“Anaerobic Biodegradability of Pharmaceuticals and Personal Care Products in Raritan River Sediments”

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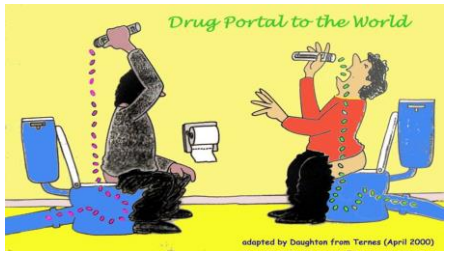
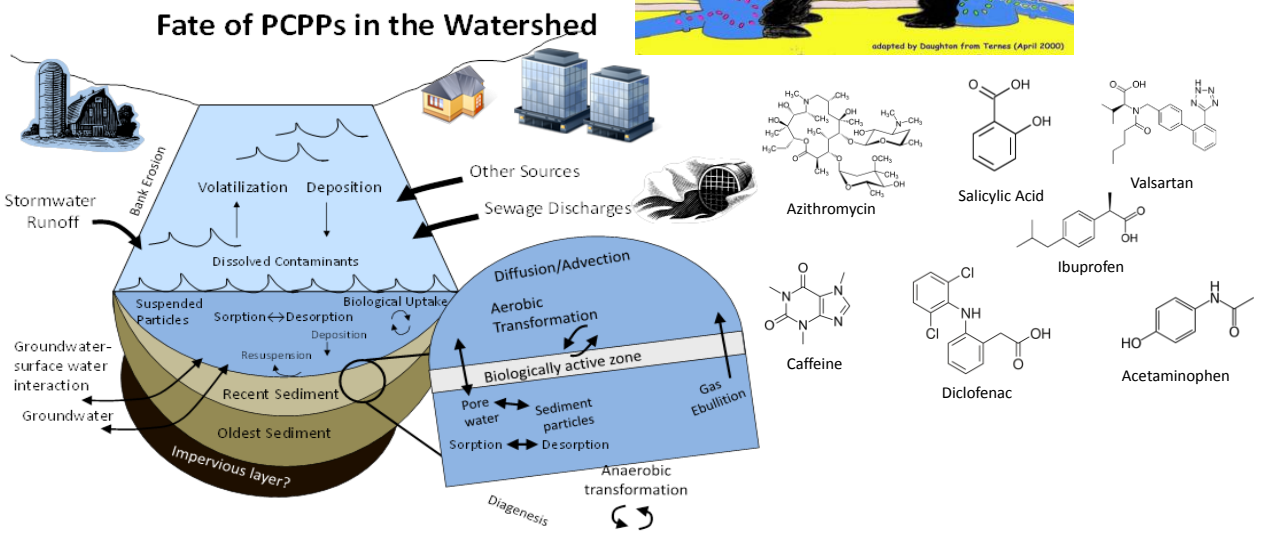
Problem





Importance of Work

- This work will lay the foundation for determining how the redox environment impacts biodegradability of PPCPs along the Raritan River Watershed.
- Determines the Suite and Quantities of PPCPs being released and found in the Raritan River.
- Identification of the microorganisms mediating anaerobic degradation of different PPCP compounds will provide new bioindicators that allow for monitoring of important microbial processes for use in combination with chemical monitoring.

Experimental Approach

Objective 1:

To determine how the "redox environment" impacts the **Biodegradability of a Suite of PPCP** compounds in the Raritan River comparing and contrasting, freshwater sites with estuarine sites (i.e. less and more impacted sites) at the mouth of the river.

Objective 2:

Assess Potential for microbial degradation and biotransformation of select PCPPs by **establishing Sediment Microcosms from Raritan River locations** representing a range of PCPP exposures (low to high) from rural to the urbanized areas, and freshwater to estuarine habitats.

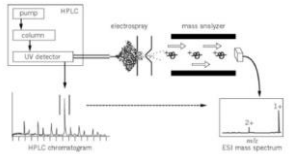
Objective 1. Where the pipe ends

Analysis of PPCPs, focusing on waste water treatment plant influent & effluent

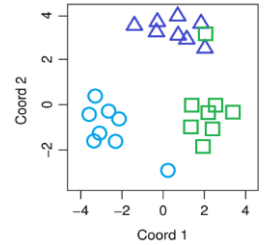
Collect samples from various locations in Raritan River, Hudson River.

Sample influent and effluent from WWTPs that discharge into these rivers

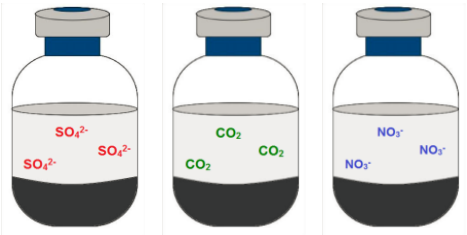
Concentrate and purify PPCPs from water by solid phase extraction (SPE)



Identify and quantify PPCPs by LC-MS/MS



Analyze the fate and distribution of PPCPs in watersheds



To mimic different conditions in WWTP sludge, river and estuarine environments -> microcosms were established under various **redox conditions,** specifically **sulfidogenic, methanogenic, and denitrifying conditions**.

Aamani Rupakula, Rutgers University

Results/Outcome

River water and influent/effluent samples from WWTPs are collected across various seasons. Specifically, we target sites upstream/downstream from WWTP discharge, as well as sampling the WWTP influent and effluents to identify the contribution of raw or treated sewage input.

LC-MS analysis of Influent and Effluent of WWTPs flowing into the Raritan River

Pharmaceuticals	Name	Abbr.	1/15/16 PVSC % Reduction	2/22/16 PVSC % Reduction	2/25/16 PVSC % Reduction	3/1/17 RTMUA % Reduction	Range of Concentrations in Influent (ng/L)
Anti-inflammatory drugs	Paracetamol crs	PCM	100	100	100	99.7	5800 - 22000
	Mefenamic acid	MFA	100	BDL	100	BDL	BDL – 11
	Salicylic acid (Aspirin)	SCA	99.1	98.7	94.2	86.3	706 - 10000
	Naproxen	NPX	98.5	73.9	44.5	BDL	BDL - 39000
	Ibuprofen	IPF	92.8	82.2	61.7	BDL	BDL - 13000
	Indomethacin	IDM	11.9	27.5	BDL	BDL	BDL – 23
	Diclofenac sodium salt	DCF	6.5	52.4	27.3	BDL	BDL – 515
Antibiotics	Lincomycin hydrochloride	LIM	100	BDL	BDL	100	BDL – 7
	Sulfamethoxazole	SMX	89.3	93.2	81.2	99.5	21 - 1100
	Ofloxacin	OFC	75.2	64.9	18.2	96.7	68 – 352
	Ciprofloxacin crs	CFC	75.0	67.1	58	99	34 – 233
	Azithromycin crs	ATM	20.0	40.6	(7.9)	94.2	50 – 223
	Chloramphenicol	CPC	10.7	50.3	BDL	BDL	BDL – 35
	Clarithromycin	CTM	6.1	25.0	6.3	95.2	57 – 271
	Trimethoprim	TMP	0.2	68.3	47.6	99.6	40 – 435
	Sulfadiazine	SDZ	(7.6)	35.7	17.3	100	13 – 54
	Vancomycin hydrochloride	VCM	BDL	88.1	BDL	BDL	BDL – 634

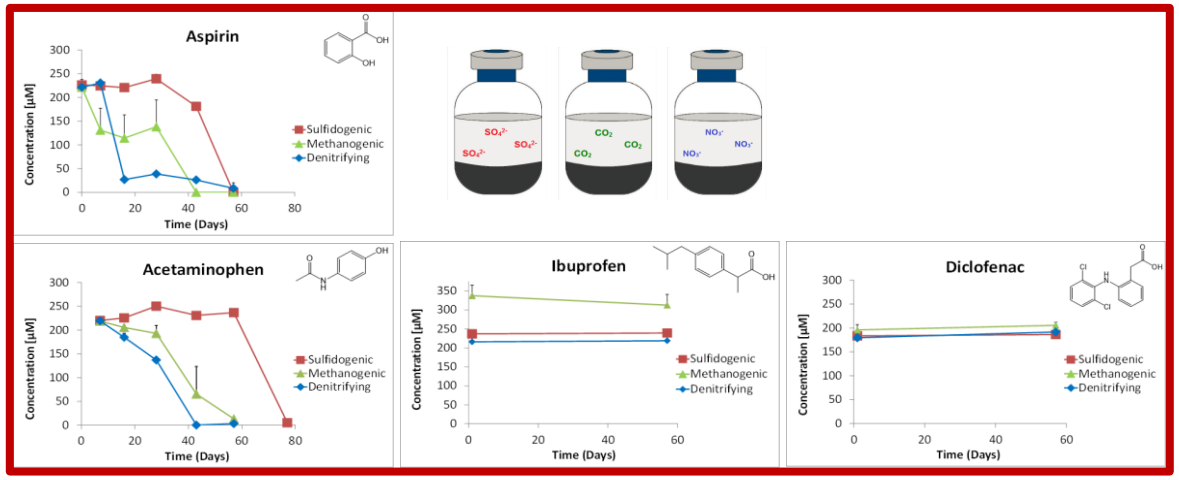
- (PVSC): Passaic Valley Sewerage Commission WWTP in Newark, NJ
- (RTMUA): Raritan Township Municipal Utilities Authority WWTP in Flemington, NJ

Characterization of PPCP-degrading Microbes in River Sediments

Poster by: Samuel Wieczerzak

Where The Pipe Ends: The Fate of PPCPs in the Raritan River Watershed

Poster by: Alex Mossavir



Acknowledgements

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