

# The e-learning Platform "Analytics+" for Analytical Chemistry

- Learn, Practice, Apply -

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## Overview

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We aim to convey a clearly structured content about general (bio-)analytics and data analysis. This includes chromatographic methods like GC, SFC or LC and mass spectrometry, but also basic chemical knowledge.

Learning material can be accessed with a tum/mytum account via the learning management system of TUM „Moodle“ (moodle.tum.de).  
**Contact us if you want to participate.**



Analytics+



Analytical chemistry is an increasingly evolving scientific field. Understanding analytical methodology & perspectives should therefore be part of a comprehensive scientific education.

Students and apprentices interested in (bio-)analytics.

- Well-structured content
- Complemented by external content, e.g. Youtube methodological tutorials and analytical handbooks provided by companies like Agilent or GE Life Sciences
- Additional material like „The Virtual Laboratory“ (by Dr. Stefan Asam) [1]

Level 1  
„Learn“

**Chromatography - HILIC**  
 Classification of HILIC stationary phases

**Mass Spectrometry**  
 Quadrupole ion trap (QIT)  
 Ion trap

**SFC**  
 gets the gap between and liquid chromatography (LC)

**GC**  
 • Gaseous mobile phase  
 • Separation by temperature gradient  
 • Limited variety of stationary phases  
 • No limitation in stationary phase length

**SFC**  
 • Supercritical mobile phase  
 • Separation by solvent and density gradient  
 • Huge variety of stationary phases  
 • Modifiers and additional factors to modify selectivity

**LC**  
 • Liquid mobile phase  
 • Separation by solvent gradient  
 • Huge variety of stationary phases  
 • Limitation by in column pressure drop

- „Brief review“: Glossary with graphical illustrations and summaries of Level 1 content allows an easy recapitulation.
- „Playful learning“: HPLC simulator tool [2] enables the user to select relevant parameters (e.g. flow rate, injection volume) in order to learn about their respective effects on a chromatographic separation.

Level 2  
„Practice & Repeat“

**Mobile phase composition**

**Chromatogram**

Compounds	Concentration (µM)	Retention time (min)	sigma	W
n-benzyl formamide	30	0.828	4.983	4.15
benzophenone	30	0.725	8.429	3.82
acetophenone	30	0.588	8.831	3.87
benzylalcohol	30	0.813	5.451	4.119
nitrobenzene	30	0.735	0.724	3.941
benzophenone	30	0.48	8.136	3.319
ethylbenzene	30	0.519	8.989	3.452

**Results**

Parameter	Value
Dwell volume (µL)	400.0
Dwell time (min)	4.0
HETP (µm)	2.417E-3
Theoretical plates	3428
Backpressure (bar)	27.82
Eluent viscosity (cP)	0.1850
Reduced plate height	18.2885

- „Test your knowledge“ - The knowledge obtained in L1 and L2 can be applied in Level 3.
- „Quiz“: Conduct a quiz to deepen the acquired knowledge.
- „Trial and error“: Plan your own HPLC experiment with a specially programmed HPLC learning tool and get immediate feedback.

Level 3  
„Apply“

**Van-Deemter Equation:**

$$H = A + \frac{B}{v} + C \cdot v$$

## References

- [1] <http://vimp.wzw.tum.de/videos>  
 [2] <http://www.hplcsimulator.org/>

## Acknowledgment

The authors thank the TUM Lehrfond for the financial support; Marco Luthardt, Tobias Placht, Veronika Wörle and Fabian Schmerbeck for the adaptation of HPLC simulator tool as well as the Analytics+ users for their helpful feedback.