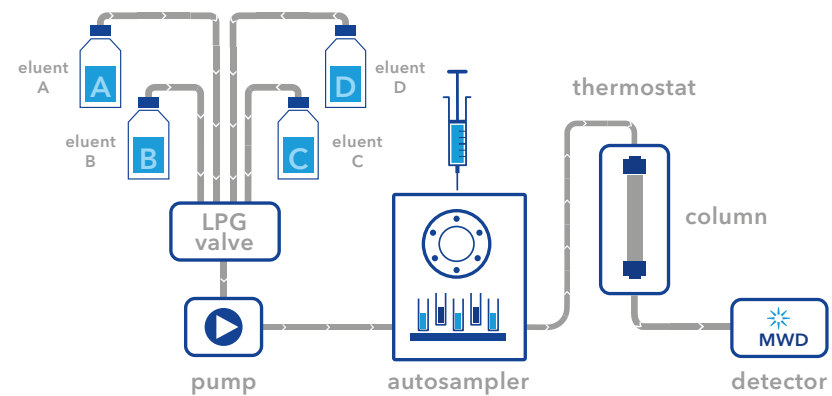


Cannabis and hemp LC solutions

Liquid chromatography is central to a broad cross-section of cannabis testing applications. It has been used to help characterize the cannabinoids extracted from the cannabis plant, demonstrating radically different pharmacological mechanisms of action from one to the next.

LC for the quality control of cannabis products

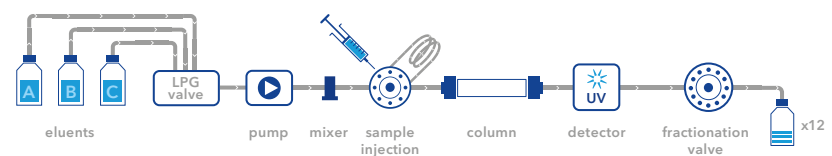
Analytical HPLC is used in a variety of ways to help professionals on all sides of the cannabis market with regulatory affairs. To ensure a safe product of highest quality, several tests should be carried out. They include cannabinoid profiling, potency testing via quantification of THC (presence/absence of THC), determination of naturally occurring contaminants like mycotoxins and determination of artificial contaminants like pesticides. Which regulations apply for a user depends on the market the product is intended for.



Flow path for AZURA Cannabis Profiler

LC for cannabinoid purification

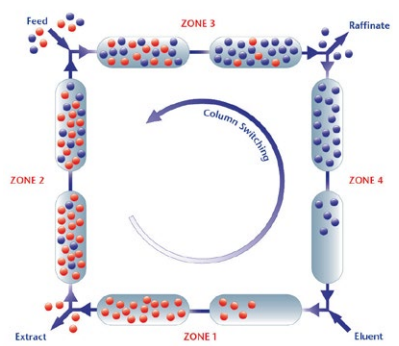
Whenever highly pure cannabinoids should be produced from cannabis plants or raw extracts, preparative chromatography is the most versatile method to choose.



Flow path for AZURA Cannabis Purifier

LC for cannabinoid production

Whether to favor batch LC or a continuous process like simulated moving bed (SMB) chromatography, depends on the specific customers' needs. KNAUER has extensive experiences in customized solutions for both types of applications for the cannabis industry.



SMB process principle



We separate molecules
and unite people.



KNAUER Wissenschaftliche Geräte GmbH
Hegauer Weg 38
14163 Berlin, Germany
Telefon +49 30 809727-0
Telefax +49 30 8015010
E-Mail info@knauer.net

Visit us for further information: www.knauer.net

V7784US/250/08.21



Cannabis and hemp HPLC solutions

- Quality control and potency testing
- Purification of cannabinoids
- Continuous production of cannabis products



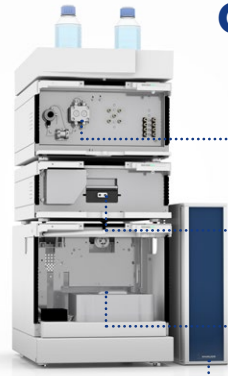
Science Together

Quality testing using analytical HPLC



Potency testing: Simplified analysis of THC content and THC/CBD ratio according to the German Pharmacopoeia (Monograph on Cannabis flos, DAB 2018)

Cannabis Profiler

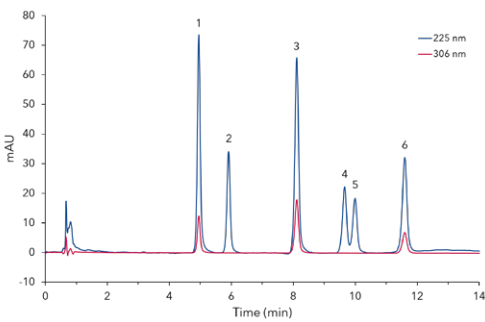


System layout

- Gradient pump
flow rates up to 10 ml/min at 862 bar
- MWD detector
8 variable wavelengths
- Autosampler
- Colum thermostat

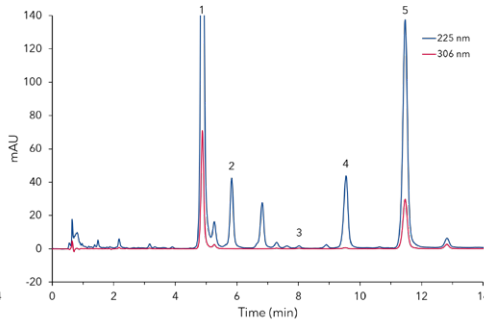
Regulative cannabinoid profiling

Quantification of 6 cannabinoids in 20 min according to DAB/Ph. Eur.



Chromatogram of standard mix

- 1 Cannabidiolic acid (CBDA)
- 2 Cannabidiol (CBD)
- 3 Cannabinol (CBN)
- 4 Δ^9 -tetrahydrocannabinol (Δ^9 -THC)
- 5 Δ^8 -tetrahydrocannabinol (Δ^8 -THC)
- 6 Δ^9 -tetrahydrocannabinolic acid (Δ^9 -THCA)

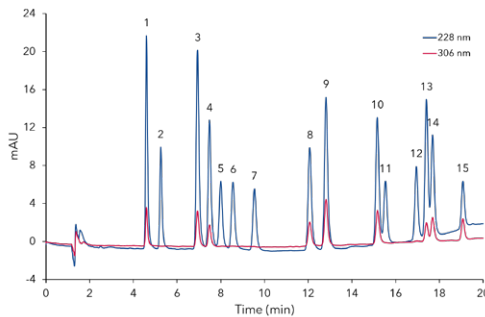


Chromatogram of medicinal Cannabis Bediol®

Also available:
Determination of Aflatoxins
(Ph. Eur. 2.8.18)

Cannabinoid profiling

Detailed analysis of 16 main cannabinoids in 20 min

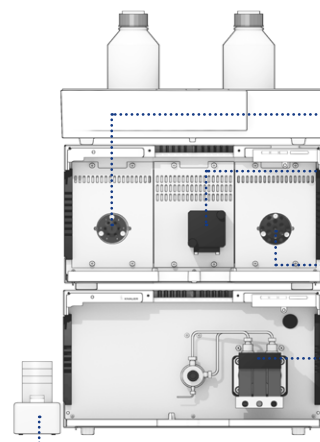


Chromatogram of standard mix

- 1 Cannabidivarinic acid (CBDVA)
- 2 Cannabidivarin (CBDV)
- 3 Cannabidiolic acid (CBDA)
- 4 Cannabigerolic acid (CBGA)
- 5 Cannabigerol (CBG)
- 6 Cannabidiol (CBD)
- 7 Δ^9 -Tetrahydrocannabivarin (THCV)
- 8 Δ^9 -Tetrahydrocannabivarinic acid (THCVA)
- 9 Cannabinol (CBN)
- 10 Δ^9 -Tetrahydrocannabinol (Δ^9 -THC)/Cannabinol acid (CBNA)
- 11 Δ^8 -Tetrahydrocannabinol (Δ^8 -THC)
- 12 Cannabicyclol (CBL)
- 13 Δ^9 -Tetrahydrocannabinolic acid (Δ^9 -THCA)
- 14 Cannabichromene (CBC)
- 15 Cannabichromene acid (CBCA)

Cannabis Purifier

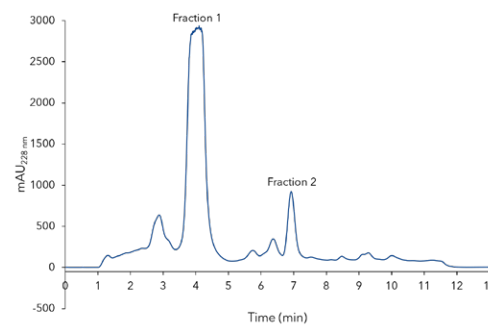
Purification of single cannabinoids from extracts of cannabis flos or cannabinoid oil.



System layout

- Injection valve
- UV detector
Single variable wavelength
- Fraction collection valve
for 11 fractions and waste
- Gradient pump
flow rates up to 250 ml/min at 200 bar
- Dynamic mixer

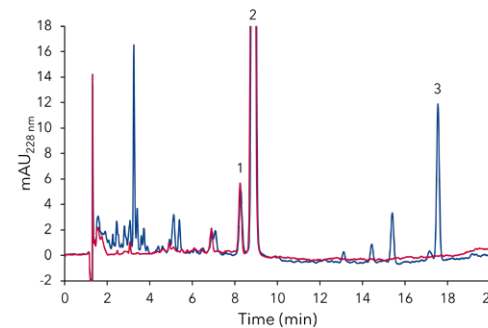
Purification of cannabidiol (CBD) from CBD oil



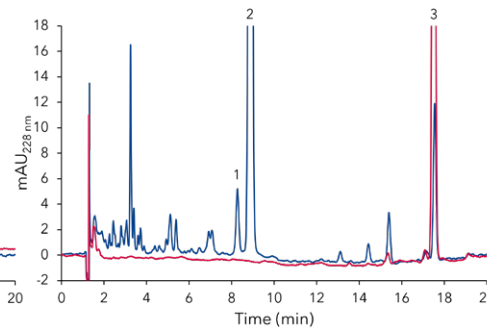
Chromatogram of CBD purification

Easy scale-up by changing the pump head, valves, flow cell, and capillaries. **No exchange of devices necessary.**

Fraction 1



Fraction 2



Chromatograms of analysis before (–) and after (→) purification

- 1 Cannabigerol (CBG)
- 2 Cannabidiol (CBD)
- 3 Δ^9 -Tetrahydrocannabinolic acid (Δ^9 -THCA)

Cannabinoid purification using preparative HPLC



Cannabis Producer

It is a major challenge to extract high-purity pharmaceutical active ingredients from natural products at high yields. This applies not only to the cannabinoid sector. Simulated moving bed (SMB) chromatography sets the benchmark for productivity, purity and yield in the continuous processing of chromatographic separations.

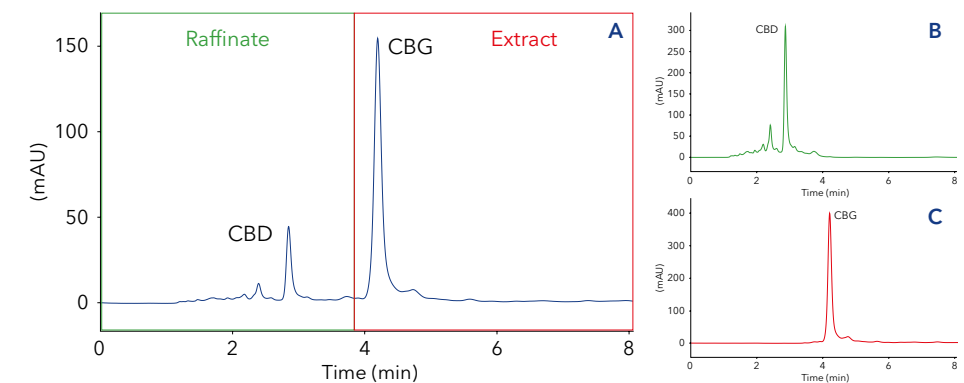
What is the difference between batch LC and SMB?

Batch chromatography (single-column)	SMB chromatography (multi-column)
Unlimited number of fractions	Two fractions, no waste
Recovery typically below 80%	Recovery up to 100%
EITHER high purity OR high yield	High purity AND high yield
Isocratic or gradient	Isocratic
High solvent consumption	Can be as low as 10% of batch consumption
Very diluted product	Product concentration comparable with input concentration (feed)



Cannabinoid production using continuous LC

Purification of cannabigerol (CBG) from cannabis extract



Chromatogram of feed (A); of raffinate (B); of extract (C)

SMB systems from KNAUER

The class-leading AZURA® SMB systems from KNAUER enable highly efficient purification of cannabinoids from cannabis and hemp. Already successfully applied was the Cannabis Producer for the continuous purification of CBD, CBG and THC by normal and reversed phase.

