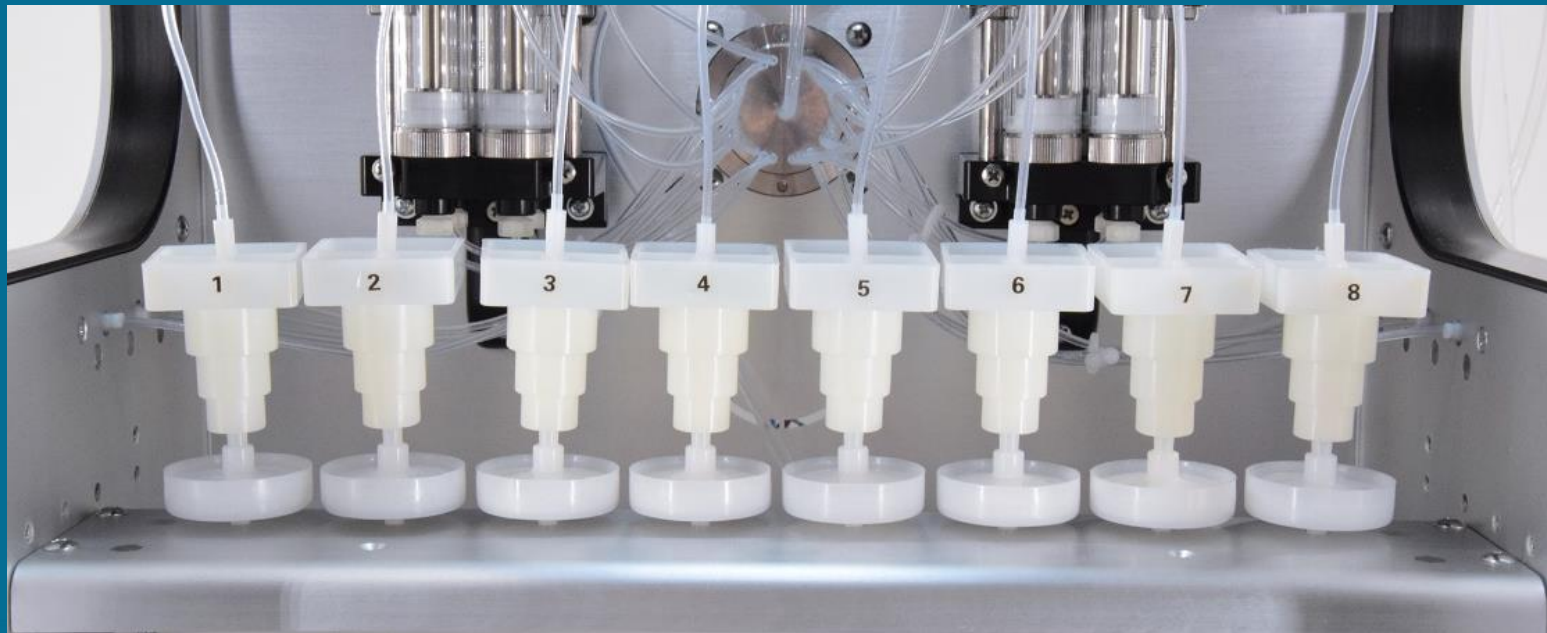


A Novel Solid Phase Extraction Disk



PROMOCHROM
TECHNOLOGIES

that combines the advantages of SPE cartridges and conventional 47-mm disks while overcoming their challenges

Ian Wan | Product Manager
ian_wan@promochrom.com
PromoChrom Technologies

Solid Phase Extraction



- Used for large volume water samples
- Most challenging and time-consuming stage



Solid Phase Extraction



SPE-03 System

- Processes 8 samples in parallel
- Compatible with SPE cartridges and disks



Solid Phase Extraction

SPE Cartridges



Typically 1/3/6 mL
6mL is ~14mm

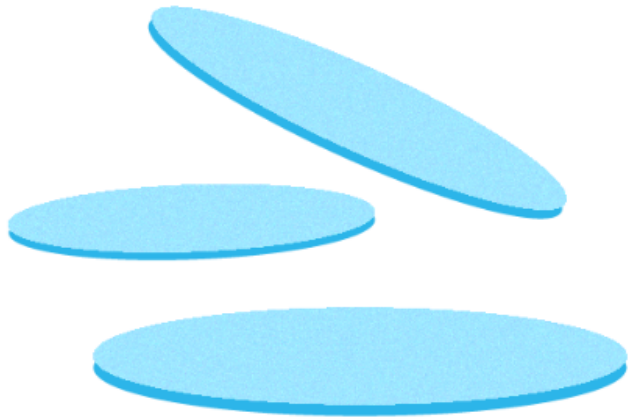
SPE Disks



Typically 47 mm

Cartridge vs Disk

DISKS



Pros:

- High flow
- Clog resistance

Cons:

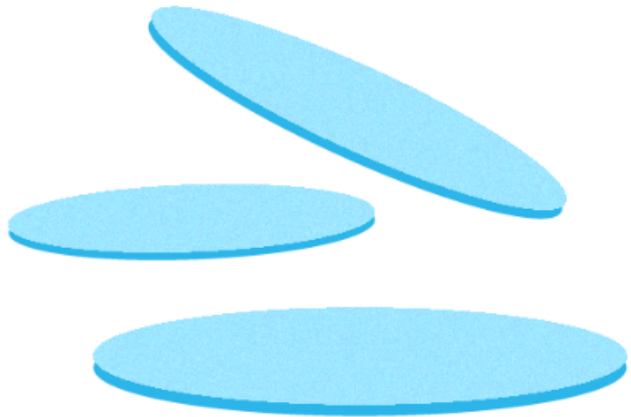
- Limited options
- System compatibility
 - High solvent use

CARTRIDGES



Cartridge vs Disk

DISKS



CARTRIDGES



Pros:

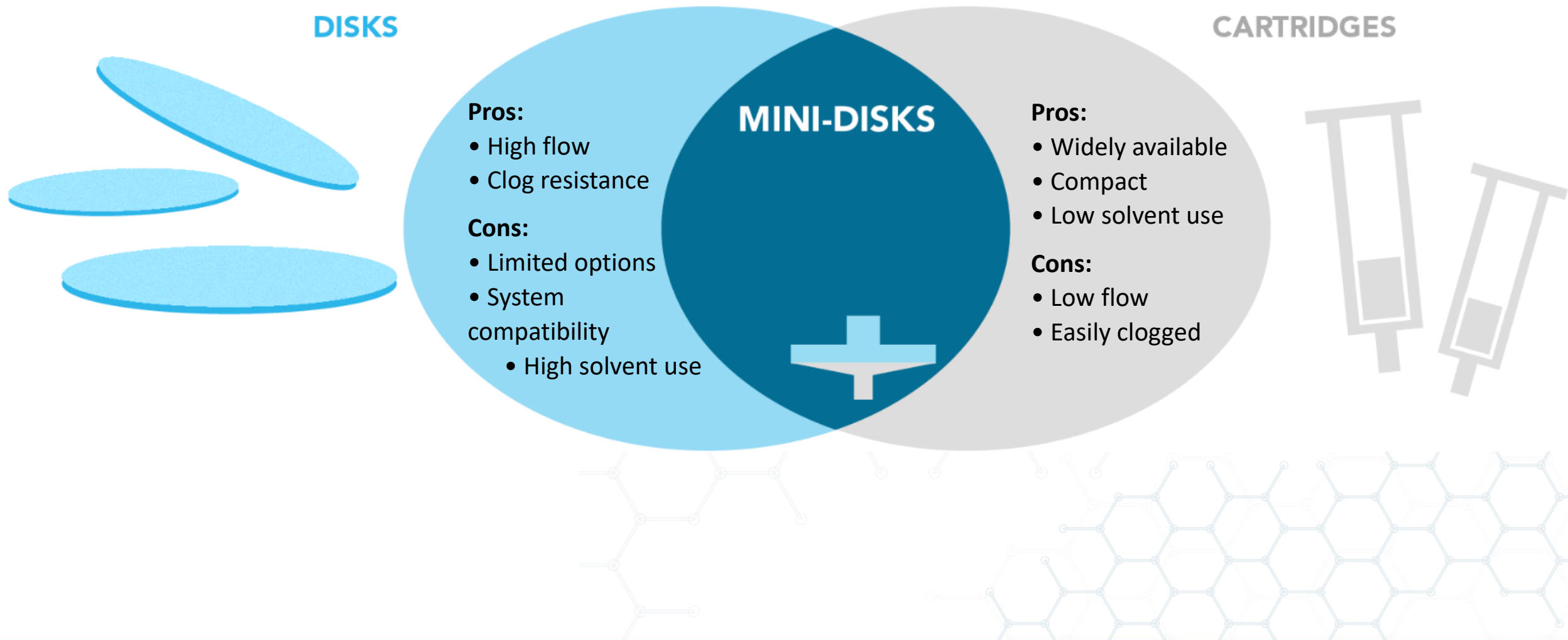
- Widely available
- Compact
- Low solvent use

Cons:

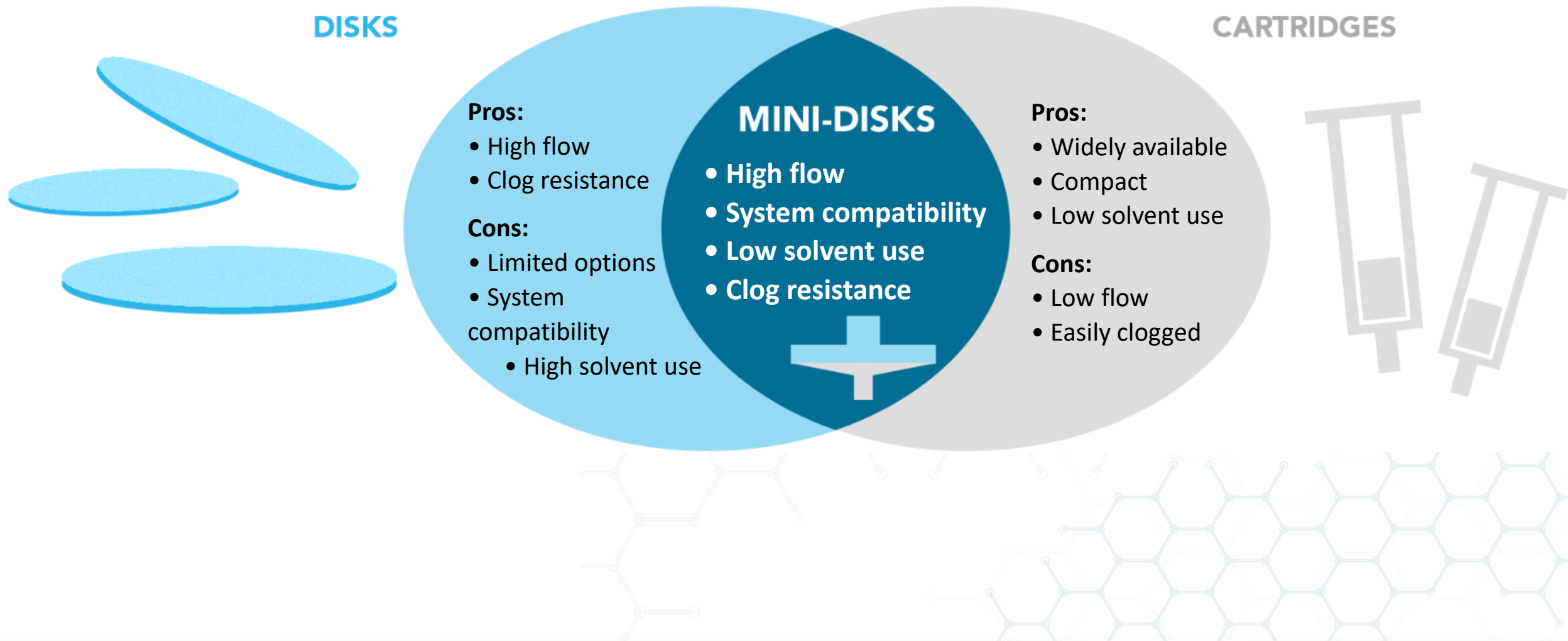
- Low flow
- Easily clogged



Cartridge vs Disk



Cartridge vs Disk



Mini-Disk

- Similar to syringe filter with luer tips



Mini-Disk

- Similar to syringe filter with luer tips
- Smaller than 47-mm disk, more surface area than 6mL cartridge



Mini-Disk

- Similar to syringe filter with luer tips
- Smaller than 47-mm disk, more surface area than 6mL cartridge
- Anti-clogging feature



TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan



TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan
- Originally using 47-mm disks + vacuum-based extractor (**Benchmark**)



TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan
- Originally using 47-mm disks + vacuum-based extractor (**Benchmark**)

	Analytes
Basic	Pyridine
Acidic	2-Methylphenol 3, 4-Methylphenol 2,4,6-Trichlorophenol 2,4,5-Trichlorophenol Pentachlorophenol
Neutral	Hexachloroethane Nitrobenzene Hexachlorobutadiene 2,4-Dinitrotoluene Hexachlorobenzene

TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan
- Originally using 47-mm disks + vacuum-based extractor (**Benchmark**)

Extraction Summary

1. Condition disks
2. Load 500mL sample
3. Dry disks
4. Adjust disk pH to acidic
5. Elute acidic/neutral fraction
6. Purge disks
7. Adjust disk pH to basic
8. Elute basic fraction

TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan
- Originally using 47-mm disks + vacuum-based extractor (**Benchmark**)
- Initial goal to run 47-mm disks on SPE-03 8-Channel system

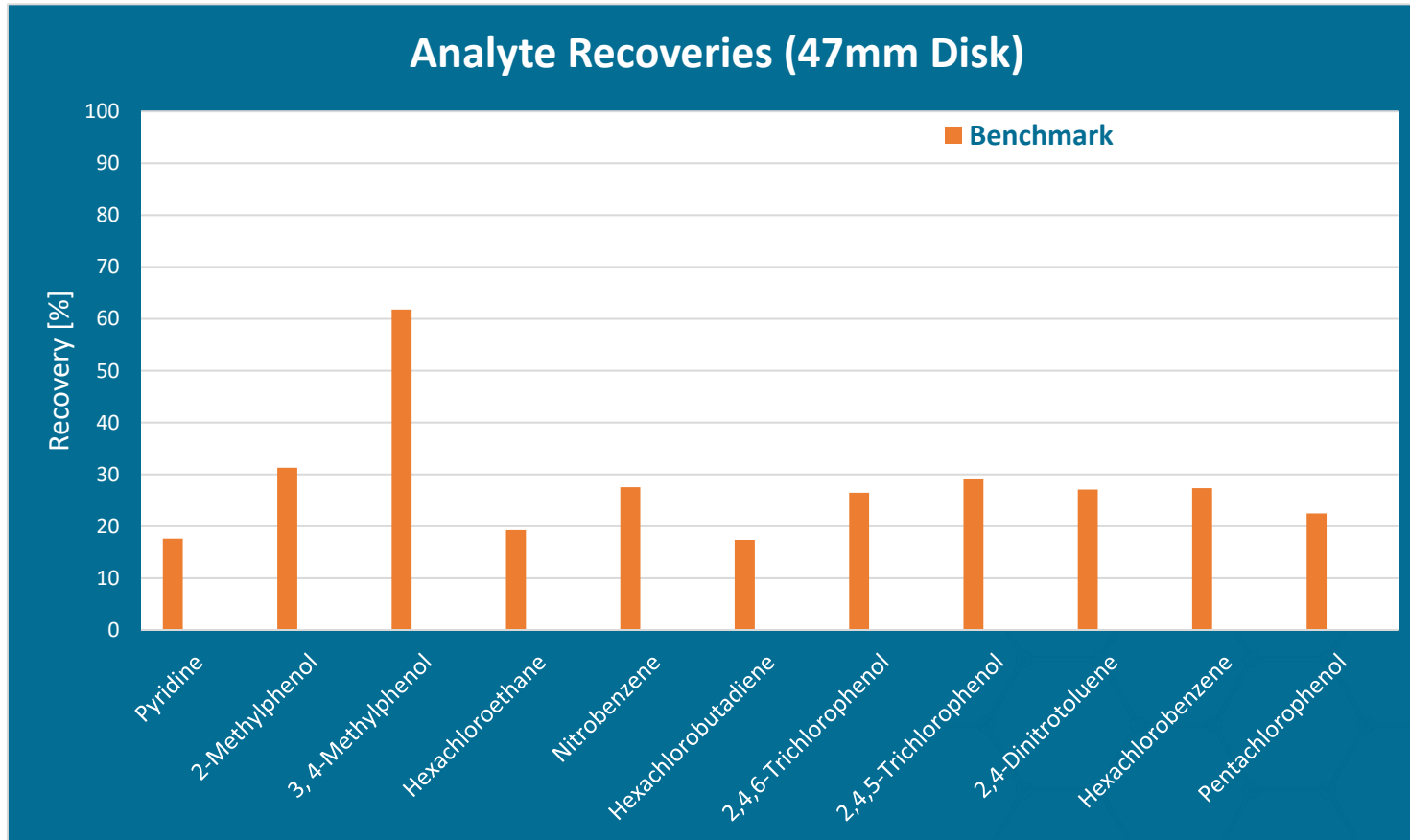


TCLP Semi-volatiles

- Journey with **Merit Labs**, Michigan
- Originally using 47-mm disks + vacuum-based extractor (**Benchmark**)
- Initial goal to run 47-mm disks on SPE-03 8-Channel system
- Introduced our mixed-mode Mini-disk (MD-BNA-30)



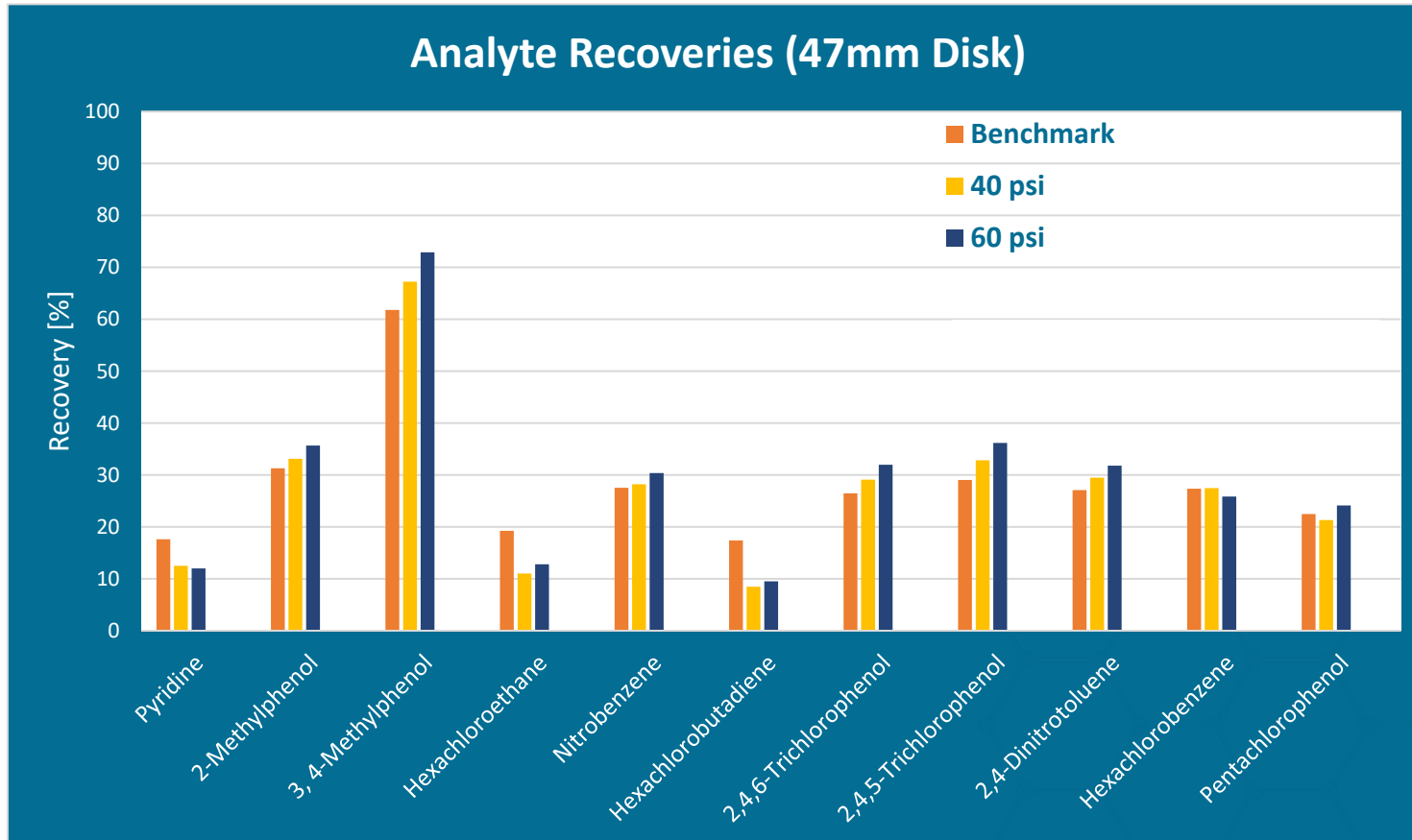
TCLP Semi-volatiles – 47mm Disk



Benchmark Recoveries

- Typical recoveries (averaged from 2 LCS extracted on Day 1)
- Interested in improving Pyridine
- Later translated benchmark method steps onto SPE-03

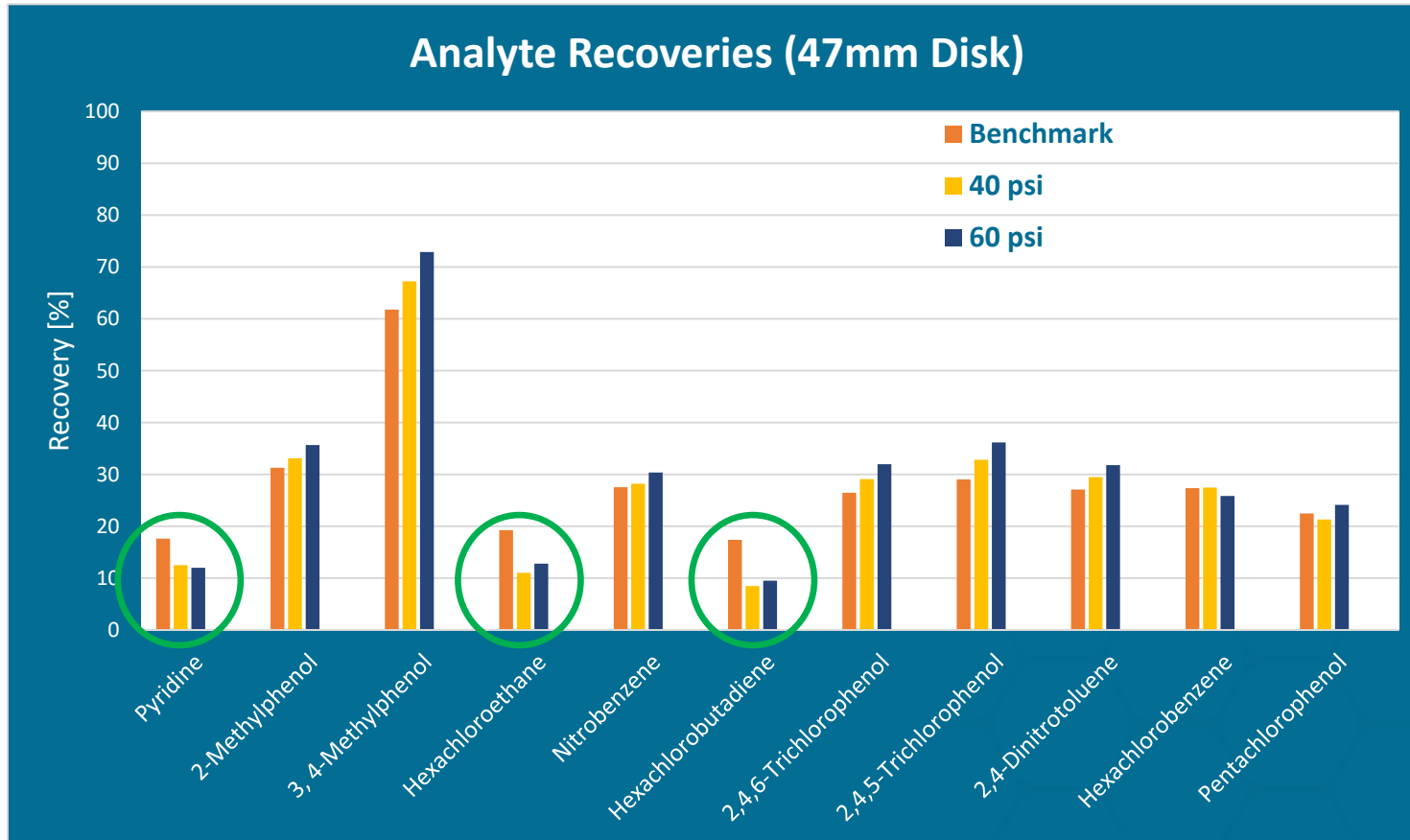
TCLP Semi-volatiles – 47mm Disk



40 psi vs 60 psi Disk Drying

- Slight improvements seen with 60psi, except Pyridine

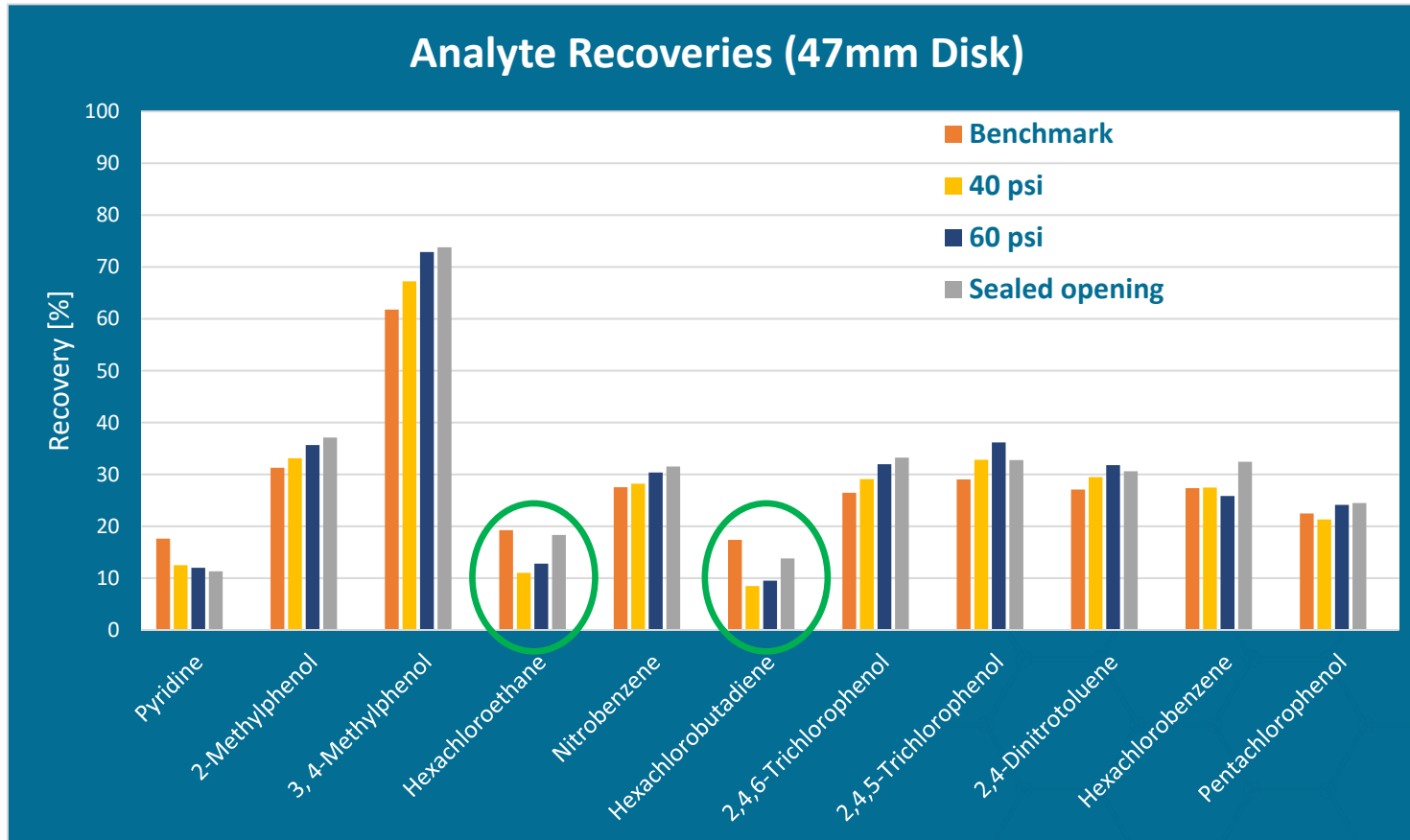
TCLP Semi-volatiles – 47mm Disk



40 psi vs 60 psi Disk Drying

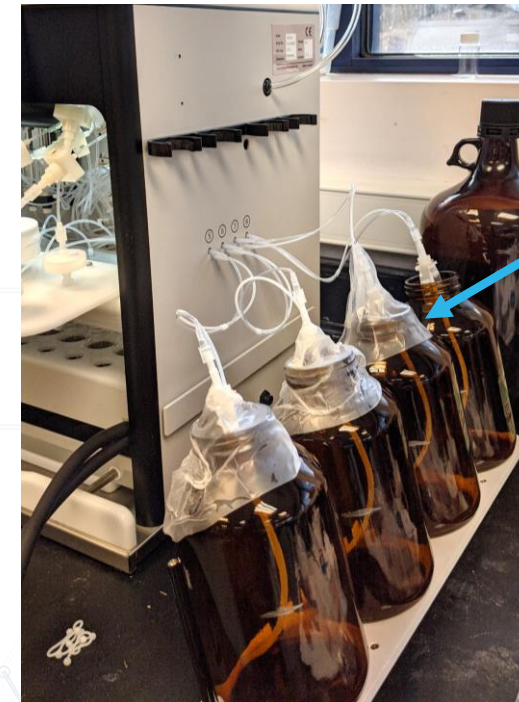
- Slight improvements seen with 60psi, except Pyridine
- Compared to benchmark
 - Lower Pyridine
 - Lower Hexchloroethane and Hexchlorobutadiene

TCLP Semi-volatiles – 47mm Disk

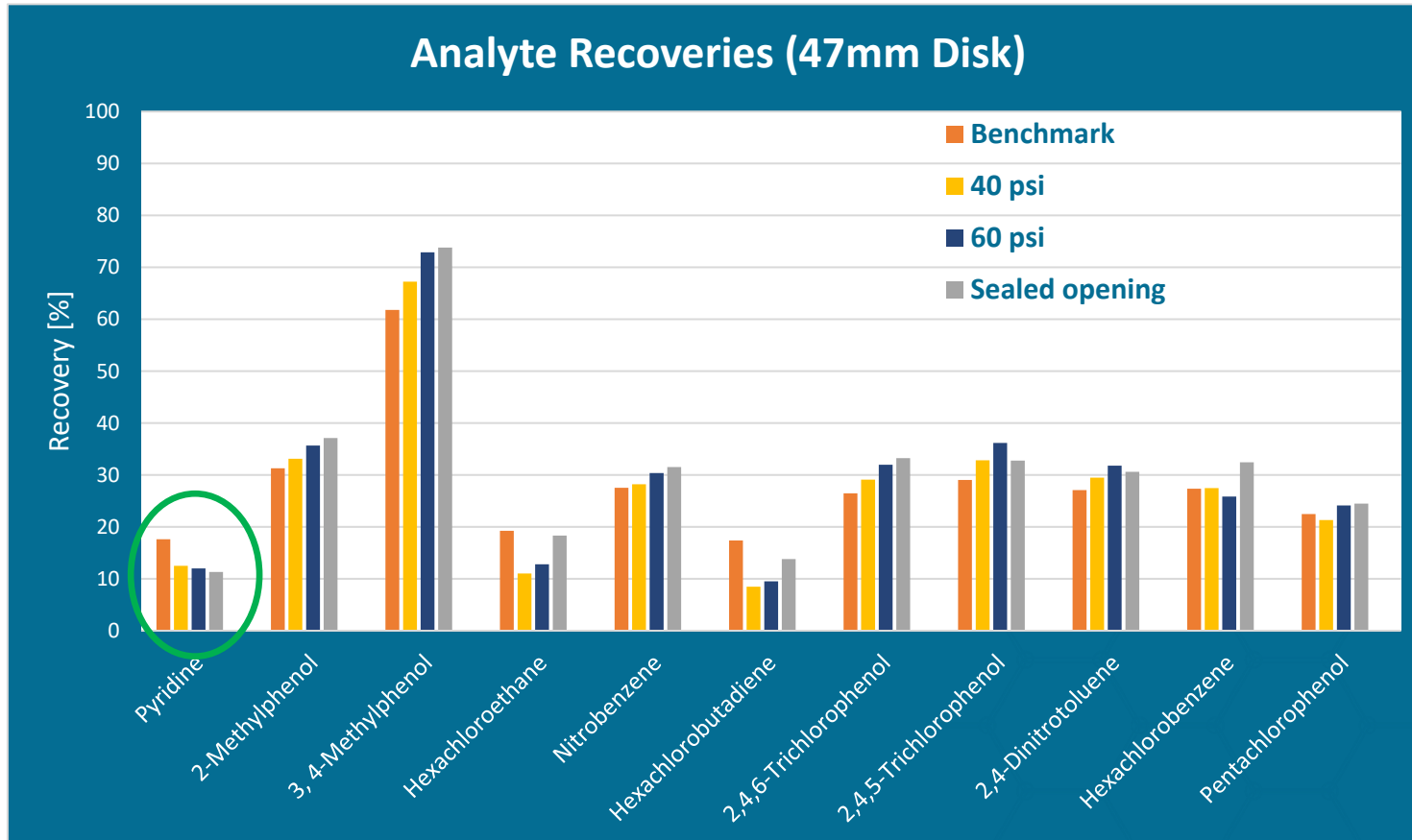


Sealing Sample Bottle Opening

- Improvement on Hexchloroethane and Hexchlorobutadiene

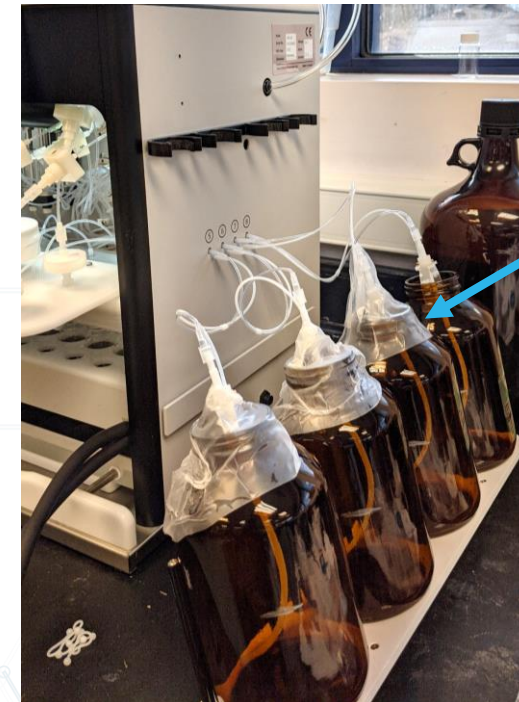


TCLP Semi-volatiles – 47mm Disk

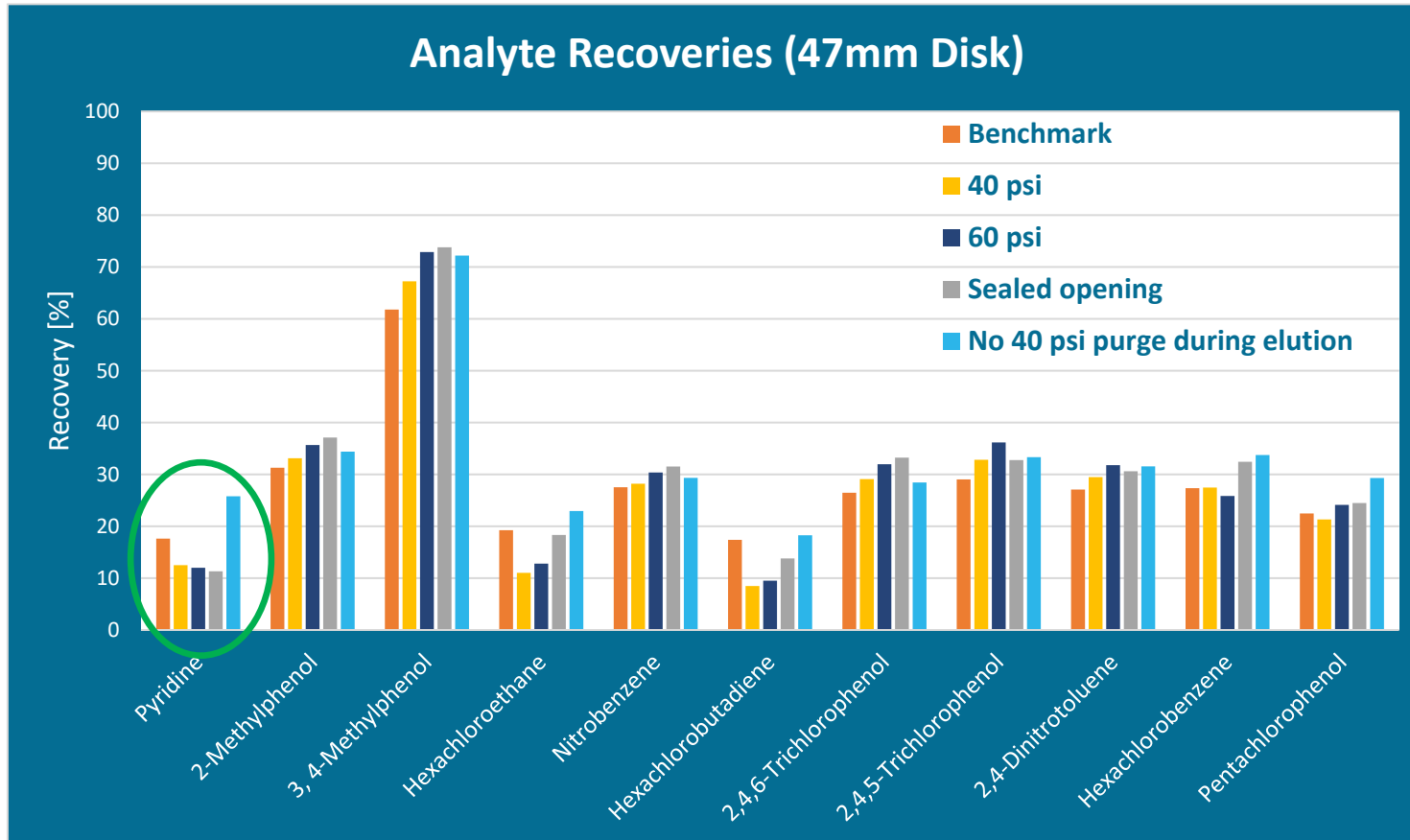


Sealing Sample Bottle Opening

- Improvement on Hexchloroethane and Hexchlorobutadiene
- No effect on Pyridine



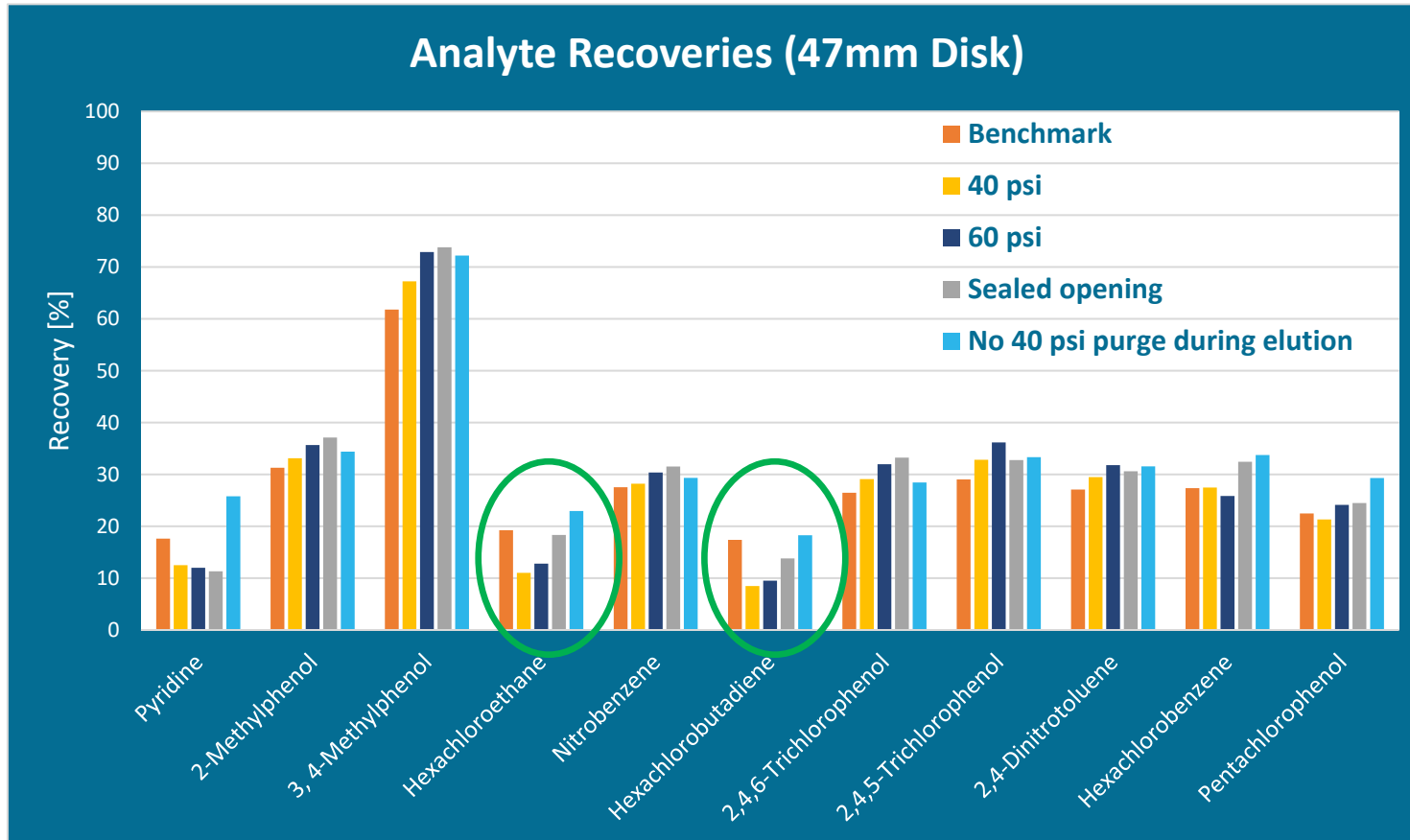
TCLP Semi-volatiles – 47mm Disk



No 40 psi purge during elution

- Significant improvement with Pyridine

TCLP Semi-volatiles – 47mm Disk

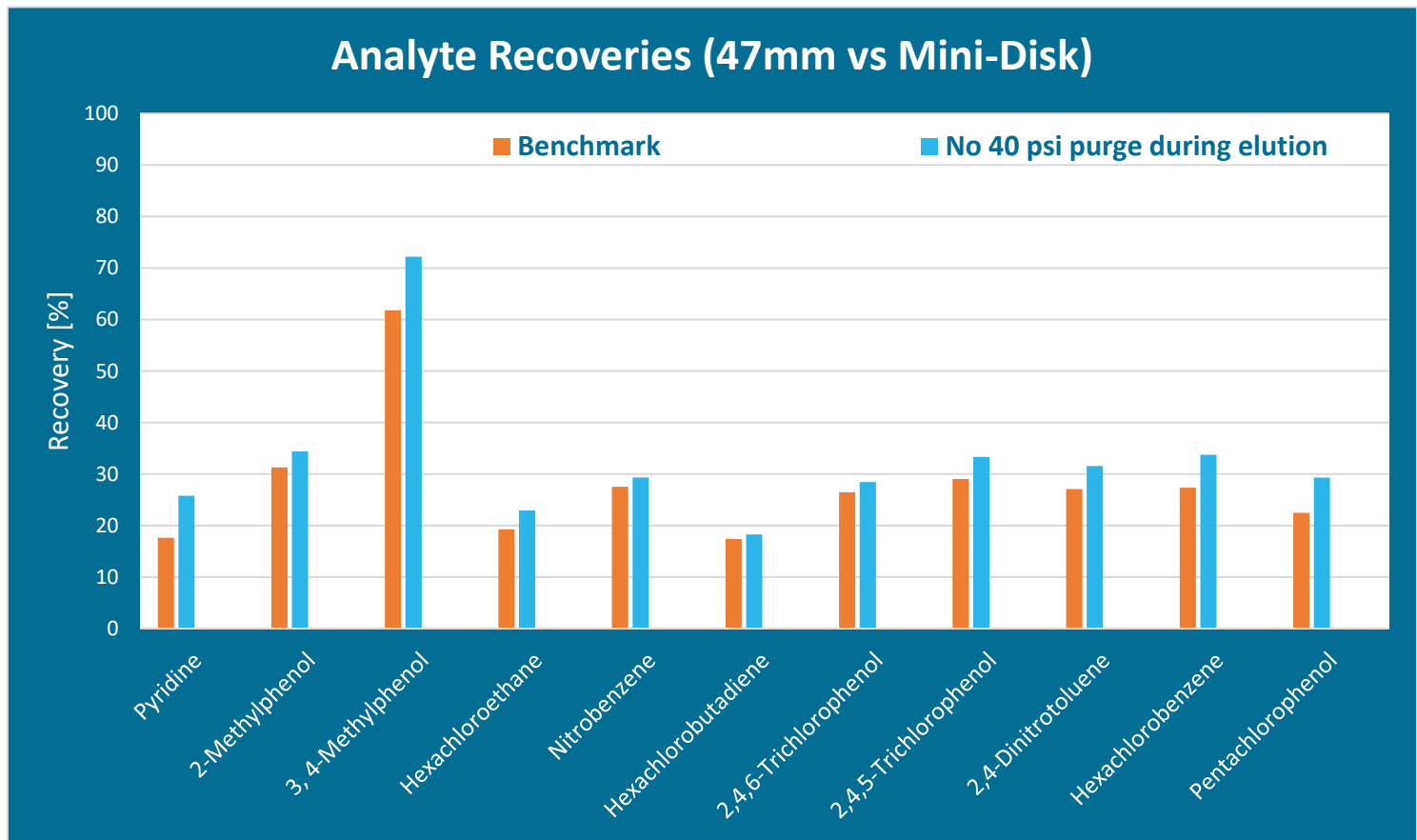


New sample bottle adapters

- Significant improvement with Pyridine



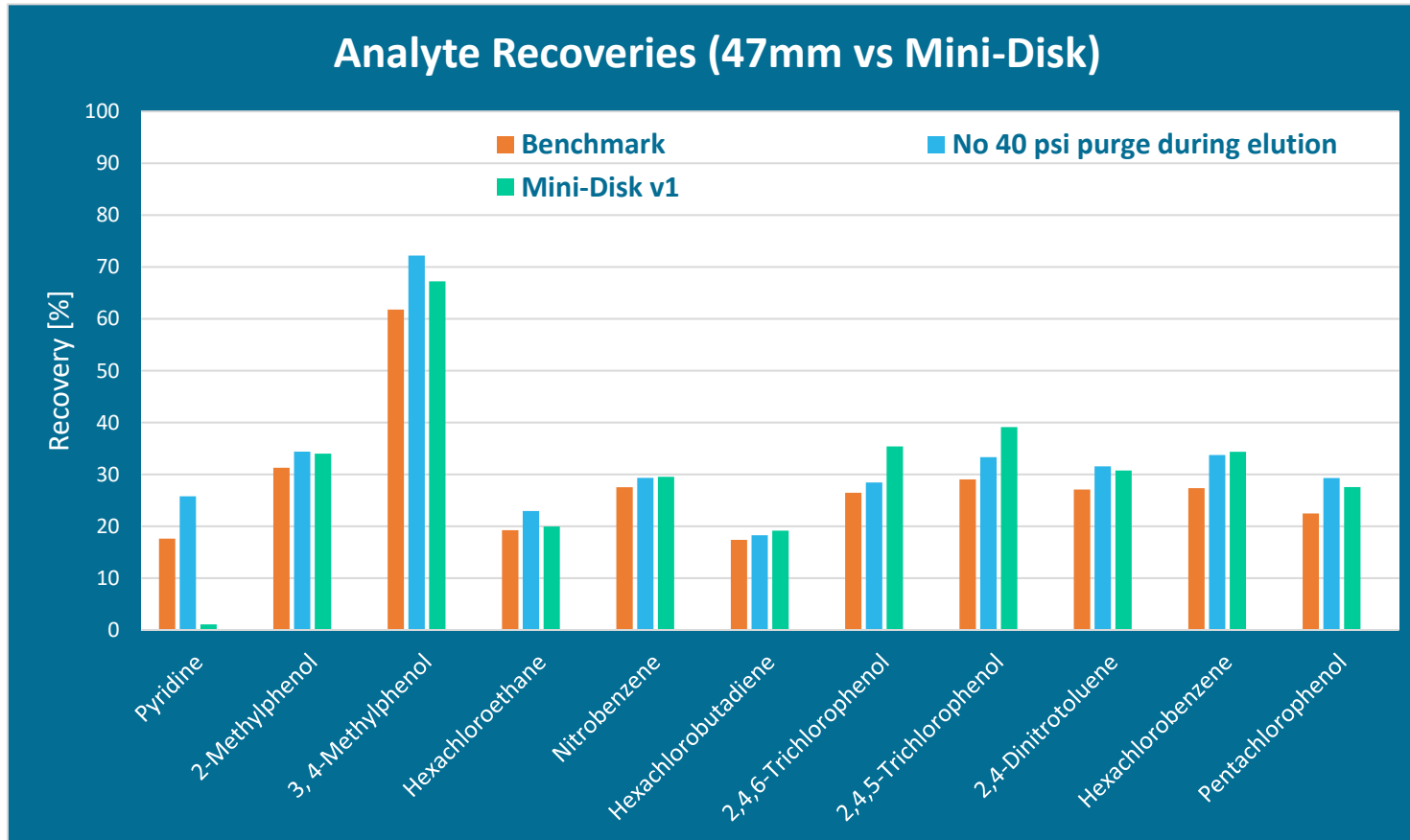
TCLP Semi-volatiles – Mini-Disk



Mixed-Mode Mini-Disk (v1)



TCLP Semi-volatiles – Mini-Disk

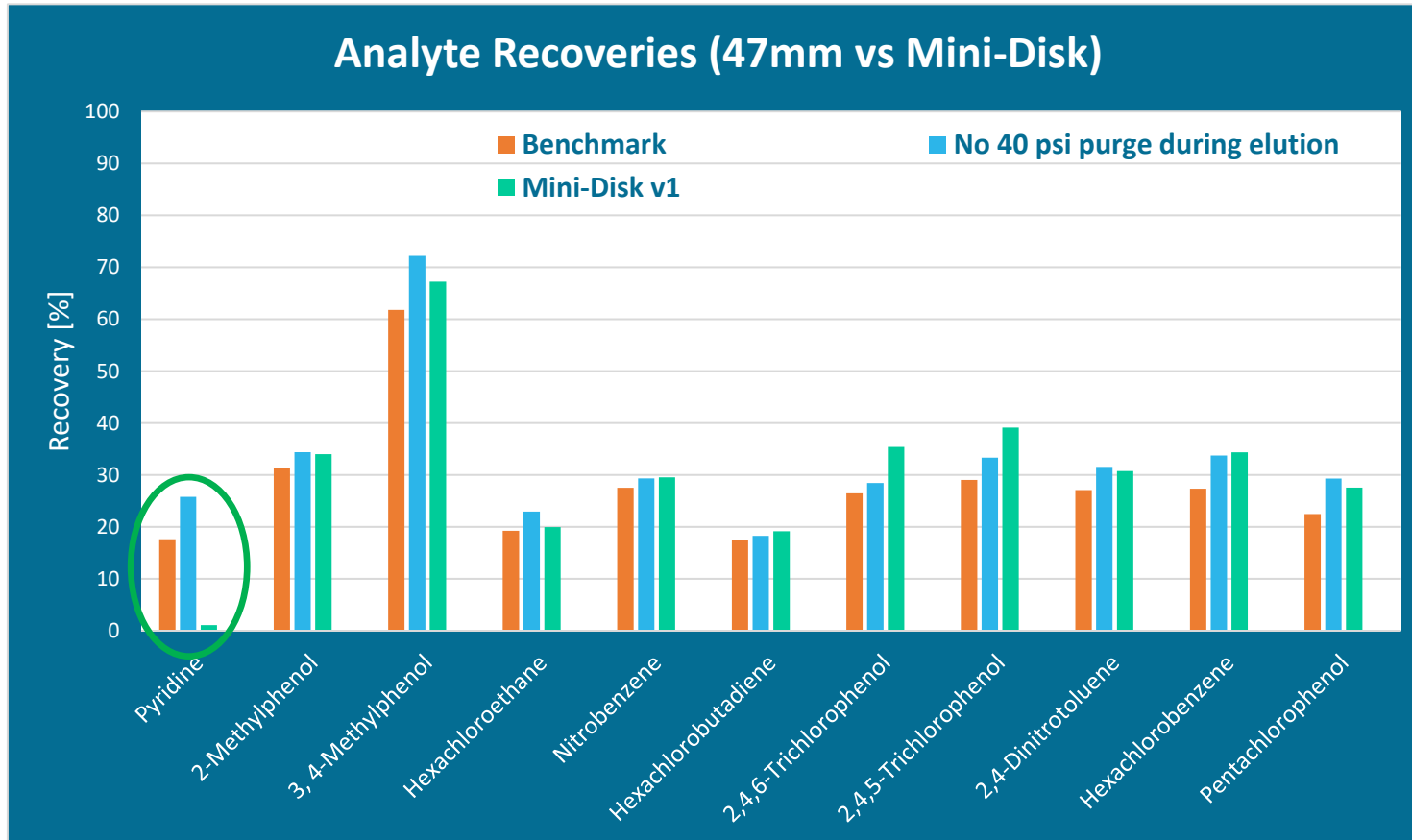


Mixed-Mode Mini-Disk (v1)

- Good acidic and neutral recoveries



TCLP Semi-volatiles – Mini-Disk

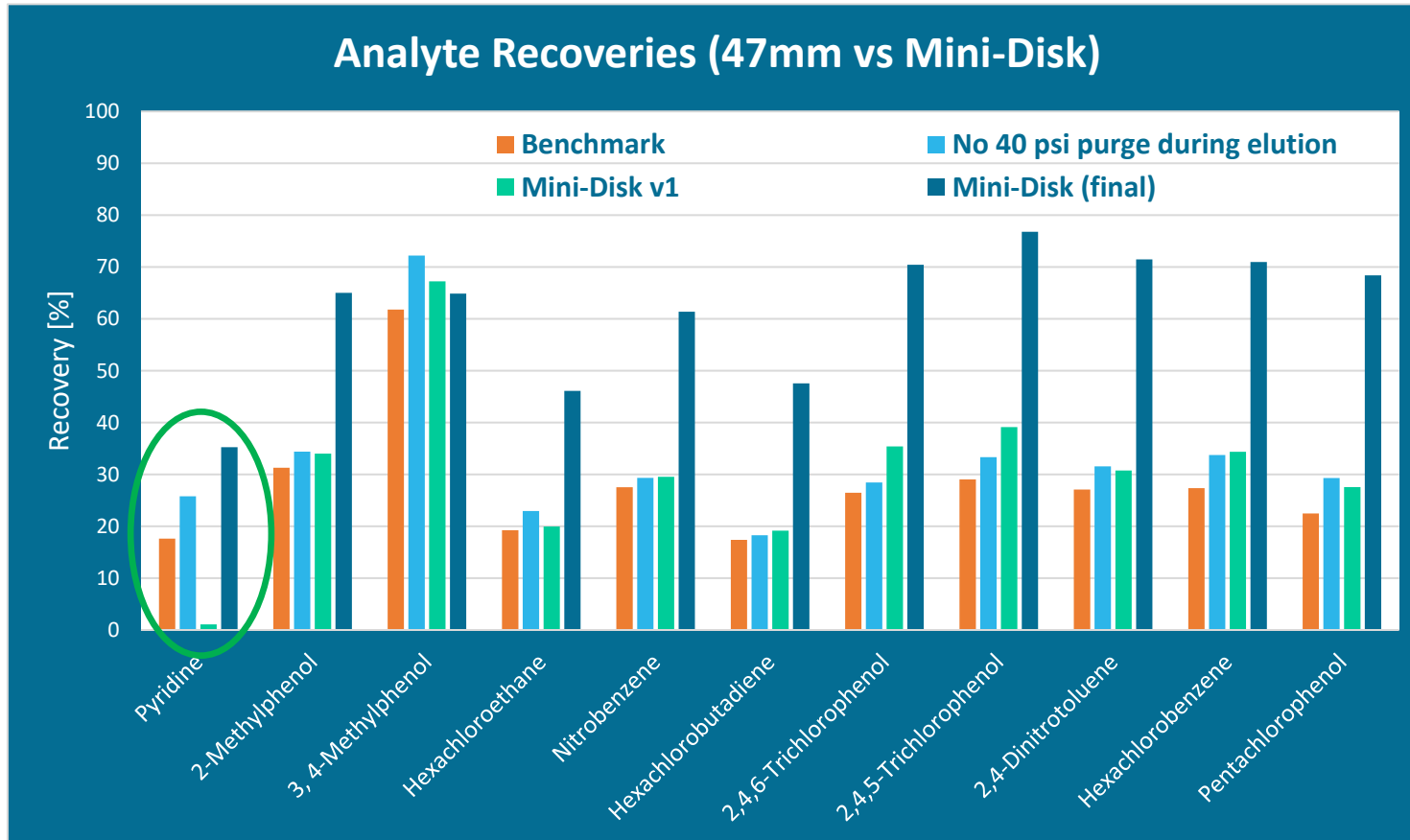


Mixed-Mode Mini-Disk (v1)

- Good acidic and neutral recoveries
- No pyridine recovery



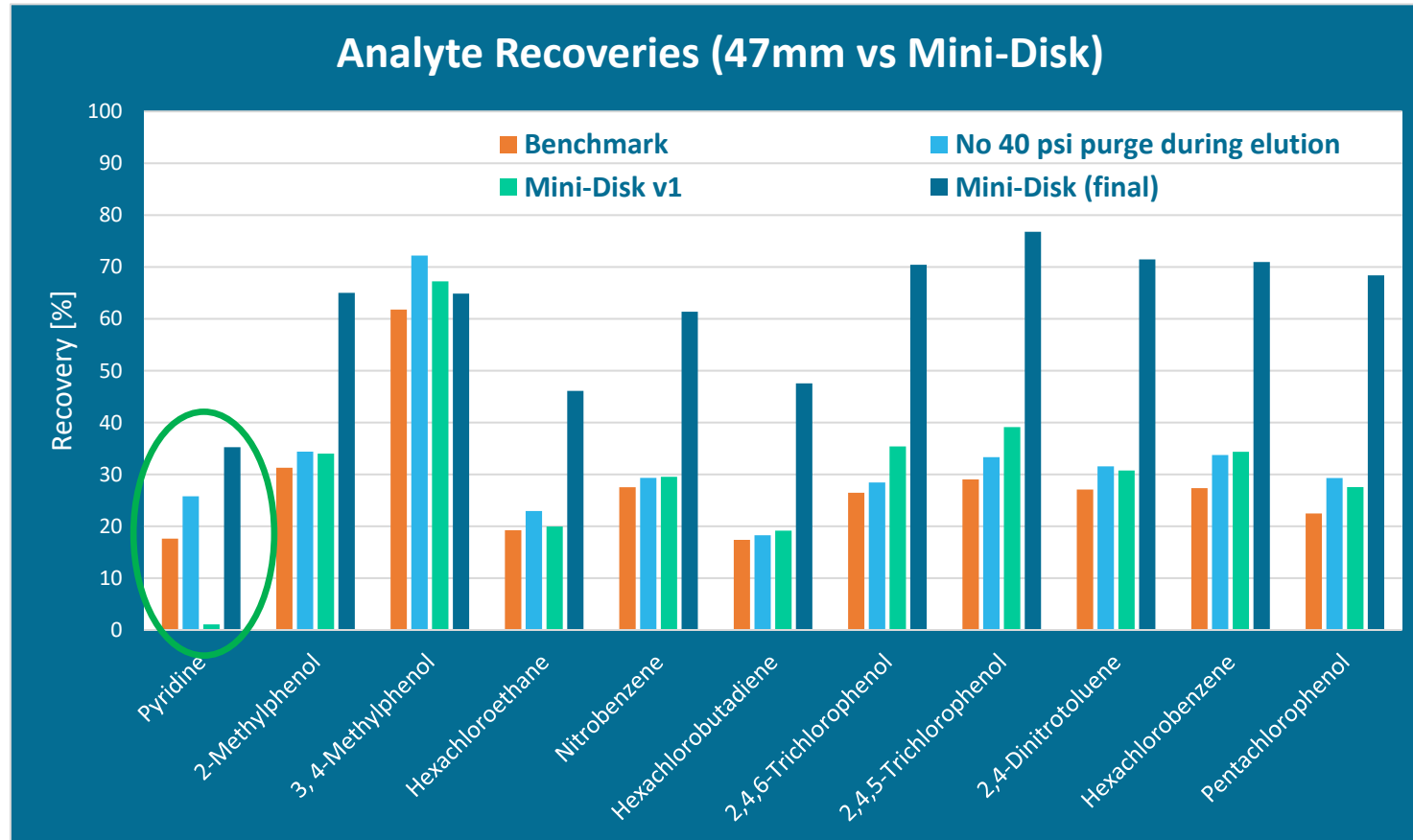
TCLP Semi-volatiles – Mini-Disk



Mixed-Mode Mini-Disk (v2)

- Significant improvements to Pyridine
 - ~18% recovery on **Benchmark**
 - ~25% on **SPE-03 + 47-mm disk**
 - >30% on **SPE-03 + Mini-disk**

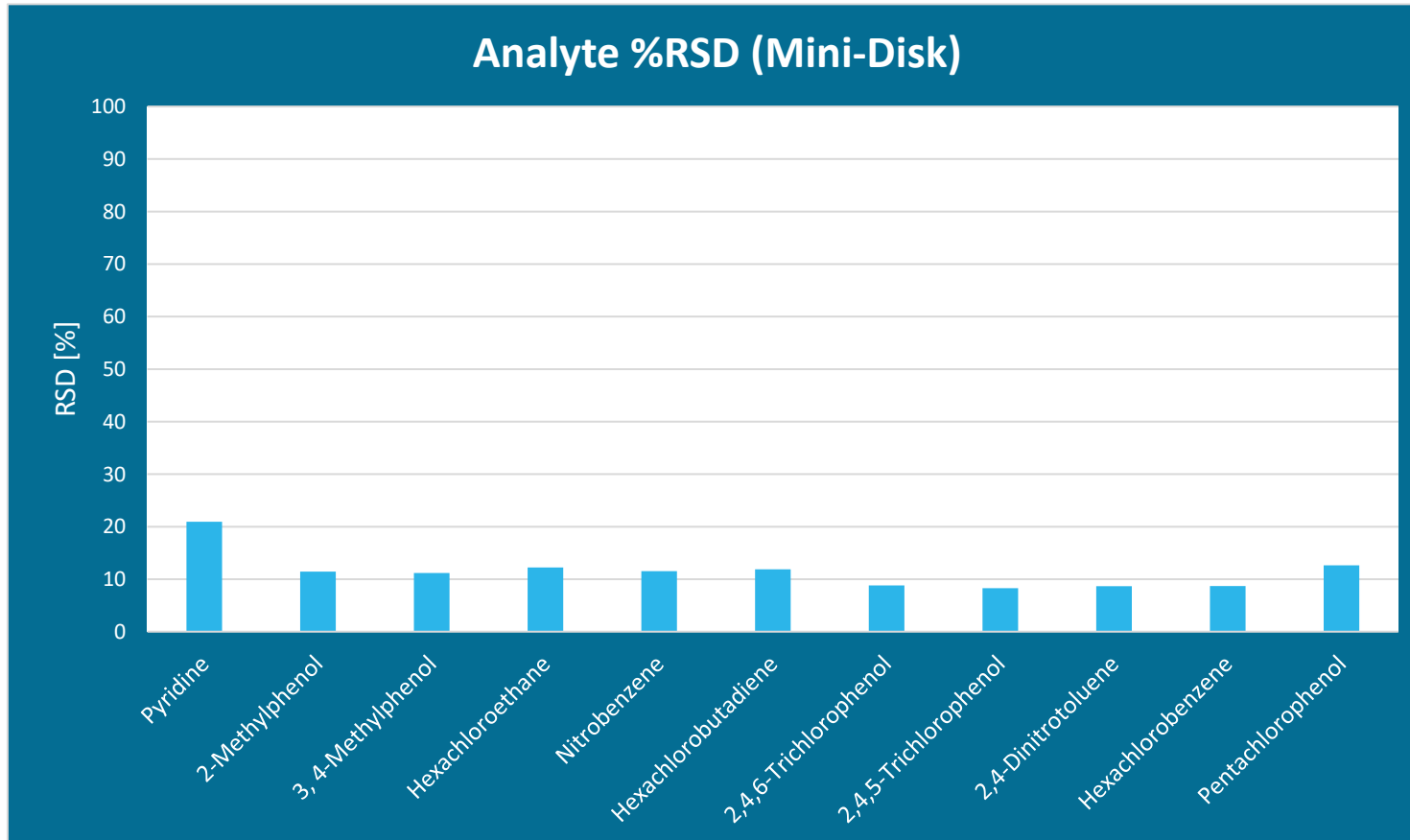
TCLP Semi-volatiles – Mini-Disk



Mixed-Mode Mini-Disk (v2)

- Significant improvements to Pyridine
 - ~18% recovery on **Benchmark**
 - ~25% on **SPE-03 + 47mm disk**
 - >30% on **SPE-03 + Mini-disk**
- Other compounds (except 3,4-Methylphenol)
 - 17-31% recovery on **Benchmark**
 - 18-34% on **SPE-03 + 47mm disk**
 - 46-77% on **SPE-03 + Mini-disk**

TCLP Semi-volatiles – Mini-Disk



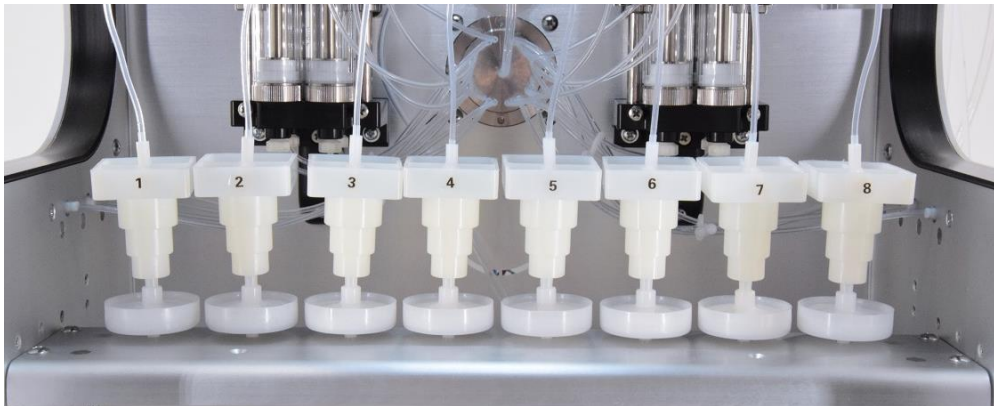
Mixed-Mode Mini-Disk (v2)

- 16 LCS across 8 extractions
- RSD <13% for acidic and neutral compounds
- 21% RSD for Pyridine

EPA Method 525.2 Compounds – Mini-Disk

MD-525-30

- **100 mins for 8 x 950 mL samples**
- Condition with 5mL of DCM, EtAc and MeOH
- Load sample at 55 mL/min
- Elute with 7.5 mL of EtAc and 5 mL of DCM



Pesticides		
Analytes	Recovery	RSD
Aldrin	86.2	1.5
Hexazinone	137.4	3.3
4,4-DDD	126.8	5.5
4,4-DDE	94.9	1.6
4,4-DDT	88	10.4
Alachlor	100.6	0.6
Ametryn	98.7	2.9
Atraton	77.6	2
Atrazine	102.3	1
Bromacil	97.1	2.2
Butachlor	109.7	0.3
Butylate	94.9	1.1
Carboxin	98.9	7
gamma-Chlordane	98.9	12.7
trans-Chlordane	90.7	10.4
alpha-Chlordane	62.2	8.5
Chlorneb	104.2	0.6
Chlorobenzilate	124.4	10.6
Chlorothalonil	106.4	3.3
Chlorpropham	105.3	4.4
Cycloate	98.9	2
Dacthal	101.2	3.2
Dieldrin	97.3	0.8
Diphenamid	105.1	0.9
Endosulfan I	95.3	2.8
Endosulfan II	106.8	9.3
Endosulfan Sulfate	112.5	9.2
Endrin	128.3	9.4
Endrin Aldehyde	100.9	15.6
EPTC	96.4	1.9
Etridiazole	109.3	0.6
Fenarimol	122.3	3
Fluridone	115.6	6.4
Heptachlor	91.6	22.7
Heptachlor Epoxide	85.9	12.1
Hexachlorocyclopentadiene	75.4	21.9
alpha-BHC	101.8	0.5
beta-BHC	104.2	2.6
delta-BHC	101.9	2.2
gamma-BHC	104.1	1.3
HCCPD	75.4	21.9
Lindane	106	2
Methoxychlor	112.6	9.5
Metolachlor	105.5	1.9
Metribuzin	99.3	2
MGK-264 B	102.1	5.6
MGK-264A	101.5	12.5
Molinate	100.1	1.5
Napropamide	108.7	1.3
Norflurazon	113.2	9.3

Pesticides (continued)		
Analytes	Recovery	RSD
Pebulate	102.1	0.7
Pentachlorophenol	76.7	5.5
Permethrin, cis	109.5	4.2
Permethrin, trans	106.2	4
Prometon	94.3	3.3
Prometryn	100.3	2.6
Pronamide	100	1.9
Propachlor	98.7	1.9
Propazine	106.3	3.5
Simazine	93.3	2.1
Simetryn	86.1	2.2
Stirofos	109.9	17.8
Tebuthiuron	92.2	4.2
Treacle	89.5	3.6
Terbutryn	103.6	0.7
Triademefon	108.3	4.2
Tricyclazole	124.5	5.6
Trifluralin	88.8	1.7
Vernolate	95.6	1.4
PAHs		
Acenaphthylene	101.3	1
Anthracene	102.4	2.5
Benzo(a) anthracene	102.5	1.9
Benzo(a) pyrene	117.9	2.2
Benzo(b) fluranthene	117.6	7.1
Benzo (g,h,i) perylene	88.2	2.1
Benzo (k) fluoranthene	103.7	0.6
Chrysene	102.5	1.9
Dibenzo(a,h) anthracene	86.1	2.9
Fluorene	102.1	1
Indenopyrene	89.9	4.7
Perylene-d12	112.4	12.1
Phenanthrene	94.8	1.9
Pyrene	101.7	1.3
Phthalates, Adipates, others		
Butylbenzylphthalate	124.1	7
Di 2-ethylhexyl adipate	109	9.2
Di 2-ethylhexyl phthalate	124.3	5.7
Diethylphthalate	91.4	3.6
Dimethylphthalate	105.7	0.9
Di-n-butylphthalate	114.7	4
1,3-Dimethyl-2-Nitrobenzene	96.8	2.2
2,4-Dinitrotoluene	96.9	4.4
2,6-Dinitrotoluene	101.9	16
Hexachlorobenzene	85.7	14.5
Isophorone	91.9	4.6
Triphenyl phosphate	86.3	22.9

Conclusion

Mini-disk

- High speed
- Compact
- Low solvent use
- Good recoveries



Conclusion

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- Customizability



Conclusion

Mini-disk

- High speed
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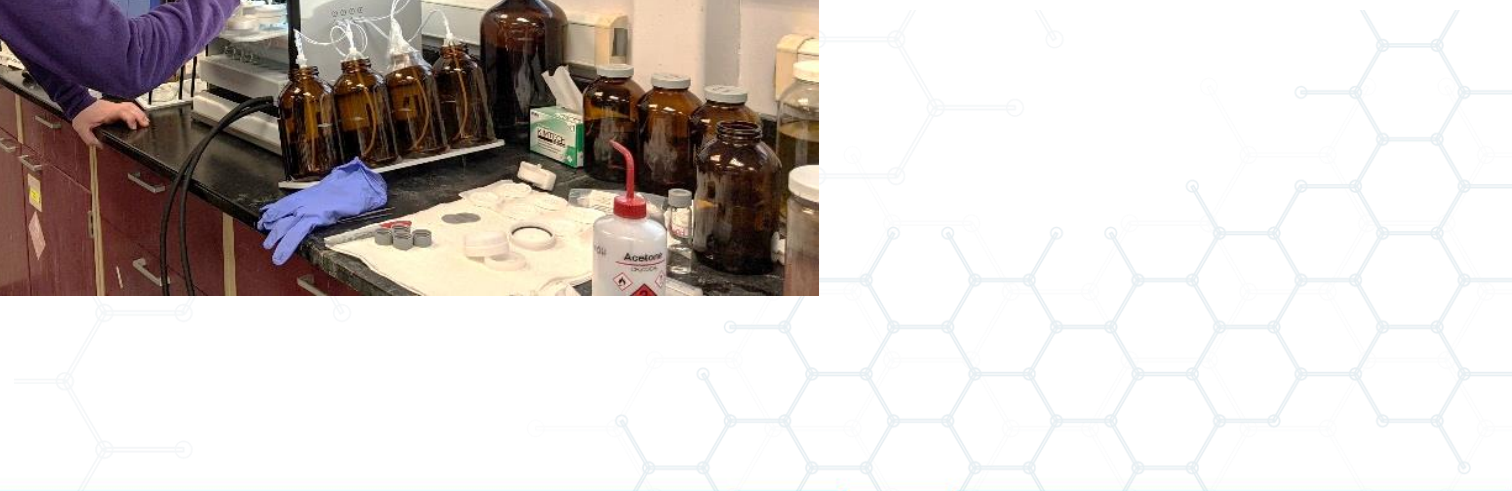
SPE-03

- 8-Channel system
- Mini-disks
- SPE Cartridges
- 47-mm disks



Acknowledgements

Merit Laboratories



Questions?

- ian_wan@promochrom.com
- www.promochrom.com



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