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#EU GREEN WEEK

EU Green Week Partner Event

Pharmaceuticals in sewage sludge
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Monitoring and possible removal

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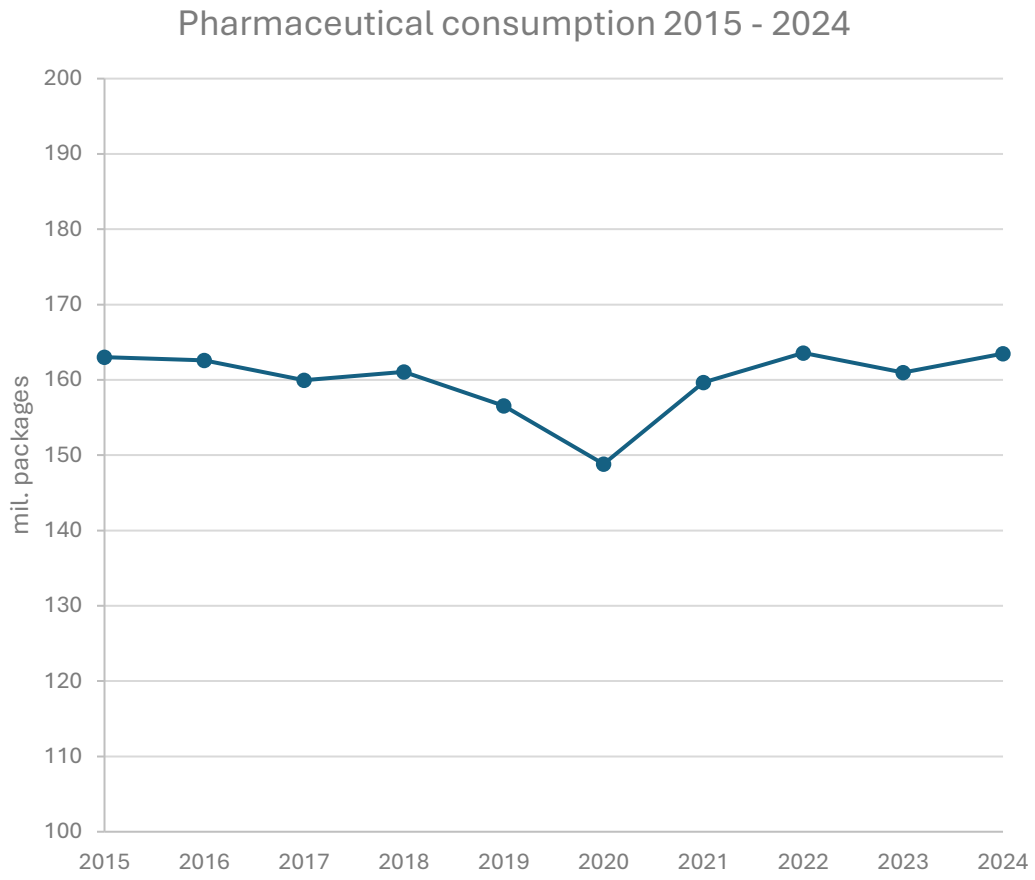
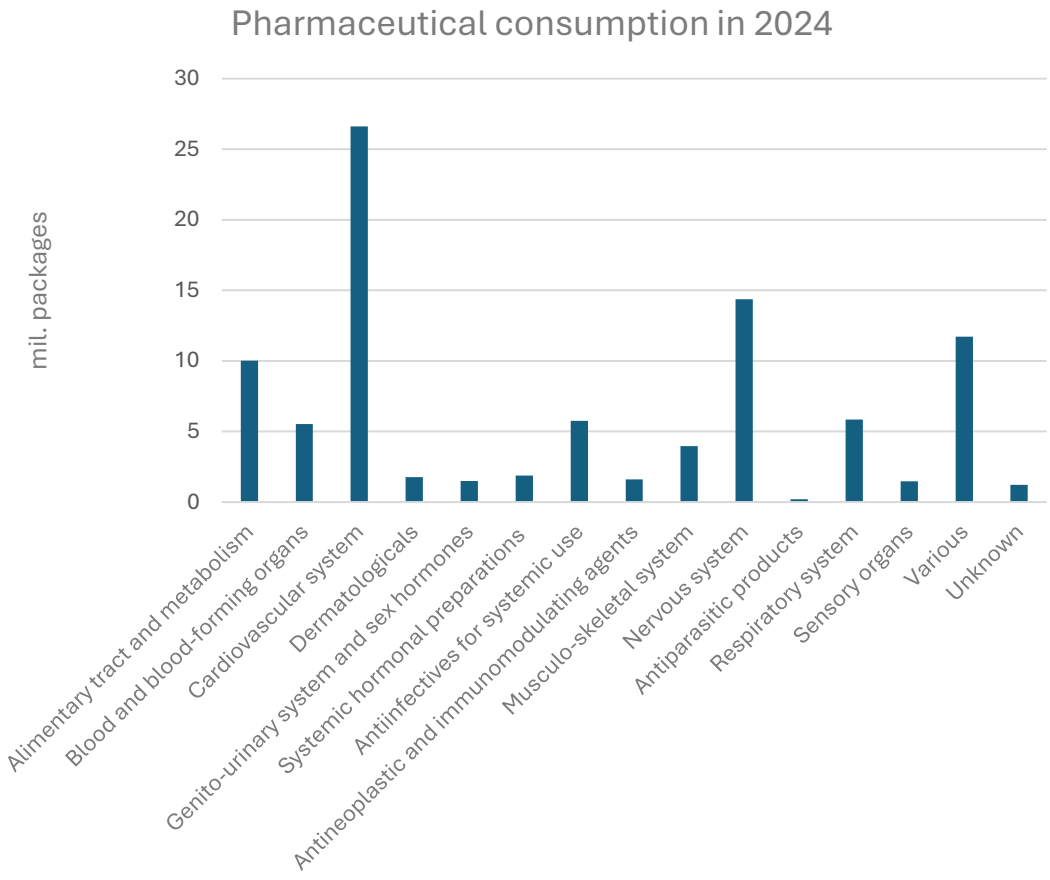
WASTEWATER AS A RESOURCE:
REGIONAL WORKSHOP ON
SEWAGE SLUDGE MANAGEMENT
AND ENERGY EFFICIENCY

DANUBE REGION strategy Water Quality

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

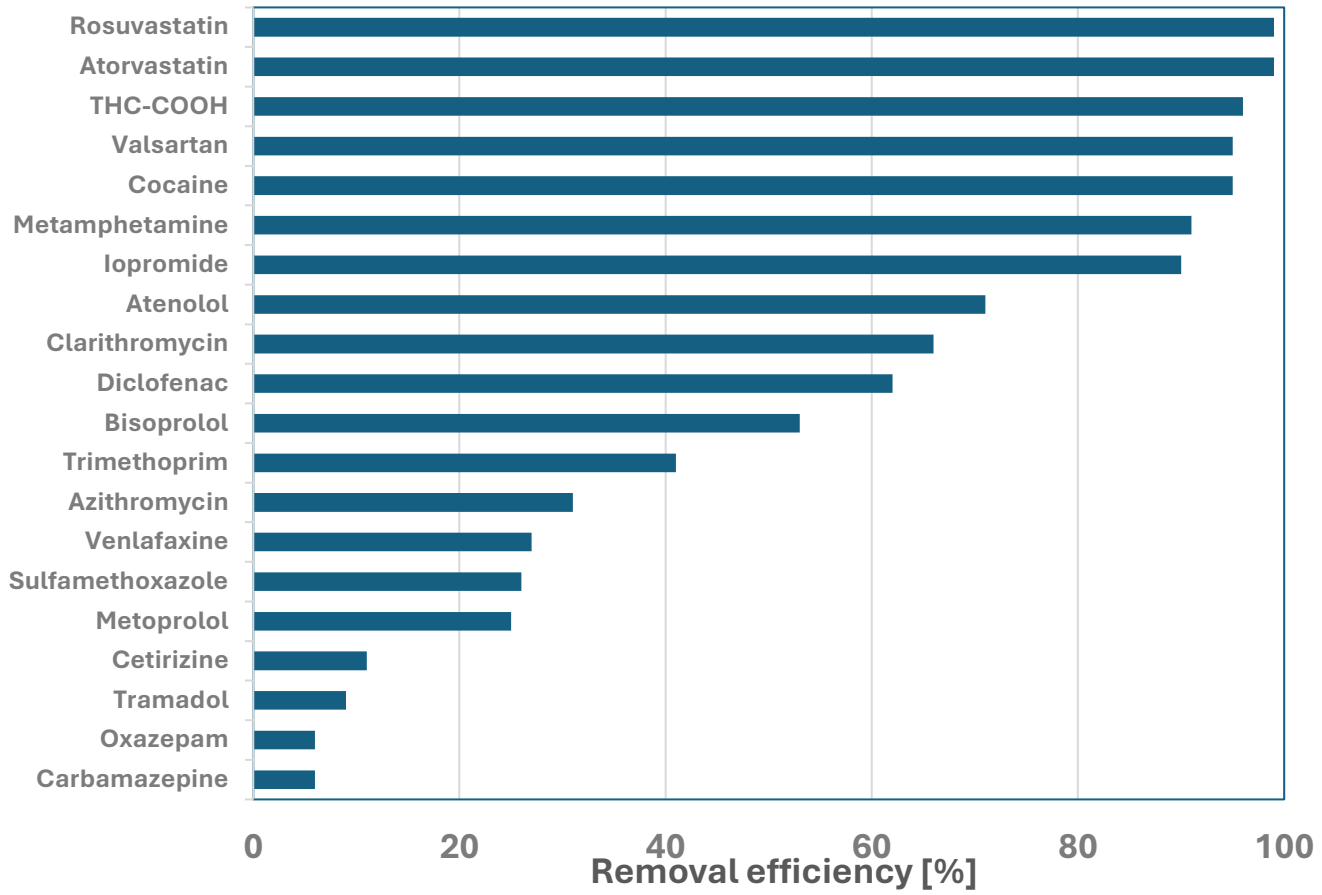
Pharmaceutical consumption in Slovakia

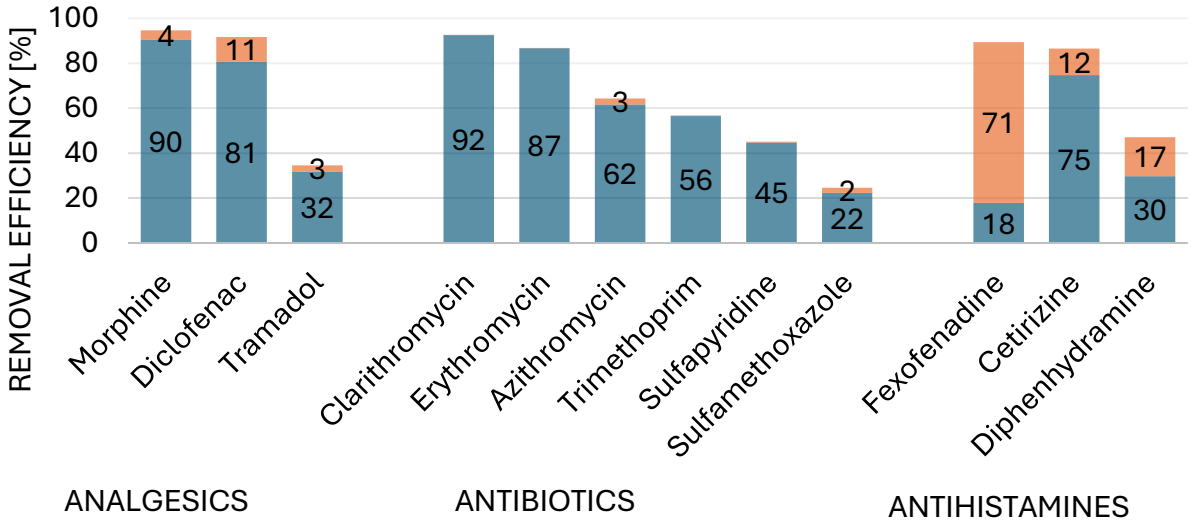


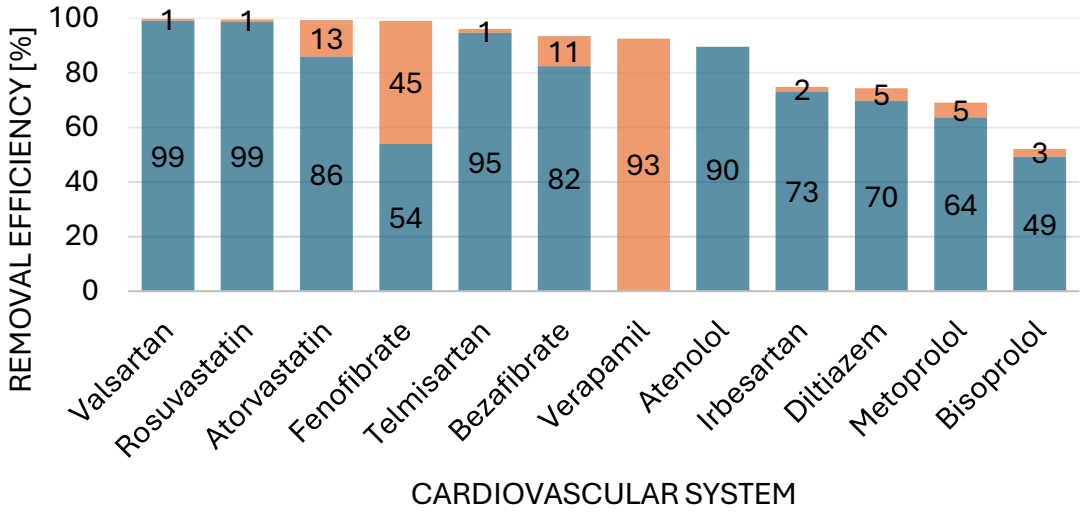


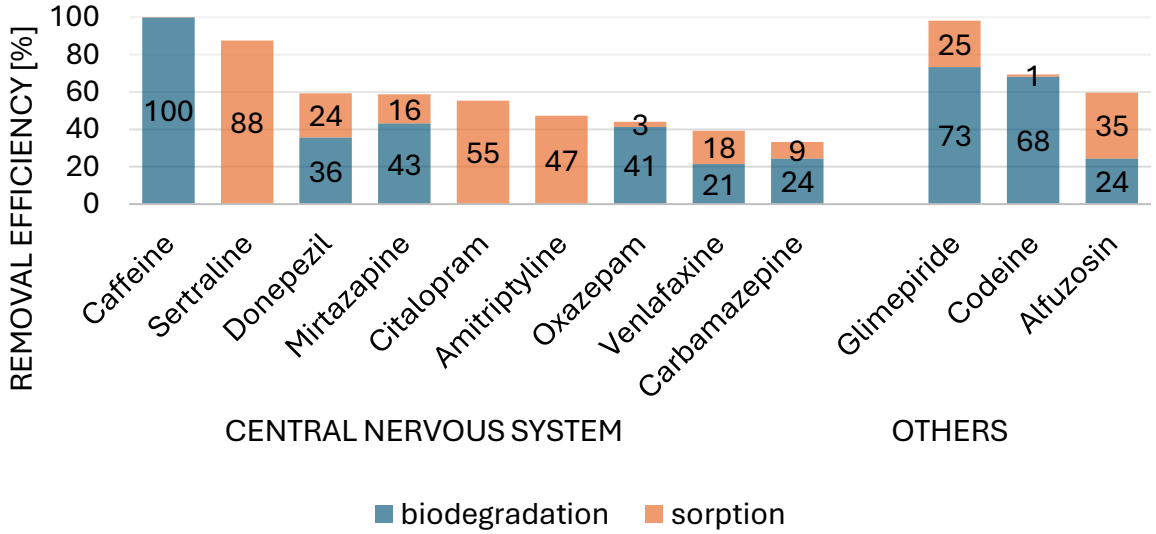
Pharmaceuticals on WWTP

- ongoing research from 2013
- more than 1500 samples
- inflow, primary sedimantation, sludge water, effluent, seware sludge
- 22 WWTP (1,6 mil. people)
- wide range of removal efficiency







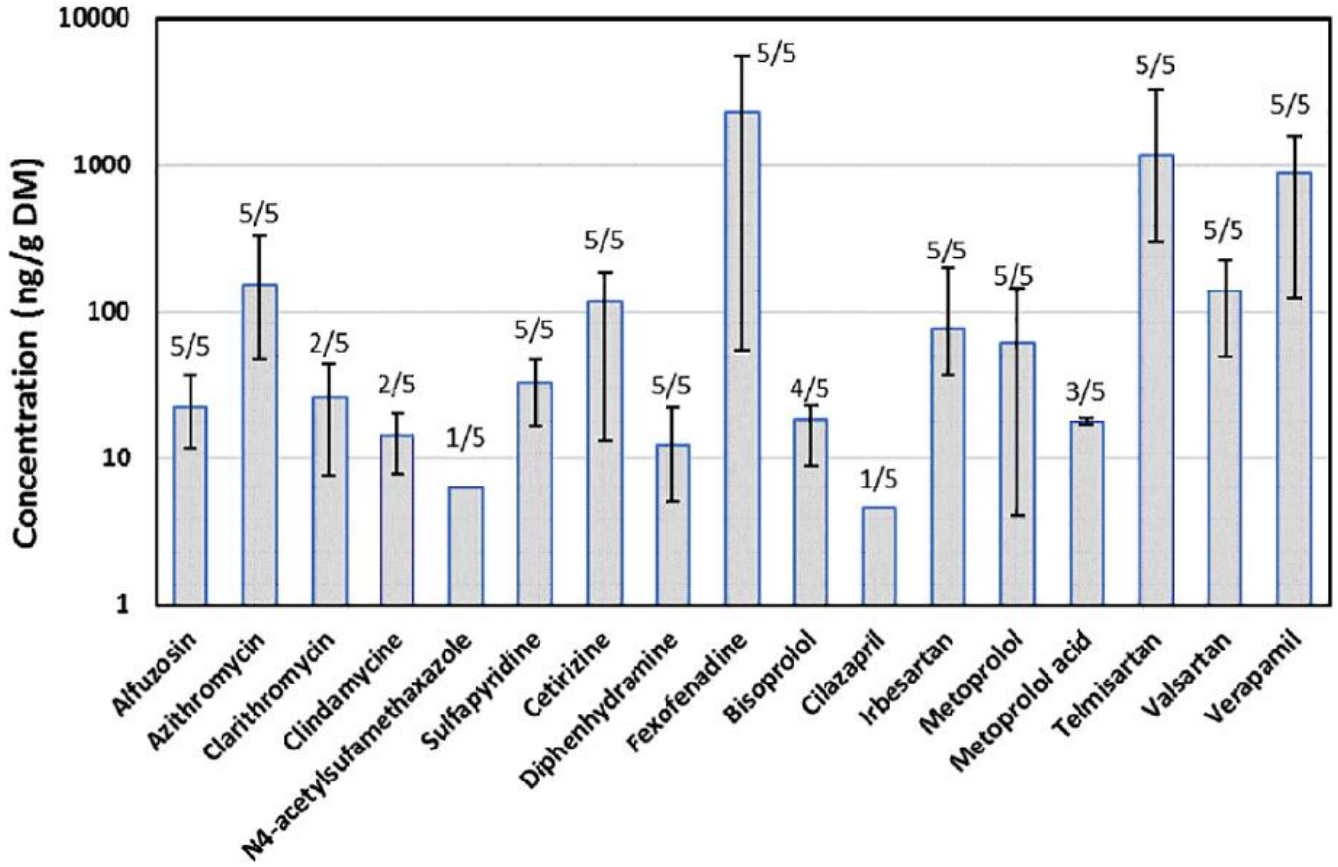


Pharmaceuticals in sewage sludge

WWTP	PE	Typ of sludge stabilisation	Production of sludge	Dry matter	Number of identified pharmaceuticals	Sum of pharmaceutical concentration
			ton TS/year	(%)	(No.)	ng/g TS
CWWTP Bratislava	440 000	anaerobic	6650	29.6	43	7460
Bratislava DNV	45 000	anaerobic	400	22.0	40	11800
Komárno	35 000	anaerobic	450	15.3	36	4870
Senec	22 500	aerobic	200	18.9	45	11300
Spišská N.Ves	50 000	aerobic	400	23.0	33	2540

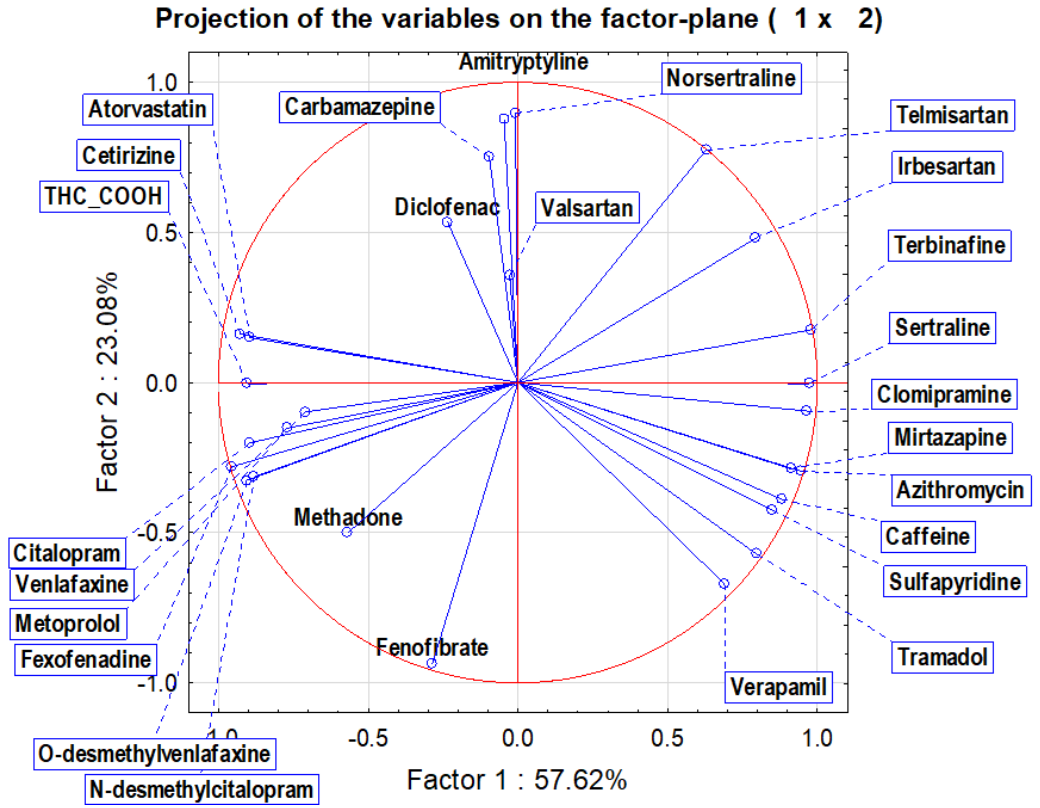
Pharmaceuticals in sewage sludge

- analysed 93 pharmaceuticals
- 41 pharmaceuticals <LOQ
- 25 pharmaceuticals present in every sewage sludge
- 32 pharmaceuticals average above 10 ng/g TS



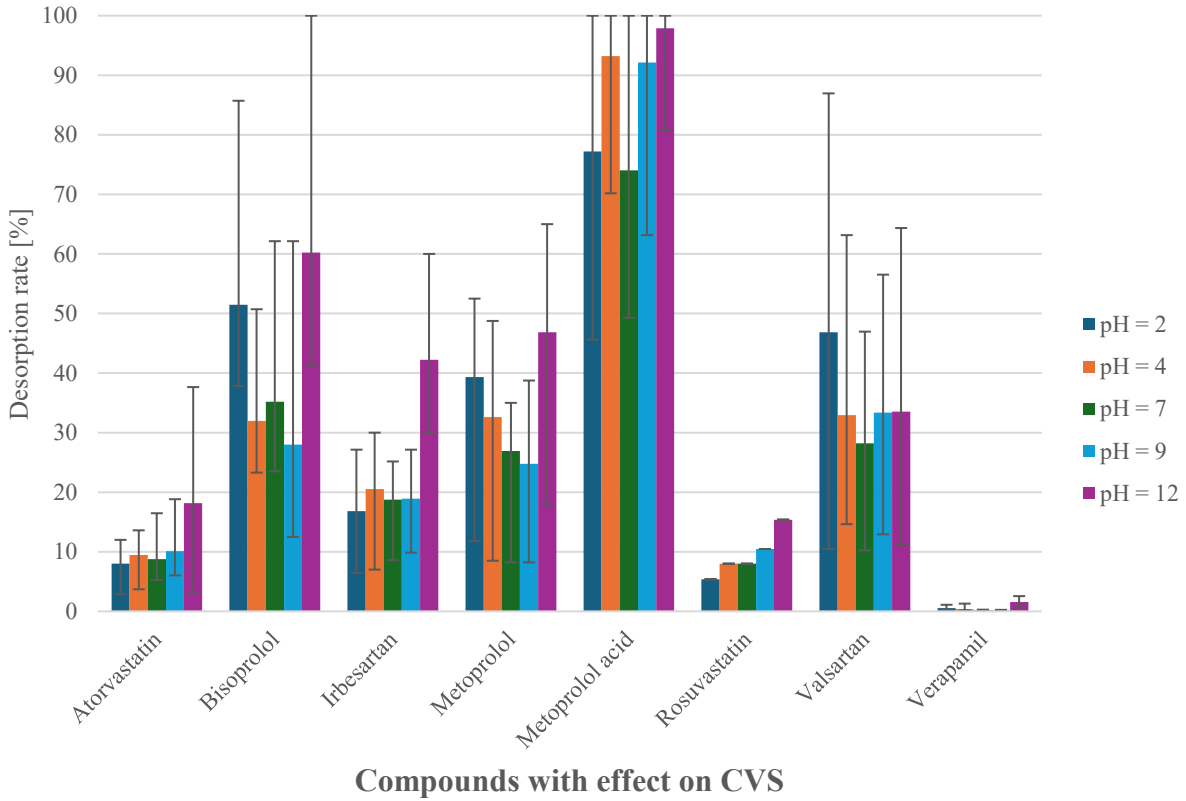
Pharmaceuticals in sewage sludge

- type of stabilisation influences amount of pharmaceuticals
- ↑ aerobic stabilisation
  - Telmisartan (1950 vs. 651 ng/g DM)
  - Sertraline (800 vs. 377 ng/g DM)
  - Azithromycin (292 vs. 60 ng/g DM)
- ↑ anaerobic stabilisation
  - Fexofenadine (3440 vs. 686 ng/g DM)
  - Citalopram (593 vs. 358 ng/g DM)
  - THC-COOH (196 vs. 33 ng/g DM)

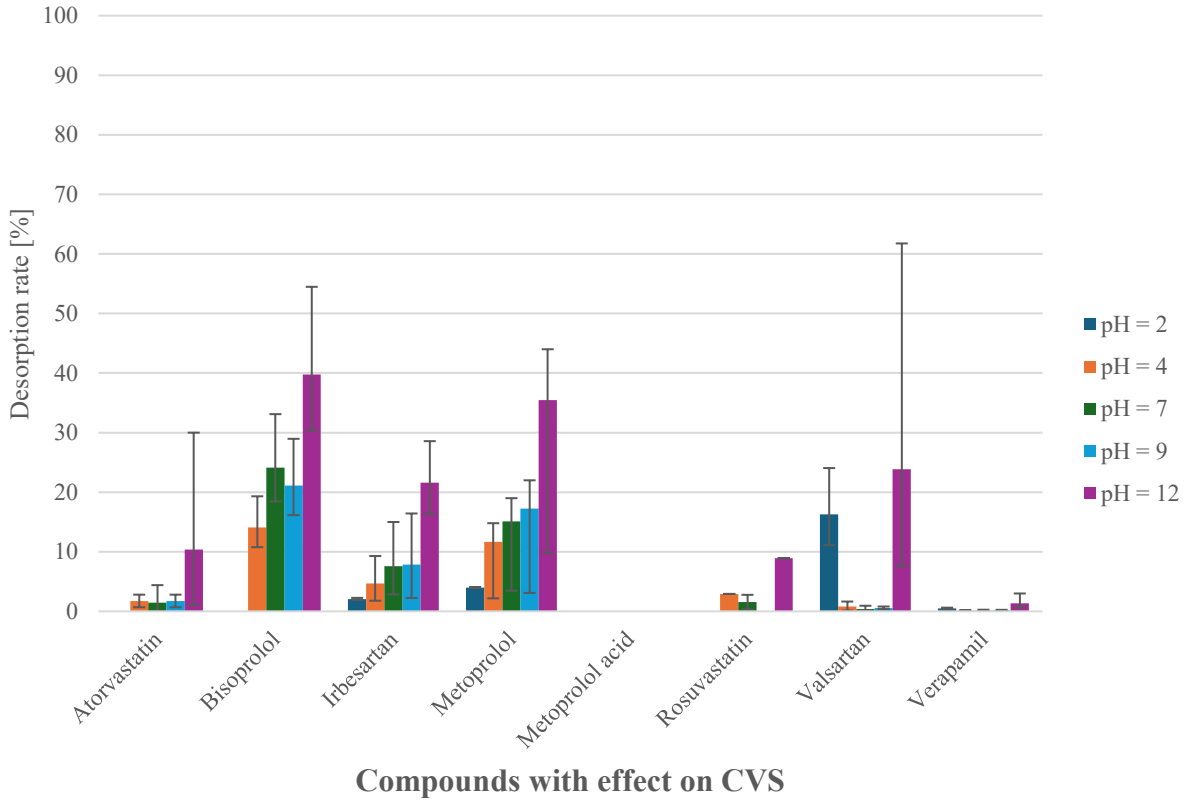


Desorption of pharmaceuticals from sewage sludge

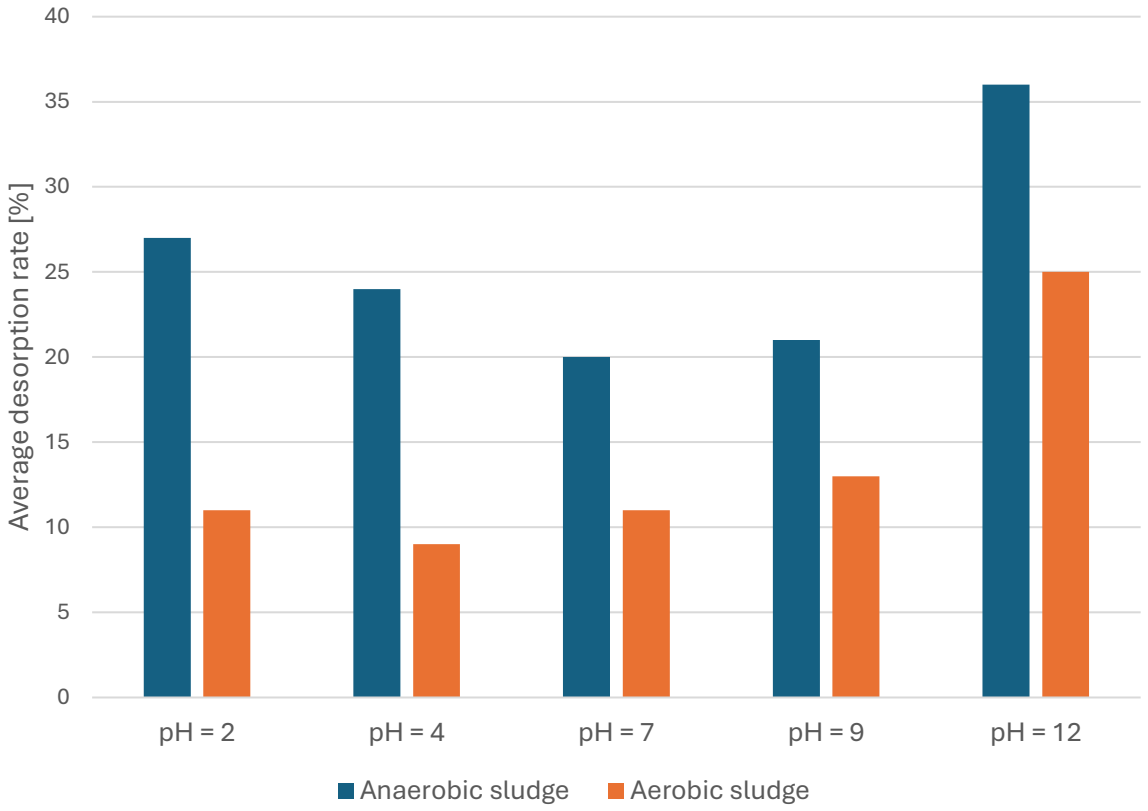
Sludge after anaerobic stabilisation



Sludge after aerobic stabilisation



Desorption of pharmaceuticals from sewage sludge



- desorption occurred under each investigated pH
- maximal desorption detected for pH = 12
- if desorption is realized under controlled conditions:
  - + treated sludge in higher quality
  - - lower DM of treated sludge

Thermal decomposition of sewage sludge

- 8 WWTP with anaerobic stabilisation of sewage sludge
- thermally treated sewage sludge after dewatering from the WWTP - temperature: 80°C, 105°C, 250°C, 550°C

	WWTP							
	KE	TT	BB	NR	PP	DNV	TN	PN
	sum of pharmaceuticals ng/g DM							
untreated	2500	1800	2100	3500	2700	2900	3900	2300
80°C	590	350	450	510	480	670	640	420
105°C	380	300	410	420	530	270	440	310
250°C	2.9	2.6	6.9	9.9	1.6	6.5	3.2	2.0
550°C	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	n.a.	<LOQ	<LOQ

Thermal decomposition of sewage sludge

- increasing temperature up to 80°C – 105°C can significantly decrease amount of pharmaceuticals in sewage sludge
  - pharmaceuticals with effect na CVS – 80 – 95%
  - pharmaceuticals with effect na CNS – 70 – 90%
  - others – 30 – 70%
- temperature 250°C – almost all pharmaceuticals <LOQ (exception - telmisartan ca. 3 ng/g DM)
- temperature 550°C – all pharmaceuticals <LOQ

Thank you for your attention!

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