# Employing a **Novel SPE Mini-Disk and Solid Phase Extraction System** to Maximize the Efficiency of extracting **Organic Compounds**

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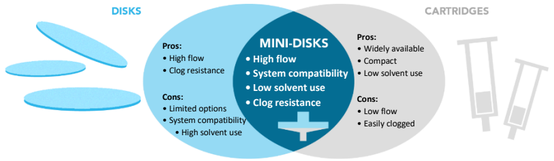
## ABSTRACT

Using **Mini-disks** to capture the advantages of:

- **SPE disks** in extraction speed and clogging resistance
- **SPE cartridges** in system compatibility and low solvent use



While eliminating their shortcomings.





## INTRODUCTION

Solid phase extraction **(SPE)** is the most time-consuming process in the analysis of large volume water samples. Majority of SPE are performed using SPE cartridges, even though SPE disks offer higher flow rate and clogging resistance. This is due in part to the higher cost and solvent usage. In addition, SPE disks require more complicated mounting with holders and screens which limit their ease-of-use.

To capture the advantages of SPE disks in speed and overcome the shortcomings in solvent consumption, PromoChrom developed a suite of **Mini-disks**. The Mini-disks come in a format similar to a 30-mm syringe filter for easy attachment and a cross section area 5 times of a 6-mL SPE cartridge. The increased cross-section area and optimized sorbent properties enable the Mini-disks to work with much higher flow rates than SPE cartridges. The small format keeps solvent use similar to cartridges.

To further enhance extraction efficiency and automation, PromoChrom introduced the new **Presto 8-Channel accelerated SPE system** which features continuous pumps designed for high flow applications. This poster discusses the extraction of **TCLP Semi-volatile Organic Compounds (SVOCs) in leachate** and **Brevetoxins in seawater** using Mixed Mode and C18 Mini-disks with the SPE-03 and Presto.

***Figure 1*** *- Presto Accelerated SPE System*

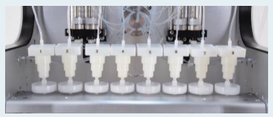


***Figure 2*** *- Mini-disks within the Presto*

## TCLP SEMI-VOLATILE COMPOUNDS

Merit Laboratories was extracting TCLP SVOCs using 47-mm disks and a vacuum-based extractor, hereon referred to as the "benchmark". To overcome the limitations in sample throughput and variations in extraction time, PromoChrom's MD-BNA-30 Mini-disk and SPE-03 8-Channel extractor were introduced. While 47-mm disks require disk holders, the Mini-disks come pre-packaged for direct connection to the SPE-03 or any standard luer connector.

## MATERIALS

- Mini-disk: PromoChrom Mini-disk with mixed-mode polymers for extracting acidic, basic and neutral compounds (Cat. No.: MD-BNA-30)
- Extractor: SPE-03 8-channel SPE system with MOD-00P configuration
- Instrument for analysis: Agilent GCMS

## METHOD

The SPE-03 was first validated using 47-mm disks to achieve similar results to the benchmark. The method was developed based on the benchmark using similar amounts of conditioning and elution solvents. PromoChrom's mixed-mode Mini-disks were then introduced following similar extraction parameters.

## RESULTS

The Mini-disk results were taken from LCS and LCS duplicates across 8 different extraction batches on different days.

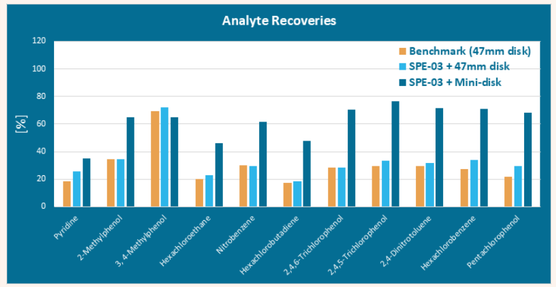



***Figure 3*** *– TCLP Sem-volatiles extracted on the SPE-03 vs Benchmark*

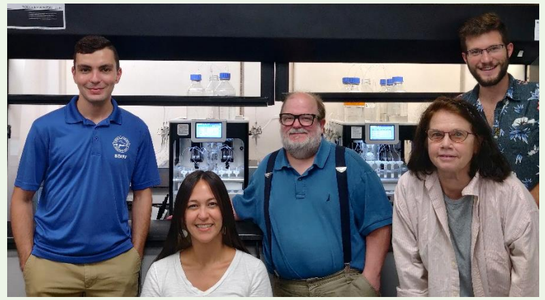
As shown in the Figure 3, recoveries comparable to the benchmark (orange) was achieved by the SPE-03 using 47-mm disks (light blue). In comparison, The MD-BNA-30 Mini-disk (dark blue) demonstrated a significant improvement in overall analyte recoveries. The basic compound, Pyridine, has also been a challenging analyte in the past due to its low recoveries, which saw more than 30% improvement on the Mini-disk. The improved performance of the Mini-disk is attributed in part to the optimized sorbent proportion, flow design within its housing and smaller disk area also allows for easier conditioning, drying and elution.

## HANDLING CHALLENGING SAMPLES

Since April 2024, Merit Labs has installed a Presto accelerated SPE system to run alongside their SPE-03. While achieving comparable results**, the Presto reduces the extraction time by 50%** and has shown further resilience towards dirty samples.

## BREVETOXINS IN SEAWATER

Prior to its release, PromoChrom's Presto system was Beta-Tested in a variety of conditions at the Mote Marine Lab in Florida. Additionally, PromoChrom's C18 and mixed-mode Mini-disks were compared to their original 3 mL C18 SPE cartridges for the extraction of brevetoxins in salt water.



## MATERIALS

- SPE Media: PromoChrom C18 Mini-disk (Cat. No.: MD-C18-30) and Mixed-Mode Mini-disk (Cat. No.: MD-525-30), C18 3 mL 200 mg SPE cartridge
- Equipment for Extraction: Presto 8-channel Accelerated SPE System
- Instrument for analysis: Agilent LCMSMS

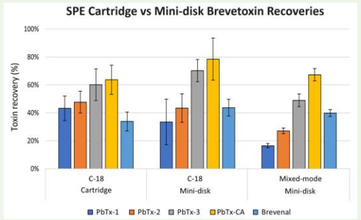
## METHOD

The extraction of brevetoxins involve conditioning the SPE media with 5 mL of MeOH followed by 5 mL of water. 500 mL of aqueous samples are then loaded before the SPE media is dried with air or nitrogen for 9 minutes. Finally, 12 mL of MeOH is used to elute the SPE media and collect the fractions for analysis.

The lab was originally using the SPE-03 system with 3 mL SPE cartridges at a slow flow rate of 5 mL/min. Using the Presto with C18 Mini-disks, the flow rates were increased to 50mL/min for conditioning and sample loading, while elution was performed at 60mL/min.

## RESULTS

The C18 Mini-disk performed similarly to the SPE cartridges, whereas the Mixed Mode Mini-disk had lower recoveries overall. There was substantial time savings achieved by utilizing the Mini-disks in conjunction with the Presto system, with extraction times for a 500mL sample dropping from >2 hours to just 45 minutes.



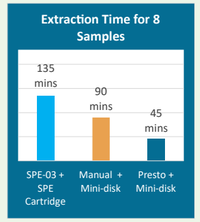




***Figure 4*** *– Brevetoxin extraction recoveries and time using cartridge vs Mini-disk*

## HANDLING CHALLENGING SAMPLES

PromoChrom's Anti-clogging Tips attached to the sample lines of the Presto system allowed smooth extraction of seawater samples filled with substantial quantities of sediment and algae. The extractor also includes pressure and flow regulation to maintain flow rate within an acceptable pressure range. According to Mote, processing speed was consistent at 50 mL/min, and did not affect recovery.

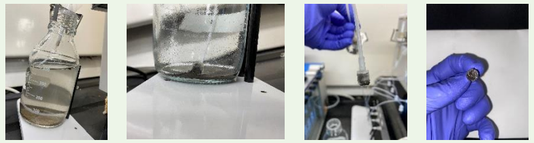


***Figure 5*** *– Using Anti-clogging Tips for seawater samples with sediment and algae*


## ACKNOWLEDGEMENTS

We would like to thank Merit Labs and Mote Marine labs for conducting the Beta-Test of our Presto system with Mini-disks and generously sharing with us their results.