Waters™

# Automating Sample Preparation and Data Analysis Methods to Streamline and Synchronize Biopharmaceutical Workflows

**A global healthcare company tackles bottlenecks and promotes the standardization of workflows across multiple sites by integrating the Waters Automation Portal.**

## BIOPHARMACEUTICALS AT THE COMPANY

A global healthcare company, with locations in more than 100 countries, works hard to innovate in treatments and vaccines to improve lives around the world. The organization, with more than 13,000 employees across and four business units in the United States alone, turned to Waters for help implementing automation technology and standardizing processes across its multiple sites.

In 2019, the company opened a new biopharmaceutical manufacturing facility in America, which is among the world's first digitally-enabled facilities to use continuous biologics-production technology. Its end-to-end platform uses millions of points of data captured by sensors to continuously optimize for excellence. Company leaders believe these process changes and optimizations are necessary to develop new effective biologics in a cost-effective and productive way.


*The team has beta-tested the Automation Portal's capabilities in real-world workflows.*

## WORKING WITH WATERS

During a visit to the Waters™ facility in Milford, Massachusetts, the company's Automation Leader (Associate Director) spotted a prototype of the Waters Automation Portal and immediately envisaged the potential impact the equipment could have in the lab. That encounter led to the current working relationship with Waters, as his team beta-tested the Automation Portal's capabilities in real-world workflows.

The Associate Director values being involved in the design and improvements of new instruments, and he was impressed by Waters' efforts to work with the company and its third-party integrator, Retisoft. He comments:

"It was a great beta collaboration. Waters personnel have consistently met our needs and provided excellent support. Whenever we've raised concerns or issues, they've been proactive in addressing them. This collaborative approach extends to both our team and the integrator company, where Waters has been receptive to questions and feedback."

The healthcare company employs automation tools to enforce standard operating procedures and to ensure that all steps are carried out consistently across different experiments and sites, which is crucial for quality control and compliance. The Associate Director leads a Chemistry, Manufacturing, and Controls (CMC) automation team that focuses on effectively assessing the range of available tools and the ability to enhance them to better align with the needs of the company's scientists. That includes developing customized solutions, both internally and externally.

"I always consider how automation can bring benefits not only to throughput, but also to safety. Some of the reagents used in these processes might have toxicity concerns or pose ergonomic challenges. People often find themselves performing the same tasks repeatedly, leading to physical strain and even injuries like wrist issues from pipetting, especially for the Good Manufacturing Practice (GMP) groups. So, when I evaluate automation, I consider all the factors – including throughput, precision, accuracy, ergonomics, safety, and time."

ASSOCIATE DIRECTOR

Since 2020 the Associate Director and his team have worked with Waters as beta testers for the Waters Automation Portal, to help the company reduce bottlenecks and synchronize workflows, as well as provide essential feedback to help the Waters team enhance its automation products.

## AUTOMATION IN BIOPHARMACEUTICAL WORKFLOWS

Swift advancements in analytical instrumentation and data processing have empowered researchers to create new techniques for application within the biopharmaceutical sector. However, progress in sample preparation techniques has lagged, often resulting in bottlenecks in high-throughput analytics. As a result, healthcare companies are integrating automation into sample preparation and data analysis procedures to tackle these limitations, as well as facilitate the standardization of workflows across multiple sites. The Associate Director oversees the connection of the company's lab instruments via software and robotics.


*The Waters Automation Portal is readily configurable with a wide range of Waters HPLC and UPLC™ Systems.*

He describes his team's work:

"We are a small group that specializes in building integrated workstations to streamline end-to-end workflows. We aim to achieve a level of process automation which goes from direct manual control to a largely autonomous operation, minimizing the human role. A semi-automated process can sometimes be more effective than a fully automated process. By linking automated processes together, we hope to autonomize analytical paradigms. We develop methods for liquid handlers, and other functional equipment, that are primarily used for sample preparation across various analytical equipment. We then connect the functional equipment to the analytical equipment both digitally and mechanically. We may also develop software to control third-party instruments. Additionally, we automate data-related tasks to help minimize the mundane tasks frequently encountered at the computer; dashboards, reports, parsing."

As an example of this work, the Associate Director describes a common scenario in the life sciences where a biochemist acquires a liquid handler, and the manufacturer programs a single method for them. However, the vendor's involvement often ends there. As a result, the user is left with a piece of equipment configured for just one specific task, and they lack the knowledge to reprogram it for different applications. He explains how the company is working to address this problem:

"This issue is quite prevalent, where vendors focus on selling their equipment, providing minimal initial support, and then moving on. This approach can render the equipment obsolete within a year or two, especially as project requirements evolve. To address this concern, we emphasize the importance of ensuring that our equipment and solutions remain adaptable and avoid becoming obsolete."

Additionally, the company believes the integration of automation into biopharmaceutical laboratories offers a wide range of benefits, making it a valuable investment for both research and production purposes in the industry. By diminishing the variability associated with sample handling and data acquisition, automation enhances data quality, a pivotal element in safeguarding the veracity of experimental findings and adhering to regulatory requirements. Automation systems excel at executing repetitive and time-consuming tasks with precision and consistency. Consequently, they minimize the potential for human errors and accelerate operational workflows, resulting in swifter experimentation and increased throughput. Automation also reduces sample contamination by reducing human involvement, especially in sterile environments, as well as improves safety around handling dangerous or toxic materials. These benefits are crucial in the biopharmaceutical industry, where precise measurements and consistent results are paramount.

*Automated systems can operate around the clock, allowing for continuous data collection and processing.*

The Associate Director's extensive experience has shown that automation may start with one idea from a requestor, but new concepts emerge through ongoing discussions and a dynamic exchange of ideas about what automation can offer.

As a result, he explains, often the original request undergoes changes:

"It's a process that mirrors the classic software development story, where someone may start by requesting a software solution for tasks A, B, and C. However, as they engage in conversations with the developer, they end up with software that handles tasks C, D, and E because the initial understanding of A, B, and C evolves. This dynamic nature is inherent to the entire request and development system."

ASSOCIATE DIRECTOR

However, the Associate Director is quick to explain that automation can be approached in many ways:

"You don't always need full automation. I'm a huge fan of semi-automation. Let's say one of our team members comes in with an assay that has steps A, B, C, and D. We might not automate every step, but if automating step B can have a huge impact for them, then that's what we'll do."

## WATERS AUTOMATION PORTAL

While beta testing the Waters Automation Portal, the team worked to improve the lab's R&D bioprocess analytics by minimizing tedious manual procedures in LC workflows, thereby improving lab throughput, reducing analyst errors, and freeing up analysts' time to focus on more important scientific work. The Waters Automation Portal is readily configurable with a wide range of Waters HPLC and UPLC Systems, and it enabled the company to work with its preferred integrator for all integrator-assisted and customer-controlled automation workflows.

While the original plan was to use the Waters Automation Portal for a peptide mapping workflow, the Associate Director and his team saw another area that needed improvements, and the team pivoted to incorporate the equipment into that workflow.

He describes this shift:

"At the outset, the plan was to integrate a Hamilton liquid handler and robotic arm for automating sample preparation for peptide mapping, which was already automated in the liquid handler. The idea was to connect a mass spectrometer to the Automation Portal to receive the plates and trigger the run. However, others noticed my work and expressed interest in a more extensive workstation to combine various analytics into one workstation. But the LC method for peptide mapping takes an hour, and the goal was to process 96 samples in a single day for all the analytics automated, making it impractical due to the extended runtime. Consequently, we removed the peptide mapping from the automation station but continued with SEC analysis, which takes 10 minutes only, allowing for processing 96 samples in a day. This doubled our turnaround times enabling us to comfortably reach our KPIs. We're now doing twice as much SEC as we were before, and we now have a second system on the way to further boost productivity. We can also accommodate other short-form HPLC methods. I love the versatility."

The flexibility of the Waters Automation Portal enabled these changes to the original plan, which the Associate Director particularly appreciates.

> "This versatility was invaluable. What's great about the setup is we already use many Waters kits and assays, and the Portal could be adapted for various assays that we run on our Waters ACQUITY™ Systems. So, the project evolved based on the specific needs and the practicality of the methods, and we were able to pivot from the initial focus on peptide mapping."
>
> ASSOCIATE DIRECTOR

The Waters Automation Portal is vendor-agnostic, and this customer-centric approach delivers neutrality, both virtually and mechanically, to customers. The Associate Director appreciates the open approach that Waters brings to the market, which he says is unusual:

"Waters has developed this piece of equipment that allows you to third-party control it. I can use whatever robotic arm I choose. Both the virtual and the mechanical components are completely open to me. That's not the case with other vendors."

Now that the Waters Automation Portal is fully implemented in the laboratory, it's been analyzing real samples for about 1-½ years. The Associate Director and his team are pleased with the results.

"Our group is using it two to three times a week, anywhere between 40 to 96 samples on each of those occasions. It's demonstrated great value for the team, and I don't even think half the users know it's a beta model."

## ROI OF AUTOMATION

Automated systems can operate around the clock, allowing for continuous data collection and processing, which can be particularly valuable in time-sensitive research or production processes. The healthcare company has already experienced such benefits. The Associate Director explains:

"Before the introduction of this integrated workstation, the process involved six different analytics, each necessitating a separate individual to handle the task. On Mondays, six people were each dedicated to preparing and running one specific analytical test. However, due to the limited capacity of each person, only 40 samples could be processed in a day. This sequential approach also required one full day for sample preparation and instrument loading, followed by another day for the analysis. Hence, the earliest they could obtain the aggregation data was on Wednesday, three days after receiving the samples. With the new system in place, a single person could load the liquid handler with the samples and reagents for all the analytics and initiate the process. Although not fully parallel, this approach allowed them to complete the sample preparation and analysis in a single day. Automation ensured that even if they left work at the end of the day, the sample preparation would continue seamlessly overnight, thanks to the robotic arm. Now, they can achieve the same work with just one person conducting the process twice a week, as opposed to having six people working on it once a week."

While the initial investment in automation can be significant, it often leads to cost savings in the long run due to reduced labor requirements, increased productivity, and decreased error-related costs. The Associate Director explains:

"Many of these assays demand a significant amount of labor and time. If you're paying a highly skilled employee a substantial salary to perform repetitive pipetting tasks, it's not an efficient use of their expertise. My perspective is that they should be working behind a computer, analyzing data to bring life-changing therapeutics to market, rather than being tied to the bench and performing manual tasks all day. Also, once you double your throughput, you also double your data analysis. So that person, instead of being at the bench, is now behind the computer analyzing data, which is our end goal here."

## NEXT STEPS

With the first beta-version of Waters Automation Portal in place and working, the Associate Director and his team are turning to bigger projects. The company's long-term plan includes continuing to scale up by using the Automation Portal in different workflows. They are currently waiting for the full release of the Waters Automation Portal that will include some of the improvements suggested by their team, including new sensor capabilities to detect the presence of plates in the numerous Automation Portal trays. The Associate Director explains:

"We are in the process of establishing a high-throughput laboratory that will accommodate all the groups within CMC, including the cell culture, purification, and analytical teams. My responsibility is to create a larger robotic workstation in this high-throughput lab. This workstation will be designed to provide end-to-end automation for the three groups, encompassing cell culture, purification, and analytical processes, as opposed to the current context, which primarily focuses on analytics."

This new workstation will also help automate a peptide mapping workflow, which was the Associate Director's initial vision for the first Waters Automation Portal. He explains:

"The new Automation Portal will serve a similar function to the current one, but it will be integrated into a much larger analytical system. With the addition of this new workstation, I hope to install a mass spectrometer onto the Waters Automation Portal to reintroduce the peptide mapping workflow, which a specific group is eager to have. They have multiple Waters ACQUITY Systems connected to various mass spectrometers and want a Hamilton system positioned next to a long-railed robot behind these mass spectrometers, along with the Portals, to facilitate loading. They don't mind if it runs continuously for four days because they won't be dependent on other analytics. This setup will serve as a standalone LC-MS peptide method."

The Associate Director sees the flexibility of Waters instrumentation and equipment as a key factor as the company expands automation across multiple locations, providing significant productivity and cost benefits.

"Waters ACQUITY Instrumentation is highly configurable. You can equip it with various detectors, including absorbance detectors, and multiple mass spectrometers. Waters has promised that the Automation Portal will remain completely detector-agnostic to offer versatility in both HPLC and LC-MS analysis. I love that we'll still be able to control the instrumentation third-party. The key point is that the Automation Portal isn't limited to specific detectors. Instead, it can connect to anything that the ACQUITY System can connect to. This flexibility is invaluable because it's not something you encounter frequently."

ASSOCIATE DIRECTOR

Waters™

Waters, ACQUITY, and UPLC are trademarks of Waters Corporation.
All other trademarks are the property of their respective owners.

©2024 Waters Corporation. March 24-12058 720008144EN Rev. A

Waters Corporation
34 Maple Street
Milford, MA 01757 U.S.A.
T: 1 508 478 2000
F: 1 508 872 1990
waters.com