Resodyn™ ACOUSTIC MIXERS

AbbVie Innovates with ChemBeads and RAM

Accurate, Drug-Sparing Method for High-Throughput Experimentation ResonantAcoustic® Mixing

Photo credit: AbbVie

P: +1 (406) 497-5333 E: info@resodynmixers.com W: resodynmixers.com

OVERVIEW

AbbVie Pharmaceuticals, a global leader in drug discovery and development, continuously seeks new ways to accelerate the journey from scientific concept to viable medicine. One of the most significant bottlenecks in pharmaceutical innovation occurs during early compound discovery, where thousands of chemical candidates must be prepared and evaluated before a promising drug candidate emerges.

To address this challenge, AbbVie scientists implemented a new workflow combining ResonantAcoustic® Mixing (RAM), a research-backed technology that has been revolutionary in drug discovery and formulation, with a technique known as dry particle coating. The approach dramatically improved solid chemical compound preparation, handling, and screening, enabling significantly faster experimentation and discovery.

Solution

- ResonantAcoustic® Technology
- Automated High-Throughput Experimentation
- Even Coating of Glass Bead Host
- Repeatable, Accurate Performance

Achievement

- Rapid Experimentation
- Easy Handling by Automated Systems
- Accurate Dosing of Reagents at Nanomol Scale
- Reduced Weighing Time and Manual Processes

CHALLENGES

One of the most difficult aspects of early drug discovery is not testing compounds, it is making them usable for testing.

Researchers must determine optimal reaction conditions for each chemical candidate through repeated experimentation. However, several obstacles complicate this process:

- Compounds are very expensive and used in the smallest quantities possible
- Solid materials vary widely in particle size, shape, and flow behavior
- Powders in such small amounts are difficult to weigh, transfer, or dose accurately
- Traditional preparation methods limit automation and throughput

Because these materials must be used in very small amounts and do not flow consistently, automated systems struggle to handle them reliably. As a result, researchers spend significant time preparing samples instead of generating experimental results, creating a major bottleneck in high-throughput experimentation (HTE).

AbbVie needed a solution for accurate measurement and consistent flow to unlock automation and speed in a historically slow and labor-intensive process.

RAM Enables Automated Systems

"All ChemBeads have very nice solid properties and can be dispensed with high accuracy using a solid dispensing robot like ChemSpeed."

"The robot can complete the task within a couple of hours unattended because the robot can work day and night without any human intervention we stockpile many copies of the screening sample."

-Noah Tu, Senior Scientist at AbbVie High-Throughput Chemistry Group [1]

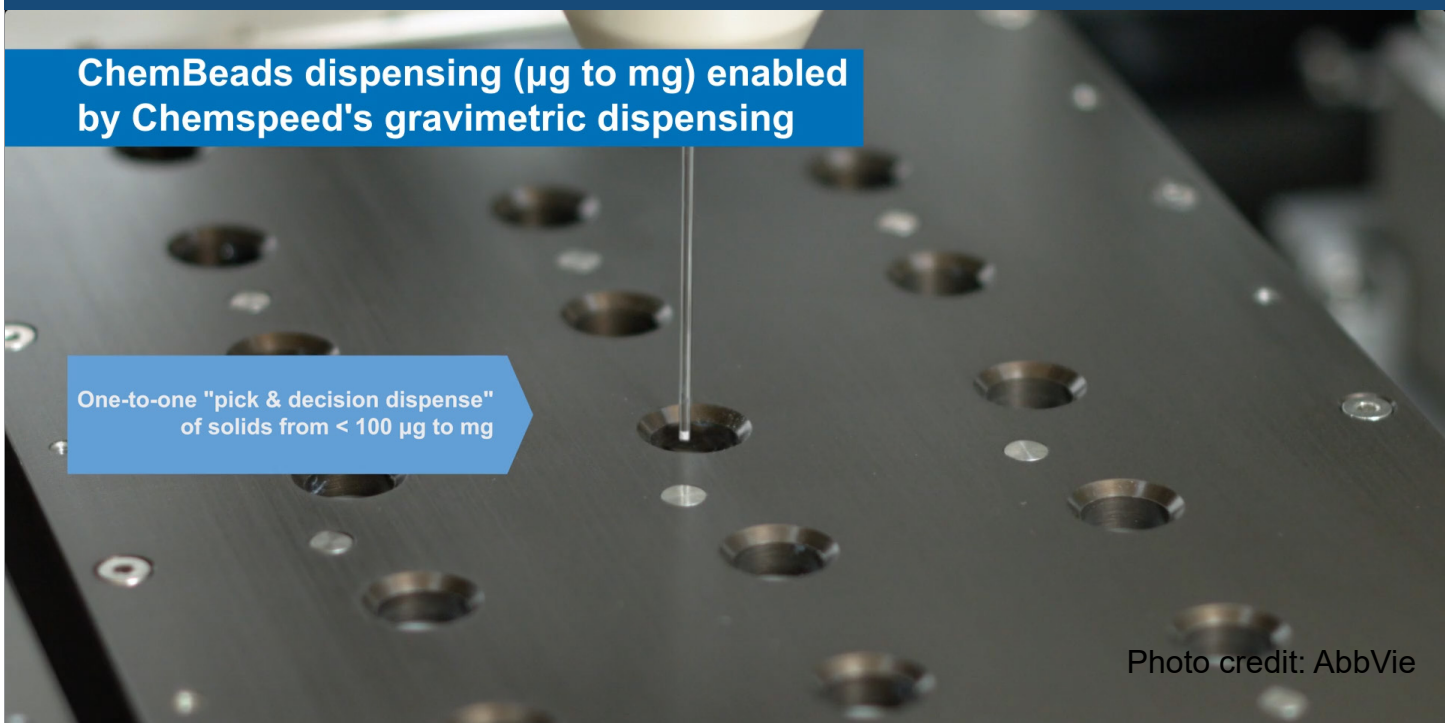

Photo credit: AbbVie

SOLUTION

AbbVie's research team set out to find a faster, scalable way to prepare solid reagents for automated testing.

> *"We realized that if we wanted a better solution, we had to find it ourselves."*
>
> -Amanda Dombrowski, Ph.D., Senior Scientist, Discovery Chemistry and Technologies, AbbVie [2]

After exploring several approaches, they achieved a breakthrough using a Resonant Acoustic® Mixer (RAM).

The team introduced small quantities of solid chemical reagents into a mixing vessel containing small, smooth glass beads. Inside the resonant acoustic mixer, high-frequency, low-shear acoustic energy rapidly shook both the beads and the powder.

During mixing:

- The powders repeatedly contacted the bead surfaces, coating it evenly in seconds
- Natural Van der Waals forces caused the solid particles to adhere uniformly to the glass beads
- No solvents, binders, or liquid processing steps were required

The result was an even coating of chemical reagent on each bead, a process known as dry particle coating.

Unlike conventional mixing methods, resonant acoustic mixing distributes energy uniformly throughout the entire vessel, enabling fast and consistent coating without damaging sensitive materials. In essence, RAM mixes everywhere, all at once.

This transformation converted difficult-to-handle powders into free-flowing, standardized particles that could be easily dispensed and automated. Essentially, the chemical reagents would now handle and flow like the glass beads, while the even coating gave researchers an accurate way to measure nano mol amounts with ease.

ChemBeads inventors: Ying Wang, Noah Tu, and Amanda Dombrowski

CHEMBEADS

AbbVie named the resulting coated particles ChemBeads.

ChemBeads are defined as: glass beads uniformly coated with precise quantities of solid chemical reagents, designed for use in high-throughput experimentation.

Despite the original powders differing dramatically in morphology and handling behavior, the coated beads exhibit:

- Consistent size and shape
- Excellent flowability
- Precise and repeatable dosing
- Compatibility with automated systems

Because every bead behaves similarly, robotic platforms such as Chemspeed automated synthesis systems can rapidly dispense reagents with high accuracy.

RESULTS

The impact on workflow efficiency was immediate and substantial.

By converting irregular powders into standardized ChemBeads, AbbVie researchers achieved:

- Reliable automated handling of solid reagents
- Reduced material waste
- Improved reproducibility
- Dramatically increased throughput

Most importantly, timelines were reduced from two to three weeks using traditional preparation methods to just two to three days.

This advancement allowed scientists to evaluate reaction conditions faster, make decisions sooner, and accelerate the progression of promising compounds toward development.

KEY TAKEAWAY

The enabling technology behind ChemBeads is resonant acoustic mixing.

The ResonantAcoustic® Mixer provides the acoustic energy required to perform dry particle coating quickly, uniformly, and without solvents. By rapidly coating solid reagents onto glass beads in seconds, the process transforms challenging powders into automation-ready materials.

In essence:

- Dry Particle Coating creates ChemBeads
- RAM makes dry particle coating fast, scalable, and practical

Together these technologies remove a critical bottleneck in drug discovery, enabling faster screening, smarter experimentation, and a shortened path from compound discovery to potential medicine.

Contact Resodyn Acoustic Mixers, Inc. to discuss improving your high-throughput experimentation and screening processes.

P: +1 (406) 497-5333
E: info@resodyn.com
W: www.resodynmixers.com

CITATIONS

1. AbbVie High Throughput Chemistry Group. https://chemspeed.com/media/abbvie-high-throughput-chemistry-group-chemspeeds-gravimetric-solid-dispensing/
2. ChemBeads: Improving Artificial Intelligence Through Human Ingenuity. https://www.abbvie.com/who-we-are/our-stories/chembeads-improving-artificial-intelligence-through-human-ingenuity.html