

Abschlusskolloquium

Med-zeroSolvent

Ausgewählte Ergebnisse - Ökotoxikologie

Institut für Hydrobiologie

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24.10.2024

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

B | BRAUN
SHARING EXPERTISE



LABORATORIEN
DR. FREITAG GMBH

DAS
Environmental Experts.

ILK Dresden
Institut für Luft- und Kältetechnik
gemeinnützige Gesellschaft mbH

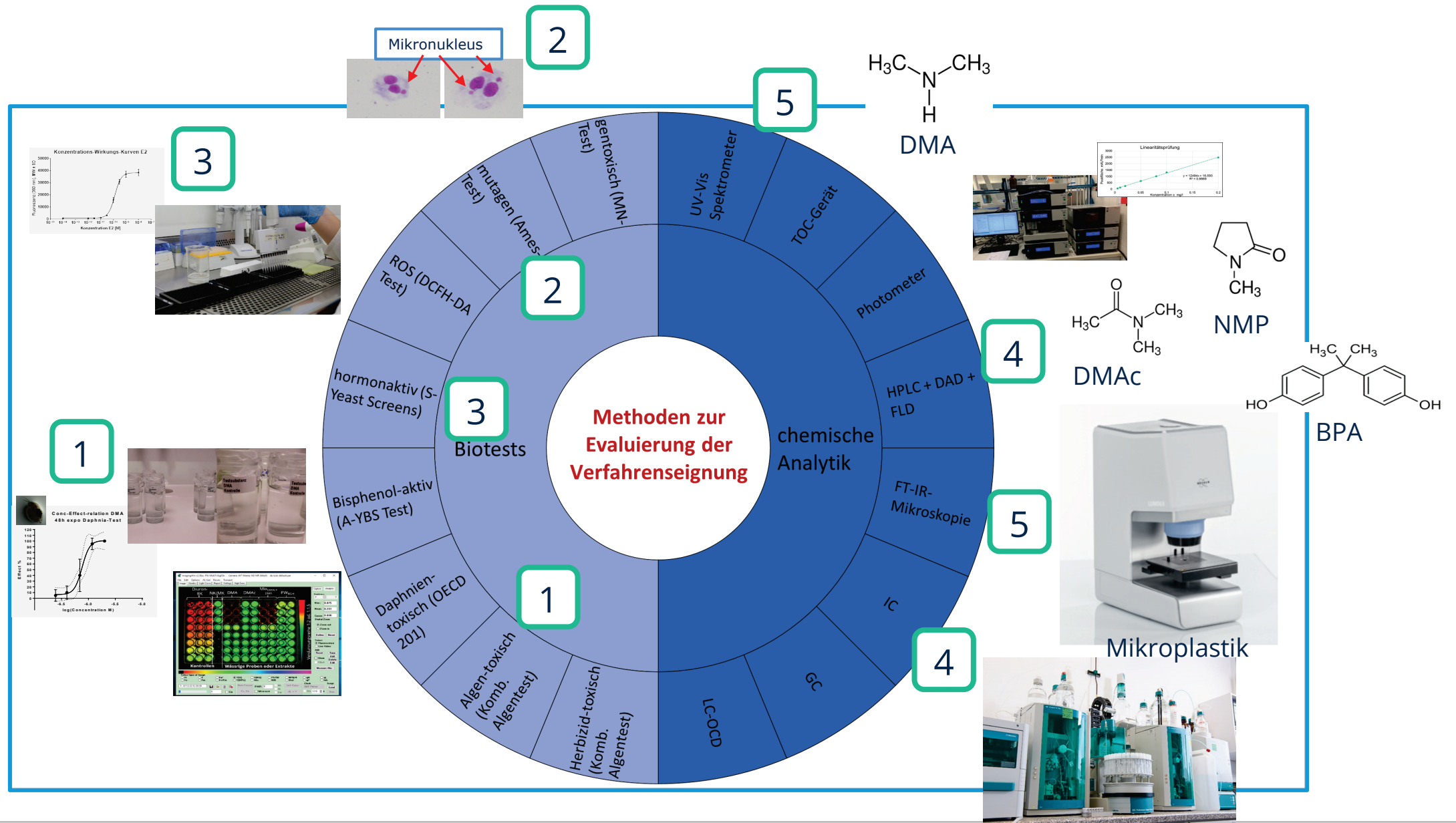


Me  Sep



**TECHNISCHE
UNIVERSITÄT
DRESDEN**

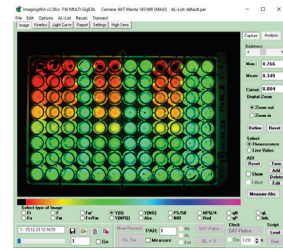
wasserWerkstatt
Ingenieurbüro für ökologische Wasserwirtschaft



1. (Öko-)Toxikologische Effekte der Lösemittel:

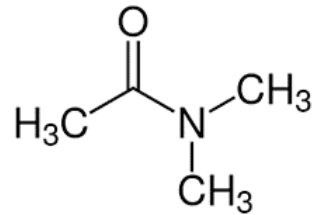
Quantifizierung der Effektkonzentrationen durch die Kombination von EBM und chemische Targetanalytik

Kombination von EBM und chem. Targetanalytik der Fokussubstanzen

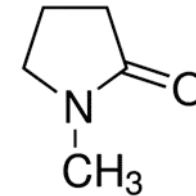


Charakteristische (Ab-)Wasserinhaltsstoffe

Lösungsmittel und deren
Abbauprodukte



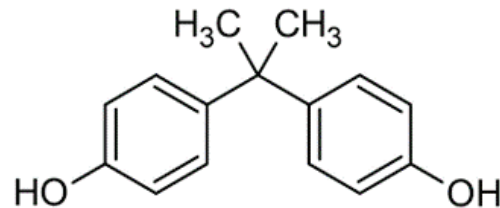
DMAc
N,N-Dimethylacetamid



NMP
N-Methyl-2-pyrrolidon

? mutagen, gentoxisch, endokrin wirksam, oxidativer Stress, Mischtoxizität ?

Weichmacher und
Mikroplastik

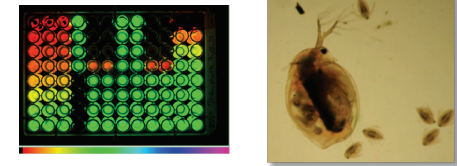


BPA
Bisphenol A



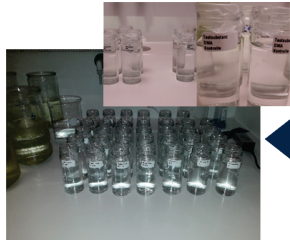
Mikroplastik
Restfeststoffe

? mutagen, gentoxisch, endokrin wirksam, oxidativer Stress, Mischtoxizität ?



Effect-based methods and chemical analyses

Results



acute toxicity test using *Daphnia magna* [3]
(immobilization)

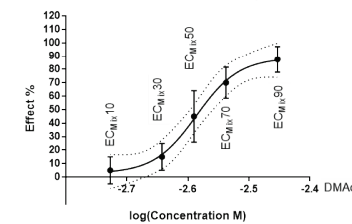
Single compound testing

$EC_{50_{DaphniaDMAc}} = 575 \text{ mg/L}$
 $EC_{50_{DaphniaDMA}} = 34 \text{ mg/L}$

Calculation of addition toxicity

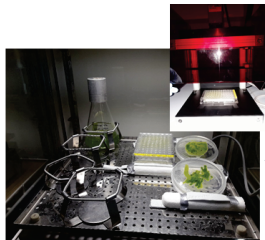
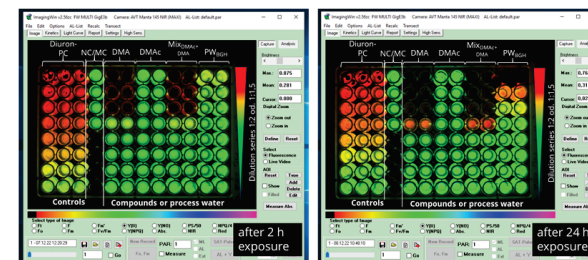
Mixture compound testing

Concentration-Effect-relation
Mix DMAc+DMA 48h expo

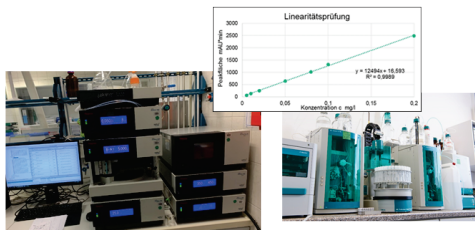


$EC_{50_{DaphniaMix}} = 288 \text{ mg/L DMAc}$
and 17 mg/L DMA

Single and mixture compound testing



combined algae test using *Raphidocelis subcapitata* [4,5,6]
(inhibition of PSII (IPAM, Walz)
and growth)



Chromatographic analyses of
actual concentrations of **DMAc**
(HPLC, B. Braun) and **DMA** (IC,
CUP)

- **Additive toxicity in mixture**
in acute toxicity test (48 h) using *Daphnia magna*
- **Real process water:**
 $EC_{50_{DaphniaPW}} =$ dilution of 1.56 to 3.12% (163 to 311 mg/L DMAc; 7.4 to 18 mg/L DMA)
- **Check of actual exposure concentrations** by HPLC or IC
DMAc: -39 to 11% (single); -16 to 13% (mix in higher exposure conc.)
DMA: -26 to 12% (single); 0 to 33% (mix)
- **Growth and PSII inhibition** in combined algae test using *Raphidocelis subcapitata* (24 h)
DMAc and PW: **no to low inhibition** of growth and PSII
DMA and Mix: **high inhibition** of growth and PSII



Bewertung der Toxizität von Industrieabwasser - Kombination von Effekt-basierte Methoden und chemische Targetanalytik

**Wassergefährdungs-
klasse 2
Einleitbeschränkung**

DMAc

**Wassergefährdungs-
klasse 1
keine
Einleitbeschränkung**

- Akute Daphnientoxizität (OECD 202)
- Chromatographische Analytik von DMAc und DMA

1

Einzelsubstanztests

$EC_{50_{DaphniaDMAc}} = 575 \text{ mg/L}$
 $EC_{50_{DaphniaDMA}} = 34 \text{ mg/L}$

additive Toxizität

3+4

Reales Prozesswasser

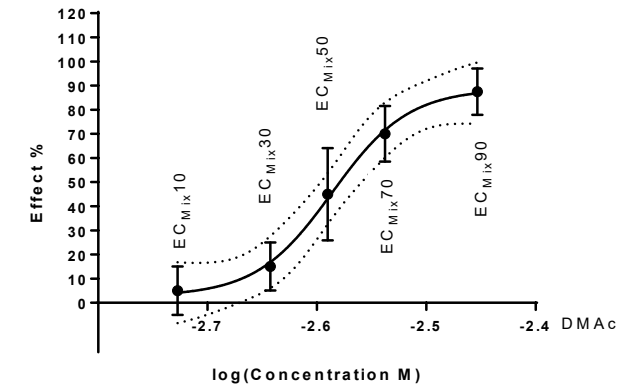
$EC_{50_{DaphniaPW}} = 1,56 - 3,12 \% \text{ PW}$
= zw. 163 - 311 mg/L DMAc (by HPLC) und zw.
7.4 - 18 mg/L DMA (by IC)

Abgleich

2

Mischungstests

Concentration-Effect-relation
Mix DMAc+DMA 48h expo

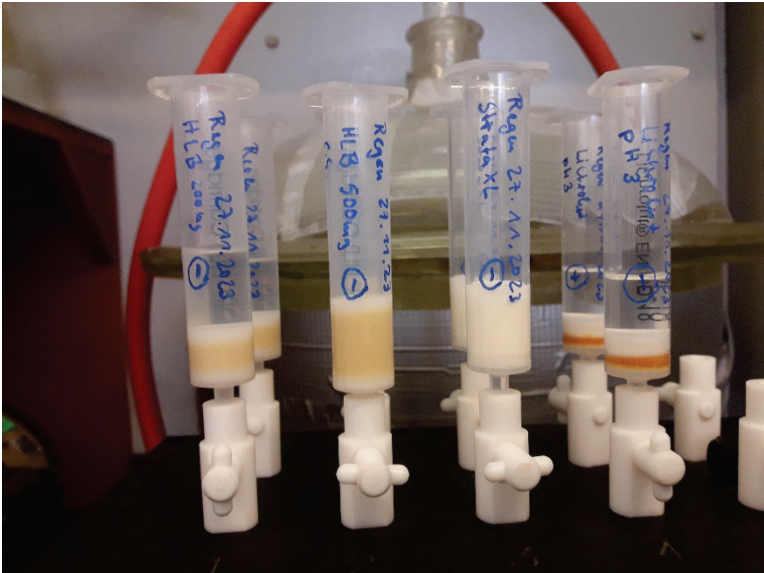
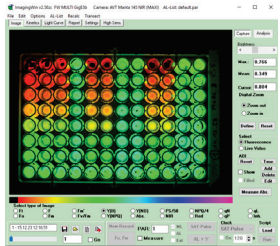


$EC_{50_{DaphniaMix}} = 288 \text{ mg/L DMAc und } 17 \text{ mg/L DMA}$

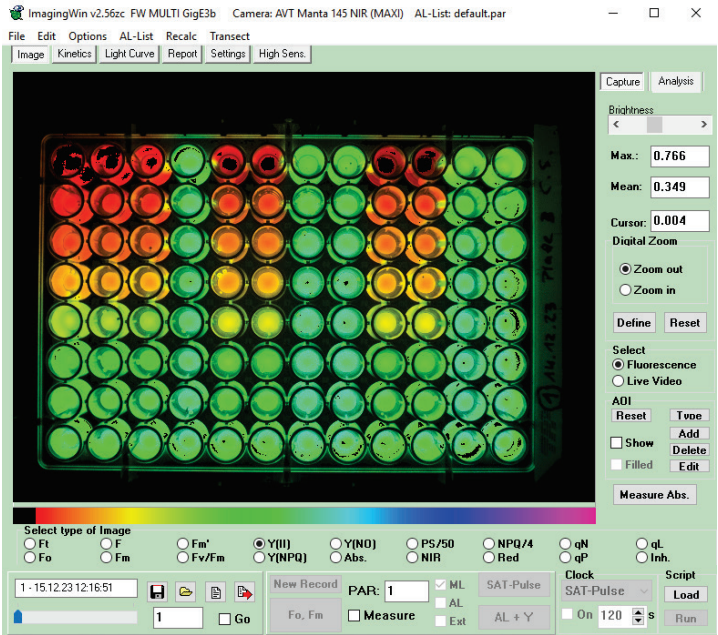
(Öko-)Tox & chem. Analytik der Fokussubstanzen

Festphasenextraktion

Kombinierter Algentest
Wachstumshemmung, PS-II-Hemmung



Kartuschenvergleich

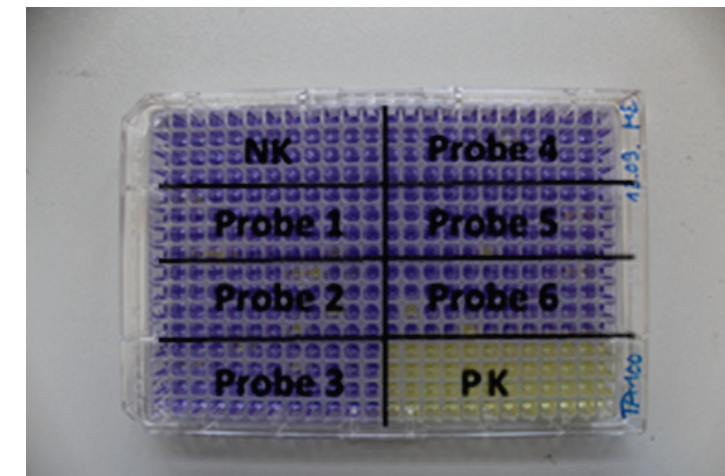
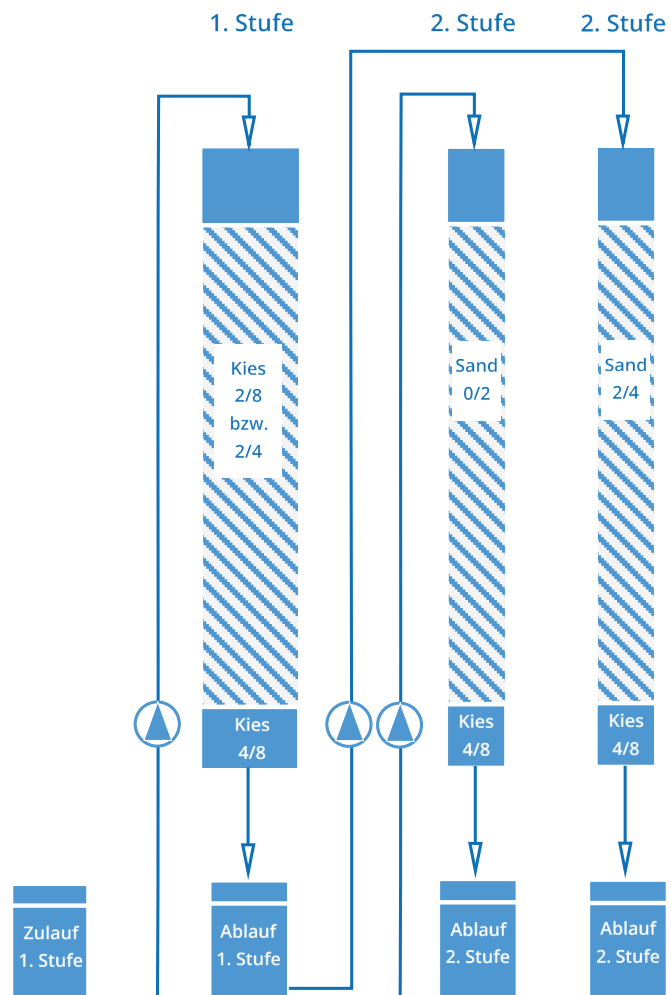


2. Lab scale:

(Öko-)Toxikologische Begleituntersuchungen zur Identifizierung der Vorzugsvariante



Lab scale



Mutagenität,
Gentoxizität, ROS

DMAC + Spurenstoffe

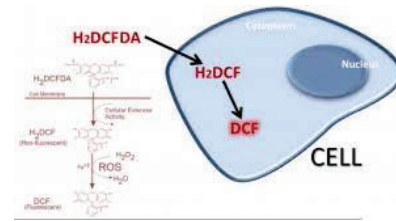


Biotest

Effekte

ROS-Test
ISO/TS
19006:2016

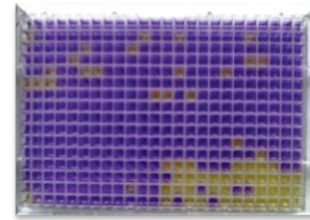
reactive oxygen
species
(oxidativer
Stress in den
Zellen)



<https://www.biotrend.com>

Ames-Test
OECD 471

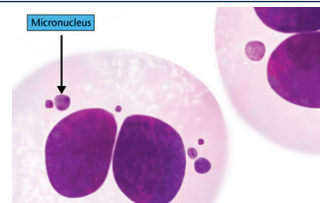
Mutagenes
Potential
(Punktmutation)



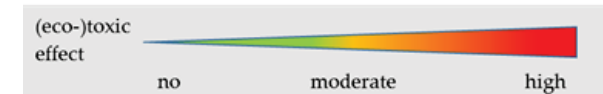
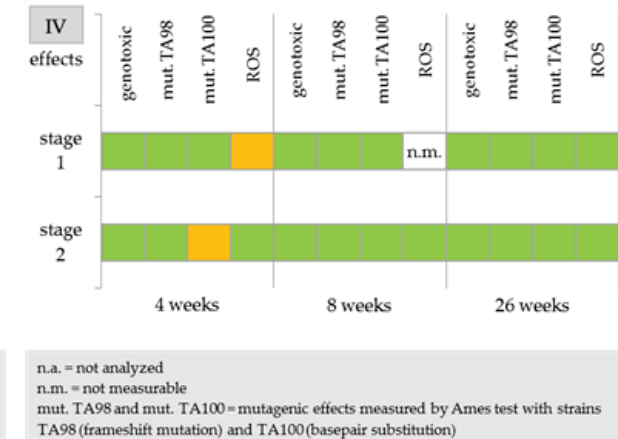
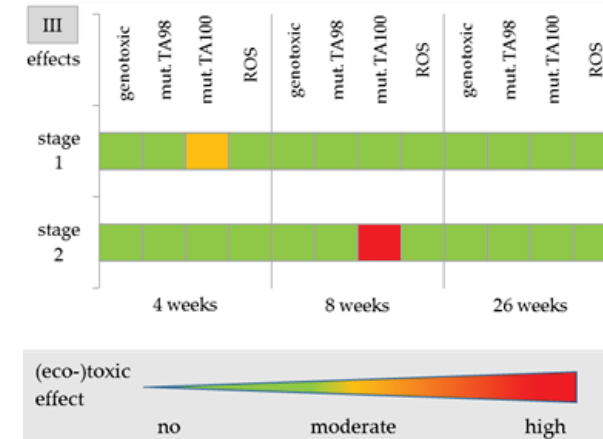
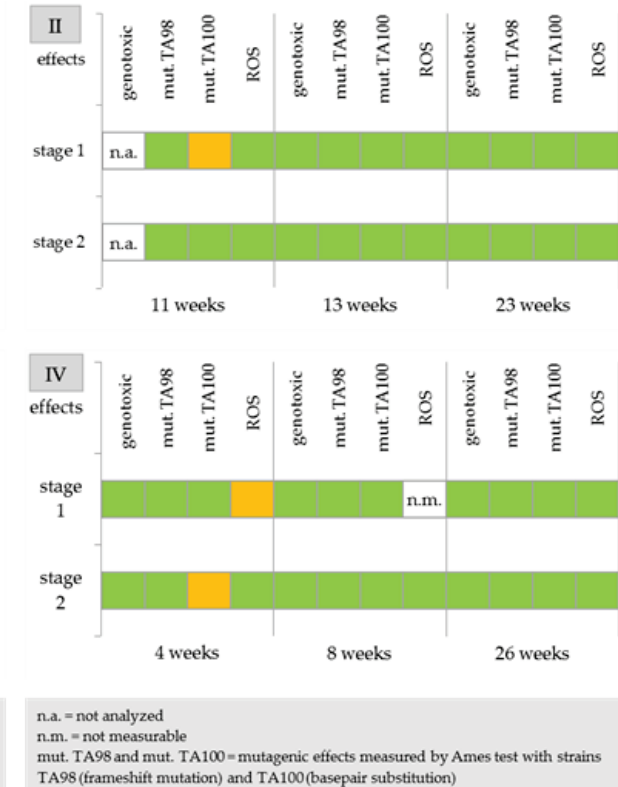
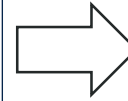
S. Ostermann

Mikrokern-Test
OECD 487

Gentoxisches
Potential
(Chromosomen-
schäden)



bat-science.com



n.a. = not analyzed
n.m. = not measurable
mut. TA98 and mut. TA100 = mutagenic effects measured by Ames test with strains TA98 (frameshift mutation) and TA100 (basepair substitution)

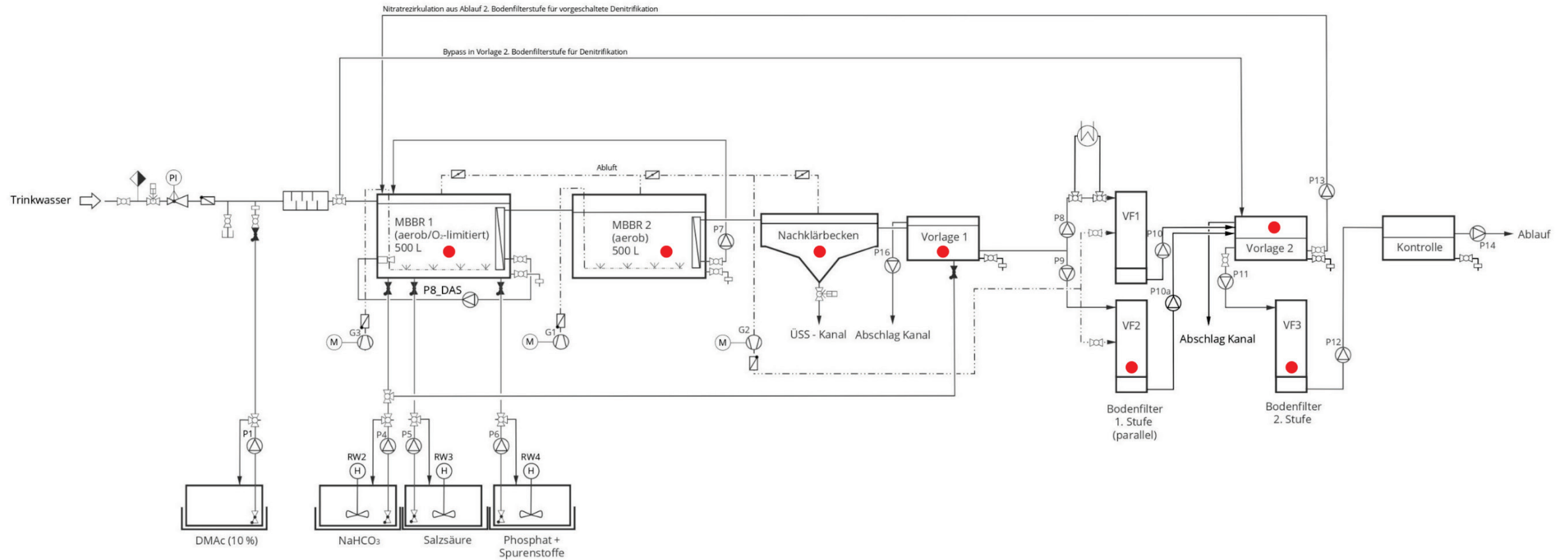
Thomas Schalk et al. 2023

3. Pilot scale:

(Öko-)Toxikologische Begleituntersuchungen beim Upscaling von Vorzugsvariante zur Pilotanlage



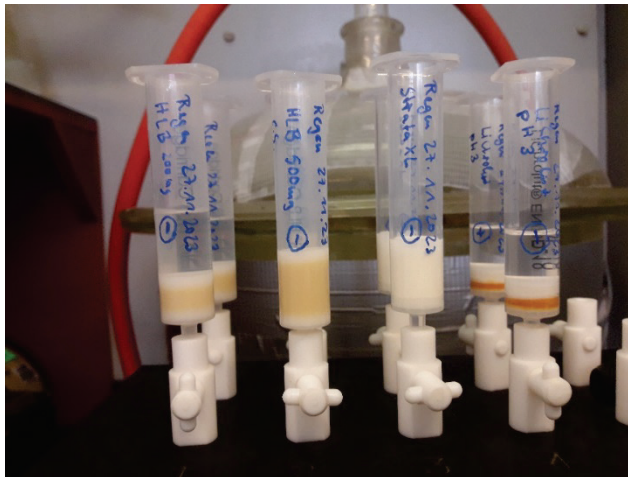
Pilot scale



Pilot scale

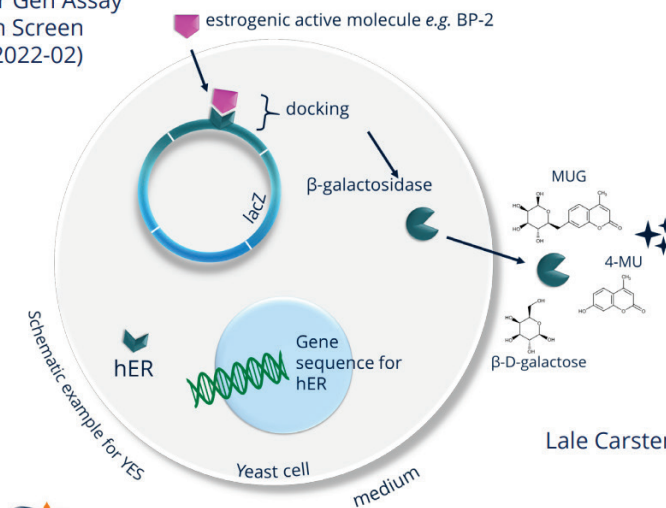


Festphasenextraktion



Hefereporteragenassays zur Bestimmung von Hormonaktivität

Yeast Reporter Gen Assay
Yeast Estrogen Screen
(ISO19040-1: 2022-02)



Lale Carstensen et. al 2022



MHYB01 Ökotox Sara Schubert

Vielen Dank für Ihre Aufmerksamkeit!