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Database - Pharmaceuticals in the environment

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Pharmaceutical residues occur globally in the environment. This is demonstrated in the updated database “PHARMS-UBA”. Residues of pharmaceuticals in the environment have been measured in 89 countries in all UN regions. For Germany, 414 active substances or their transformation products were reported, 749 for the European Union and 992 worldwide.

You are invited to browse the 276,895 data entries from 2,062 publications in the publicly available database [here](#).

NEW! Access the PHARMS-UBA database also in the IPCHEM Portal: <https://ipchem.jrc.ec.europa.eu>.

A brief instruction how to access the PHARMS-UBA database is available [here](#).

Background

Residues of pharmaceuticals are known to occur widely in the aquatic environment of industrialized countries. Even in developing and emerging countries, information on the occurrence of pharmaceutical residues in the environment has become more readily available in recent years. However, a concise and comprehensive overview of the relevant pharmaceuticals, their concentrations in the environment and their potential effects on human health and ecosystems is still pending. The information on worldwide exposure of pharmaceuticals is increasing and the German Environment Agency intends to organise these data in a publicly available database. In 2014, worldwide environmental concentrations (MEC - Measured Environmental Concentrations) of human and veterinary pharmaceutical residues were compiled in a database within the framework of the research project "Pharmaceuticals in the environment - occurrence, effects and options for action". The now available update of this database focuses on all worldwide MECs published in peer-reviewed journals between 2017 and 2020.

Summary of results

The database now contains 276,895 entries. Active substances or their transformation products were detected in the environment of 89 countries of all five UN regions (see also Figure 1 and 2). In total, 992 different pharmaceutical substances were measured worldwide in concentrations above their detection limits of the respective analytical methods employed, revealing regional patterns. In Germany alone 414 active substances were detected above their detection limits as well as 749 active substance in EU countries (see Table 1). Most of these substances were found in the effluents of wastewater treatment plants (liquid emission – globally: 771, EU: 4591, Germany: 339). In surface water, groundwater and drinking water 703 substances were detected globally and 198 in Germany (liquid immission). 37 substances were detected in surface water, groundwater or drinking water in all five UN regions (see Table 2).

In the final report on the database update further exemplary evaluations can be found

The database

For the database 2,062 publications were comprehensively reviewed and analysed. Environmental concentrations of human and veterinary pharmaceutical residues could be collected for 61 matrices. Most pharmaceutical residues were found in surface water, groundwater, tap/drinking water as well as in soil and sediment.

The data were transferred from the publications, reports and other data sources into the database (MEC database). The database is available for download as Microsoft Excel© or as Microsoft Access© file. Each database entry comprises 33 fields, including amongst others the name of the pharmaceutical substance, its CAS number, the environmental matrix the substance was measured in, geographical location, sampling

period, number of measurements, measured concentration in original and standardised units, detection limit of the analytical method employed, pollution source (if stated in publication), literature citation, publication language and type, and quality flag.

All references used were compiled in an Endnote© literature database. For transparency and to allow for better working with the MEC database please download here the literature database as travelling library and in other formats in a zip-file.

Matrices

The 992 pharmaceutical substances were detected in 61 matrices in total. Matrices with the most environmental concentrations are surface water, riverbank filtration, groundwater, well-water, tap/drinking water, sewage, effluents and sludge of wastewater treatment plants (WWTP), manure, soil, sediments and suspended particulate matter. Further matrices were distinguished. During the data import of the years 2017-2020 seven further environmental matrices (e.g. compost, sediment lagoon, spring water) were added to the database.

Regional aggregation

The geographic sampling were categorised according to the United Nations regional groups of Member States (Africa Group; Asia-Pacific group; Eastern Europe group (EEG); group of Latin American and Caribbean States (GRULAC); Western Europe and Others Group (WEOG), including North America, Australia, and New Zealand).

Data aggregation

Many publications contain multiple environmental concentrations in rather evaluated form (e.g. average, median, 90th percentile, minimum or maximum of a monitoring campaign) than single observations. These aggregated data are compiled additionally in a database entry together with information on statistics and number of underlying measurements.

Quality assessment

A quality flag of each database entry refer to the reliability, plausibility and applied analytical standards of each publication. However, the quality of a publication is difficult to assess and can also be a matter of subjectivity, thus the information on data quality should be seen as an indicator only. Generally, peer-reviewed publications are considered verified sources of high quality. The quality of other sources such as reports or university theses are more difficult to evaluate. Nevertheless, even though some of the methods and results published in non-peer reviewed publications were difficult to verify, the majority of publications can be considered of good quality.

The database "Pharmaceuticals in the Environment" - Update for the period 2017-2020

The database "Pharmaceuticals in the Environment" - Update and new analysis

Arzneimittel in der Umwelt - vermeiden, reduzieren, überwachen

Empfehlungen zur Reduzierung von Mikroverunreinigungen in den Gewässern

Antibiotika und Antibiotikaresistenzen in der Umwelt

Gallery

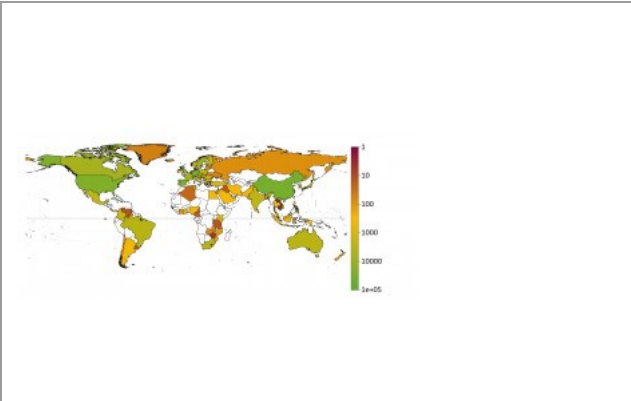


Figure 1: Map of worldwide distribution of MECs

Countries with a high number of MECs are shown in green and countries with a low number of MEC data in red. Most reported MECs were found for China (37.708 DB entries), Germany (34.001 DB entries), Spain (26.988 DB entries) und USA (25.647 DB entries).

Source: own source / TUD GmbH

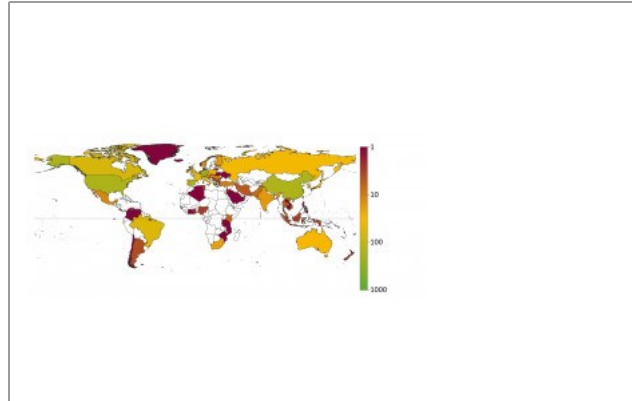


Figure 2: Map of worldwide distribution of publications reporting MECs

Countries with a high number of publication are shown in green, whereas countries with a low number of publications are shown in red. Most publications reporting MECs were found Germany (295 publications), China (274 publications), USA (226 publications) und Spain (199 publications). New are publications from the following countries: Egypt, Bangladesh, Iraque, Kamerun, Lesotho, Lettland, Moldawien, Sambia, Sri Lanka and Uruguay.

Source: own source / TUD GmbH

Tables

The PHARMAS-USA v3 database - in numbers - global, for the European Union and for Germany - compared to v2						
Number of	Global	European Union	Germany	v2	Change	
Publications	2.662	+349	940	+181	230	+14
MECs	96	+130	138	+1	1	+1
Positively detected MECs	121.252	+66.962	61.618	+18.676	17.683	+7.885
Liquid emission (WWTW effluent)	121.061	+66.847	58.038	+18.676	17.683	+7.885
Liquid emission (surface water/boast)	49.118	+19.718	19.456	+6.984	7.540	+1.028
Liquid emission (drinking and tap water)	4.628	+345	3.051	+252	150	0
Solid emission (sewage/sludge treatment from WWTPs and WWTW)	5.522	+6.750	6.248	+5.883	5.414	+5.266
Positively detected substances	882	+221	788	+188	424	+145
Liquid emission (WWTW effluent)	771	+218	581	+117	139	+113
Liquid emission (surface water/boast)	303	+175	483	+90	158	+19
Liquid emission (drinking and tap water)	107	+182	250	+184	39	+12
Solid emission (sewage/sludge treatment from WWTPs and WWTW)	201	+111	227	+85	120	+16

Table 1 Key Facts DB v3

Table 1: The database in numbers – number of active substances including their metabolites or transformation products with detections above their detection limits - global, for the European Union and for Germany; in comparison to version 2 of the database.

Source: own source / TUD GmbH

Number of positively detected MECs in surface water, groundwater or drinking water for substances occurring in all five UN regions								
UN region	Substance	Western Europe (WEOG)	Latin American and Caribbean Group (GRULAC)	Eastern Europe Group (EEG)	Asian Group (ASG)	African Group (AFG)		
North America	Acetaminophen	22	3	20	3	8		
	Amoxicillin	224	48	267	34	160		
	Aspirin	230	412	125	19	14		
	Chloramphenicol	61	61	70	7	16		
	Clotrimazole	107	268	117	4	16		
	Fluconazole	100	269	76	26	10		
	Paracetamol	100	43	220	42	18		
	Salicylic acid	43	0	460	21	6		
	Streptomycin	87	0	200	17	1		
	Tetracycline	34	1	0	12	3		
South America	Amoxicillin	18	1	60	16	1		
	Clotrimazole	176	4	440	35	1		
	Fluconazole	176	17	36	14	1		
	Salicylic acid	10	1	64	1	1		
	Tetracycline	25	6	271	16	1		
	Trimethoprim	162	10	450	41	11		
	Africa	Amoxicillin	19	2	0	2	1	
		Paracetamol	19	1	0	2	1	
		Asia	Amoxicillin	230	1	30	2	4
			Chloramphenicol	126	428	127	68	16
Clotrimazole			161	12	117	12	1	
Fluconazole			139	0	30	2	1	
Streptomycin			106	2	107	1	1	
Tetracycline			122	10	76	2	10	
Europe			Amoxicillin	147	1	107	9	4
			Fluconazole	104	10	204	6	10
	19 other pharmaceuticals		105	0	10	3	17	
	21 other pharmaceuticals		120	28	76	49	10	
	Sum	10	14	39	1	14		

Tab2: MECs in 5 UN regions

Table 2: Number of positively detected MECs in surface water, groundwater or drinking water for substances occurring in all five UN-regions: WEOG – Western Europe and Others Group, GRULAC – Latin American and Caribbean Group, EEG – Eastern Europe Group, ASG – Asian Group, AFG – African Group.

Source: own source / TUD GmbH

The UBA’s motto, For our environment (“Für Mensch und Umwelt”), sums up our mission pretty well, we feel. In this video we give an insight into our work.

The UBA

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