

Thermo Scientific
SOLA μ SPE Plates
Technical Guide

Consistent excellence
for bioanalysis

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SOLA μ - delivering reproducible low volume extractions. Everytime!

Thermo Scientific™ SOLA μ ™ plates are designed for bioanalytical and clinical research analyst's who require cleaner, highly reproducible and robust sample extraction at very low sample and solvent volumes in high throughput workflows. SOLA μ achieves this due to the unique and innovative frit-less SPE technology.

SOLA μ is the first micro elution product to truly meet the requirements of the bioanalyst.

Pharmaceutical and Biopharmaceutical analytical challenges

The modern bioanalytical and clinical research laboratory must provide high quality analytical results from complex biological samples in a high throughput environment while complying with strict legislation.

These demands are compounded by the continued drive to higher efficacy drugs and long acting formulations which continue to push the required quantification limits to lower levels. There is also the desire to take advantage of the replacement, refinement and reduction policy. The growth of biopharmaceuticals also brings into consideration additional analytical challenges such as solvation and non-specific binding.

What is required of the bioanalytical method to meet these demands?

- Robustness – low analytical failure rates
- Ability to process low sample volumes
- High sensitivity
- High reproducibility
- Ease of use
- High throughput processing
- Efficient and fast

The micro elution SPE format is uniquely positioned to deliver on these requirements.

The proprietary SOLA manufacturing process generates an SPE micro elution product which eliminates the issues with traditional loose-packed micro elution formats. By combining the support material and active media components into a solid uniform sorbent bed we remove the need for frits (Figure 1).

Stable and controllable flow through the SPE micro elution device is another key factor controlling reproducibility of the final analytical method. This is especially important in low bed weight devices where flow control is more difficult due to lower back pressure from the sorbent. The macro-porous structure found within SOLA μ is defined by a well controlled, reproducible manufacturing process which results in uniformity well to well, plate to plate and batch to batch. This provides an added advantage when dealing with viscous biological samples, preventing blocking and enabling high throughput processing of samples.

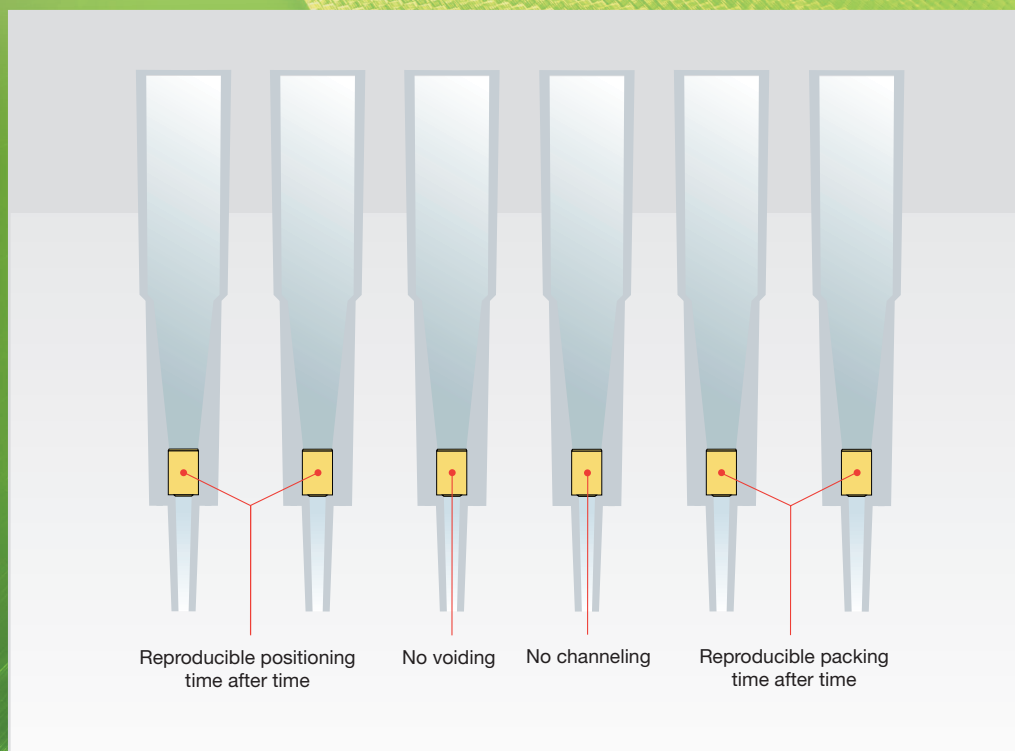


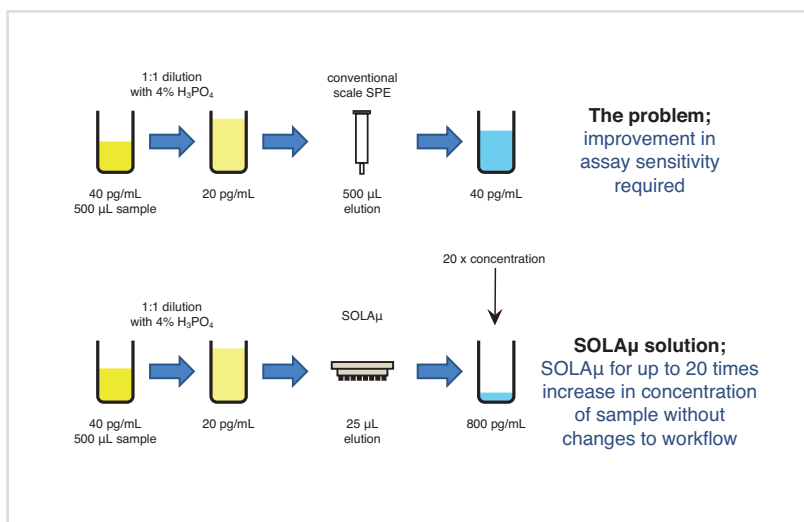
Figure 1: SOLA μ SPE design – limiting issues associated with conventional SPE formats

SOLA μ provides you with reproducible sensitivity

Concentration of a large sample volume to achieve quantitation limits

Up to 20 times increase in sensitivity can be achieved by loading a large volume of sample and eluting in a low volume.

In the following example 500 μ L human plasma was loaded onto the SOLA μ plate for the analysis of niflumic acid. The compound was eluted in 25 μ L providing a 20 times increase in concentration whilst maintaining excellent precision.



Sample preparation protocol

Sample pre-treatment

500 μ L of human plasma diluted 1:1 with 4% phosphoric acid

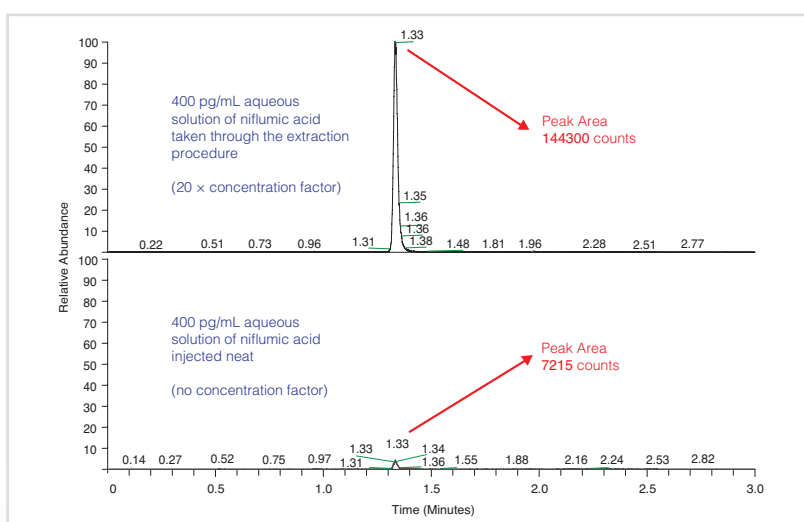
Sample preparation

Compound(s):	niflumic acid, niflumic acid d5 (IS)
Matrix:	human plasma
	SOLA μ WAX 96 well plate (60209-005)
Condition:	200 μ L methanol
Equilibrate:	200 μ L 4% phosphoric acid
Load:	apply sample at 0.5 mL/min
Wash:	200 μ L 25 mM ammonium acetate (pH4)
	200 μ L 70% methanol (pH4)
Elute:	2 \times 12.5 μ L 50/50 methanol/acetonitrile with 2% ammonia

Direct injection of eluent

HPLC system:	Thermo Scientific™ Dionex™ UltiMate™ 3000 RSLC system
Column:	Thermo Scientific™ Accucore™ RP-MS HPLC column 50 mm \times 2.1 mm 2.6 μ m (17626-052130)
Guard column:	Thermo Scientific™ Accucore™ RP-MS Defender™ guard cartridge (17626-012105) Thermo Scientific™ Uniguard™ drop-in guard holder (852-00)
Mass spec system:	Thermo Scientific™ TSQ Vantage™ Triple Stage Quadruple mass spec

Sample enrichment (20 x pre-concentration)



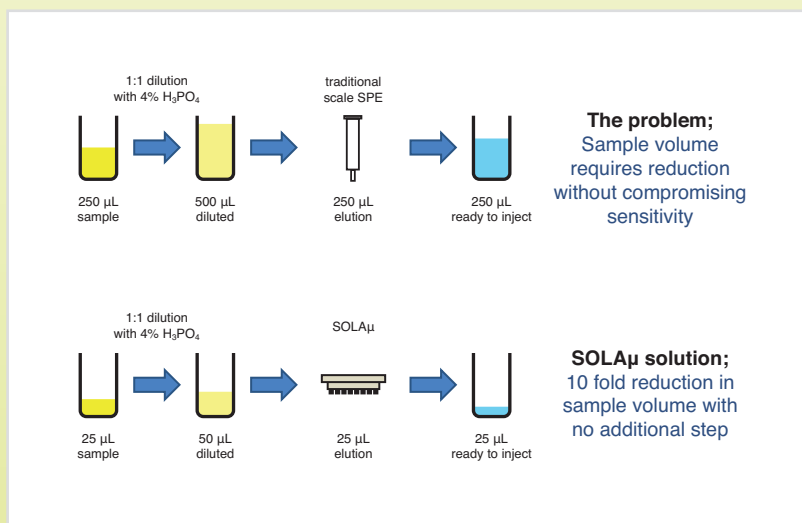
	Precision Data for Niflumic Acid Peak Area Ratio (%RSD) n = 18	Recovery of Niflumic Acid (%)	Matrix Effects (%)
QC Low (0.4ng/mL)	1.31	89.9	8.63
QC high (30ng/mL)	1.06	94.0	3.21

Precision, recovery and matrix effects data for niflumic acid at Low QC 10 ng/mL and High QC 750 ng/mL (n=18)

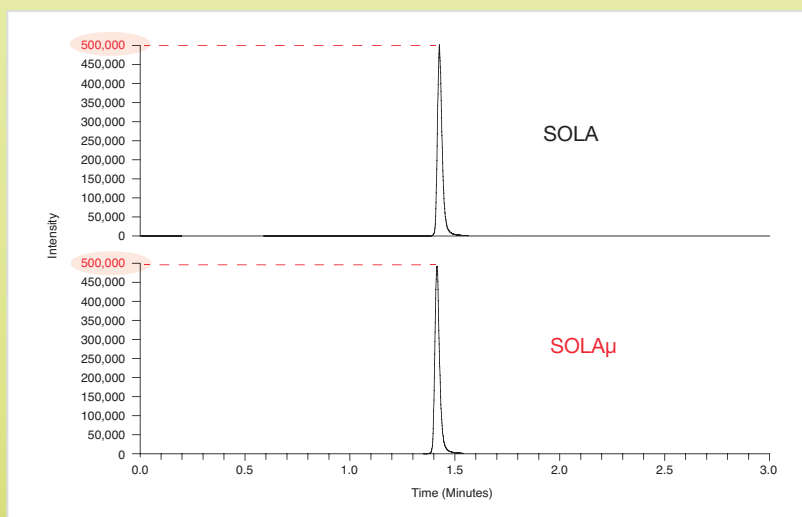
Sample limited assays or scaling down a conventional SPE method and obtaining equivalent sensitivity

SOLA μ allows users to directly scale down the volumes used in their analytical methods, allowing for a reduction in sample usage and eliminating issues caused by evaporation without compromising the sensitivity of their assay. This is also an important consideration when sample volumes are limited.

The following example shows that by loading 25 μ L of niflumic acid sample onto the SOLA μ plate and eluting in a total of 25 μ L a ten-fold decrease in sample volume was achieved when compared to a traditional scale higher bed weight product. Equivalent method performance and high levels of reproducibility provided by SOLA technology were still maintained.



Equivalency of results obtained with niflumic acid (500 ng/mL) extracted with 10 mg SOLA WAX using 250 μ L of sample and SOLA μ WAX using 25 μ L of sample.



Sample preparation protocol

Sample pre-treatment

500 μ L of human plasma diluted 1:1 with 4% phosphoric acid

Sample preparation

Compound(s):	niflumic acid, niflumic acid d5 (IS)
Matrix:	human plasma
	SOLA μ WAX 96 well plate (60209-005)
Condition:	200 μ L methanol
Equilibrate:	200 μ L water
Load:	apply 25 μ L sample at 0.5 mL/min
Wash:	200 μ L 25 mM ammonium acetate (pH4)
	200 μ L methanol
Elute:	2 \times 12.5 μ L methanol with 2% ammonia

Direct injection of eluent

HPLC system:	Thermo Scientific™ Dionex™ UltiMate™ 3000 RSLC system
Column:	Thermo Scientific™ Accucore™ RP-MS HPLC column 50 mm \times 2.1 mm 2.6 μ m (17626-052130)
Guard column:	Thermo Scientific™ Accucore™ RP-MS Defender™ guard cartridge (17626-012105) Thermo Scientific™ Uniguard™ drop-in guard holder (852-00)
Mass spec system:	Thermo Scientific™ TSQ Vantage™ Triple Stage Quadruple mass spec

Precision Data for Niflumic Acid

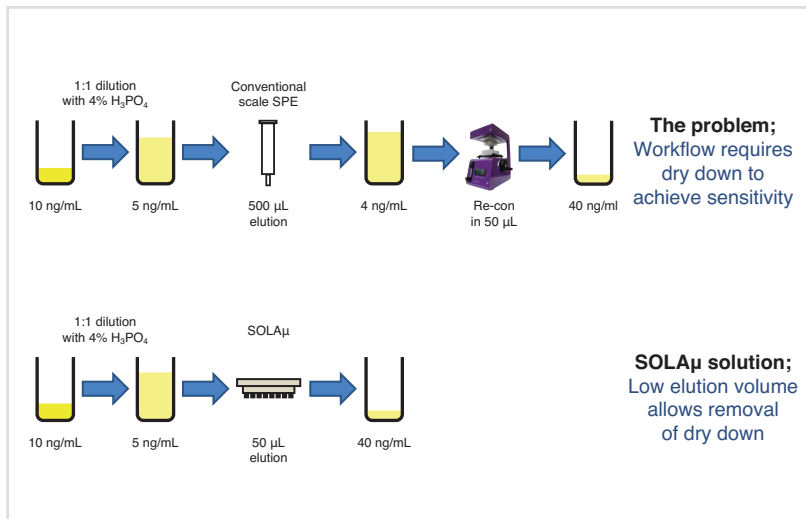
	Analyte Peak Area (%RSD)	Peak Area Ratio (%RSD)
Low QC	7.32	0.356
High QC	5.33	0.195

Precision data niflumic acid at Low QC 10 ng/mL and High QC 750 ng/mL (n=18)

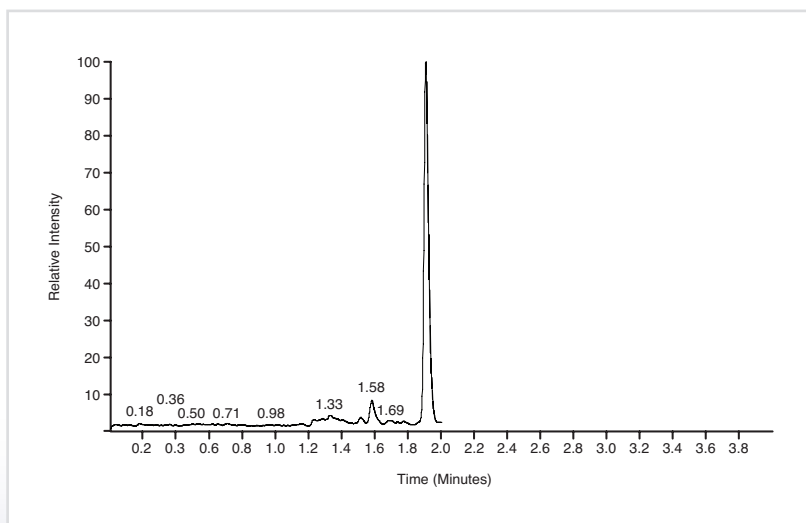
Extracting samples which are susceptible to solvation and non-specific binding issues

With traditional SPE the eluted sample is typically blown down to increase the concentration of the sample and thus improve the sensitivity. This causes an issue for certain compound types which can be lost during this step resulting in reduced sensitivity. SOLA μ allows the sample to be extracted without the need for dry down and reconstitution. Not only does this maximize recovery of the analytes it also improves workflow efficiency and increases productivity.

In the case of extraction of ibuprofen a four-fold pre-concentration was achieved without the need for dry down by loading 200 μ L of sample onto the SOLA μ plate and eluting in a total of 50 μ L. The results demonstrate that even with this low elution volume, excellent reproducibility was achieved.



Example chromatogram at quantitation limit of 10 ng/mL for ibuprofen



Sample preparation protocol

Sample pre-treatment

200 μ L of human plasma diluted 1:1 with 4% phosphoric acid

Sample preparation

Compound(s):	ibuprofen, ibuprofen d3 (IS),
Matrix:	rat plasma
	SOLA μ SAX 1 mL 96 well plate (60109-002)
Conditioning:	200 μ L methanol 200 μ L water
Application:	load sample at 0.5 mL/min
Washing:	200 μ L water with 1% NH ₄ 200 μ L methanol with 1% NH ₄
Elution:	2 \times 25 μ L 50/50 methanol/acetonitrile with 2% formic acid
Dilution:	add 50 μ L water to each sample

Direct injection of eluent

HPLC system:	Thermo Scientific™ Dionex™ Ultimate™ 3000 RS system
Column:	Accucore RP-MS 50 mm \times 2.1mm 2.6 μ m (17626-052130)
Guard column:	Accucore RP-MS defender (17626-012105) Uniguard drop-in guard holder (852-00)
Mass spec system:	Thermo Scientific™ TSQ Vantage™ Triple Stage Quadruple mass spec

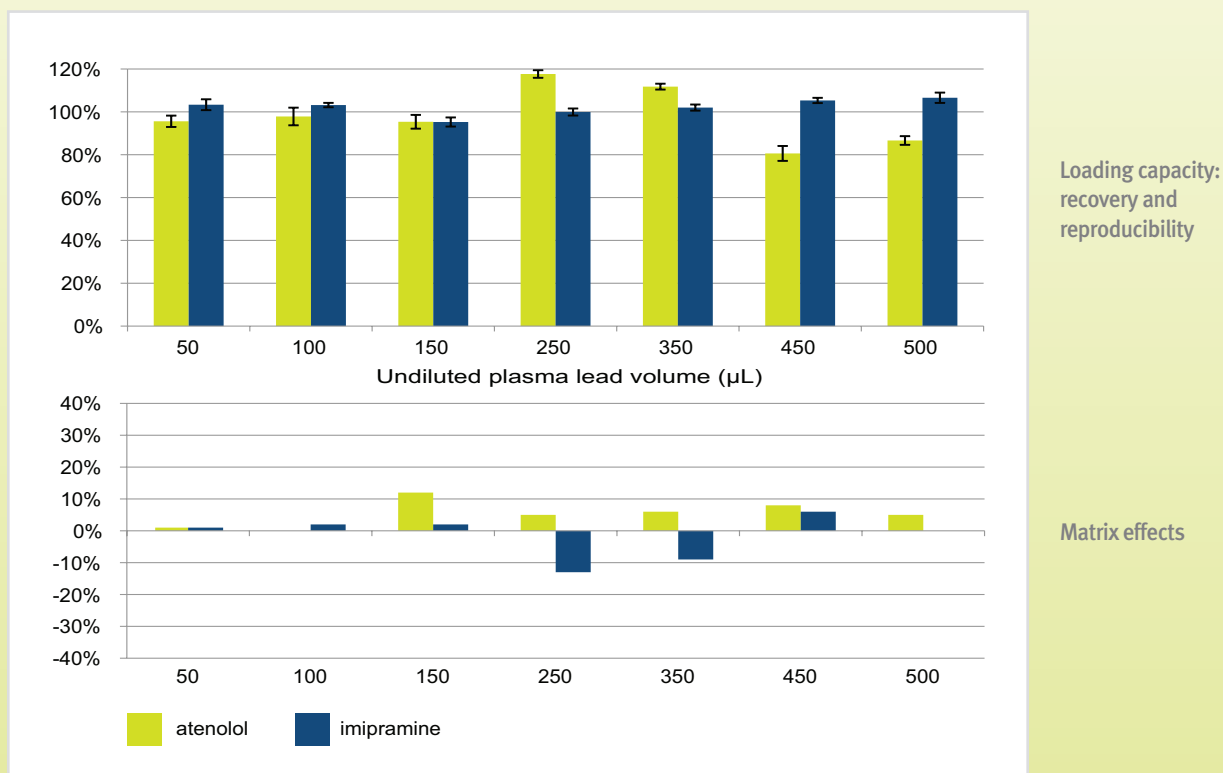
	Ibuprofen (%RSD) n=18	Ibuprofen recovery (%)
Low QC (25 ng/mL)	4.00	90
High QC (750 ng/mL)	1.70	95

Precision data for ibuprofen at Low QC 25 ng/mL and High QC 750 ng/mL (n=18)

SOLA μ loading capacity

The utilization of our advanced polymeric technologies in SOLA μ provides an SPE phase with excellent loading capacity. This ensures that good retention of analyte and removal of matrix interferences is achieved when a larger range of sample volumes are applied.

In the following example incremental volumes of human plasma spiked at 200 ng/mL with a polar (atenolol) and non polar (imipramine) analyte were extracted. Recovery and matrix effects were monitored across the loading range to demonstrate acceptable assay performance.



Conclusion

SOLA μ meets bioanalytical needs by providing:

- A robust low sample volume preparation platform
- Reproducibility at low sample and solvent levels
- Processing of low volume samples
- Sample enrichment (20 times)
- Mitigates against solvation and non-specific binding issues

Ordering information

Description	Part Number
SOLA μ HRP 96 well plate	60209-001
SOLA μ SCX 96 well plate	60209-002
SOLA μ SAX 96 well plate	60209-003
SOLA μ WCX 96 well plate	60209-004
SOLA μ WAX 96 well plate	60209-005

Complimentary products

Description	Part Number
HyperSep-96 Well Plate Manifold	60103-351
Vacuum Pump, European Version	60104-241
Vacuum Pump, North American Version	60104-243

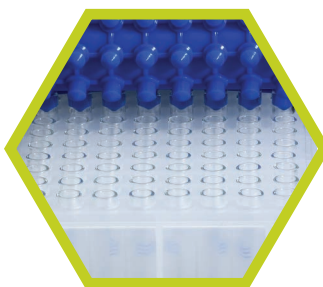


A comprehensive product offering for your complete bioanalytical workflow

Sample Preparation



Sample Handling



LC Columns and Accessories



Separation



Detection



Data Processing



thermoscientific.com/sola-spe
thermoscientific.com/chromatography

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India +91 22 6742 9494
+91 27 1766 2352
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0120 753 671 fax
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New Zealand 0800 933 966 (free call domestic)
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