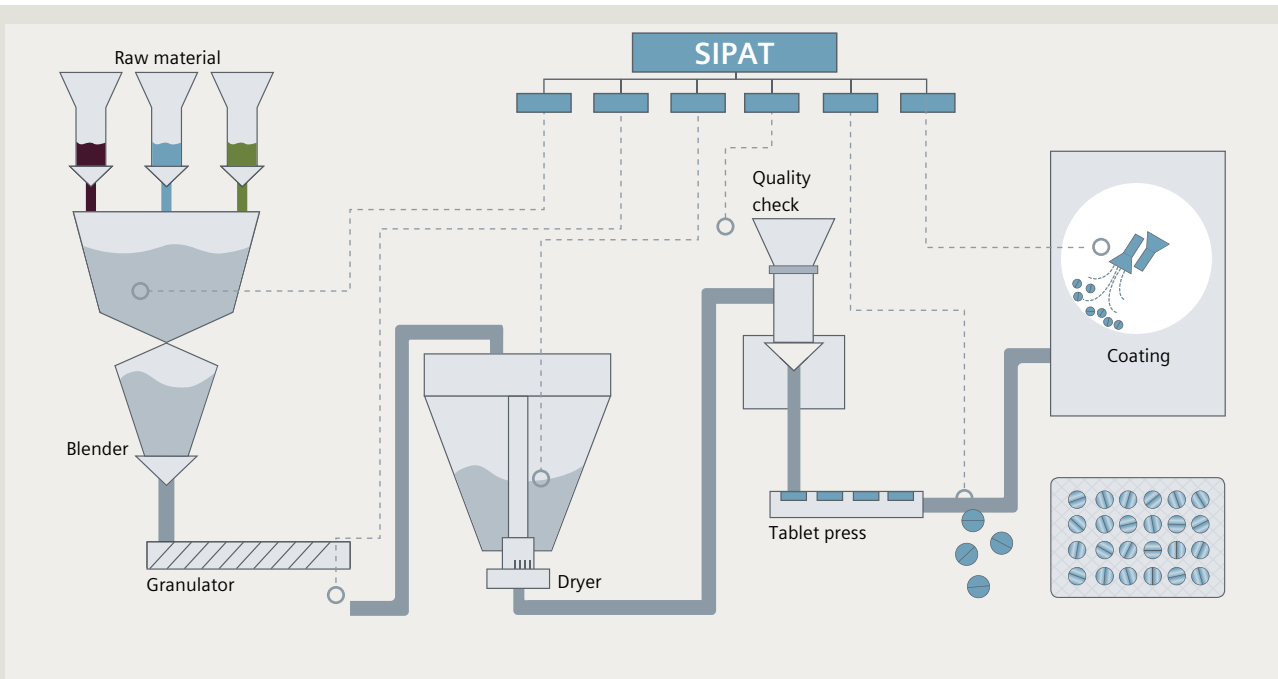


analysis time. PAT closes this information gap with in-process data and analysis tools that improve process understanding and control. Built-in process optimization and quality assurance ensure right-first-time quality, reducing the risk of losing batches because of non-compliance. Electronic PAT tools give companies a basis for continuous quality verification during continuous operation. Although actual real-time release is not yet available, companies are already making huge strides with process understanding and continuous quality verification. Its availability is getting closer and closer.

... with the Siemens integrated control platform

The Siemens SIMATIC SIPAT data management platform provides the process understanding and process control architecture that companies need for continuous processing. SIMATIC SIPAT integrates all of the process analytical technology (PAT) tools into one overall platform. This allows companies to orchestrate feed-forward, feed-backward controls over the different unit operations within the whole line. In addition to SIMATIC SIPAT software, Siemens can provide much of the on-the-line automation hardware. Measuring the process parameters at work dur-

ing manufacturing requires a wide range of technologies and unit operations, which are typically supplied by a variety of OEM vendors. Not only do these devices and measurements need to be integrated and the interdependencies between them understood, companies also need to have certainty over control systems. SIMATIC SIPAT provides the architecture to deploy an overall control strategy and continuous quality verification. It includes or links all PAT tools – process analyzers, control tool, data analysis and mining, reporting and knowledge management – into one PAT system architecture, allowing full transparency on quality aspects from unit operation up to MES or even ERP. Siemens has proved the value of an integrated platform with PAT in control.



Process Analytical Technology: key enabler for continuous manufacturing and real-time product release

Benefits across the board

The assurance that comes with PAT is accompanied by several other benefits, including significantly lower inventory and quality control costs, reduction of equipment size and reduced or even complete elimination of waste products. Small, fully enclosed processes with a high level of automation enable companies to reduce variability, achieve high yields and increase profitability – at lower operating, inventory and capital costs.

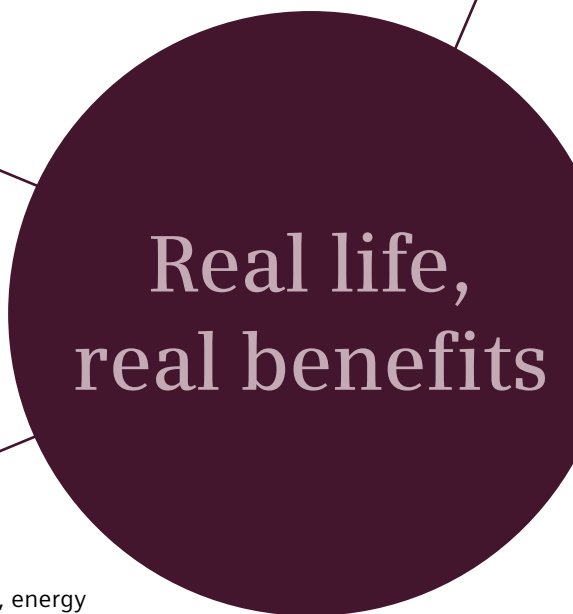
Lower costs

Companies that are already implementing continuous manufacturing processes are anticipating a fast return on their investment and cost savings of 10 to 20% as compared to batch manufacturing. For one, facilities cost less to build and 100% of the capacity is utilized once they are in operation. Another major saving comes from that batches do not have to be taken to the laboratory for analysis, thus reducing the time needed to get the product to patients from hundreds of days to less than ten.

Reduced energy and carbon footprints

In addition to time and cost savings, continuous manufacturing can dramatically reduce building, energy and carbon footprints. An oral solid dosage continuous manufacturing unit developed by Siemens with a leading pharma company occupies a tenth of the space needed for traditional batch process equipment. The continuous tablet making unit easily fits into a regular room or a container. As such, continuous manufacturing also offers companies many opportunities to “green up” their production with more energy-efficient operations and reduced carbon footprints.

Integrated unit operations also help to improve overall safety and reduce the bioburden risk. Directly interconnected unit operations typical of continuous processing increase product safety. Tightly integrated processes mean less product exposure to the environment and to operators. Integrated continuous bio-processes also allow you to explore new facility layouts to create more open production spaces.



Real life,
real benefits

Faster time to market

A continuous manufacturing platform gives companies the benefit of much faster time to market for new drugs. Time is saved at the development stage and in the move from development to production. The whole test transfer phase from development to production becomes easier. Companies will already have all of the necessary PAT tools, controls and process understanding at the development stage. In effect, they can skip the scale-up tests that are a normal feature of the late-phase process development stage. Quite simply, continuous manufacturing can take place on the same equipment platform as the development stage.

Greater production flexibility

The flexibility of continuous manufacturing also offers major advantages in terms of profitability at the other stages of the product life cycle. Once the product is launched, capacity can be dynamically adjusted to match market requirements. Production capacity is more robust. Maintenance or failure of individual production stations has little impact on productivity as alternatives can be more readily deployed. Smaller facilities can be geographically dispersed with the benefit of reduced transportation and adjustment for local markets. When the patent protection has expired, the equipment can be transferred easily to contract manufacturing or generic partners, and modular equipment can be recycled for new products.



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siemens.com/pharma

Discover our ideas
for a strong future of
the pharmaceutical
industry.

The benefits
of continuous
manufacturing
at a glance



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