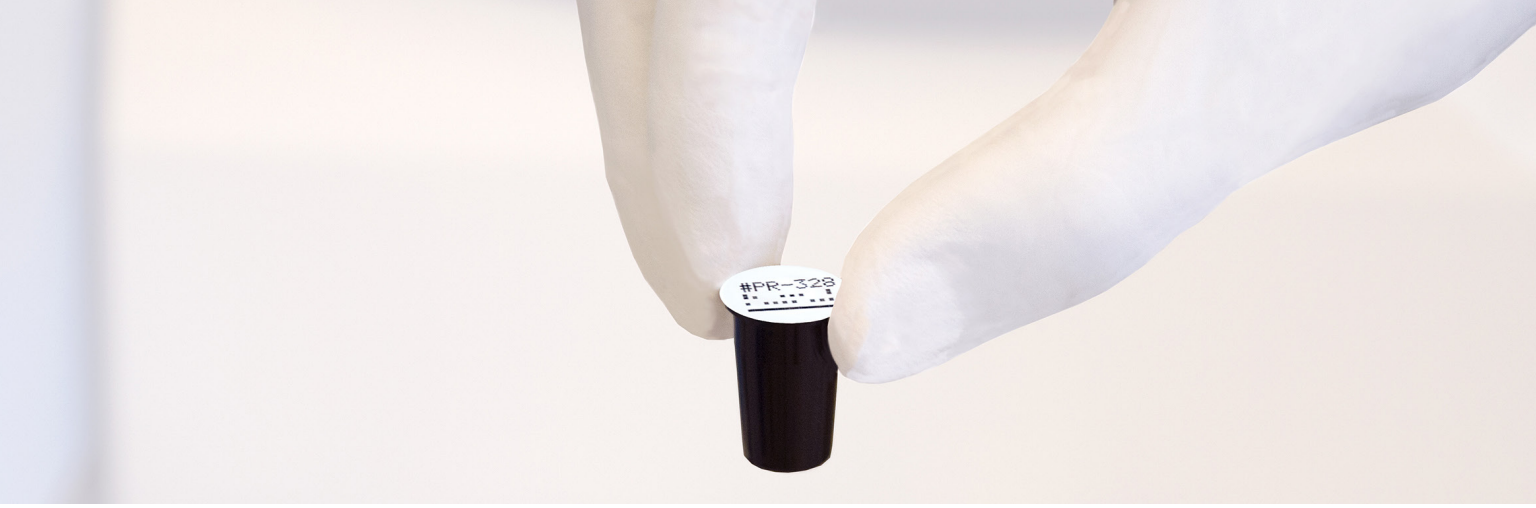


Comparing Wet Versus Dry Reagents in Immunoassay Testing

DRY REAGENTS OFFER A STREAMLINED ALTERNATIVE, HELPING CLINICAL LABS MINIMIZE VARIABILITY, REDUCE WASTE, AND ENHANCE EFFICIENCY

Clinical laboratories are under mounting pressure to deliver high-throughput, precise, and efficient immunoassay testing as diagnostic demand continues to grow. Traditional wet reagent systems are increasingly unable to meet this demand and pose several challenges for labs, including variability, waste, and storage. Dry reagent technology can optimize laboratory efficiency without compromising analytical performance. These systems eliminate the need for liquid handling and cold storage, streamline workflows, reduce operational waste, and enhance consistency. Here we will explore the key advantages of dry reagents over wet reagents, and how they can support immunoassay testing in increasingly busy laboratories.

Challenges associated with traditional wet reagents

Wet reagent systems have long been the standard for immunoassay testing; however, they present a number of challenges that can hinder efficiency, consistency, and scalability. These challenges are especially apparent in high-throughput settings that demand reliable outcomes with fast turnaround times.

A major limitation of wet reagent systems is the number of manual steps involved in the protocol. Technicians must carefully measure and mix reagents and ensure they are properly refrigerated. Each of these steps increases the potential for human error, as manual handling can introduce variability and contamination that compromises data integrity.

Reagent stability is another challenge, as wet reagents often have a short shelf life and limited onboard stability once placed in an analyzer. Maintaining calibration stability over time can also be difficult, and recalibration creates downtime. Similarly, the long incubation periods required can further slow diagnostic workflows and impact patient care in urgent or time-sensitive testing situations.

Some of the costs associated with wet reagent protocols are often overlooked. With reagent dead volume, for example, a portion of the reagent in each kit or cartridge is often unusable, remaining in the tubing or container. This increases waste, decreases the number of reportable results per unit, and ultimately increases the cost per test. The laboratory water supply is also a consideration. Many analyzers that use wet reagents require a continuous supply of high-quality water—typically grade 1 or purified water—consuming between 2.5 and 5.0 liters per hour of operation. These systems also require dedicated drainage, adding to installation costs and infrastructure demands.

Together, these factors contribute to hidden costs and limit the consistency, efficiency, and sustainability that modern clinical laboratories require. For those looking to streamline operations, dry reagents offer an alternative approach.

The case for dry reagents: Efficiency, accuracy, and operational simplicity

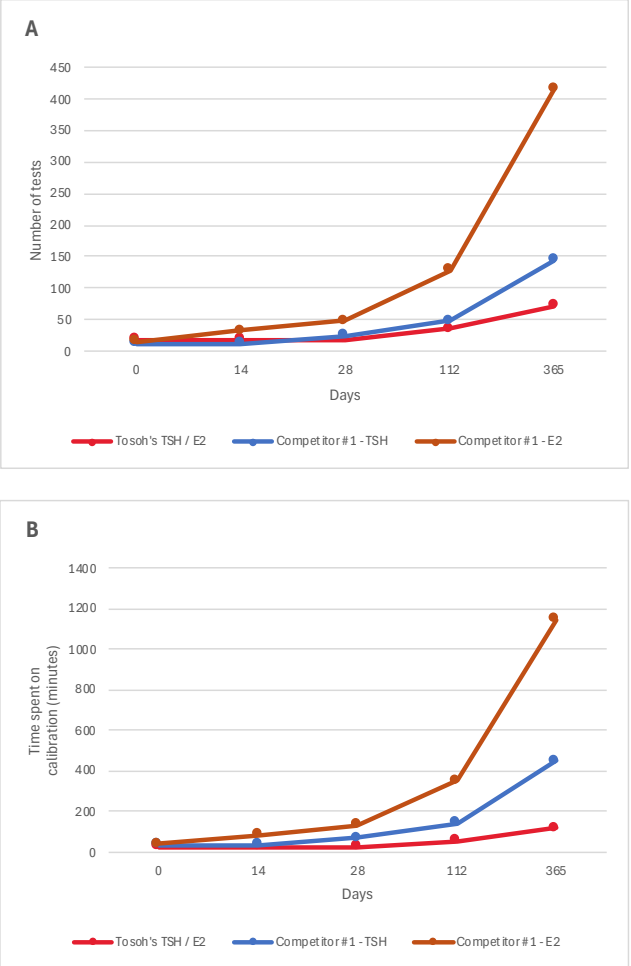
Dry reagents offer an alternative to traditional wet chemistry methods, with the potential to simplify workflows, reduce waste, and enhance safety. At Tosoh Bioscience, lyophilized reagents are pre-measured and sealed in barcoded, single-use AIA-PACK test cups containing all necessary components for analysis. This "one-test, one cup" model eliminates manual steps such as measuring, mixing, and reagent transfer to reduce the risk of human error and contamination.

The unit-dose design eliminates dead volume, helping laboratories reduce liquid waste and operational expenses. With a shelf life of up to 12 months and no need for onboard refrigeration, these dry reagents also provide greater flexibility in inventory management.

Improved efficiency is another advantage. The majority of reagents' 10-minute incubation period enables quick turnaround times, making the format well suited for high-throughput environments and intraoperative testing.

In addition to workflow benefits, dry reagents support strong analytical performance. Robust signal detection chemistry enables a high signal-to-noise ratio, providing both analytical and functional sensitivity.

Dry reagents also simplify lab operations by eliminating the challenges associated with handling liquid reagents. Unlike wet reagents, which can cause disruptions due to spills requiring immediate cleanup, dry reagents streamline the analytical process, minimizing downtime and enhancing overall efficiency. The ready-to-use format of dry reagents supports a more seamless workflow, allowing laboratory staff to focus on testing without interruptions. Dry reagents represent a significant leap forward in laboratory diagnostics, offering a streamlined, reliable, and safer alternative to legacy wet chemistry platforms.



▲Figure 1. Calibration efficiency over time by number of tests (A) and time spent on calibration (B). Across a one-year period, Tosoh's AIA systems could require up to 5.7 times fewer tests and up to 9.8 times less technician time compared to a wet reagent platform.*

Streamline workflows and reduce costs with a dry reagent system

Dry reagent systems build on the strengths of dry reagents, addressing broader operational challenges like calibration stability. Tosoh Bioscience's AIA line of dry reagent systems offers calibration stability for up to 90 days, reducing the procedure to just four times per year.

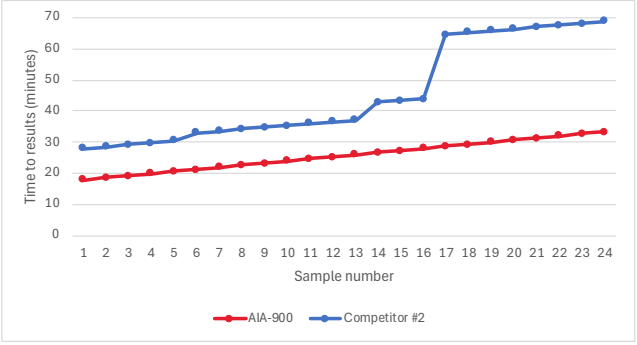


Figure 2. Time to results by number of samples Across 24 samples using six different analytes, the AIA-900 theoretically demonstrated a 52 percent improvement in total run time, completing the run 35.5 minutes faster than a wet reagent system.*

This minimizes reagent use and decreases the time medical technologists spend on calibration. In contrast, wet reagents require frequent calibration—usually every 14 to 28 days—leading to higher test reagent consumption and increased time investment, with around 24 calibrations per year for biweekly intervals and 12 calibrations for monthly intervals (Figure 1).*

Rapid turnaround time is another key advantage of dry reagent systems. A majority of assays in Tosoh's test menu have a turnaround time of 18 minutes, enabling faster result delivery for time-sensitive tests such as hormone panels and IVF testing. In comparative evaluations, the AIA-900 could theoretically have up to 52 percent shorter total run times than wet reagent systems in a scenario using 24 samples and six different analytes (Figure 2).*

This improved operational efficiency, combined with extended calibration intervals, reduced consumable use, and decreased technician involvement, lowers the total cost of ownership and ensures reliable performance. At Mid Florida Hematology Oncology, Amishi Vora relies on the AIA-2000. "What we like about the dry reagent is that there is minimal waste, and that it is accurate, reliable, speedy, low maintenance, and cost-effective," she explains.

The AIA line supports scalability and flexibility across diverse clinical environments, from small physician labs to satellite sites or high-volume reference centers. Features such as STAT mode, which prioritizes urgent samples, help accommodate variable testing demands, while optional nine- or 19-position reagent tray sorters in the AIA-900 allow labs to handle larger test volumes and increase automation without requiring additional method validations.

A smarter solution for the future of clinical testing

Laboratories relying on traditional wet reagent systems must contend with challenges such as workflow and maintenance complexity, as well as reagent dead volume that translates to reagent waste. These factors can compromise test accuracy and operational efficiency.

Tosoh Bioscience's dry reagent technology offers an alternative approach designed to simplify operations without compromising performance. Each lyophilized, single-use cup delivers a stable, contamination-resistant format that eliminates the need for on-board refrigeration and complex preparation. This format also reduces hands-on time while supporting accurate and reproducible outcomes.

With broad coverage, including thyroid, cardiac, reproductive, tumor, diabetes, vitamin D, anemia, metabolic, and renal markers, AIA-PACK supports a wide range of needs across key clinical areas. The AIA line's efficiency, scalability, and flexibility make it well-suited for labs looking to improve throughput and resource utilization while delivering high-quality diagnostic testing.

*Theoretical values calculated using public access data sourced from the competitor's instructions for use.

WET VERSUS DRY REAGENTS: WHAT'S THE BEST FIT FOR YOUR LAB?

Feature	Wet reagents	Dry reagents (AIA-PACK)
Reagent format	Liquid	Lyophilized (dry)
Onboard storage requirements	Requires onboard refrigeration	Does not require onboard refrigeration; the laboratory professional uses only what is needed, with minimal reagent waste
Shelf life	Weeks to months	12 months
Calibration stability	Depends on the analyte, typically 7, 14, or 28 days	Up to 90 days for most assays
Preparation steps	Pre-mixing and measuring are required	Ready-to-use test cups
Waste generation	Higher (bulk usage)	Minimal
Risk of biotin interference	Potential interference	Free of biotinylated antibodies by design
Turnaround time	Typically ≥ 30 minutes	18 minutes for most assays
Reagent interchangeability	Limited	Universal across AIA systems