Automation of Sample Preparation

SPE-03

8-Channel System

PROMOCHROM TECHNOLOGIES

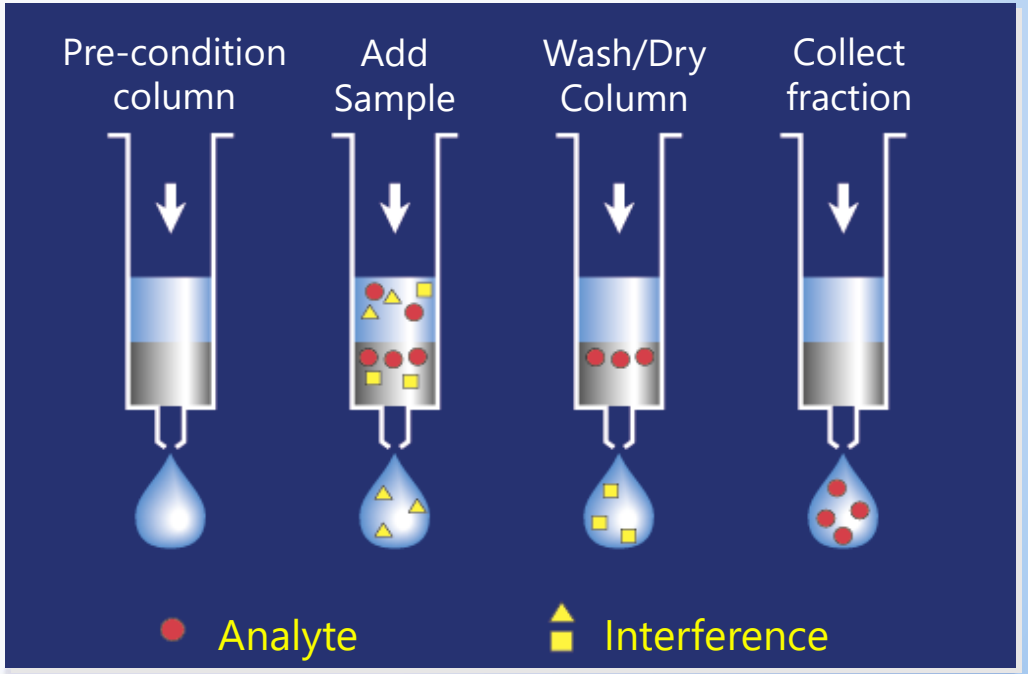
Purpose of Sample Preparation

- Remove Interference from instrumental analysis
- Enrich analytes for lower detection limit
- Convert analytes to a form suitable for analysis

Solid Phase Extraction

- Common method for extraction and clean up
- Much lower solvent usage than liquid/liquid extraction
- Cleaner extracts, less matrix effects

Basic steps of Solid Phase Extraction



Challenges of Manual SPE

Time Consuming – requires constant supervision

Tedious – many steps for conditioning/loading/elution

Challenging – maintaining flow rates, SPE cartridge clogging

Low throughput – 1-2 batches/shift, 4-12 samples/batch

Human Error – inconsistent results, mistakes during extraction

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Automated SPE

Push start and walk away
All conditioning/loading/elution/bottle rinsing steps automated
Constant flow rates, much higher resistance to clogging
Up to 4 batches/shift, 8 samples/batch with 1 system
Consistent results and extraction time, no mistakes

SPE-03 vs Other SPE Systems

SPE-03	Other Systems
8-Channel	1 to 6 Channels
Patented multi-channel valve technology – two valves to handle all 8 samples	Conventional valves – three 3-way valves required for each channel, 24 valves for 8 samples
Compact footprint (34cm x 34cm x 45cm)	Much larger footprint, cannot fit fume hood
Up to 2 fractions per sample	Usually 1 fraction
All steps are performed in parallel	Some only perform sample loading in parallel, conditioning/elution in series
Automated sample bottle rinsing	Requires system pause and manual rinsing
Built-in touch screen computer – up to 100 methods, 100 lines per method, exportable	Requires external computer
Compatible with 1/3/6mL SPE cartridges (other sizes customizable)	Requires separate adapters for 1/3/6mL SPE cartridges

Working Principle

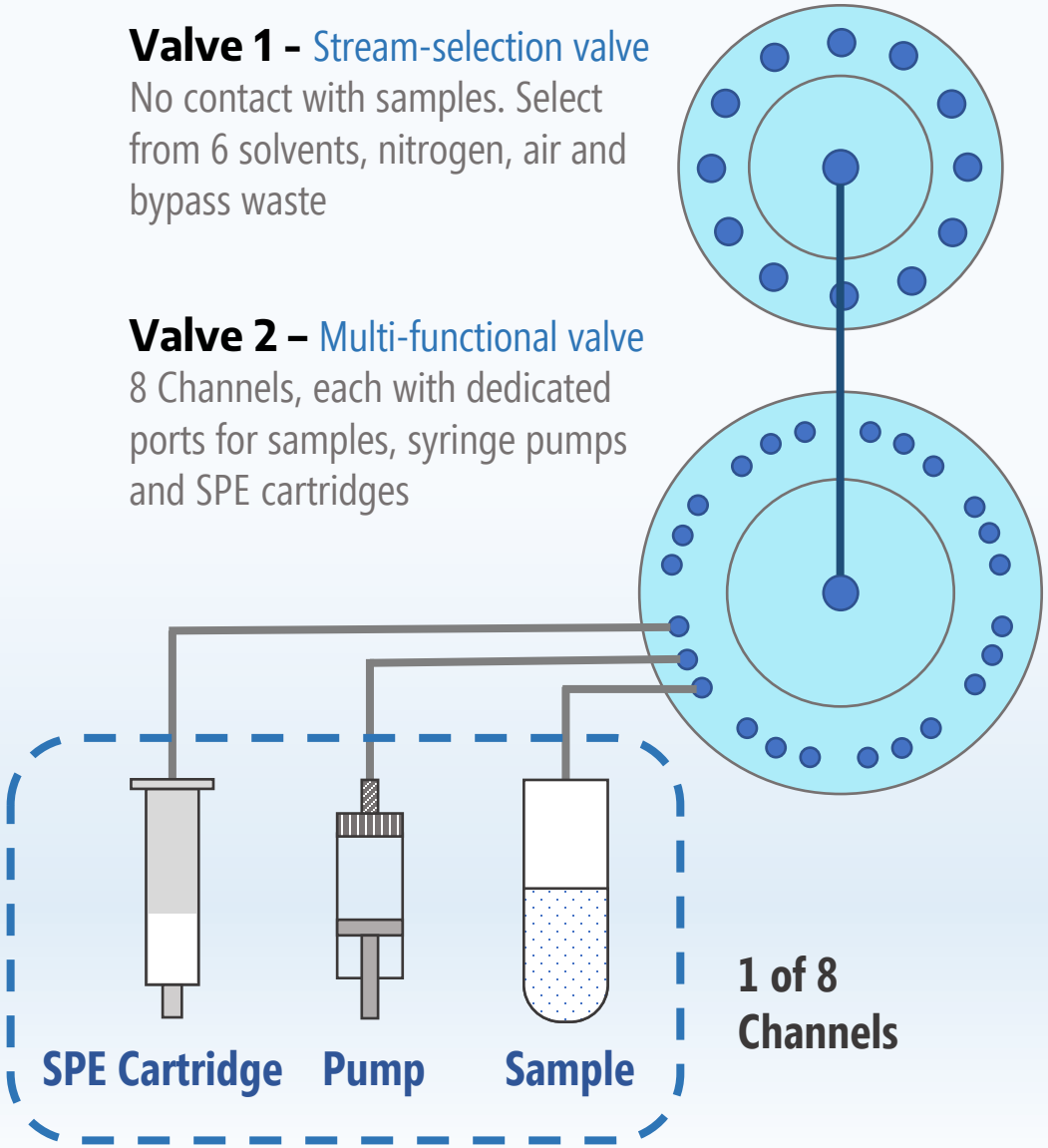
flexible • compact • isolated

Patented Valve Design to Achieve Complex Liquid Handling

PromoChrom's multi-functional valve is based on our flow-path-integration technique. The function of one such valve is equivalent to several normal stream selection valves and isolation valves, keeping the design compact and easy to maintain.

Valve 1 – Stream-selection valve
No contact with samples. Select from 6 solvents, nitrogen, air and bypass waste

Valve 2 – Multi-functional valve
8 Channels, each with dedicated ports for samples, syringe pumps and SPE cartridges



User Interface

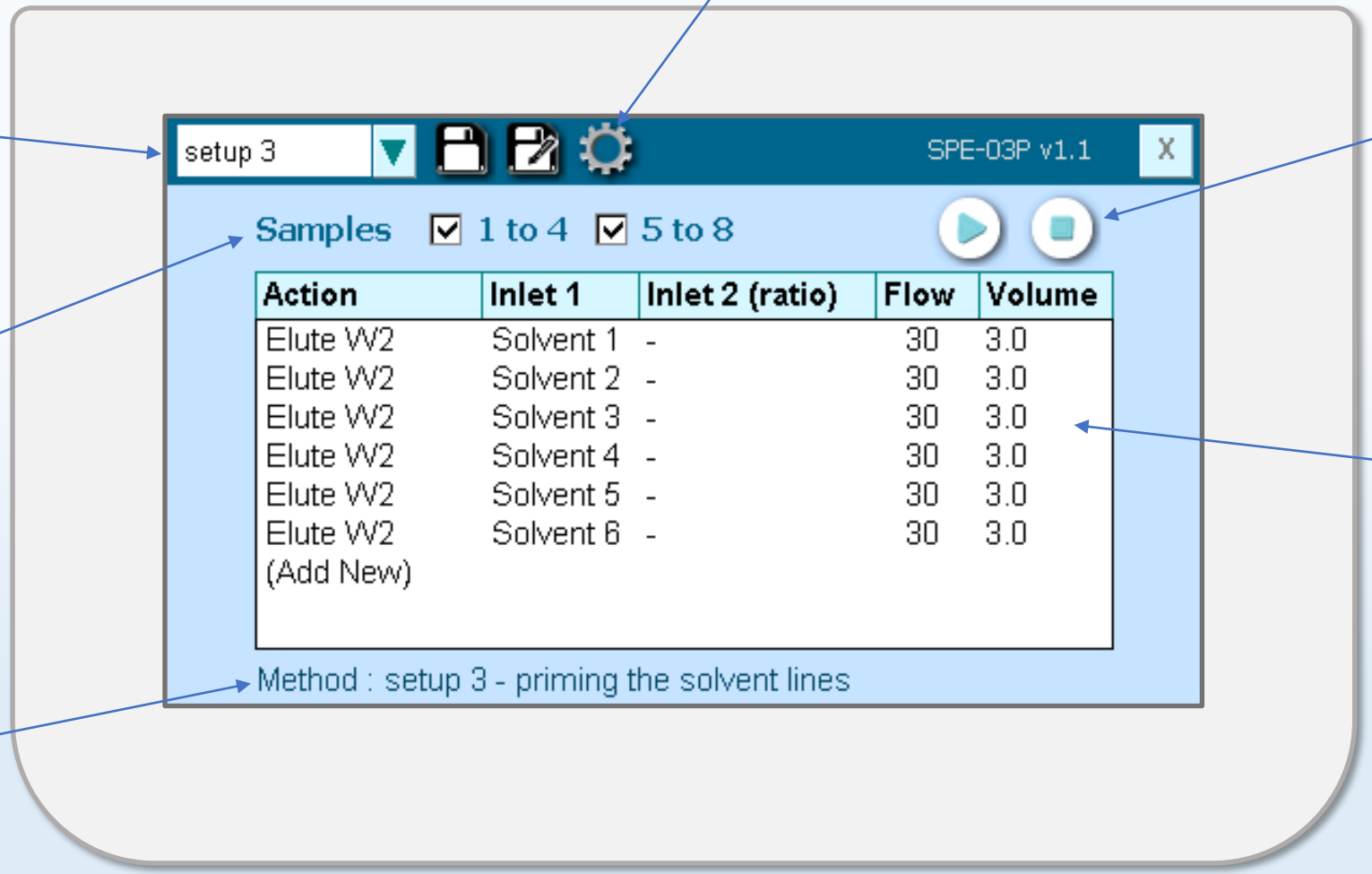
computer-free • intuitive • simple

Step 1. Choose method
Step 2. Press start

Settings and direct control

Access different methods

Start/Stop/Pause



Select which samples to run

View and edit all method steps directly

Method name and description

Water
- Drinking, Ground, Surface, Waste

PFAS, Pesticides, Drugs, PAHs, PCBs

Extract Clean Up
- Solid, Biosolid and Soil samples

PFAS, EPHs, PPCPs

Marine Diesel Oil, Jet Fuel

Saturated hydrocarbon, aromatic hydrocarbon, polar components

Applications

Food/Feed

Mycotoxins, pesticides

Protein Purification

Antibodies, antigens, metabolites

Application Example – PFAS in Drinking Water

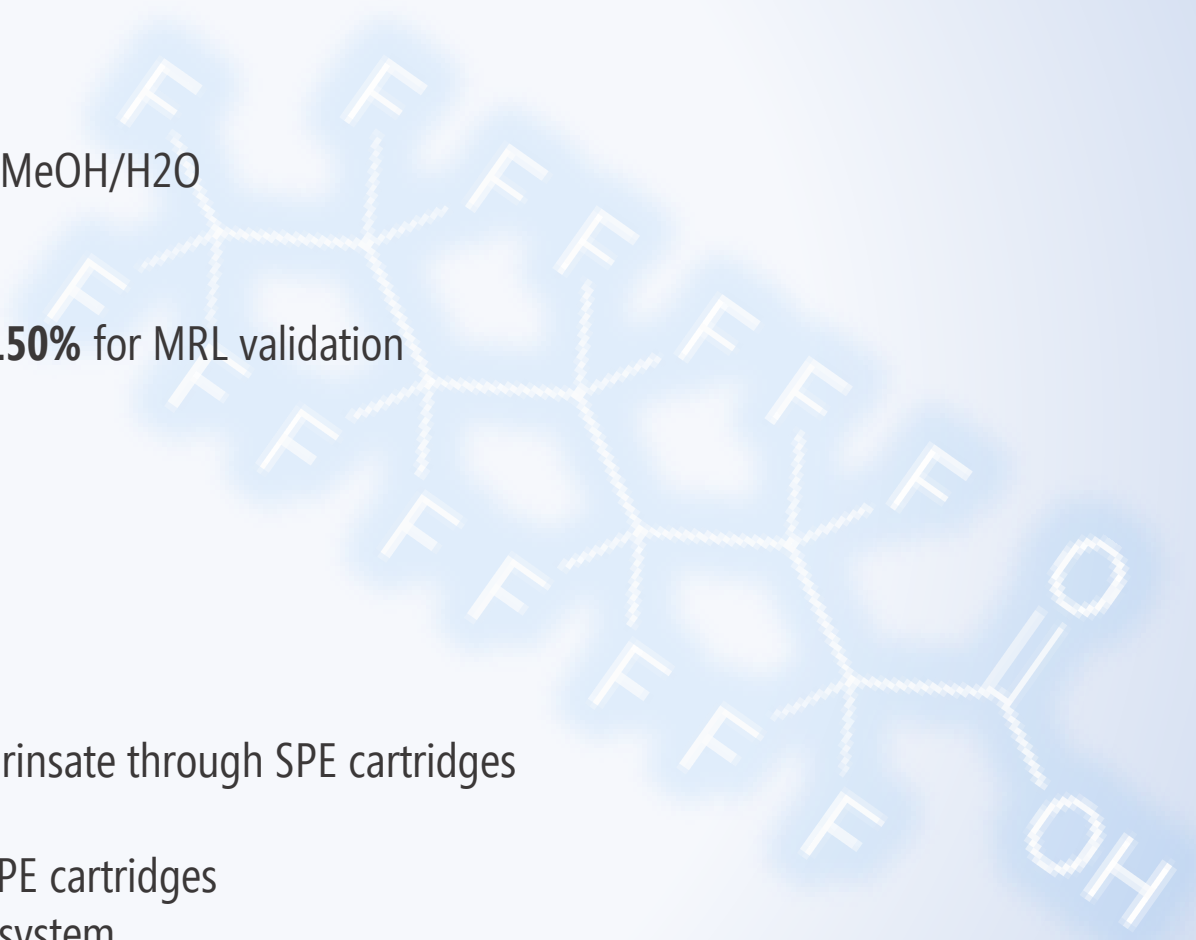
EPA Method 537.1 | **EPA Method 533** | **DOD** | **ISO 21675** | **Modified & Proprietary Methods**

- MOD-005 Minimal-Teflon configuration achieving low background
- MOD-004 Automated sample bottle rinsing – a step required by most PFAS methods
- Up to 6 solvents – enough to perform any PFAS method
- Used by the largest commercial labs, government labs and universities in USA
- Can also perform clean up after extraction of PFAS from solids, biosolids and soil samples

Application Example – EPA Method 537.1

Method Details

- Looking at 18 PFAS compounds in drinking water
- 250mL samples extracted using 6mL 500mg SDVB cartridges
- Extracts evaporated to dryness and re-constituted to 1mL 96:4 MeOH/H2O
- Run extracts on LC-MSMS
- System background requirement **<1/3 MRL**
- System recovery requirement **70% - 130%** for IDC and **50% - 150%** for MRL validation



Extraction Steps

- Precondition with 15mL MeOH, followed by 15mL H2O
- Add 3mL H2O
- Load sample at 10-15mL/min
- Rinse sample bottles with 2 aliquots of 7.5mL H2O and deliver rinsate through SPE cartridges
- Dry SPE cartridges for 5mins
- Rinse sample bottles with 2 aliquots of 4mL MeOH and elute SPE cartridges
- Extraction time of 8 samples takes ~75 minutes on the SPE-03 system

Application Example – EPA Method 537.1

System Background

- Most labs in USA have 2ppt MRL
- Background requirement is <1/3 MRL, ie. < 0.667ppt, all compounds fall well below this limit

Initial Demonstration of Low System Background - 8 x LRBs

Requirements: For 2ppt MRL, background must be < 0.667ppt

Compound	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos7	Pos 8
PFBS	ND	ND	ND	ND	ND	ND	ND	ND
PFHxA	ND	ND	ND	ND	ND	ND	ND	ND
HFPO-DA (GenX)	ND	ND	ND	ND	ND	ND	ND	ND
PFHpA	ND	ND	ND	ND	ND	ND	ND	ND
PFHxS	ND	ND	ND	ND	ND	ND	ND	ND
ADONA	ND	ND	ND	ND	ND	ND	ND	ND
PFOA	0.060	0.036	0.052	0.007	0.076	0.072	0.012	0.006
PFOS	ND	ND	ND	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND	ND	ND
9Cl-PF3ONS	ND	ND	ND	ND	ND	ND	ND	ND
PFDA	ND	ND	ND	ND	ND	ND	ND	ND
NMeFOSAA	ND	ND	ND	ND	ND	ND	ND	ND
PFUnA	ND	ND	ND	ND	ND	ND	ND	ND
NEtFOSAA	ND	ND	ND	ND	ND	ND	ND	ND
11Cl-PF3OUdSND	ND	ND	ND	ND	ND	ND	ND	ND
PFDoA	ND	ND	ND	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND	ND	ND	ND
PFTA	ND	ND	ND	ND	ND	ND	ND	ND

* Results obtained from customer lab during on-site system installation

Application Example – EPA Method 537.1

System Recovery

- IDC requires **70%-130%** and RSD **<20%**
- MRL requires **50%-150%**

IDC - 4 x 50ppt LFBs

Requirements: 70% - 130%, RSD < 20%

Compound	%Recovery	%RSD
PFBS	84	5.16
PFHxA	93	7.81
HFPO-DA (GenX)	95	6.59
PFHpA	104	8.71
PFHxS	99	1.81
ADONA	101	4.92
PFOA	104	5.60
PFOS	95	3.98
PFNA	105	4.73
9Cl-PF3ONS	96	1.88
PFDA	96	8.48
NMeFOSAA	101	3.93
PFUnA	96	6.78
NEtFOSAA	101	1.26
11Cl-PF3OUdS	86	1.84
PFDoA	87	4.83
PFTrDA	89	7.81
PFTA	85	10.11

MRL - 7 x 2ppt LFBs

Requirements: 50% - 150%

Compound	%Recovery	%RSD
PFBS	100	5.69
PFHxA	101	4.77
HFPO-DA (GenX)	97	5.14
PFHpA	111	5.02
PFHxS	104	3.79
ADONA	101	5.92
PFOA	112	8.08
PFOS	102	2.24
PFNA	105	7.59
9Cl-PF3ONS	96	2.95
PFDA	96	8.52
NMeFOSAA	98	5.56
PFUnA	100	5.47
NEtFOSAA	103	4.21
11Cl-PF3OUdS	95	6.38
PFDoA	95	12.66
PFTrDA	95	11.45
PFTA	92	5.99

* Results obtained from customer lab during on-site system installation

Full SPE-03 Specifications

No. of Samples	8 in parallel
No. of fractions	2
No. of waste channels	2
No. of solvents	6
Sample volume	0.5 – 4000 mL
Fraction volume	Up to 50 mL
SPE cartridge size	1/3/6 mL (Customizable)
Flow rate	0.5 – 100 mL/min
Fluid delivery	Positive pressure
Display	5″ resistive touch
No. of methods	100
Method actions	Cartridge pre-condition/soak/wash, add sample, elution, sample bottle rinsing, sample bottle shaking, sample line cleaning, air purge, solvent mixing, nitrogen dry, pause
Dimensions	34 cm x 34 cm x 45 cm
Weight	13 kg
Power	1.5 A @ 24 VDC

Configuration Options

MOD-003	**SPE Disk Kit** Expansion for using 47mm disks, option only available with MOD-00P. Includes disk rack and 8 x disk holders.
MOD-004	**Sample Bottle Rack** For automated sample bottle rinsing, recommended for up to 250mL bottles. Includes 2 racks and 8 x bottle rinsing adapters.
MOD-005	**Minimal-Teflon Option** For PFAS applications. Replaces all PTFE tubing.
MOD-00P	**Volume-Matrix Plus Option** Automated sample bottle rinsing with separate sample and rinse lines to handle tough matrices. Recommended for 500mL to 4L samples that require bottle rinsing or sample filtration.

MOD-003

MOD-004

MOD-00P