LABORATORY SUSTAINABILITY: LEVERAGING FLEXIBLE INSTRUMENTATION FOR PURIFICATION USING LESS SOLVENT, SHORTER RUN TIMES, LOWERING COST OF OWNERSHIP

Instrumentation

Advion Interchim Scientific
puriFlash® XS 530

With any growing lab, scientists find an increasing list of needs to improve in throughput, capabilities, or just the addition of staff to your team. This can result in several outcomes that make it difficult to meet environmental and sustainability goals, or a laboratory's bottom line.

By building flexibility into your lab with multi-use instrumentation, scientists can help improve some of the biggest pain points in the purification process, including run-times and solvent use, leading to an overall lower cost of ownership.

DOES GROWING YOUR LAB MEAN GROWING YOUR CARBON FOOTPRINT?

Considerations for a growing lab, from physical space to usage and long-term requirements

With any growing lab, scientists find an increasing list of needs to improve in throughput, capabilities, or just the addition of staff to the laboratory team. This can result in several outcomes that make it difficult to meet ESG goals, or negatively impact a laboratory's bottom line.

Laboratory expansion and adding additional equipment brings several considerations to the forefront:

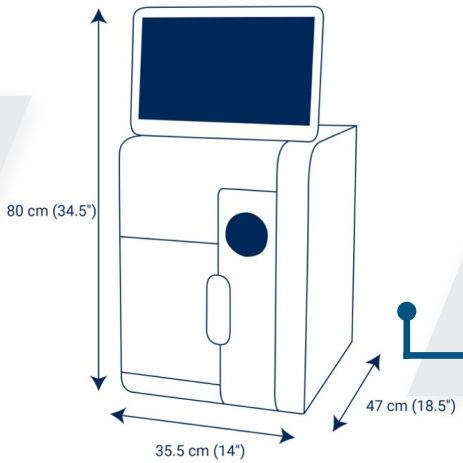
- **Additional Equipment Investments:** Investing in additional equipment for your lab results in much more than just the initial cost. Laboratories must consider the cost of ownership, including service, to understand how a purchase impacts the laboratory outside of the initial investment.
- **Overall Energy Consumption:** The increase in energy required to run your equipment is another consideration – more instrumentation, more energy use. This should be considered across the entire purification workflow – from reaction to evaporation.
- **Additional Consumables & Solvent Usage:** For high-throughput labs with a large number of samples, the financial resources needed for consumables and solvents can be double or even triple the cost of the instrument. High-quality consumables paired with the required solvents is a mandatory consideration in allocating financial resources to support the cost of instrument ownership.
- **Additional Waste & Disposal Requirements:** With the additional solvent needs, comes additional waste/disposal requirements.

BUILDING FLEXIBILITY INTO YOUR LAB: CONSIDER MULTI-USE INSTRUMENTATION

Leveraging one instrument across a range of applications to increase overall laboratory sustainability

In many cases, instrumentation required to meet purification requirements is very specific – flow rates, column size, throughput and final product purity are the top considerations when making a purchase. In a time when flexibility is key, using purification instruments that have been adapted to fit a lab with changing needs is a must.

Currently, laboratories need the flexibility of combined purification techniques, such a flash and semi-prep, in an all-in-one system. The Advion Interchim Scientific® puriFlash® XS 530 was developed to provide laboratories with the required flexibility. The system can run normal or reversed phase, flash and prep columns (20 and 30mm, down to 10 µm media) – and produce the peaks that you would typically only see on a much more expensive system with higher energy, solvent, and service costs.



Small and mighty

A small footprint and a single instrument with multiple uses can improve the energy and workplace efficiency within the lab.

A combined flash/prep optimization also solves a frequent challenge in the lab: one instrument that can run both flash and prep can take the place of two systems. This also greatly reduces energy costs, reduces space at the bench, and can improve laboratory workflow efficiency.

Application Highlight: Leveraging the use and flexibility of Prep columns on a Flash system

Sample:
Diethylphtalate,
Dimethylphtalate
(125mg/mL each)
Volume injected: 1mL
Detection: UV 254nm
Method:
Solvent A: Cyclohexane
Solvent B: Ethyl acetate

Possible with a semi-prep and prep adaptation kit to easily install prep columns on the puriFlash® XS 530

Figure 1:
Column: puriFlash® 30 micron 25g flash cartridge with high performance silica (PF-30SIHP-F0025)

Optimal Flow Rate: 15ml/min
Pressure = 1bar

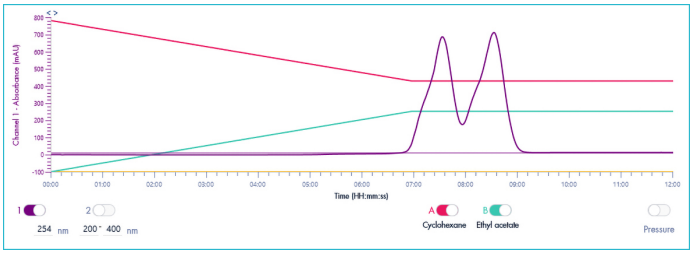


Figure 2:
Column: puriFlash® stainless steel Prep, 10 micron, 150mm length, 212 diameter, with high performance silica (PF10SIHP-150/212)

Optimal Flow Rate: 16ml/min
Pressure = 10bar

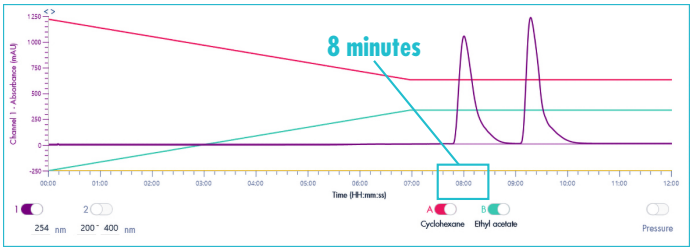
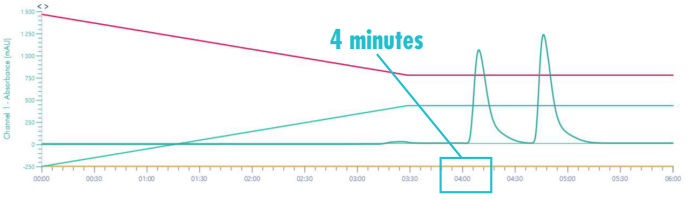


Figure 3:
Column: puriFlash® stainless steel Prep, 10 micron, 150mm length, 212 diameter, with high performance silica (PF10SIHP-150/212)

2x Optimal Flow Rate: 32ml/min
Pressure = 22bar



✓ Decreased run time ✓ Increased purity

TIME & ENERGY SAVINGS USING UPFP: ULTRA PERFORMANCE FLASH PURIFICATION

Less solvent, additional benefits of optimized purification solutions

With shorter run times, users may consume less solvent, leading to greener, cleaner, and more efficient process in the lab. Decreased solvent consumption can also lead to lower collected fraction volumes, which in turn can reduce the amount of energy required to dry down final products during the evaporation process.

Through time, flash chromatography has evolved, from basic, gravity/flow applications, toward optimized purifications leveraging automation and optimization for higher throughput. With the Ultra Performance Flash Purification (UPFP) technique, run times are further reduced, along with many added benefits that ultimately result in time and energy savings, without sacrificing purity.

With any liquid chromatography technique, it first requires finding the right selectivity to properly separate the compounds – then, recover the compound of interest with an aim of purity, recovery and productivity.

Improvements in the analytical techniques of liquid chromatography over the last thirty years have mainly focused on the transition from the use of irregular to spherical silica particles, the increase in the variety of stationary phases and finally the benefit of reducing the size of the silica particles.

This evolution has led to a high increase in productivity by a significant reduction of the runtime, tens of minutes to just minutes. It is always a challenge and often a compromise to obtain the desired purity, loading capacity and throughput. Because of this, chemists have tried to simplify the process. Another example from Advion Interchim Scientific includes the "Ultra Performance Flash Purification" technique, or UPFP. This technology offers an innovative solution that provides a larger spectrum of purification options versus other techniques.

Application Highlight: Efficiency (N) influence: Example

The application below highlights the benefit of smaller particle sizes in terms of resolution and purification cost. High efficiency (N) allows for better separation and a large increase in sample loading capacity.

PF-15SIHP vs IR-50SI columns: The Ultra Performance Flash Purification (UPFP) concept accelerates throughout by reducing the time and cost per sample of the purification process with increased confidence. The most significant difference in UPFP versus Flash purification is the combination of advanced "built to last" machine technology and mastery of small particle spherical silica puriFlash® columns which offers significant benefits over the traditional flash grade silica.

This information can be simplified in application data below.

Conditions:
Solvents:
A-Cyclohexane
B-Ethyl acetate
Injection Mode: Liquid Injection
Crude Sample Mixture: 400 mg of each phthalate
Injection Volume: 3.2 mL
UV Detection: 254 nm
Eluent Conditions:

Step	CV	Time	%A	%B
1	0	0	100	0
2	3.28	09:50	80	20
3	5.63	16:51	80	20

Step	CV	Time	%A	%B
1	0	0	100	0
2	3.28	06:03	80	20
3	5.63	10:21	80	20

Figure 4:

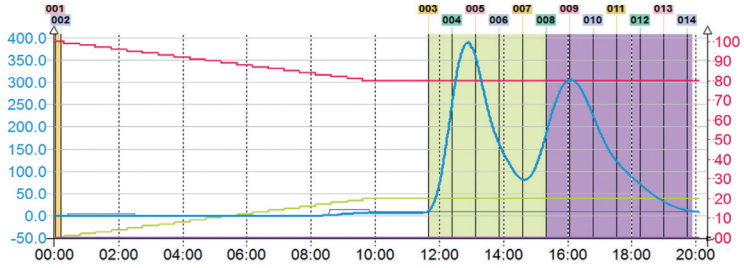
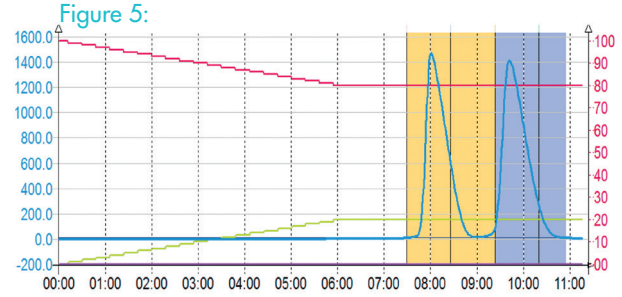


Figure 5:



A a 15 µm spherical silica column (PF-15SIHP-F0040) gives a better result with greater resolution, efficiency, loading capacity and improved retention versus a 50 µm irregular silica column (IR-50SHI-F0040). Using a 15µSIHP reduces run time by 45%, improves time for purification by 114%, reduces the solvent consumption by 59% and improves cost reduction for purification by 26%. Lower collection volume means reduced evaporation time.

If the appropriate selectivity is reached, the 15µSIHP can achieve greater compound purity. The best ratio cost/productivity is obtained with 15µm silica. In summary, the UPFP strategy encompasses a greater range of flash conditions over traditional analytical HPLC, preparative HPLC, and low pressure flash purification.

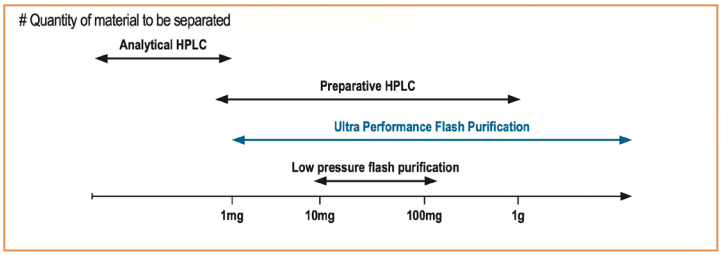


Figure 6: A chart to help demonstrate the ability of UPFP for flash purification over alternative methods.

CONCLUSION: CROSSOVER FLASH/PREP, UPFP FOR LESS SOLVENT & SHORTER RUN TIMES

Less solvent, additional benefits of optimized purification solutions

Ideal for labs requiring precision and reliability, the puriFlash® XS 530 offers semi-prep scale purification with our smallest footprint system. With flow rates of up to 300 mL/min and back pressure up to 30 bar, you can easily decrease your run time and increase purity. The system is a flexible normal or reverse phase, flash and prep tool (20 and 30mm ID, down to 10 µm media) designed to maximize your time in the lab. Paired with advanced UPFP technology, there is no better way to create a leaner, cleaner and greener laboratory.