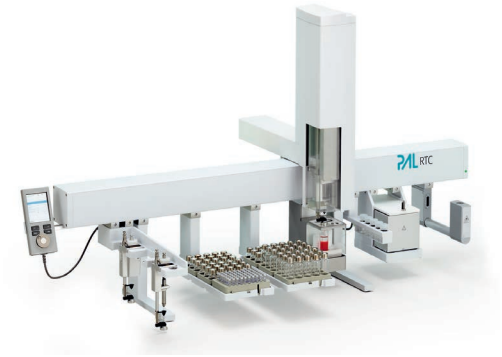
PAL SYSTEM
Ingenious sample handling



PAL3 Series II
Performance and Process Safety

The new PAL3 Series II with SMART technology is taking sample prep into a new dimension of performance, process safety, reliability and ease of use.

- Full traceability
- Scheduling of preventive maintenance, zero instrument downtime
- Perfectly matched PAL Certified Consumables
- Lower cost per sample

PAL3 Series II

- Improved productivity
- Increased process safety
- Smart technology
- Fully compatible with existing PAL3 workflows

PAL Smart Syringe

- Guaranteed quality
- Increased process safety
- Automatic loading of correct parameters
- Tracking of key parameters for preventive maintenance and support

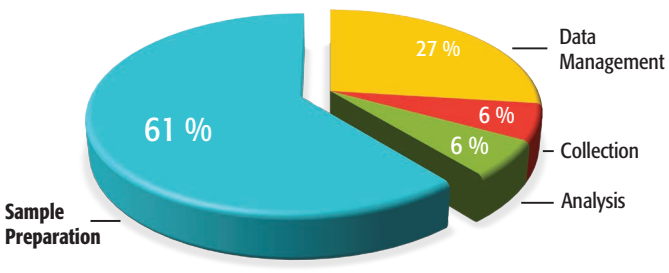
PAL3 Accessories and Consumables

The complete portfolio of PAL3 tested and certified consumables ensuring consistent performance of every PAL System

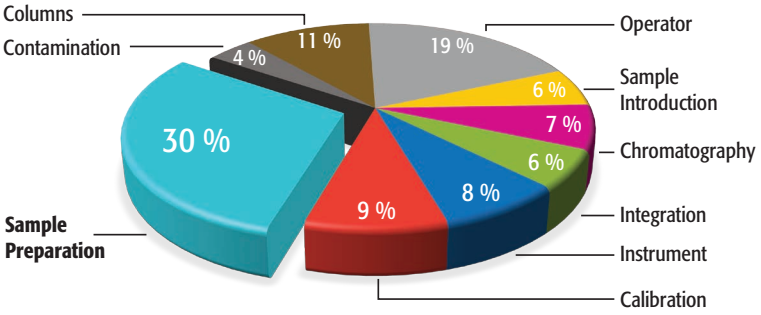
- PAL Smart Syringes
- PAL Smart SPME Fibers
- PAL Smart SPME Arrows
- PAL µSPE Cartridges
- PAL Vials and Caps
- PAL Pipette Tips
- PAL Needle Seals

A fast, safe and reliable sample preparation is the key factor for high productivity and reduced costs per sample.

Time Spent on Typical Chromatographic Analysis



Sources of Error Generated During Chromatographic Analysis



* data taken from the book "SAMPLE PREPARATION FUNDAMENTALS FOR CHROMATOGRAPHY" from Agilent Techologies.

PAL3 Smart SPME Fibers

Excellent extraction properties combined with smart handling and operational safety

Full traceability

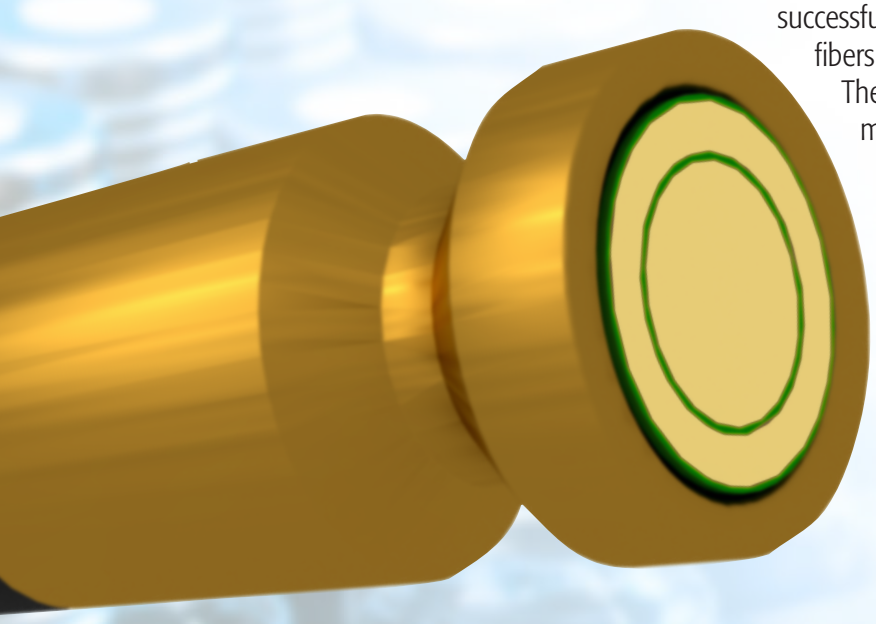
- Each SPME Fiber is equipped with its unique Smart chip containing parameters, ranges and usage history.
- Automatic application of the correct parameters for the individual Smart SPME Fibers.
- Color Code for easy identification of coating type and thickness.

https://www.palsystem.com/index.php?id=819

PAL3 SPME Fiber

Since its introduction by Pawliszyn et al. (ref. 1) Solid Phase Micro Extraction (SPME) has seen a tremendous development. SPME is a very effective way of automated sample preparation. It is used for extracting organics from a matrix (solid, liquid or gaseous) into a stationary phase immobilized on a fiber. The analytes are thermally desorbed directly in the injector of a gas chromatograph.

PAL SPME Fibers have been developed and optimized for the most successful SPME sampler, the PAL System Autosampler. The fibers are offered with different coatings and film thicknesses. Their excellent extraction properties have been proven for many important applications.



Reference [1]: Detection of substituted benzenes in water at the pg/ml level using solid-phase microextraction and gas chromatography-ion trap mass spectrometry. Potter DW, Pawliszyn J., J Chromatogr. 1992 Nov 20;625(2):247-55.

PDMS Fiber, 7 µm

PDMS Fiber, 30 µm

PDMS Fiber, 100 µm

Acrylate Fiber, 85 µm

Carbon WR Fiber / PDMS, 95 µm

DVB / PDMS, 65 µm

DVB / PDMS / Carbon WR - Triple phase, 80 µm (50 µm / 30 µm)

Bigger, Smarter, Better - PAL3 SMART SPME Arrow

Bigger surface, faster extraction

More sorption phase, superior sensitivity

Optimized geometry, greater robustness

Full Traceability

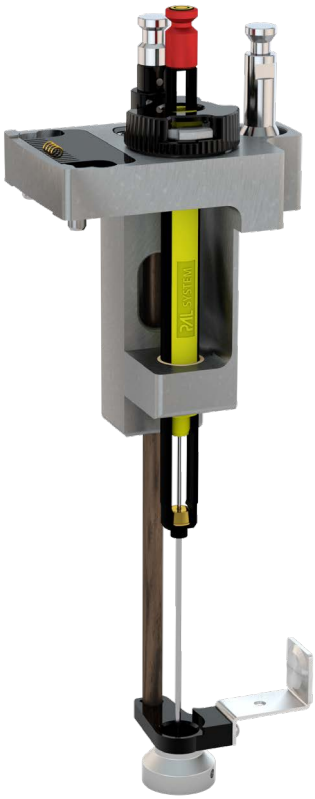
Patented

- Each SPME Arrow is equipped with its unique Smart chip containing parameters, ranges and usage history.
- Automatic application of the correct parameters for the individual Smart Arrow.
- Color Code for easy optical identification of coating type and thickness.

PAL3 Smart SPME Arrows - The new dimension for Solid-Phase Micro Extraction

SPME has become one of the most widely used extraction technologies for environmental, food and clinical analyses. It is well suited for automated sample preparation resulting in reduced time per sample, less sample manipulation and solvent consumption. However, the technology remained almost unchanged with some significant drawbacks, such as the limited mechanical stability and small phase volumes of the fibers.

The PAL SPME Arrow is a new patented technology for micro-extraction, combining trace level sensitivity with high mechanical robustness. The PAL SPME Arrow has an outer diameter of 1.1 or 1.5mm, resulting in large sorption phase surfaces and volumes. The arrow-shaped tip allows smooth penetration of vial and injector septa. In contrast to traditional SPME fibers, the Arrow design fully protects the sorptive material, minimizing adverse influences and loss of analytes during transfer processes.
With PAL RTC and PAL RSI the SPME Arrow sampling is fully automated leading to high productivity.



PAL3 Smart SPME Arrow installed in tool.

https://www.palsystem.com/index.php?id=822

Stay in contact with your Smart Syringes

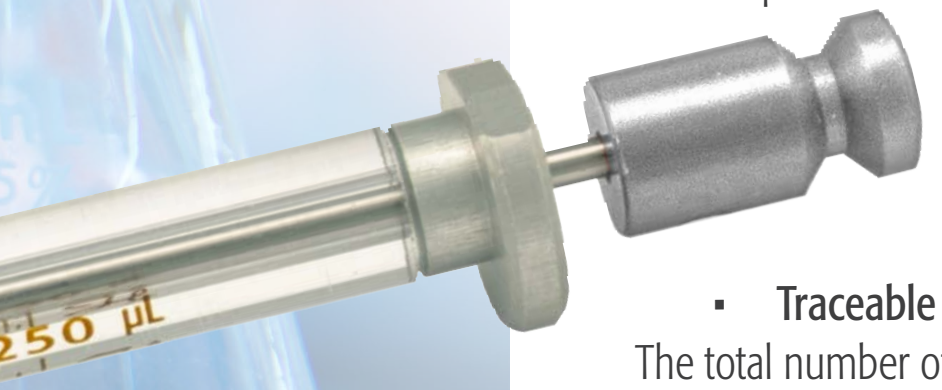
Each Smart Syringe is equipped with its own read/write chip with preset parameters, ranges and usage tracking.

The PAL Smart Syringe is an integral part of the superior quality of every PAL System.

https://www.palsystem.com/index.php?id=consumables

PAL Smart Syringe

- **Guaranteed Quality:** The consistent quality of each syringe is guaranteed by CTC Analytics.
- **Increased Process Safety:** The syringe design is tailor-made for use with the PAL System - approved and validated by CTC Analytics.
- **Ease of Use:** The syringe is automatically recognized by the PAL System and all important parameters are automatically loaded - for a simple, fast, and error-free setup.



- **Identification/Recognition:** Every syringe can be traced over its complete lifetime by means of its own specific ID.
- **Traceable Syringe History:** The total number of strokes, temperatures, date of first use and other information can be stored on the chip of every PAL Smart Syringe. Warnings for preventive maintenance can be configured.
- **Color Code for Easy Identification of the Syringe Type:** Each syringe head is colored according to the color code printed on every CTC syringe package.

PAL Accessories and Consumables

It's all about your samples - PAL Consumables for safe and reliable processing.

PAL System Accessories are an integral part of the superior quality of every PAL System guaranteeing a safe and reliable operation.

- **PAL Smart Syringe** with electronic data storage for highest precision and process safety.
- **PAL Smart SPME Fiber** for the traditional Solid Phase Micro Extraction optimized for use with the PAL System
- **PAL Smart SPME Arrow** for SPME with higher sensitivity, faster extraction and extended life-time
- **µSPE cartridges** for SPE of small volumes without the need for evaporation
- **PAL Vials and Caps** - for centrifugation, de- and recapping
- **PAL Pipette Tips** for consistent pipetting with the PAL Pipette Tool
- **PAL Needle Seal** for optimized LC injection with long lifetime, easy handling and no carryover.

PAL System quality ensuring highest performance

PAL System Accessories & Consumables are selected and tested under CTC Analytics' ISO 13485/IVD quality control regime. They ensure consistent performance and longevity of your PAL System.

https://www.palsystem.com/index.php?id=consumables

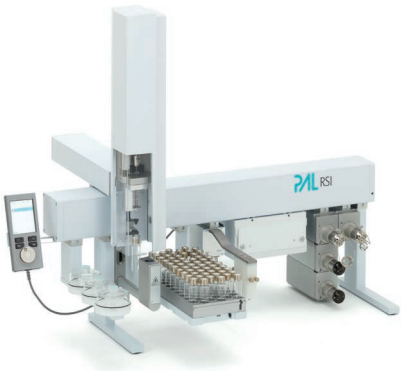
PAL Vials and Caps - for de- and recapping

PAL Vials and Caps for centrifugation

PAL Pipette Tips for automated pipetting with the PAL Pipette Tool

PAL SYSTEM

Ingenious sample handling



Contact the experts for sample preparation:

Or find your nearest value added reseller.

For more information on the PAL RTC and RSI, including the latest application notes visit:

www.palsystem.com

Part No. PAL Broch-Series-2 | Rev 1 – February 2019