

Compound storage made simple







StoragePod® and MultiPod®

- Store compounds in a nitrogen atmosphere
- Avoid DMSO moisture absorption, concentration dilution and loss of compound from precipitation
- Maintain compound concentration, solubility and activity
- Easily expand storage capacity with the use of modular StoragePods

The industry problem: DMSO moisture absorption

DMSO moisture absorption is the silent killer of compound collections. DMSO is an aggressively hydrophilic substance, rapidly absorbing moisture from the surrounding environment at an approximate rate of 20% in 24 hours.

This moisture absorption can result in irreversible damage to precious small molecule compound libraries, which are every Research Operation's crown jewels. Moisture related damage can be seen in the following forms:

- Compound concentration dilution DMSO can see in excess of a 20% weight gain in just 24 hours.
- Freezing point depression DMSO that is 20% saturated with just moisture will not freeze until below -30°C. As a result, compounds cannot be frozen, and reactions will take place allowing compound degradation.
- Crystallisation moisture will freeze into ice crystals, crushing solubilised compound.
- DMSO suppression and compound precipitation moisture absorption will suppress DMSOs solubilising performance and cause hydrate formation, causing compound to fall out of solution.

In addition to the above, compounds can be damaged by exposure to oxygen (which is highly reactive) and aggressive light conditions (which contain UV).

How should compounds be stored?

Compounds should ideally be stored in the following conditions:

- A moisture free environment (to stop moisture absorption).
- An oxygen free environment (to stop oxygen reactions).
- A dark environment (to stop UV damage).

Provided the above storage conditions are employed, compounds can be stored for long periods of time and re-accessed on multiple occasions.

Freeze thaw cycles are sometimes considered to be damaging to compounds, with Research Professionals often referring to their compounds falling out of solution as a result. However, this freeze thaw related damage has been traced to the presence of moisture in DMSO. There has now been substantial research that concludes compounds suspended in moisture free DMSO, can be subjected to multiple freeze thaw cycles without damage.

These compound management objectives are all satisfied by Roylan's StoragePod and MultiPod compound storage solutions.

What are StoragePod and MultiPod?

StoragePod and MultiPod are modular compound storage systems, designed to stop damaging exposure to moisture and oxygen when storing, handling and delivering small molecule compounds.

These storage systems are conceived to be low cost, modular, easy to use and can be applied not only as devices to maintain compounds during basic storage, but also to maintain compounds during distribution and delivery between chemistry, storage and screening. Additionally, StoragePods can be used to recover samples by removing moisture from the DMSO they are solubilised in.

A StoragePod system comprises a benchtop controller instrument and as many storage enclosures (StoragePods) as the end user requires to meet their storage needs.

Compounds in SBS format plates or racks of tubes may be placed within the StoragePods, which can be manually hermetically sealed in a matter of seconds. The StoragePods may then be connected to the StoragePod Controller, which will flush the connected StoragePod with inert nitrogen gas until a user-defined level of nitrogen purity is reached.

Performance data AstraZeneca test data

AstraZeneca investigated the StoragePod system to assess its ability to maintain compounds. Areas of key interest were its ability to:

- Maintain DMSO purity (stop moisture absorption in DMSO)
- · Maintain compound solubility
- Provide improvements in IC50 results

The experiments used a test set of nine compounds that covered three distinct chemical series and three molecular weight bands (300, 400, 500). The compounds were solubilised in 2ml Finneran glass vials with conical snap plugs.

Duplicate samples of each compound were put into various storage conditions: room temperature, a 4°C fridge and a StoragePod with nitrogen atmosphere.

The samples were weighed at regular intervals over a fourweek period (typical laboratory storage period) and all measurements recorded. Plots are shown of volume gain and stock concentration against time. The typical starting volume was 500ul, so a 100ul water gain corresponds to a decrease in stock concentration from 10mM to 8.3mM

Room temp analysis vs StoragePods

The results in the plots show that the amount of water absorbed by DMSO rapidly increases with time at room temperature and at 4°C. The compounds stored in a nitrogen atmosphere for the four-week duration showed minimal water uptake (shown on both graphs). There is considerable variability between the results when different compounds have been solubilised, particularly at 4°C as condensation from the fridge atmosphere occurs. Statistical analysis shows this variability does not appear to depend on chemical series or the molecular weight of the compounds, meaning the error cannot be compensated for. When the compounds were stored under nitrogen in StoragePods no problems were identified.

It is important to reiterate that the dilution of compound stocks by water is not the only issue. The negative effects seen in the statistical analysis are likely to be larger due to the added risk of compound precipitation, crystallisation and degradation. During the four-week period of testing, four of the nine compounds came out of solution at room temperature and at 4°C; again, this was not an issue for the compounds stored under nitrogen in StoragePods.



Fridge analysis vs StoragePods



Performance data ,||| Maintain compound integrity and activity - MultiPod system test

A mid-sized pharmaceutical company noted the loss of activity of their compounds during storage, both at room temperature and in -20°C freezers. To resolve this they evaluated the MultiPod system as an alternative, assessing its ability to maintain compound integrity over time.

11 compounds were formulated in fresh DMSO (10mM concentration), then dispensed out into 96 well plates and foil sealed. Duplicate samples were then stored over a period of a month at room temperature, in a -20°C freezer and in the MultiPod system's StoragePods under nitrogen. Analysis by LCMS at day 1, 5 and 30 showed that for the plate samples stored in the MultiPod system there was:

- No loss of compound observed through chemical degradation
- No loss of compound observed through precipitation
- Compound/DMSO concentration was maintained. •

In comparison, the plate samples stored at room temperature and in freezers saw reductions in concentration as a result of moisture absorption, precipitation and chemical degradation to varying levels. For example, after 30 days compound 6 maintained a starting concentration of 10mM within the MultiPod system. In comparison, after 30 day concentrations were 8.93mM and 8.64mM in room temperature and freezer conditions respectively.

Additionally, 4 of the compounds were stored for 40 days and then tested by both LCMS and biological assay. Of these, two compounds (10 and 11) were selected as they had been historically inconsistent with up to a 1.000 variability after just one freeze/thaw cycle.

In the results plots below for compounds 10 and 11, the black plots show the results for freshly made up compound, representing the ideal compound activity. In comparison the red plots were very closely matched demonstrating that the MultiPod system was very well maintaining the activity of these compounds. However, yellow and blue plots for frozen storage showed significant differences identifying that frozen storage is poor compared to the performance of the MultiPod system.

-4

-2



Performance data Beckman Coulter ECHO® microplate recovery

In this Customer evaluation, Dundee StoragePods were used to recover ECHO® LDV microplates. Optimum results were achieved using 2 sources of sacrificial DMSO within a Dundee StoragePod filled with 4 ECHO® microplates. DMSO concentrations were taken from ~71% to ~95% within a single 24-hour recovery cycle.

The Customer noted the powerful ECHO® microplate recovery capabilities of the StoragePods. Allowing microplates to be quickly recovered and their lives to be

significantly extended. This substantially reduced the need to dispose of and re-make microplates as often. Saving significant time/cost in both lab work and the cost of compounds.

Additionally, it was noted that compound solubility was improved with the ability to maintain higher DMSO concentrations. And thus, improved assay results were achieved.

	POSITION 1	POSITION 2	POSITION 3	POSITION 4	POSITION 5	POSITION 6
		Sacrificial DMSO 100ml			Sacrificial DMSO 100ml	
DUNDEE STORAGEPOD 6 Plate positions deep	Plate 1		Plate 2	Plate 3		Plate 4
Plate Ave % DMSO T= 0 hours	71.168		71.207	71.225		71.191
Plate Ave % DMSO T= 4 hours	84.561		84.584	84.597		84.547
Plate Ave % DMSO T= 8 hours	89.105		89.149	89.156		89.134
Plate Ave % DMSO T= 24 hours	95.115		95.137	95.14		95.125



Controller units



MultiPod® controller

Features:

- Our premium controller
- Oxygen and humidity sensor based control
- LCD interface control system
- Permanent connection of up to 20 San Francisco pods with automatic purging
- Very high capacity storage (up to 4800 shallow well plates)
- Additional functionality included for one at a time purging of StoragePod boxes

storagePod.

StoragePod® V2 controller

Features:

- Our entry level controller
- Oxygen and humidity sensor based control
- LCD interface control system
- Permanent is started manually
- One at a time purging of StoragePods

Provided the above storage conditions are employed, compounds can be stored for long periods of time and re-accessed on multiple occasions.

StoragePods®



Short Dundee

- 36 shallow well plates
- 8 full height tube racks
- Draw style, designed to sit flat on a shelf or lab bench
- Sized to fit into -20 freezer



Dundee

- 54 shallow well plates
- 12 full height tube racks
- Draw style, designed to sit
- flat on a shelf or lab bench



San Diego

- 240 shallow well plates
- 72 full height tube racks
- Mobile pod, mounted on wheels
- Contains six Roylan microplate stacker shelves

San Francisco

- 240 shallow well plates
- 72 full height tube racks
- Draw style (6 drawers) with hinged door
- To sit on a shelf or lab bench

StoragePod[®] system







About us

Roylan Developments has been serving the pharmaceutical and biotech industries since 2008 as a developer and manufacturer of modular nitrogen compound storage systems, sometimes otherwise referred to as a nitrogen storage system or nitrogen desiccator system.

MultiPod® system









About us

Our StoragePod[®] and MultiPod[®] product lines have been proven to provide excellent compound storage conditions.

They stop the problems associated with moisture absorption into DMSO and the need for damaging freeze thaw cycles. Compound activity levels are very well maintained at room temperature conditions. The modular nature of our storage systems provides starting options for the storage of a few tens of microplates or microtube racks at a low entry level cost.

Being modular our storage systems can scale up with the addition of more StoragePods to meet increasingly larger storage needs. For example, around 4,800 microplates (or an equivalent number of microtube racks) can be accommodated in a single MultiPod system.

Roylan Developments

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