

Fact Sheet on Pharmaceutical Residues in the Urban Water Cycle

Pharmaceutically active compounds

- In the EU around 3000 different pharmaceuticals are used for human health
- Many pharmaceuticals are not degraded in the human body and excreted either unchanged or as metabolites
- Furthermore, many pharmaceuticals are not completely degraded in conventional treatment processes. Thus, a wide variety of them are present in wastewater effluents, surface waters and groundwaters
- Pharmaceuticals are not (yet) regulated by the EU water framework and drinking water directives. Though acute health hazards through drinking water consumption can be largely excluded, pharmaceutical residues in the water cycle demand precaution.

Benchmarks of pharmaceuticals

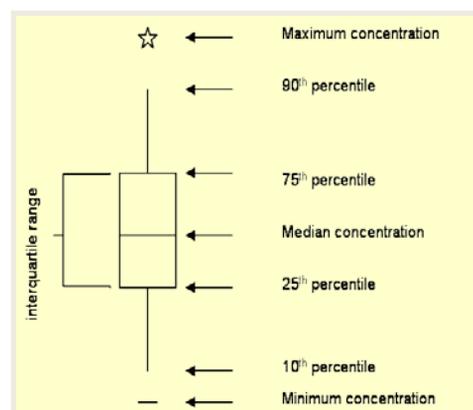
- This document provides graphical benchmarks for comparison of detected concentrations of selected pharmaceuticals
- It contains pharmaceuticals which were identified as priority pharmaceuticals by the Global Water Research Coalition in 2008. Out of 44 priority pharmaceuticals, 30 were tested in at least one of the water compartments of the study sites of Berlin and the Canton Zurich

Who is this document for?

- This benchmark paper allows water practitioners, water, wastewater and catchment managers to compare detected concentrations of priority pharmaceuticals with their own plants or catchments
- It may serve as decision support for the risk assessment of pharmaceuticals in the urban water cycle

How to use it?

- Measured pharmaceuticals are presented on the graph's x-axis, statistical values of the concentrations are illustrated by box plots
- Predicted non effect concentrations (PNEC values) for surface water and groundwater concentrations are given, if available
- Complementary tables provide the number of samples measured and detected for each compound and each water compartment
- A color-code is linked to each pharmaceutical regarding its potential degradability in conventional treatment pathways
- If, especially for easily degradable pharmaceuticals, a detected concentration is considerably higher than the benchmark values, this may indicate a malfunction of the considered wastewater system



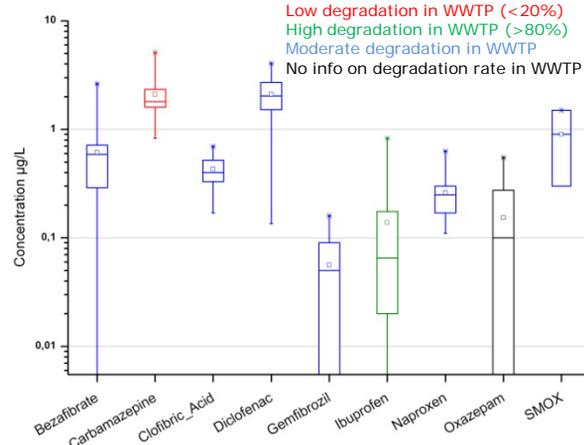
Pharmaceutical Concentrations Berlin

Measured pharmaceuticals

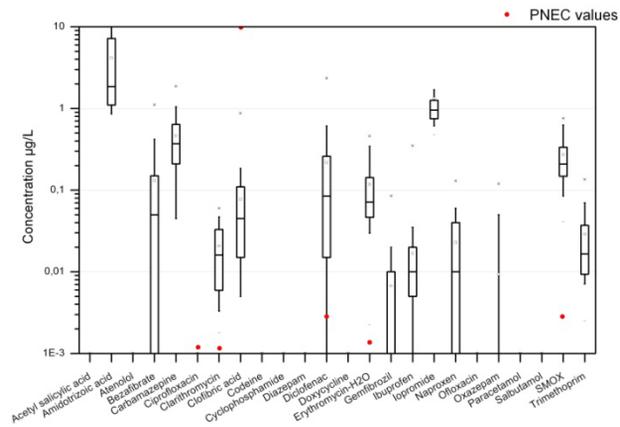
	Acetyl salicylic acid	Amidotrizoic acid	Atenolol	Bezafibrate	Carbamazepine	Ciprofloxacin	Clarithromycin	Clofibric acid	Codeine	Cyclophosphamide	Diazepam	Diclofenac	Doxycycline	Erythromycin	Gemfibrozil	Ibuprofen	Iopromide	Naproxen	Ofloxacin	Oxazepam	Paracetamol	Salbutamol	Sulfamethoxazole	Trimethoprim
STP effluents																								
Nr. of Samples	0	1	0	28	161	0	0	35	0	0	0	35	0	0	33	35	1	33	0	33	0	0	2	0
>LOD	-	1	-	26	161	-	-	35	-	-	-	35	-	-	24	30	1	33	-	19	-	-	2	-
Surface Water																								
Nr. of Samples	117	6	117	305	464	10a	48	373	117	117	117	373	a	48	279	305	71	279	10	279	117	117	47	48
>LOD	0	6	0	207	462	0	48	345	0	0	0	334	0	48	96	260	71	180	0	54	0	0	47	48
Groundwater																								
Nr. of Samples	0	7	0	695	1008	a	379	695	0	0	0	696	a	375	a	a	254	a	0	a	0	0	376	379
>LOD	-	7	-	23	764	0	33	471	-	-	-	436	0	212	0	0	109	0	-	0	-	-	284	4

a : the compound was measured but uncertainty on the number of samples exists

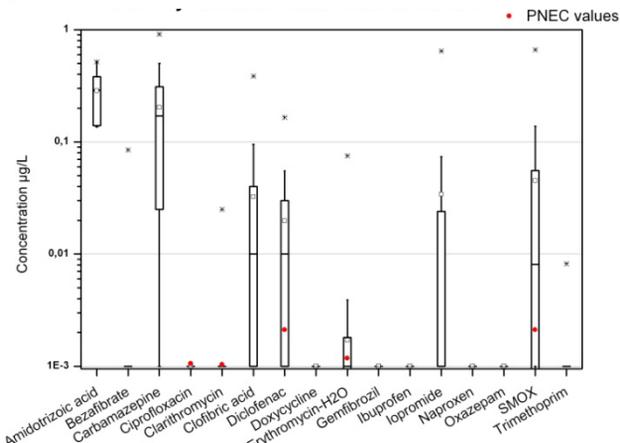
Sewage treatment plant effluents



Surface waters



Groundwaters

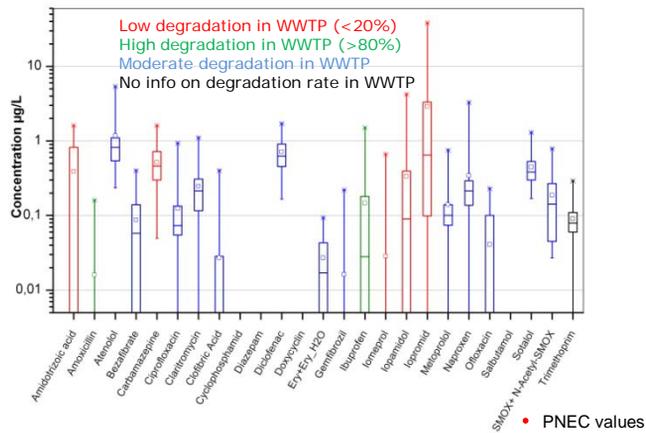


Pharmaceutical Concentrations Canton Zurich

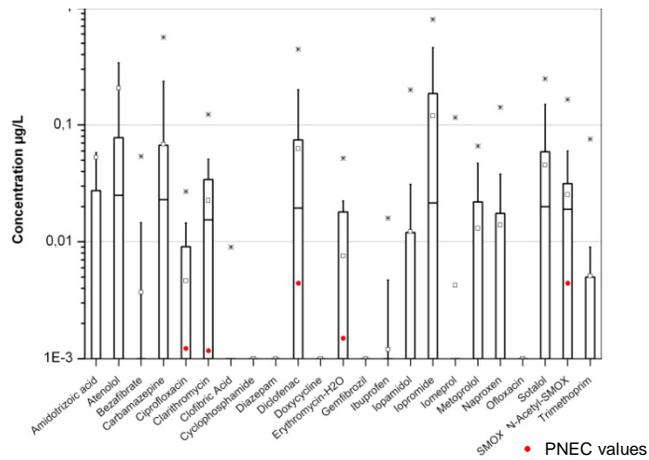
Measured pharmaceuticals

	Amidotrizoic acid	Amoxicillin	Atenolol	Bezafibrate	Carbamazepine	Ciprofloxacin	Clarithromycin	Clofibric acid	Cyclophosphamide	Diazepam	Diclofenac	Doxycycline	Erythromycin	Gemfibrozil	Ibuprofen	Iomeprol	Iopamidol	Iopromide	Metoprolol	Naproxen	Ofloxacin	Salbutamol	Simvastatin-hydroxy-acid	Sotalol	Sulfamethoxazole	Trimethoprim
STP effluents																										
Nr. of Samples	39	25	34	34	78	67	85	53	15	7	78	13	79	30	72	43	44	55	25	61	25	15	0	35	47	44
>LOD	17	3	34	23	78	57	84	25	0	0	78	0	53	4	51	7	27	42	23	58	7	0	-	35	45	42
Surface Water																										
Nr. of Samples	40	0	34	34	34	48	75	31	6	8	68	6	63	27	44	45	44	46	25	33	20	0	0	34	47	47
>LOD	14	-	25	4	27	22	63	0	0	0	51	0	27	0	11	3	13	23	13	15	0	-	-	26	19	22
Groundwater																										
Nr. of Samples	36	23	23	23	23	22	32	23	23	22	23	0	31	23	23	32	36	32	23	22	23	23	22	23	58	32
>LOD	15	0	0	0	2	0	0	0	0	0	0	-	0	0	0	0	4	0	0	0	0	0	0	0	27	0

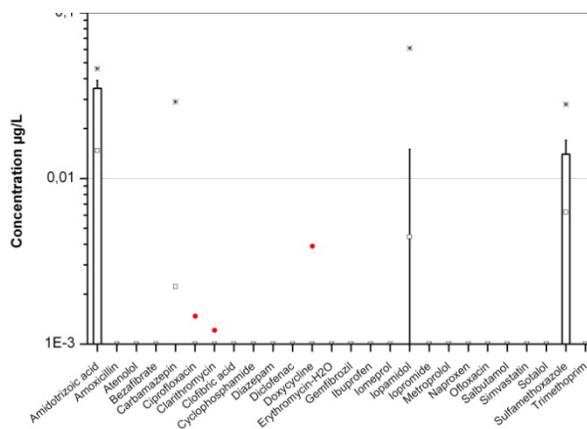
Sewage treatment plant effluents



Surface waters



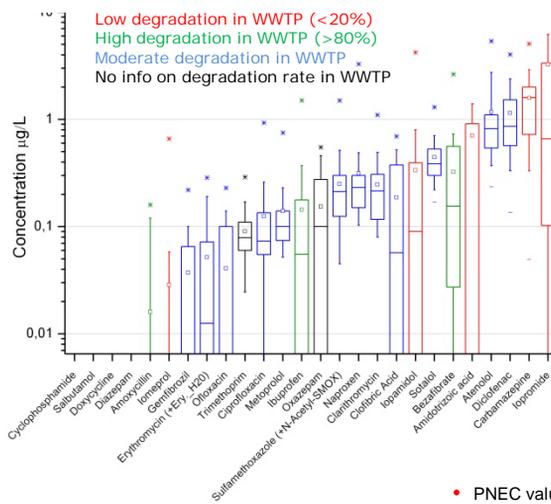
Groundwaters



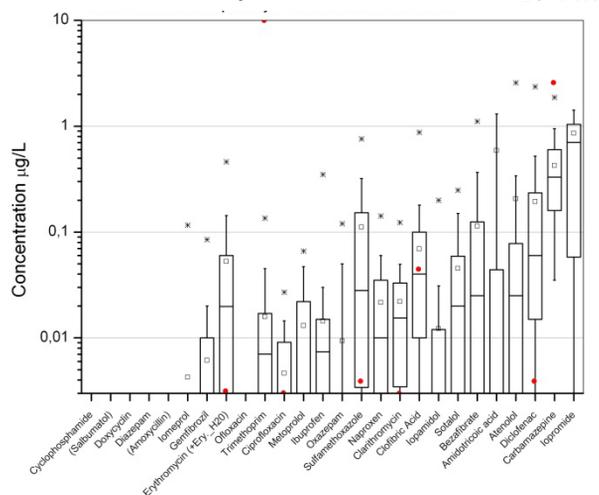
Overall benchmark

- The overall benchmark integrates both databases from Berlin and Zurich. It can be used if the considered plant or catchment cannot be related clearly to one of the two study cases.
- The pharmaceuticals are plotted according to the increasing 75%-fractile concentrations. The sorting helps the user identifying those pharmaceuticals, which are more likely to be found in high concentrations.

Sewage treatment plant effluents



Surface waters



Further information

The full report can be downloaded from the KWB website: www.kompetenz-wasser.de

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