



# SOLA $\mu$ Solid Phase Extraction (SPE) well plates technical guide

Consistent excellence for bioanalysis

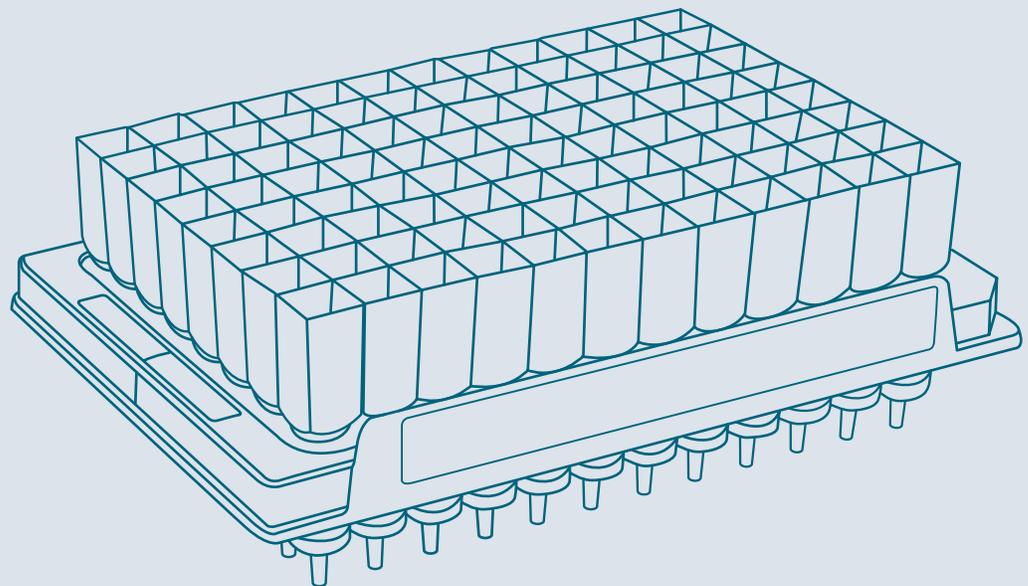
# Delivering reproducible low volume extractions

Thermo Scientific™ SOLA $\mu$ ™ Solid Phase Extraction (SPE) well plates are designed for bioanalytical and clinical research analysts who require cleaner, highly reproducible and robust sample extraction at very low sample and solvent volumes in high throughput workflows. SOLA $\mu$  well plates achieve this with unique and innovative frit-less SPE technology.

SOLA $\mu$  well plates are 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 well plate 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 $\mu$  well plate 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.

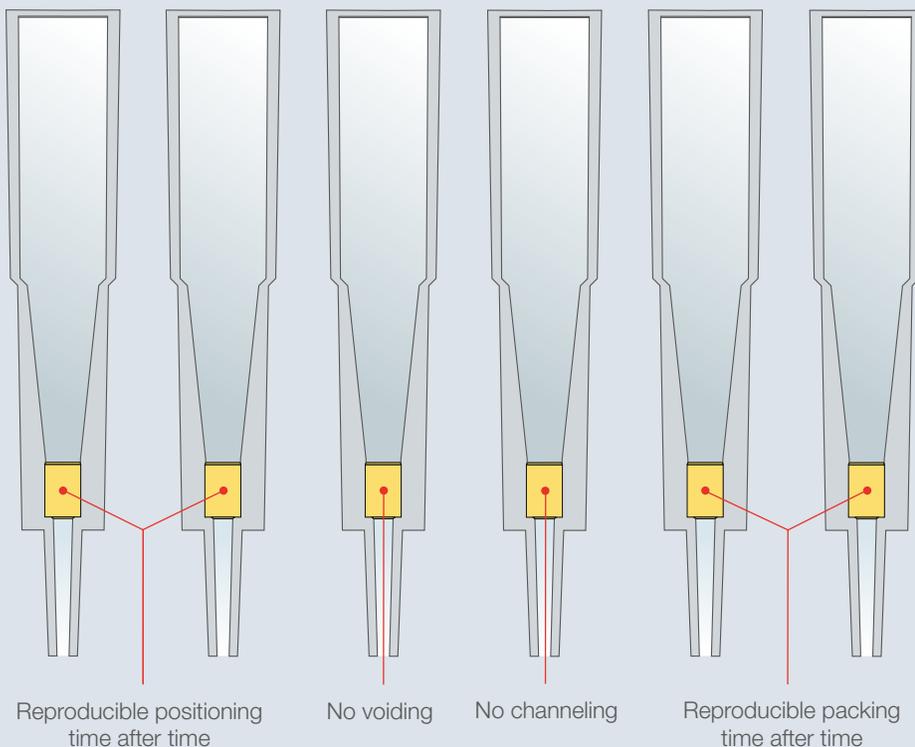


Figure 1: SOLA $\mu$  SPE design – limiting issues associated with conventional SPE formats

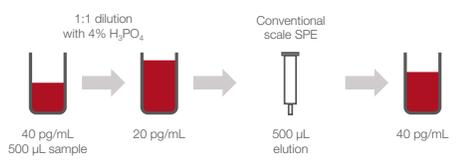
# SOLA $\mu$ well plates provide reproducible sensitivity

## Concentration of a large sample volume to achieve quantitation limits

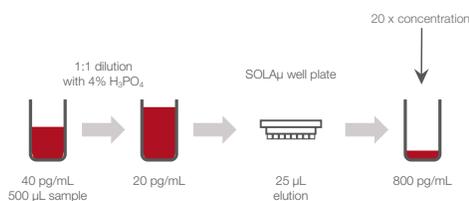
Up to 20 times increase in sensitivity can be achieved by loading a large volume of sample and eluting in a low volume.

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

**The problem:**  
improvement in assay sensitivity required



**SOLA $\mu$  well plate solution:**  
up to 20 times increase in concentration of sample without changes to workflow



## Sample enrichment (20 x pre-concentration)

### Sample preparation protocol

#### Sample pre-treatment

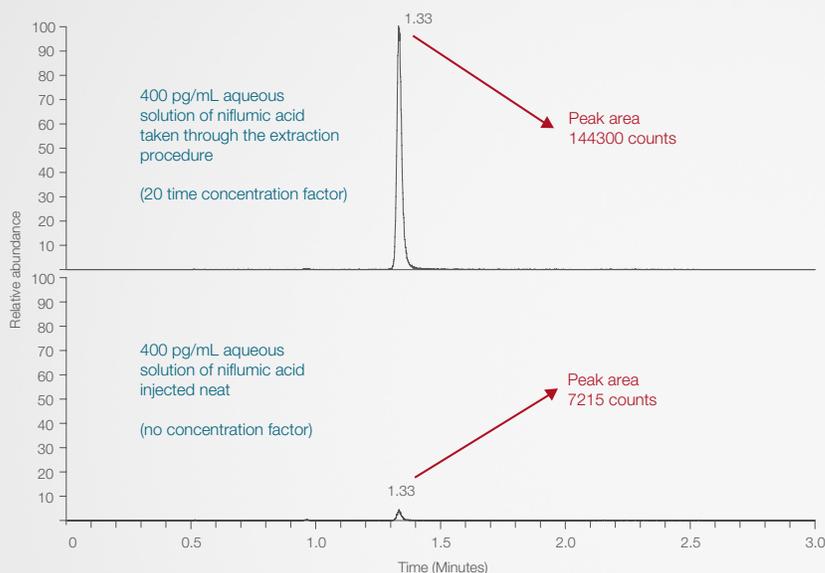
500  $\mu$ L of human plasma diluted 1:1 with 4% phosphoric acid

#### Sample preparation

Compound(s)	Niflumic acid, niflumic acid d5 (IS)
Matrix	Human plasma
	SOLA $\mu$ WAX 96 well plate (60209-005)
Condition	200 $\mu$ L methanol
Equilibrate	200 $\mu$ L 4% phosphoric acid
Load	Apply sample at 0.5 mL/min
Wash	200 $\mu$ L 25 mM ammonium acetate (pH4)
	200 $\mu$ L 70% methanol (pH4)
Elute	2 $\times$ 12.5 $\mu$ 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 $\mu$ 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 peak area ratio (%RSD) n = 18	Recovery of niflumic acid (%)	Matrix effects (%)
Low QC (0.4 ng/mL)	1.31	89.9	8.63
High QC (30 ng/mL)	1.06	94.0	3.21

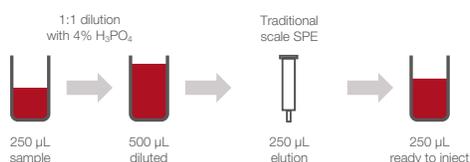
Precision, recovery and matrix effects data for niflumic acid at Low QC 0.4 ng/mL and High QC 30 ng/mL (n=18)

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

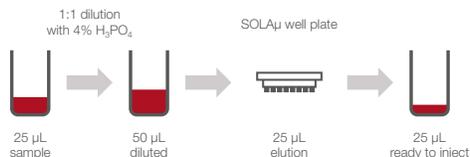
SOLA $\mu$  well plates allow users to directly scale down the volumes used in their analytical methods, allowing for a reduction in sample usage and eliminating issues caused by evaporation without compromising the sensitivity of their assay. This is also an important consideration when sample volumes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

The following example shows that by loading 25  $\mu$ L of niflumic acid sample onto the SOLA $\mu$  plate and eluting in a total of 25  $\mu$ 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.

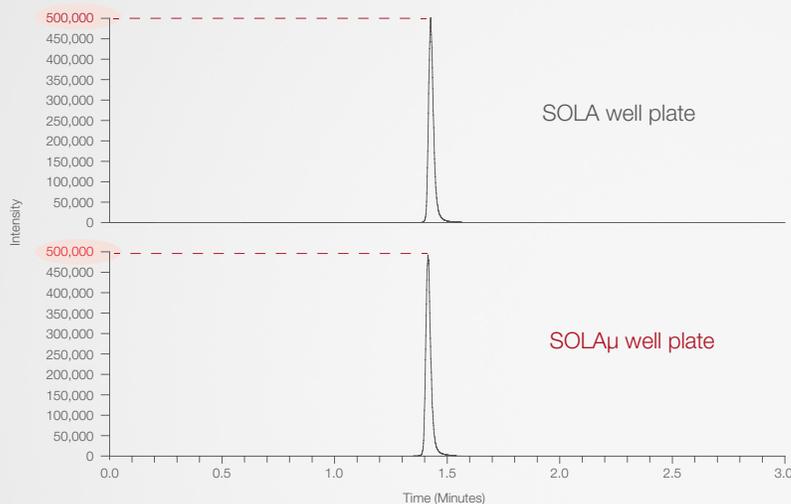
**The problem:**  
Sample volume requires reduction without compromising sensitivity



**SOLA $\mu$  well plate solution**  
10 fold reduction in sample volume with no additional step



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



## Sample preparation protocol

### Sample pre-treatment

Human plasma diluted 1:1 with 4% phosphoric acid

### Sample preparation

Compound(s)	Niflumic acid, niflumic acid d5 (IS)
Matrix	Human plasma
	SOLA $\mu$ WAX 96 well plate (60209-005)
Condition	200 $\mu$ L methanol
Equilibrate	200 $\mu$ L water
Load	Apply 25 $\mu$ L sample at 0.5 mL/min
Wash	200 $\mu$ L 25 mM ammonium acetate (pH4)
	200 $\mu$ L methanol
Elute	2 × 12.5 $\mu$ 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 × 2.1 mm 2.6 $\mu$ 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 Quadrupole 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 0.4 ng/mL and High QC 30 ng/mL (n=18)

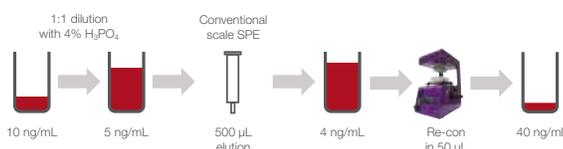
# Extracting samples which are susceptible to solvation and non-specific binding issues

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.

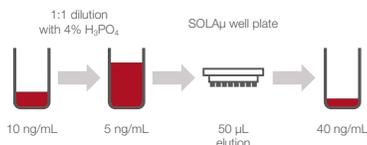
SOLA $\mu$  well plates allow the sample to be extracted without the need for dry down and reconstitution. Not only does this maximize recovery of the analytes it also improves workflow efficiency and increases productivity.

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

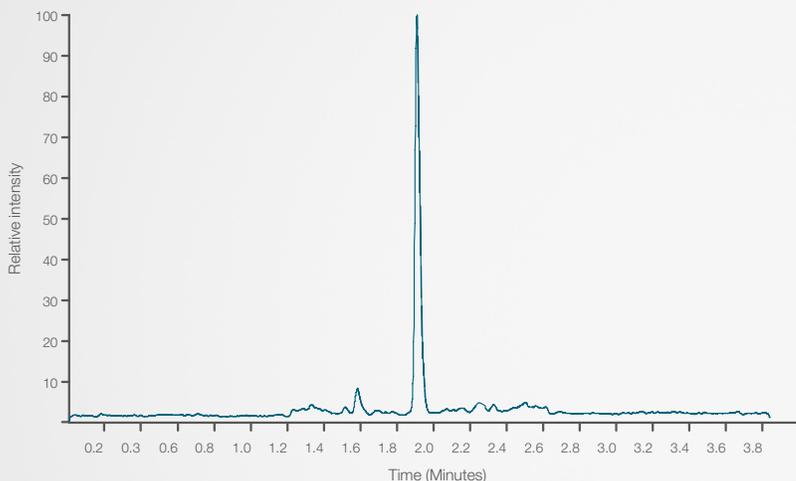
**The problem:**  
Workflow requires dry down to achieve sensitivity



**SOLA $\mu$  well plate solution:**  
Low elution volume allows removal of dry down



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



### Sample preparation protocol

#### Sample pre-treatment

200  $\mu$ L of rat plasma diluted 1:1 with 4% phosphoric acid

#### Sample preparation

Compound(s)	Ibuprofen, ibuprofen d3 (IS),
Matrix	Rat plasma
	SOLA $\mu$ SAX 1 mL 96 well plate (60109-002)
Conditioning	200 $\mu$ L methanol
	200 $\mu$ L water
Application	Load sample at 0.5 mL/min
Washing	200 $\mu$ L water with 1% NH <sub>4</sub>
	200 $\mu$ L methanol with 1% NH <sub>4</sub>
Elution	2 $\times$ 25 $\mu$ L 50/50 methanol/acetonitrile with 2% formic acid
Dilution	Add 50 $\mu$ 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 $\mu$ 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 Quadrupole mass spec

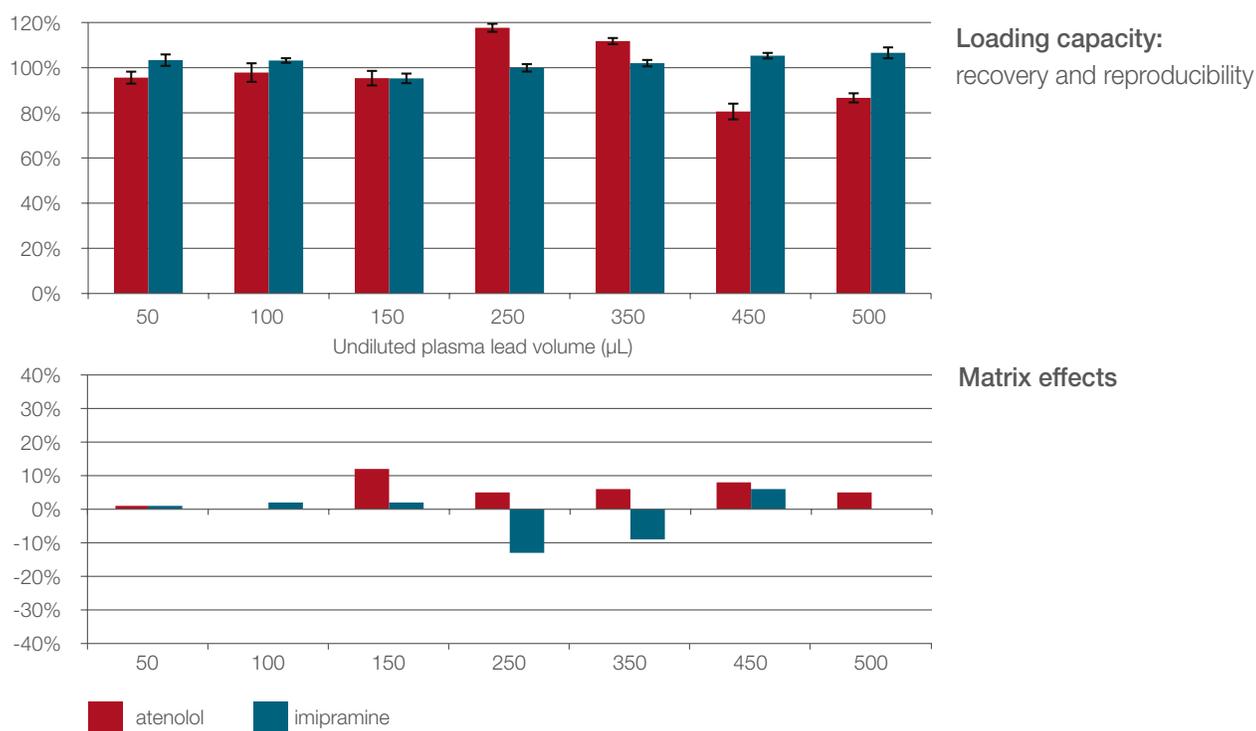
	Ibuprofen (%RSD) n=18	Ibuprofen recovery (%)
Low QC (25 ng/mL)	4.00	90
High QC (750 ng/mL)	1.70	95

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

# SOLA $\mu$ well plate loading capacity

The utilization of our advanced polymeric technologies in SOLA $\mu$  plate 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 $\mu$  well plate 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

To learn more, please visit [thermofisher.com/solaspe](https://www.thermofisher.com/solaspe)

## Ordering information

Description	Cat. no.
SOLA $\mu$ HRP 96 well plate	60209-001
SOLA $\mu$ SCX 96 well plate	60209-002
SOLA $\mu$ SAX 96 well plate	60209-003
SOLA $\mu$ WCX 96 well plate	60209-004
SOLA $\mu$ WAX 96 well plate	60209-005

## Complimentary products

Description	Cat. no.
HyperSep-96 Well Plate Manifold	60103-351
Vacuum Pump, European Version	60104-241
Vacuum Pump, North American Version	60104-243

## Expect reproducible results with sample prep, columns and vials



Don't see what you need? We would be happy to discuss your specific requirements. Please contact your local sales representative for custom orders.

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