



**ASG**  
Analytik-Service

# Portfolio Miniplant LAB

- Edition 11/2023 -

# HOW TO CONTACT US

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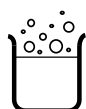
# WELCOME TO ASG



**expertise for  
over 30 years**

**~50**

**employees**



**724 analytical  
methods**

**27**

**plants in our  
Miniplant LAB**



**strong R&D  
partner**



**special  
equipment  
manufacturing**

Founded in 1992, Analytik-Service GmbH (since 2021 Analytik-Service AG) - ASG for short - is a DAkkS-accredited testing laboratory based in Neusäß near Augsburg. In addition to standard and special analysis for liquid, solid and gaseous fuels, the company's range of services also includes the production of test fuels and the construction of analytical equipment. In addition to analytical issues, ASG is also dedicated to optimizing chemical processes for basic and specialty chemicals in a Miniplant LAB set up specifically for this purpose. Due to the large variety of systems, multi-stage processes can also be represented on the basis of the individual basic operation.

## Symbiosis of analytics and Miniplant LAB

Due to the expert knowledge in the field of analysis and the variety of analytical methods, the complete characterization of complex mixtures of substances, including existing trace analysis, is possible. Due to the close integration of the Miniplant LAB with the analysis area of ASG, test results are evaluated and documented either directly online or promptly offline.

## Your R&D partner

In addition to contract research for companies in the private sector, our Miniplant LAB also works on publicly funded projects with partners from research and industry. The focus here is on the production and application of regenerative products. In particular, projects on the subject of "e-fuels", for example for aviation and shipping, are being successfully researched.

In addition, a wide variety of master's and doctoral theses have been successfully completed at ASG in recent years. This made it possible to further develop methods such as two-dimensional gas chromatography (GCxGC-TOFMS, GCxGC-FID). The know-how in the field of process modeling and simulation, as well as in catalysis, could also be expanded.

This portfolio serves as an initial guide and as an overview of the possibilities in our Miniplant LAB.



The available distillation columns and reactors allow process steps on a scale of 10 milliliters to 200 liters, as well as continuous processes. This includes simple batch reactions in stirred tank reactors (e.g. transesterification reactions), up to novel and complex procedures that can be mapped by individual basic operations (e.g. synthesis and purification of OME).

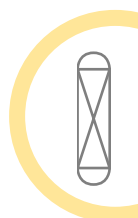
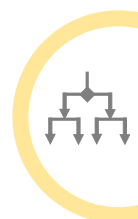


In the case of distillation columns and reactors, glass and stainless-steel variants are available in a wide variety of designs that cover a wide temperature and pressure range. Thus, not only classical distillations, but also reactive distillations or absorption and desorption processes can be mapped.



Due to the continuous expansion of our Miniplant LAB, we can help you in particular with the development and evaluation of new process concepts in specialty and fine chemicals.

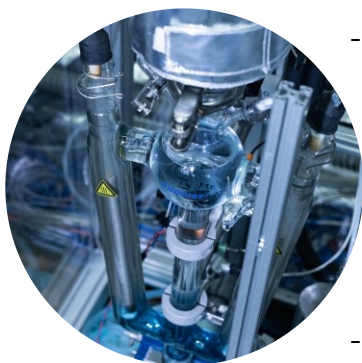
For an initial overview of our plant repertoire, you can browse through the following subcategories. **If you have any detailed questions, please do not hesitate to contact us.**



# OUTLINE

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# OUR SPECIALITIES



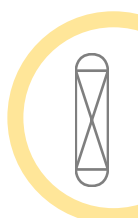
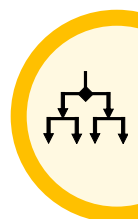
- Distillations from 100 g to 1000 kg feed
- Continuous and batch operation
- Online process monitoring
- Linking distillation with a reaction
- Adsorption/absorption/desorption processes



- Reactors from 10 mL to 190 L nominal volume
- Winterizations in triple-jacket reactor
- Online process monitoring and reaction tracking
- Hydrogenation reactions
- Screening platform (-20 °C to 150 °C)



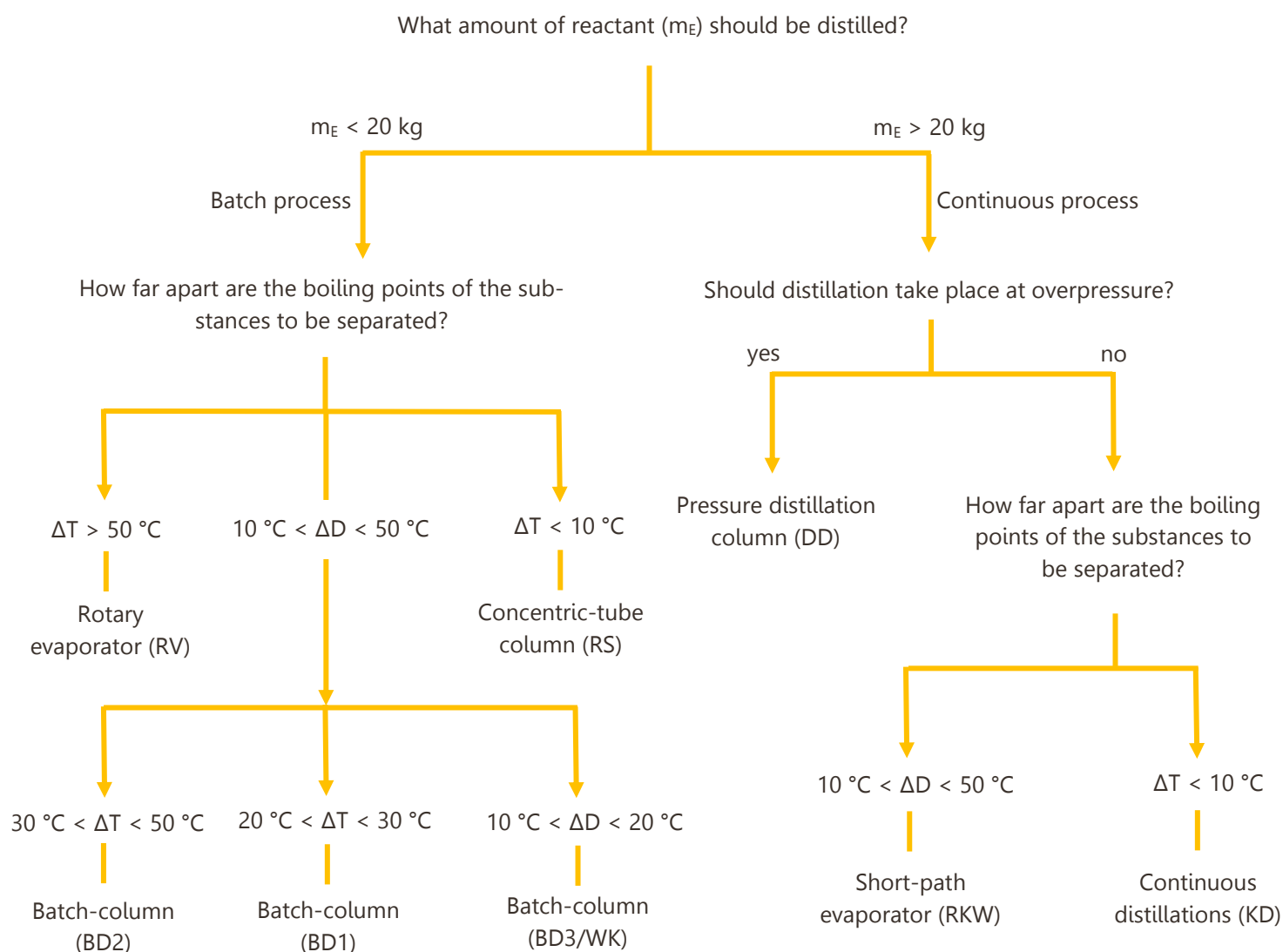
- Specialist team of engineers and chemical technicians
- Modeling and simulation
- Construction of test facilities according to customer requirements
- Flexible design of experiments
- Presentation of complex process steps



# DISTILLATION COLUMNS

Depending on the specialization, our distillation columns and evaporators can be operated in the vacuum or overpressure range. Different heating concepts (electric or via a heat transfer fluid) can cover both high and low temperatures. Depending on the plant, a gas chromatograph or an FTIR spectrometer is available for online analysis. Of course, offline analyses can be carried out simultaneously in our laboratory with our entire analytical repertoire.

You are not sure which category of distillation column is the right one for your question? The following decision tree will help you find your way around our portfolio:



**We would be happy to discuss your process for a dedicated system selection with you in advance.**

# CONTINUOUS DISTILLATIONS (KD)



RT – 200 °C



0.05 bar – atm.



CONT.



0.5 L/h up to 6 L/h

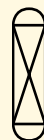
- Reboiler with automatic level control
- Feed preheating with 1500 W
- Distillation of a few liters up to 1000 liters
- Glass column with laboratory packs
- Glass shot for visual column inspection
- Theoretical number of separation stages ( $N_{th}$ ):
  - $N_{th} = 50$  (laboratory pack Sulzer EX)
  - $N_{th} = 30$  (laboratory pack PAH A3-1000)



## Our recommendation

- Distillation
- Reactive distillation

- Electrically heated column in two segments
- Heating power: 3000 W
- Condenser temperature: - 35 °C to + 95 °C
- Freely selectable reflux ratio
- Constant inert gas purge
- Recording of all distillation parameters
- Recording of distillation curves
- Analysis of the products
- Manufacture and shipment of products



# DISTILLATIONS UNDER PRESSURE (DD)



RT – 200 °C



0.3 bar – 17 bar



CONT.



0.5 kg/h up to 10 kg/h

- Feed level variable at the level of theoretical number of separation stages 3, 5, 7, 10, 15, 20 or 25
- Feed preheating up to 150 °C depending on the feed quantity
- Freely selectable reflux ratio
- Structured packing, random packings and reactive packings
- Random packing: Mesh rings ( $N_{th} = 30$ )
  - Mesh size: 0.1 mm
  - Surface: approx. 2.6 m<sup>2</sup>/L
  - Fabric: approx. 3600 meshes/cm<sup>2</sup>



## Our recommendation

- Distillation
- Adsorption
- Absorption
- Reactive distillation

- 3 separately heated column sections
- 4 sampling points along the column
- 11 temperature measurements along the column
- Bottom sampling point at the reboiler
- ATEX-compliant system
- Condenser temperature – 35 °C to + 95 °C
- Recording of all distillation parameters
- Recording of distillation curves
- Analysis of the products
- Manufacture and shipment of products

# BATCH DISTILLATIONS (BD)

## Packed columns:

- Distillations at high temperatures (up to 565 °C AET) atmospherically and under vacuum
- Distillation according to ASTM D2892
- Residual distillation according to ASTM D5236
- Dewatering (if the water content is above 0.3 %)
- Debutanization (capture of C3/C4 hydrocarbons at – 45 °C)
- Collection of fractions (up to 20 cuts per batch)

### Our recommendation

- Distillation
- Crude oil distillation
- Desorption

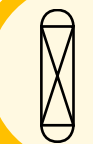


## Bubble tray column made of glass:

- Gas and liquid sampling on any tray
- Hand-blown bubble trays

## Overview of our batch distillation columns:

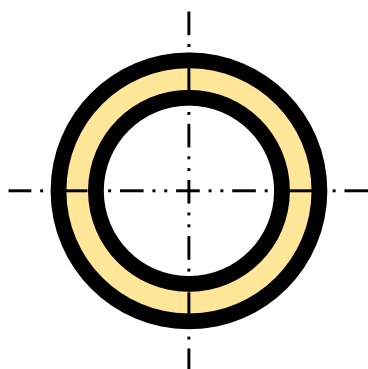
no.	pressure [mbar]	temp. [°C]	type	$N_{th}$	volume	heating
BD1	3 – atm.	15 - 450	B	$N_{th} = 15$	4 L; 6 L; 10 L	electric
BD2	0.2 – atm.	RT - 565	B	$N_{th} = 2$	4 L; 6 L; 10 L	electric
BD3	1 – atm.	RT - 300	B	$N_{th} = 60$	1 L - 6 L	electric
GD1	atm.	RT - 350	B/C	$N_{real} = 10$	2 L; 500 ml/h	electric



# CONCENTRIC-TUBE COLUMNS (RS)

- High separation efficiency due to the concentric tube within the column
- Condenser temperature – 25 °C to + 95 °C
- Vacuum-proof up to 0.1 mbar
- Low pressure drops
- Temperature-saving distillation

**Our recommendation  
for  
ultra-pure  
distillations**



In a concentric-tube column, the mass transfer between the vertically rising steam and the liquid film, which falls downwards in a spiral, is realized. The column is therefore designed as a concentric tube.

## Overview of our concentric-tube columns:

no.	pressure [mbar]	temp. [°C]	type	volume	heating
RS1	0.1 – atm.	RT - 210	B	50 – 500 mL	oil bath
RS2	0.1 – atm.	RT - 280	B	50 – 500 mL	electric
RS3	1 – atm.	RT - 300	B	1 – 6 L	electric

# SWITCH COLUMN (WK)



20 – 350 °C



1 mbar – atm.



BATCH



300 mL

- Column for small quantities of distillation and preliminary tests for rapid mixture characterization
- Suitable for determining the cutting temperatures of unknown multi-component mixtures
- Electric heating
- Fractionation of components

## Our recommendation

- Intersection search
- Preliminary tests for the selection of the appropriate column type



## Executable as:

- Structured packing column ( $N_{th} = 15 - 20$ )
- Concentric-tube column
- Random Packing column



# SHORT-PATH EVAPORATOR (RKW)

## Special features of our short-path evaporators:

- Special distillation process by forming a thin film of liquid
- Product-friendly process due to short retention time
- Fractionation of distillate and residue

**Our recommendation  
for  
product-friendly  
distillations**



## Versions of the short-path evaporators:

- Glass version with PTFE-scrapers and degassing section
- Glass version with PTFE-rolls

## Overview of our short-path evaporators:

no.	pressure [mbar]	temp. [°C]	type	variant	volume	heating
RKW1	0.01 – atm.	RT – 160	C	PTFE-scraper	Up to 3 L/d	oil bath
RKW2	1 – atm.	RT – 200	C	PTFE-rolls	50 mL/h – 500 mL/h	oil bath
RKW3	1 - atm.	RT - 200	C	PTFE-rolls	100 mL/h – 6 L/h	oil bath

# VARIABLE THIN-FILM EVAPORATOR



RT – 200 °C



$10^{-5}$  mbar – atm.



CONT.



1000 – 4000 mL/h

- **Design of the thin-film evaporator with attached rectification column (RKW4)**
- **Additional separation stages by combining the two processes ( $8 < N_{th} < 40$ )**
- Special distillation process by forming a thin film of liquid
- Product-friendly process due to short retention-time
- Distillate, middle distillate and bottom product

## Our recommendation

Combination of thin-film evaporation and rectification



# VLE-PLANT (VAPOUR-LIQUID-EQUILIBRIUM)



RT – 250 °C



1 mbar – 3 bar



BATCH



100 mL

- Basis for modeling and simulations
- High media resistance due to glass design
- Sample volume: minimum 100 mL (+ 35 mL per measuring point)
- Electric heating
- Continuous sampling
- Direct evaluation of gas-liquid equilibrium



## Our recommendation

Determination of gas-liquid equilibrium of two components before special distillations

# ROTARY EVAPORATORS (RV)

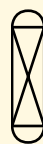
- Easy separation of highly volatile components
- Reactions with simultaneous separation of resulting light boilers
- Reactant redosing possible
- Dewatering

## Our recommendation

- Distillation
- Flash distillation

## Overview of our rotary evaporators:

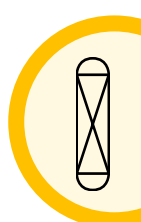
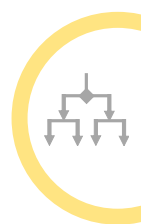
no.	pressure [mbar]	temp. [°C]	type	volume	heating
RV1	50 – atm.	RT - 95	B	50 mL – 3000 mL	water bath
RV2	50 – atm.	RT - 150	B	10 L; 20 L	oil bath
RV3	50 – atm.	RT - 150	B	50 L	oil bath



# OVERVIEW DISTILLATION UNITS

no.	material	pressure	temp. [°C]	type
KD	glass	0.05 bar - atm.	RT - 200	C
DD	stainless-steel	0.3 bar – 17 bar	RT - 200	C
BD1	glass	3 mbar - atm.	15 - 450	B
BD2	glass	0.2 mbar - atm.	RT - 565	B
BD3	glass	1 mbar - atm.	RT - 300	B
GD1	glass	atm.	RT - 350	B/C
RS1	glass	0.1 mbar - atm.	RT - 210	B
RS2	glass	0.1 mbar - atm.	RT - 280	B
RS3	glass	1 mbar - atm.	RT - 300	B
WK	glass	1 mbar - atm.	20 - 350	B
RKW1	glass	0.01 mbar -atm.	RT - 160	C
RKW2	glass	1 mbar - atm.	RT - 200	C
RKW3	glass	1 mbar - atm.	RT -200	C
RKW4	glass	0,01 mbar - atm.	RT - 200	C
VLE	glass	1 mbar - 3 bar	RT - 250	B
RV1	glass	50 mbar - atm.	RT - 95	B
RV2	glass	50 mbar - atm.	RT - 150	B
RV3	glass	50 mbar - atm.	RT - 150	B

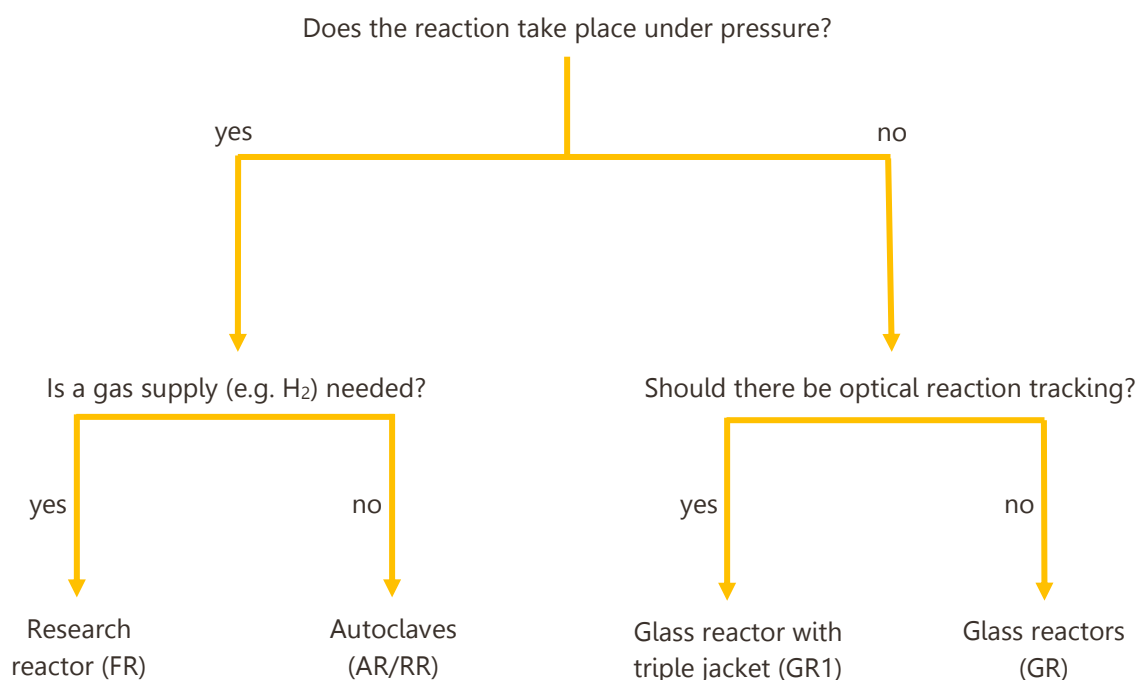
volume/flow	N <sub>th</sub> /bottoms	heating	variant
0.5 L/h - 6 L/h	30 bzw. 50	electric	--
0.5 kg/h - 10 kg/h	25	electric	variable feed
4 L; 6 L; 10 L	15	electric	--
4 L; 6 L; 10 L	2	electric	--
1 L - 6 L	60	electric	--
2 L; 500 mL/h	10 trays	electric	--
50 - 500 mL	--	oil bath	--
50 - 500 mL	--	electric	--
1 - 6 L	--	electric	--
max. 300 mL	15 - 20	electric	variable columns
bis 3 L/d	--	oil bath	PTFE-scraper
50 mL/h - 500 mL/h	--	oil bath	PTFE-rolls
100 mL/h - 6 L/h	--	oil bath	PTFE-rolls
1 - 4 L/h	8 - 40	oil bath	PTFE-rolls + column
100 mL + 35 mL	--	electric	vapour-liquid-equilibrium
50 mL - 3 L	--	water bath	--
10 L; 20 L	--	oil bath	--
50 L	--	oil bath	--



# REACTORS

Due to the different designs of our reactors, a wide range of reactions can be covered. High and low process temperatures can be achieved through different heating concepts (electric or via a heat transfer fluid). Peripherals such as a large-volume rotary evaporator (20 L) or a temperature-controlled laboratory centrifuge (3 L) complement the laboratory equipment and make it easier to work with larger batches.

You are not sure which category of reactors is the right one for your question? The following decision tree will help you find your way around our Miniplant LAB portfolio:



Detailed reactor parameters can be found in the overview table. For example, the screening platform is particularly suitable for small quantities and simultaneously testing. This and further information can be found in the respective subchapters.

**If you have any questions or would like to make a specific system selection, please do not hesitate to contact us!**

# GLASS REACTORS (GR)

- Reactor cascades possible
- Direct temperature measurement
- Dosing of components possible
- Bottom drain
- Temperature control via heat transfer fluid
- Triple jacket ideally suited for winterization

## Our recommendation

- mixtures
- reactions
- winterization

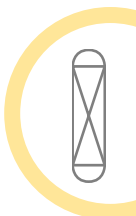
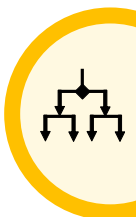


## Available stirrers

- Anchor stirrer
- Impeller stirrer
- Disc stirrer
- Sawtooth stirrer
- Propeller stirrer

## Overview of our glass reactors:

no.	pressure	temp. [°C]	type	volume	jacket
GR1	atm.	-70 - 170	B	1,5 L	triple jacket
GR2	atm.	-55 - 170	B	2 L	double jacket
GR3	atm.	-55 - 170	B	10 L	double jacket
GR4	atm.	-70 - 170	B	20 L	triple jacket

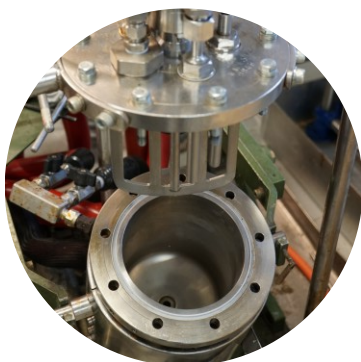


# AUTOCLAVES (AR)

- Reactions under pressure
- Temperatures up to max. 300 °C
- Fast temperature control thanks to high-temperature thermostat
- Sampling via riser
- Sampling via bottom drain

## Our recommendation

- mixtures
- reactions



- Use of different types of stirrers
- Data Recording
- Addition of liquids possible during the reaction

## Overview of our autoclaves:

Bez.	pressure	temp. [°C]	type	volume	material
AR1	up to 25 bar	- 70 - 300	B	2.4 L	stainless-steel
AR2	up to 30 bar	- 70 - 250	B	1 L	stainless-steel
AR3	up to 135 bar	- 70 - 200	B	1 L	stainless-steel
AR4	up to 3 bar	- 10 - 95	B	190 L	stainless-steel

# SCREENING-REACTORS (SR)



-20 °C – 150 °C



atm. – 25 bar

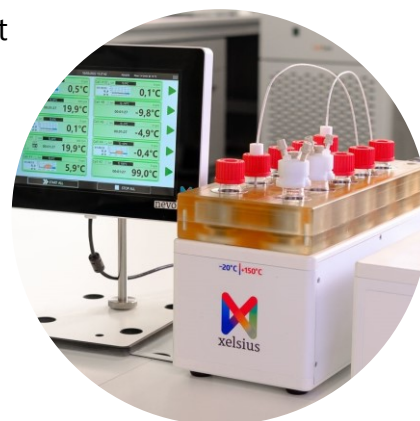


BATCH



0,5 mL up to 30 mL

- Individual temperature control of each reactor unit
- Glass variants:
  - Standard vial (30 mL)
  - Tapered vial (0.5 to 10 mL)
- Vial with water separator
- Stainless-steel variant with 10 mL volume
- Temperature: -20 °C to 150 °C
- up to 30 °C/min heating rate
- automated, individual temperature profiles

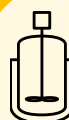


## Our recommendation

- screening
- synthesis
- stability and solubility tests

## Multiport-system:

- Sampling during reaction/operation
- Dosing during reaction/operation
- Particularly suitable for statistical design of experiments



# RESEARCH REACTOR (FR)



RT – 250 °C



up to 100 bar



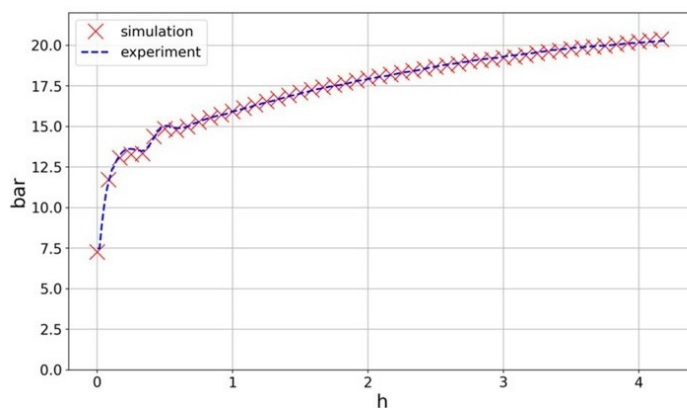
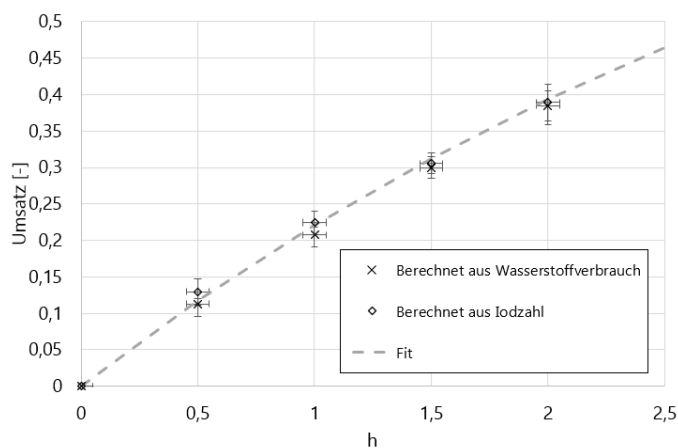
BATCH



$V_N = 130 \text{ mL}$

Fully automated batch reactor with liquid / gas sampling

- Reaction volume 130 ml
- Sampling (gas & liquid)
- Stainless-steel (Alloy 625)
- Catalyst addition during operation
- Online analysis of the gas phase (FTIR) Offline analysis of the liquid phase (gas chromatography)
- Fully automated: pressure measurement, hydrogen consumption, speed, temperature
- Heterogeneous or homogeneous catalysis
- Ideal for catalyst and solvent screenings as well as feasibility studies, etc.



# TUBULAR REACTOR (RR)



RT – 250 °C



bis 150 bar



KONT.



$V_N = 20 \text{ mL}$

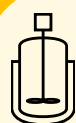
## Fully automated continuous tap reactor with liquid sampling points

- Sampling possible during operation (liquid)
- 6 taps
- Fixed-bed reactor ( $d_i = 10 \text{ mm}$ )
- Heterogeneous catalysis
- Temperature measurement possible in the catalyst bed
- Stainless steel
- Online analysis of the liquid phase by gas chromatography
- Fully automated: pressure measurement, volume flow, temperature, program-controlled sampling
- Ideal for catalyst and solvent screenings as well as feasibility studies, etc.



### Our recommendation

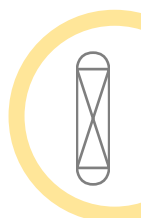
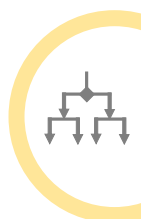
- kinetic measurements
- stability tests
- absorptions
- adsorptions



# OVERVIEW REACTORS

no.	material	pressure	temp. [°C]	type
GR1	glass	atm.	-70 - 170	B
GR2	glass	atm.	-55 - 170	B
GR3	glass	atm.	-55 - 170	B
GR4	glass	atm.	-70 - 170	B
AR1	stainless-steel	up to 25 bar	-70 - 300	B
AR2	stainless-steel	up to 30 bar	-70 - 250	B
AR3	stainless-steel	up to 135 bar	-70 - 200	B
AR4	stainless-steel	up to 3 bar	-10 - 95	B
FR	stainless-steel	up to 100 bar	RT - 250	B
SR	glass/stainless-steel	up to 25 bar	-20 - 150	B
RR	stainless-steel	up to 150 bar	RT - 250	C

volume	heating	jacket	drain
1.5 L	heat transfer fluid	triple jacket	bottom drain
2 L	heat transfer fluid	double jacket	bottom drain
10 L	heat transfer fluid	double jacket	bottom drain
20 L	heat transfer fluid	triple jacket	bottom drain
2.4 L	heat transfer fluid	double jacket	standpipe
1 L	heat transfer fluid	double jacket	standpipe
1 L	heat transfer fluid	double jacket	standpipe
190 L	heat transfer fluid	double jacket	standpipe
130 mL	electric	double jacket	standpipe /gas sample
0.5 up to 30 mL	electric	double jacket	multiport
20 mL	heat transfer fluid	double jacket	taps



FUELING YOUR SUCCESS.  
SINCE 1992.

