Automated comPOUND storage of acoustiX tubes – providing greater access to acoustic workflows

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introduction

In 2018, a collaboration between AstraZeneca, Brooks Life Sciences, Labcyte and Titian resulted in the release of the new “acoustiX tube” and associated workflow, designed to streamline the compound management process.

3 years on the adoption of this technology has mostly been limited to larger organisations with sufficient budgets to afford the significant investment required to make this change. Costs can be reduced with semi-automated approaches to liquid handling but in sample storage it has, until now, been a choice between manual storage or large and expensive automated stores.

SPT Labtech have supplied solutions for compound management for almost 2 decades, with a reputation for highly robust and reliable systems centred around pneumatic sample handling and transport in the comPOUND stores.

SPT Labtech comPOUND Storage system

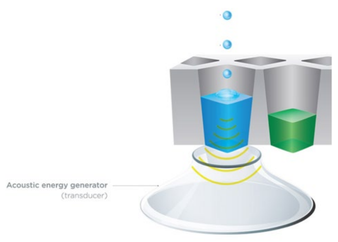
The new acoustiX tube presented SPT Labtech with several technical challenges and this poster outlines how these have been overcome to offer a robust solution.

1. Challenging features

Barcode

Acoustic dispensing requires the direct coupling of a transducer with the bottom of the tube through a liquid medium.

Acoustic transducer in contact with well/tube



A traditional 2D barcode in the centre of the tube bottom would interfere with the integrity of the transducer coupling, so a split barcode is used in the four corners of the tubes rectangular base.

Base of acoustiX tube and its 4 section split barcode

Rectangular base

The rectangular tubes also present a challenge to most automation that pick and place tubes. In standard 2D barcoded tubes the base is circular and the tube can enter the rack in any rotational orientation, whereas the acoustiX tube can only enter to rack in either 1 of 2 possible orientations 180 degrees apart.

Rectangular base of acoustiX tube (left) versus common circular base tubes (right)

An acoustiX tube placed into the rack incorrectly sits high in the rack and cannot continue to the downstream process

Mechanical pick and place robots must be able to rotate the tube and detect its orientation to position it correctly. This functionality is not available in most systems. In the comPOUND, tubes are picked and placed using a pneumatic system that is currently unable to turn the tube.

Friction fit

The final challenge is a friction fit feature. This is a safety feature to lock the tubes into the rack and tubes naturally stick in the rack when dropped into it.

In order to pick tubes from the rack they must be released from the locked position.

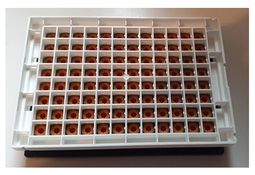
2. Solutions

Barcode

Barcode reading in comPOUND has been upgraded both in terms of imaging and software to interpret the data. This has been tested extensively and shown to be extremely reliable.

Loading tubes into racks

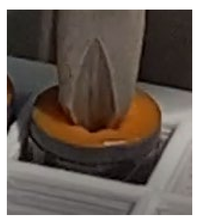
A guide plate is used on top of the acoustiX rack, to ensure the secure delivery of the acoustiX tubes to the rack. During delivery some of the acoustiX tubes will drop into the rack in the correct orientation, but the majority will not. Those standing proud are held safely in the correct rack location by the guide plate. The rack and guide plate are removed together after delivery or stored ready for collection in the new comSTACKER 2 which enables batches of up to 15 racks to be processed.



Guide plate over acoustiX rack

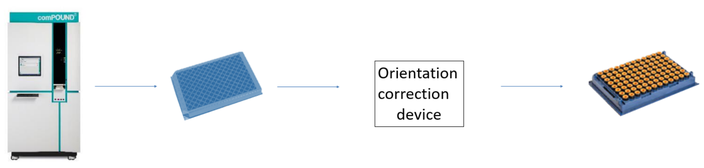
Once removed, the rack and guide plate are transferred to a small benchtop orientation correction device which rotates the tubes into the correct position. This device has a sensor to ensure tubes are correctly located.

Rotation tool locates acoustiX tube correctly and immediately retracts. Clockwise rotation ensures capping integrity is maintained

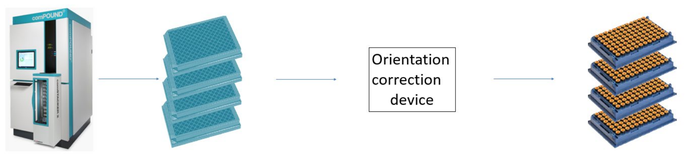


On completion of this procedure, the guide plate can be removed and the rack continues through the normal downstream process.

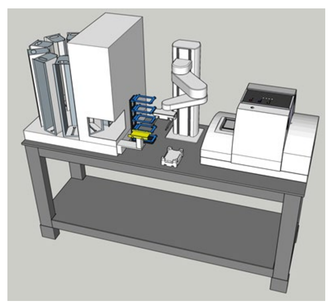
Manual workflow

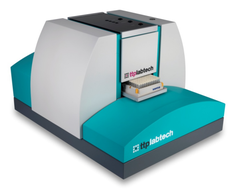


comSTACKER 2 batch workflow



For fully automated workflows, acoustiX tubes can be delivered in the same way described above to an SPL Labtech connect unit. The connect is a remote input/output device enabling transfer of tubes between the connect and up to 4 comPOUNDs. The connect is an ideal hub to provide direct transfer of tubes between storage and an automated workcell.





Above SPT Labtech connect
Left Biosero workcell

SPT Labtech is partnering with Biosero to provide a fully automated workstation that can manage a library of up to 800,000 acoustiX tubes. The standard configuration is able to retrieve up to 150 racks of cherry picked tubes and present them ready for downstream processes, as well as automating the batch storage of tubes. For customers requiring more integrated solutions including, liquid handling, Biosero offers custom solutions tailored to the customers needs.

Storing

AcoustiX tubes can be stored directly from the acoustiX rack. A simple tool releases the tubes from the rack prior to loading. This can be used both manually and in the fully automated biosero workstation.

3. Capacity and throughput

For a single comPOUND with a library of up to 100,000 tubes, 96 tubes can be delivered in less than 10 mins, rising to just over 20 mins per rack for a store at full capacity of 200,000 tubes.

Multiple comPOUND units integrated with a connect, benefit from parallel processing with throughput increasing with each comPOUND added.

	Number of comPOUNDs with connect			
Capacity	1	2	3	4
<100,000	~10 mins	<7 mins	<5 mins	<4mins
200,000	~22 mins	<15 mins	<10 mins	<7 mins

4. Availability

SPT Labtech are now able to consult with customers to configure solutions to meet specific needs and provide pricing information with the first systems available for delivery by Summer 2021.

conclusion

The product development outlined in this poster provides organisations looking to employ acoustiX tubes with more choice for automated storage and options to suit smaller libraries and lower budgets.

Libraries from a few thousand to hundreds of thousands of tubes can be accommodated and organisations can also benefit from the modular nature of SPT Labtech’s comPOUND, meaning they can scale and expand as needed. The unique pneumatic transport system offers greater ability to integrate storage directly with downstream automation as demonstrated by the collaborative solution with Biosero.