

Pharmaceuticals in MMSD's Effluent

Milwaukee Metropolitan Sewerage District

We Protect the Public & Lake Michigan:

- Convey/Store/Reclaim Wastewater
- Manage Flooding

We Serve:

- 1.1 Million Customers
- 28 Municipalities
- 411 Square Miles

We Have:

- 2 Water Reclamation Facilities
- 521 MG Tunnel System



Milorganite®

- Est. 1926
- Founded by O.J. Noer
- 1970's EPA deems the product safe for produce growth
- Today: >\$6.73M of annual cost recovery from sales of nearly 43,500 Tons

MILORGANITE

OVER 200,000 TONS ALREADY PRODUCED AND SHIPPED

THE PERFECT ORGANIC



COMPLETE ANALYSIS
Made from compost of 27,000 tons produced July 1, 1931 to June 15, 1932

1. Commonly Accepted Fertilizer Elements
Ammonia 7.5% Available Phosphoric Acid 2.5%
Available Potash 0.75% Moisture less than 5.0%
Organic Matter 75.0%

2. Other Common Mineral Elements Used by Plants % Pounds per ton

Calcium (Ca), as Calcium Oxide (CaO).....	1.61	32.2
Magnesium (Mg), as Magnesium Oxide (MgO).....	1.74	34.8
Sulphur (S), as Sulphur Trioxide (SO ₃).....	2.79	55.8
Iron (Fe), as Iron Oxide (Fe ₂ O ₃).....	6.88	137.6

3. Rare Elements Now Considered Vital

Copper (Cu), as Copper Sulphate (CuSO ₄ ·5H ₂ O).....	0.53	10.6
Manganese (Mn), as Manganese Sulphate (MnSO ₄ ·4H ₂ O).....	0.10	2.0
Lead (Pb), as Lead Oxide (PbO).....	0.22	4.4
Arsenic (As), as Arsenic Trioxide (As ₂ O ₃).....	0.015	0.3
Chromium (Cr), as Chromic Oxide (Cr ₂ O ₃).....	0.21	4.2
Titanium (Ti), as Titanium Oxide (TiO ₂).....	0.08	1.6

Iodine, Zinc, Nickel, Cobalt, Boron, also present.

THE SEWERAGE COMMISSION MILWAUKEE WISCONSIN

FIRST CARLOAD MILORGANITE MILWAUKEE'S AMMONIATE FERTILIZER PRODUCED AT SEWAGE DISPOSAL PLANT MILWAUKEE WIS.

AND OMAHA 30684

CARGIT 4000 LBS
LOAD LIMIT 4500 LBS
LIGHT WT 41500 LBS 887 25



What Brings MMSD Here Today?

- Amongst many things:
 - The growing concern of non regulated contaminants, such as pharmaceuticals, in effluent and biosolids.



Pharmaceuticals and personal care products found in the Great Lakes above concentrations of environmental concern



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HIGHLIGHTS

- Pharmaceuticals and personal care products (PPCPs) were monitored in Lake Michigan.
- Fifty-four PPCPs were assessed in surface water and sediment on six dates.
- Many PPCPs, such as metformin, were detected 3.2 km away from the shore.
- Hydrophobic compounds were detected in sediment at concentrations up to 510 ng g⁻¹.
- Using a risk quotient, the ecosystem risk was found to be high for many PPCPs.

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ABSTRACT

The monitoring of pharmaceuticals and personal care products (PPCPs) has focused on the distribution in rivers and small lakes, but data regarding their occurrence and effects in large lake systems, such as the Great Lakes, are sparse. Wastewater treatment processes have not been optimized to remove influent PPCPs and are a major source of PPCPs in the environment. Furthermore, PPCPs are not currently regulated in wastewater effluent. In this experiment we evaluated the concentration, and corresponding risk, of PPCPs from a wastewater effluent source at varying distances in Lake Michigan. Fifty-four PPCPs and hormones were assessed on six different dates over a two-year period from surface water and sediment samples up to 3.2 km from a wastewater treatment plant and at two sites within a harbor. Thirty-two PPCPs were detected in Lake Michigan and 30 were detected in the sediments, with numerous PPCPs being detected up to 3.2 km away from the shoreline. The most frequently detected PPCPs in Lake Michigan were metformin, caffeine, sulfamethoxazole, and triclosan. To determine the ecological risk, the maximum measured environmental concentrations were compared to the predicted no-effect concentration and 14 PPCPs were found to be of medium or high ecological risk. The environmental risk of PPCPs in large lake systems, such as the Great Lakes, has been questioned due to high dilution; however, the concentrations found in this study, and their corresponding risk quotient, indicate a significant threat by PPCPs to the health of the Great Lakes, particularly near shore organisms.

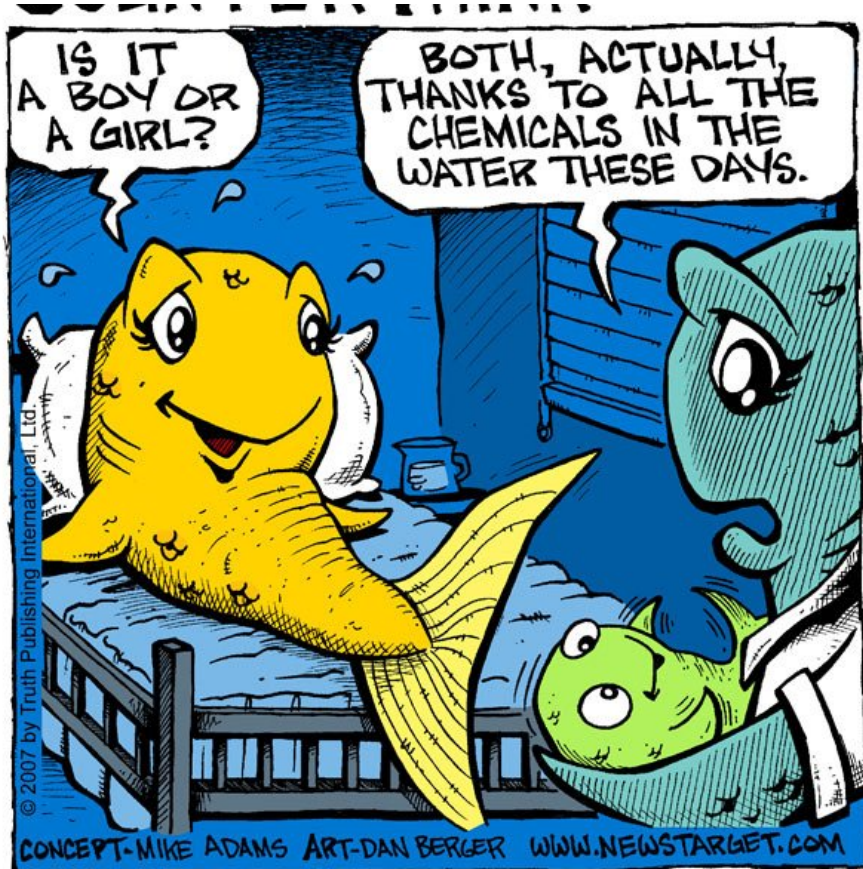
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1. Introduction

Pharmaceutical and personal care products (PPCPs) have been found in wastewater worldwide (Iernes, 1998; Gomez et al., 2007; Vieno et al., 2007; Miege et al., 2009; Suarez et al., 2012; Aydin and Talimi, 2013; Towsari et al., 2013). The level of removal has been found to vary widely depending on the chemical, the operating conditions, and the treatment technologies (Miege et al., 2009; Oulton et al., 2010; Verlicchi et al., 2012; Blair et al., 2013). Variable removal of PPCPs through WWTPs has led to detection of these compounds in the aquatic environment, albeit mostly in microgram to nanogram per liter concentrations (Halling-Sorensen et al., 1998; Kolpin et al., 2002; Cahill et al., 2004; Glassmeyer et al.,

Abbreviations: BDL, Below Minimum Detection Limit; JWRP, Jones Island Water Reclamation Facility; MDL, minimum detection limit; MEC, maximum environmental concentration; MGD, million gallons per day; MQL, minimum quantification limit; PNEC, predicted no-effect concentration; PPCPs, pharmaceutical and personal care products; RQ, risk quotient; SSWRP, South Shore Water Reclamation Facility; WWTP, wastewater treatment plant.

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FACT: PHARMACEUTICALS DESTROY AQUATIC ECOSYSTEMS.



What Are We Doing?

- Conducting research on our own influent
- Analyzing existing processes impact on identified constituents
- Researching environmental impacts of prevalent compounds in effluent and biosolids
- Built a pharmaceutical take back program and educational campaign
- Investing in research for alternative biosolids handling processes for remediation
- Conducting technology scans for promising remediation strategies



Spotlight of Pharmaceuticals in Final Effluent

- Carbamazepine (27 - 340, 80 ng L⁻¹)
 - Epilepsy and trigeminal neuralgia
- Gemfibrozil (30 - 1100, 170 ng L⁻¹)
 - High cholesterol & triglycerides
- Metformin (640 - 47000, 26000 ng L⁻¹)
 - Type II diabetes
- Naproxen (8.3 - 580, 140 ng L⁻¹)
 - Pain, fever, and inflammation
- Sulfamethoxazole (17 - 810, 180 ng L⁻¹)
 - Antibiotic (UTI, ear infections, etc.)
- Triclocarban (27 - 980, 120 ng L⁻¹)
 - Antibacterial agent



Questions?

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