

Presence of Pharmaceuticals, Personal Care Products, and Pesticides In Water Supply

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Pharmaceuticals and Personal Care Products

Pharmaceuticals;

- ❖ Generally used to treat symptoms
- ❖ Improved and expanded human life
- ❖ Used for veterinary & Agricultural purposes

Personal Care Products;

- ❖ Shampoos, Fragrances
- ❖ Herbal Remedies, etc.

Endocrine Disruptors and Pharmaceuticals and Personal Care Products in Water

The issue of the EDCs and PPCPs presence in source and drinking water is one of the emerging issues in the drinking water treatment. The investigation of the effect of different technologies to remove these compounds would provide useful information to municipalities, water systems, and the academic community.

Health Effects

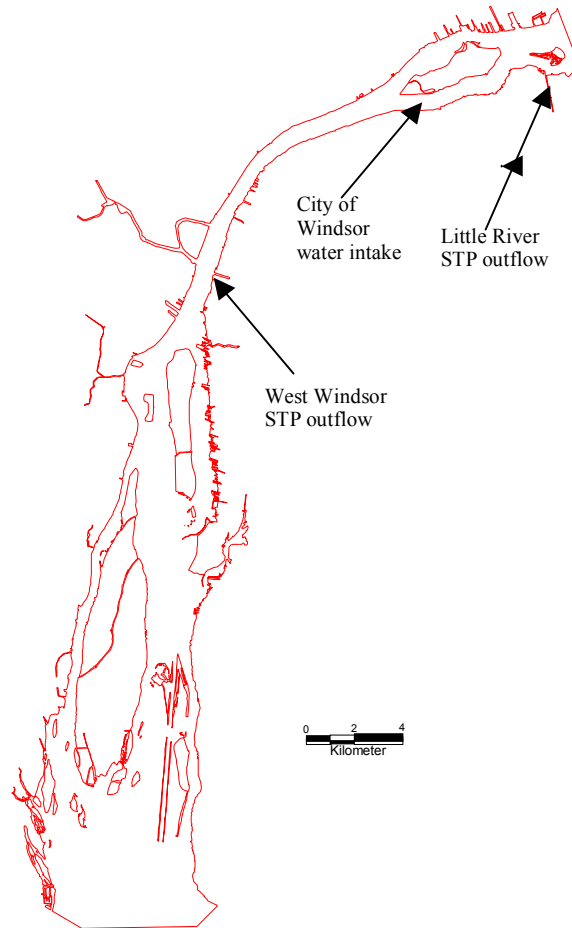
Since medical drugs are designed with a specific mode of action, it is expected that they may have a variety of effects on non-target receptors and can possibly cause adverse effects in a target organism.

Antibiotic resistance is the issue receiving the most attention of all the PPCPs, especially since a large portion of antibiotics leaves the body and end up in receiving waters. We do not know what threshold levels are toxic, especially in complex mixtures.

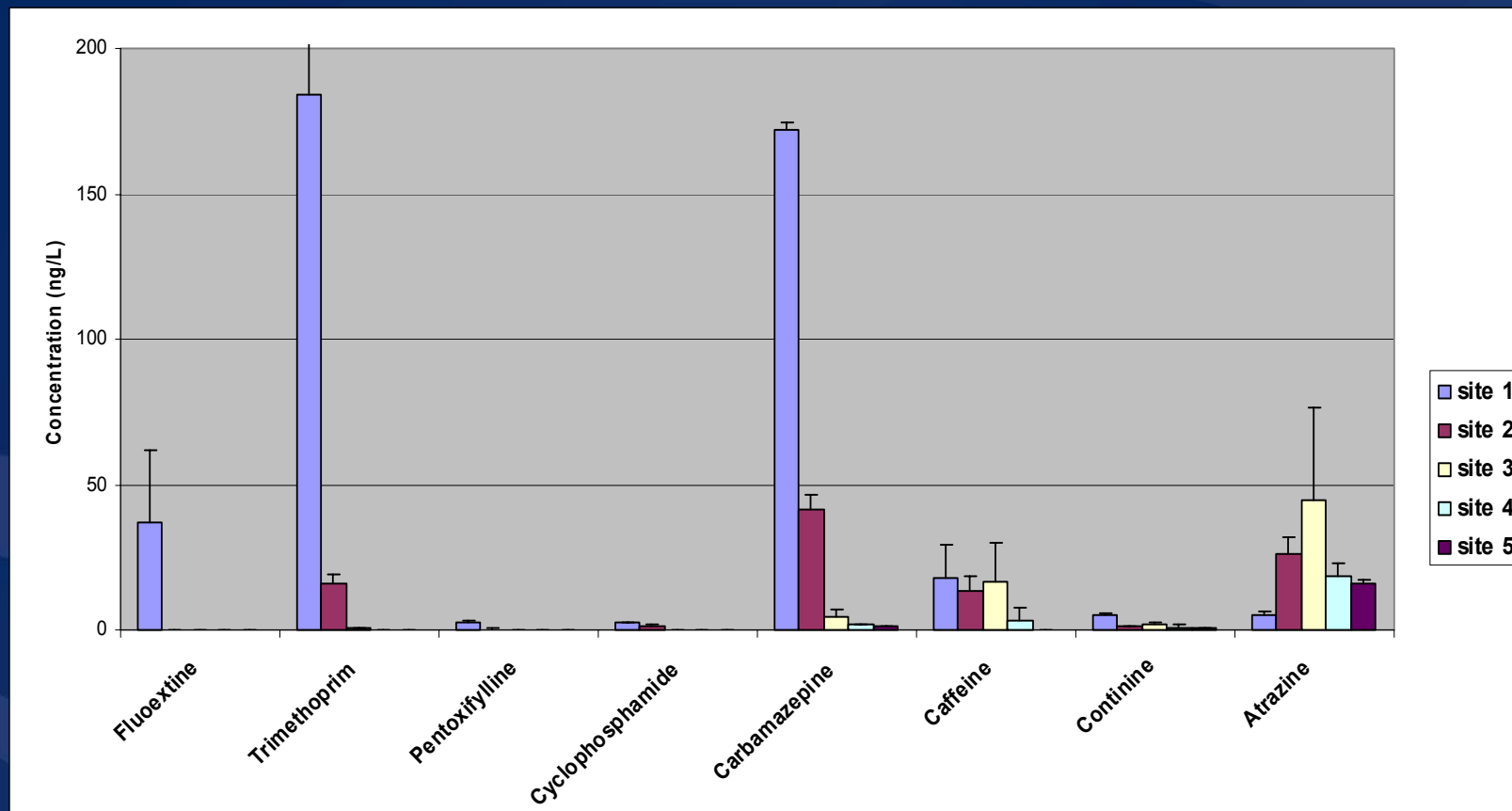
Health Effects

It is speculated that EDCs may be responsible for declining sperm counts and decreased sperm motility and function in the human population. EDCs may cause adverse effects including hormone dependent cancers, reproductive tract disorders, and reduction in reproductive fitness.

Location of Windsor's water intake and STP outflows in the Detroit River



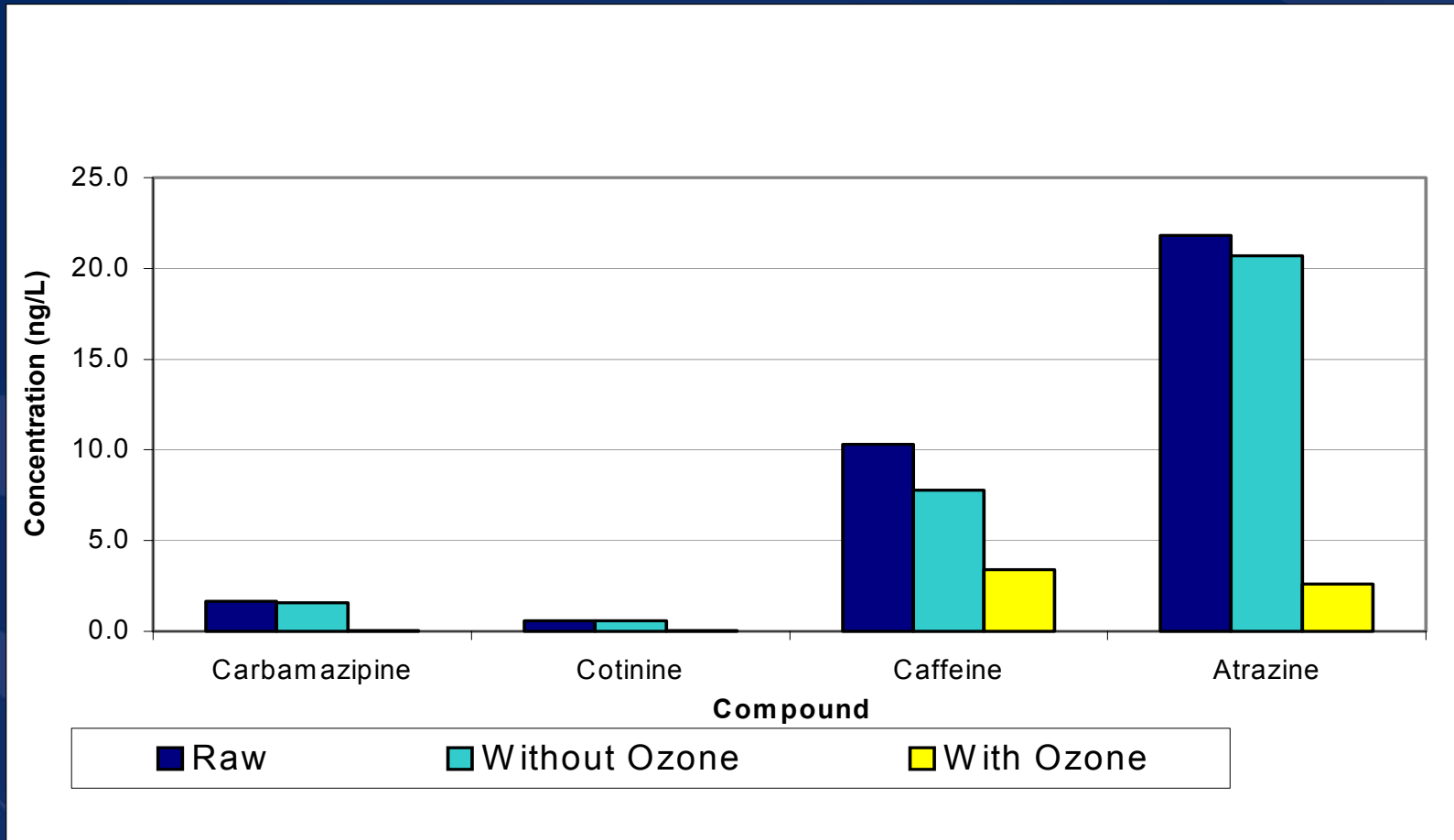
Neutral Drugs and Atrazine Identified in STP Effluent



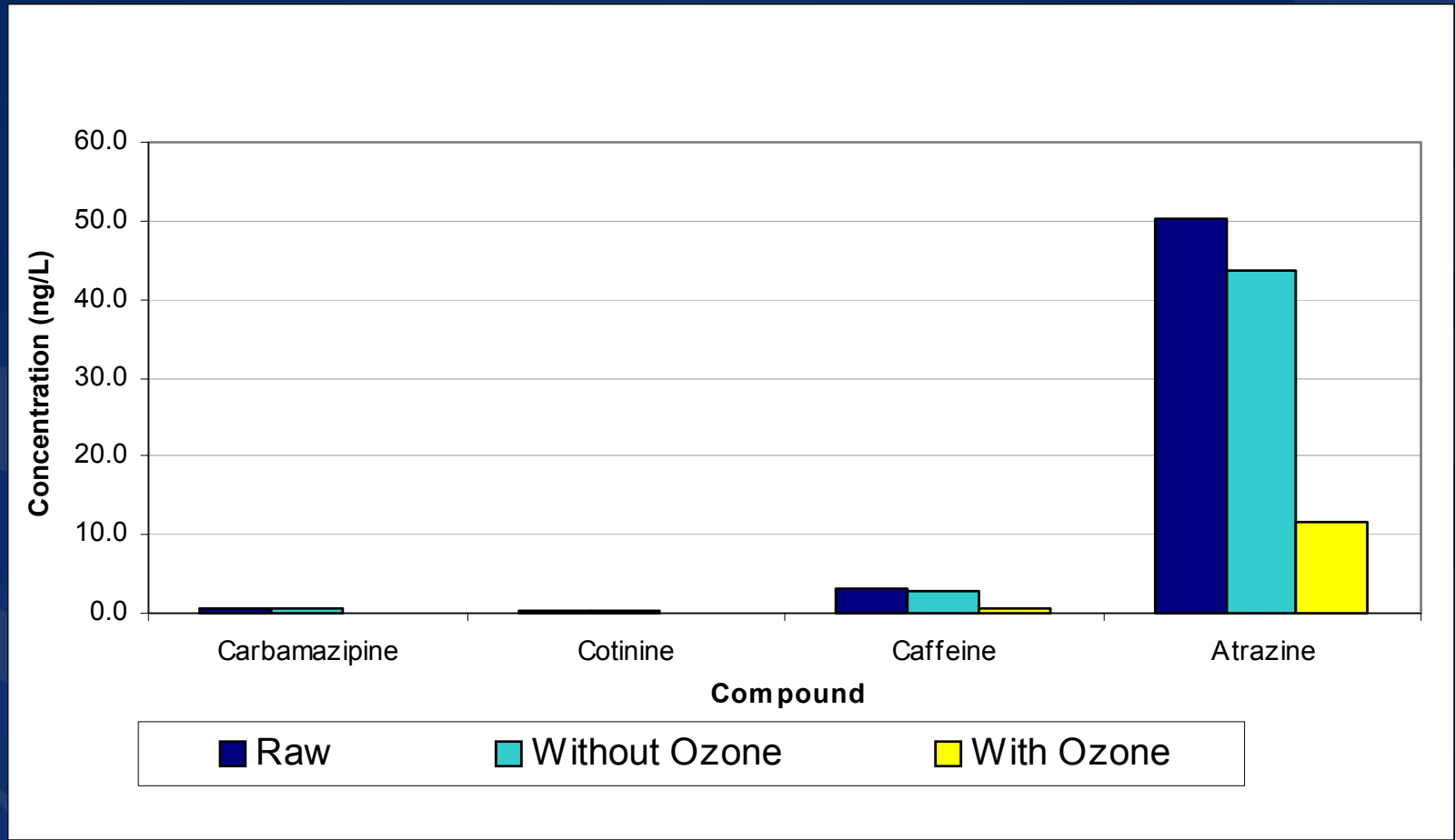
Note 1: Site 1, STP effluent; Site 2, Little River/Detroit River confluence; Site 3, Downstream of combined sewage overflow (CSO); Site 4, Reaume Park; Site 5, Raw water intake of WUC.

Note 2: the concentrations are averages of 3 samples (Hua et. al 2003).

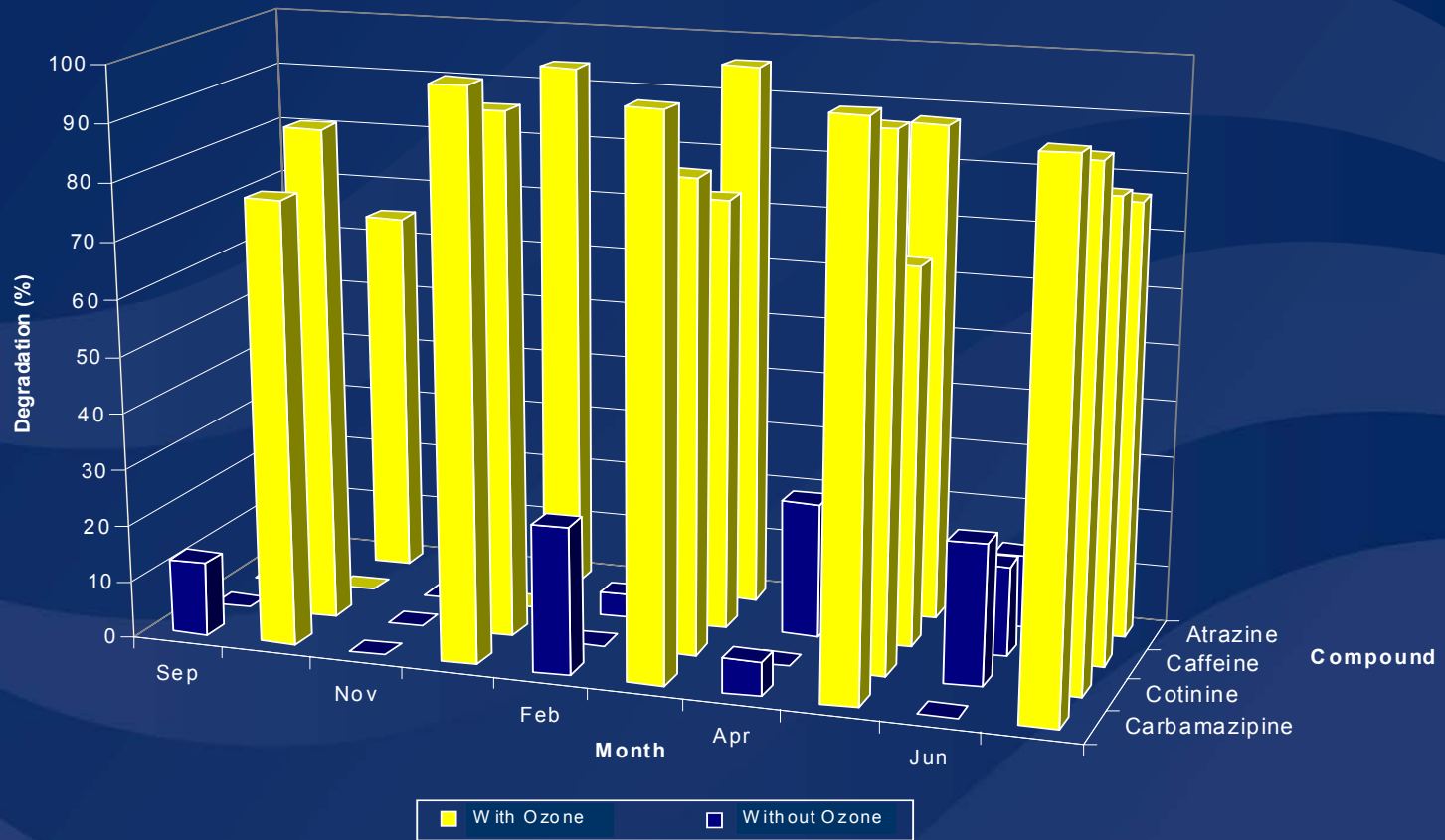
Average for Compounds in Raw Water and Filters Effluent, April 2002



Average for Compounds in Pilot Plant Raw Water and Filters Effluent, June 2003



Comparison of the Monthly Average Degradation of Carbamazepine, Atrazine, Cotinine and Caffeine, using Ozone vs. Conventional Treatment Process (without ozone)



Current Research

The Walkerton Clean Water Centre and the Ministry of the Environment are sponsoring a research for the removal of pharmaceuticals and personal care products at the University of Ottawa. The research team is:

- University of Ottawa
- Ministry of Environment
- Walkerton Clean Water Centre
- National University of Singapore
- Hyflux Inc.

PPCPs Removal by Novel Membranes

Removal of PPCPs and EDCs from water using membranes has been investigated in literature; nanofiltration and reverse osmosis membranes removed many PPCPs and EDCs well, while more porous ultrafiltration membranes showed very poor removals. This project will develop polyether sulfone (PES) membranes whose surface is modified by the incorporation of tailor-made charged surface modified macromolecules (CSMMs), achieved in a single casting/manufacturing step.

Future Studies

- ❖ Identification and determination of the seasonal loading and dynamics of major acidic and neutral PPCPs and pesticides in the discharge of Sewage Treatment Plants into Great Lakes water
- ❖ Effect of different advanced oxidation processes (Ozone, UV, with the application of Hydrogen Peroxide).
- ❖ The Centre is sponsoring a Ph.D. study (University of Windsor) to perform pilot scale study. The study will start in September 2007