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New features and benefits of automated sample preparation based on Robotic Technology

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30 YEARS OF EXCELLENCE

Challenges related to sample preparation

- ✓ **Sample throughput / productivity**
  - ✓ Price per sample
  - ✓ Batches analysis vs one by one analysis
- ✓ **(Ultra-) trace analysis**
- ✓ **Multiresidue**
  - ✓ “all in one run” (e.g. pesticides in food, “mineral oil”)
  - ✓ Migration study

Conventional sample preparation techniques

- ✓ time consuming
- ✓ high consumption of reagents and samples
- ✓ high costs per analysis
- ✓ increased waste generation
- ✓ increase in human error

Sample preparation

- ✓ Dilution
- ✓ Mixing (vortexing, agitation)
- ✓ Heating
- ✓ Sonication
- ✓ Centrifugation and recovery of the sample
- ✓ Evaporation
- ✓ Preparation of the calibration solutions
- ✓ Liquid-liquid extractions
- ✓ Solid phase extractions
- ✓ etc

Conventional sample preparation techniques

Advantages of automated sample preparation

- ✓ Run 24/7 (“unattended” sample preparation &/or analysis)
- ✓ Reproducible timing (i.e. derivatisation before analysis)
- ✓ Higher throughput (“faster”)
  - ✓ In combination with fast analysis
  - ✓ On-line versus off-line
- ✓ Low reagent consumption
- ✓ Extended application range -> several applications on one single work station
- ✓ Automated maintenance to reduce contamination

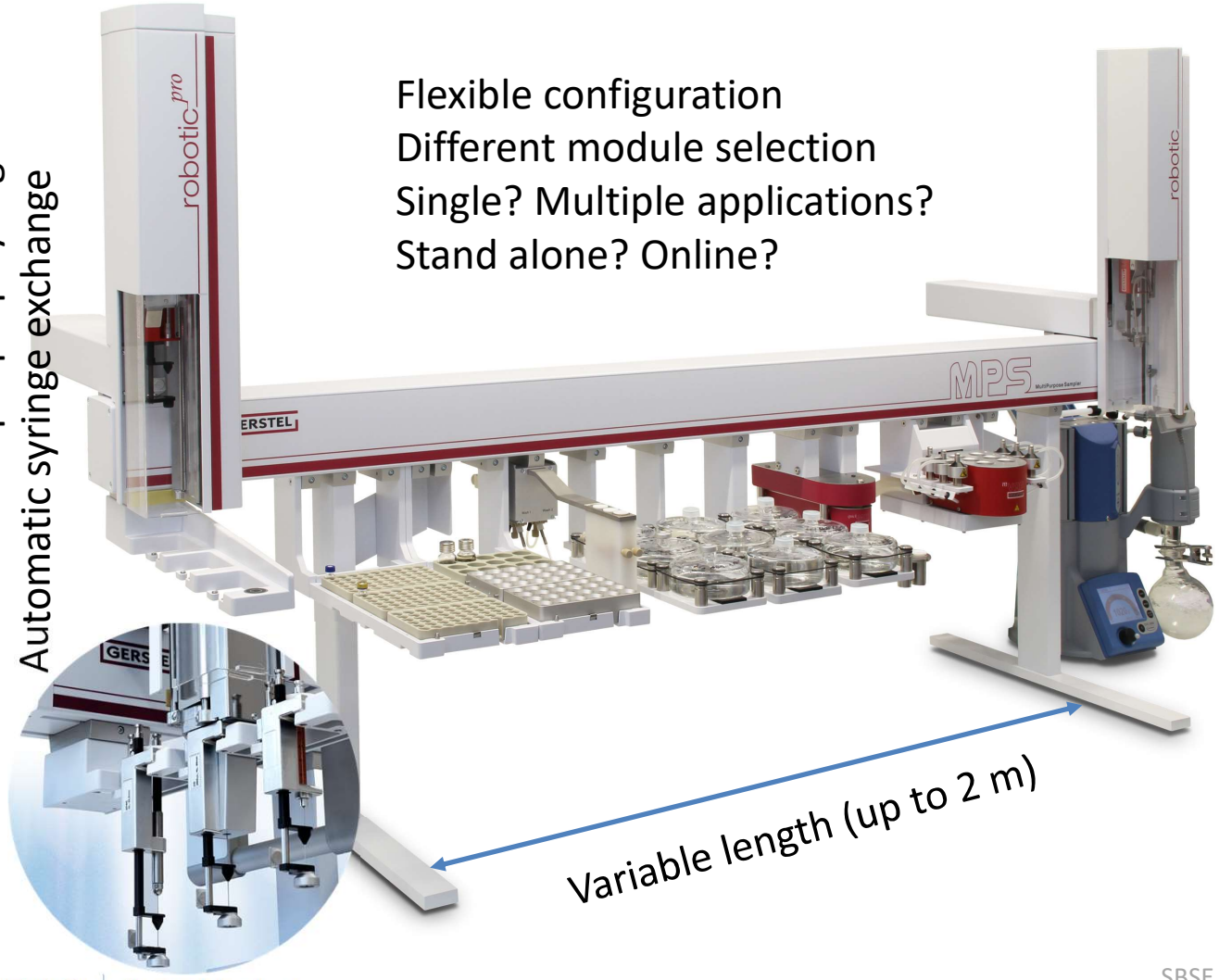
Sample prep automation – how to?

- ✓ Depends on the available modules
- ✓ Concentration ranges
- ✓ Possibility to miniaturize
- ✓ Possibility to use advanced injection and detection techniques

Configurations

Different sample prep syringes
Automatic syringe exchange

Flexible configuration
Different module selection
Single? Multiple applications?
Stand alone? Online?



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Method translation <-> miniaturisation

Reference method (ISO 28540)	Automated
1 L water + IS **Target LOD: 1 ng/L**	15 mL + IS **Target LOD: 1 ng/L = 15 pg/15 mL**
LLE with 25 mL hexane **100% recovery: 1 ng/25 mL**	µLLE with 3 mL hexane **100% recovery: 15 pg/3 mL**
Recover organic phase	Centrifuge (?)
Drying on Na_2SO_4	Transfer 1 mL to 2 mL vial with Na_2SO_4 **100% recovery: 5 pg/1 mL**
Concentration to 1 mL **Final concentration: 1 ng/mL = pg/µL**	Vortex & centrifuge (?) **Final concentration: 5 pg/mL = fg/µL**
GC-MS analysis 1 µL injection **Amount on-column: 1 pg**	GC-MS/MS analysis 40 µL injection (LVI-PTV) **Amount on-column: 0.2 pg**

Automation – Maestro scheduler

- ✓ User-friendly software
- ✓ Prep-ahead option
- ✓ Allows to automatically dispense into various types of destinations with or without moving the destination
- ✓ For online configuration -> “just in time” sample preparation (i.e. derivatisation)
- ✓ Possibility to run offline

Automation – Maestro scheduler

Sample Prep

Prep. Settings

Vial Range: 1

Prep. Action Settings

Syringe: 2.5mlALX

Action: ADD — MPS: Right MPS

Method: add water meth 1 — Edit | New | Delete

Source: SFSWash4 — Vial: AUTO

Destination: Tray2,VT32-20 — Vial: AUTO

Description: Syringe: 2.5mlALX

Add | Insert | Replace | Delete | Clean

Action	MPS	Method / Value	Source	Vial	Destination	Vial
ADD	Right MPS	add water meth 1	SFSWash4		Tray2,VT32-20	
MOVE	Right MPS		Tray2,VT32-20		mVorx,mVTC1-10	
MIX	Left MPS	mix poudre				
MOVE	Right MPS		mVorx,mVTC1-10		Tray2,VT32-20	
ADD	Right MPS	add ISTD C11Me / C13TG methode 1	Tray2,VT32-20	25	Tray2,VT32-20	
ADD	Right MPS	add ISTD C11Me / C13TG methode 1b	Tray2,VT32-20	25	Tray2,VT32-20	
MOVE	Right MPS		Tray2,VT32-20		mVorx,mVTC1-10	
MIX	Left MPS	mix ISTD				
MOVE	Right MPS		mVorx,mVTC1-10		Tray2,VT32-20	
ADD	Right MPS	add NaOCH3 5%	Wash2		Tray2,VT32-20	
ADD	Right MPS	add NaOCH3 5% b	Wash2		Tray2,VT32-20	
MOVE	Right MPS		Tray2,VT32-20		mVorx,mVTC1-10	
MIX	Left MPS	NaOCH3 mix				
MOVE	Right MPS		mVorx,mVTC1-10		Tray2,VT32-20	
WAIT	Right MPS	wait NaOCH3				
ADD	Right MPS	add hexane	SFSWash3		Tray2,VT32-20	
ADD	Right MPS	add sol de neutr	Wash4		Tray2,VT32-20	
ADD	Right MPS	add sol de neutr	Wash4		Tray2,VT32-20	
ADD	Right MPS	add sol de neutr	Wash4		Tray2,VT32-20	
ADD	Right MPS	add sol de neutr	Wash4		Tray2,VT32-20	
MOVE	Right MPS		Tray2,VT32-20		mVorx,mVTC1-10	
MIX	Left MPS	mix after neutr				
MOVE	Right MPS		mVorx,mVTC1-10		Centrifg,CT6-10	1
MOVE	Right MPS		Tray2,VT32-20	29	Centrifg,CT6-10	4
CF200	Right MPS	cemtrifuge				
MOVE	Right MPS		Centrifg,CT6-10	4	Tray2,VT32-20	29
MOVE	Right MPS		Centrifg,CT6-10	1	Tray2,VT32-20	
MOVE	Left MPS		Tray1,VT98		Tray2,VT32-20	8
ADD	Right MPS	transfer to 2 mL (dry) meth 1 poudre	Tray2,VT32-20		Tray2,VT32-20	8
MOVE	Left MPS		Tray2,VT32-20	8	mVorx,mVTC8-2	
MIX	Left MPS	Dry mix				
MOVE	Left MPS		mVorx,mVTC8-2		Tray1,VT98	
WAIT	Left MPS	wait before inj				
<INJECT>	*Left MPS*	post injection delay = 0.5 min				
ADD	Right MPS	rinse acetone	SFSWash1		SFSWaste	

OK | Cancel | Help

Typical application

- ✓ **Life science**
  - ✓ FAME's analysis
  - ✓ Organic acids
- ✓ **Food analysis**
  - ✓ FAME's
- ✓ **Cosmetics analysis**
- ✓ **Environmental**
  - ✓ µLLE for pesticides & PAH's
  - ✓ VOC's in water

Conclusions

- Take advantage of state-of-the-art instrumentation
- Miniaturized – automated – reduced solvent consumption – increased productivity – safer
- But…
  - Sampling must be reconsidered in function of (automated) sample prep
  - There is a minimum sample amount required for reliable analysis (sample homogeneity)
  - New methods should be compared to existing ones and properly validated (certified materials, proficiency tests, demonstrate equivalence)

Thank You

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