

Emerging Chemical Concerns



Many adverse ecological effects have been attributed to pharmaceutical and personal care products (PPCPs) and endocrine-disrupting compounds (EDCs), but it is not clear what risk they pose to human health. In the past, water was known to contain these chemicals, but the exact amount was difficult to quantify.

Recently, these chemicals have gained much more attention.

By Robert Potwora

Advanced analytical techniques have made the quantification of chemicals in drinking water more reliable. New analytical methods measure the presence of these chemicals down to parts-per-trillion (ppt) levels with 1 ppt equal to one drop in 26 Olympic-size swimming pools.

It has been known for some time that the presence of EDCs in wastewater effluents is linked to reproductive problems in fish, but the problem was not addressed because analytical instruments could not measure the parts-per-trillion concentrations of chemicals in the environment. With the development of liquid chromatography/tandem mass spectrometry (LC/MS/MS) instrumentation, the number of studies conducted in this area has increased dramatically. Figure 1 lists some of the more common EDCs and PCPPs found in drinking water.

Treatment solutions for chemicals affecting human health

Chemical Origins

PPCPs originate from many sources, including prescription drugs, over-the-counter drugs, disinfectants, preservatives, sunscreens and deodorants. EDCs mimic the body's natural hormones, targeting the human endocrine system, which includes the thyroid gland, pituitary gland, pancreas and reproductive system, and possibly interfering with natural human hormones like adrenaline and estrogen.

EDCs are grouped into four major categories: pesticides, chlorinated chemicals, alkylphenols and plastic additives. Common pesticides are DDT, methoxychlor, polychlorinated biphenyls (PCBs) and endosulfan. Agricultural runoff is responsible for most of these pesticides entering the water system. These pesticides are already regulated because of their known toxic effects. Common chlorinated chemicals are dioxin, furan and PCBs, which are also highly regulated. Some less common, unregulated EDCs are alkylphenols, which are mainly used to make surfactants for cleaning chemicals and plasticizers. Common plastic additives of concern are bisphenol A (BPA), diethyl phthalate and di (2-ethylhexyl) phthalate.

Units - Health Effects," does not cover most EDCs and PPCPs, but covers the reduction of specific health-related contaminants. Because the health impacts of most EDCs and PPCPs at parts-per-trillion levels in water are not fully understood, NSF/ANSI Standard 53 does not apply to them. The formulation of a new standard to test POE and POU devices specifically for EDCs and PPCPs is under development. In addition, the state of California is investigating regulating EDCs and PPCPs in drinking water, but regulations have not been issued yet.

Treatment Options

Activated carbon and reverse osmosis are proven water treatment technologies that may be used to remove EDCs and PPCPs. The background total organic carbon (TOC) concentration present in the water can impede the performance of an activated carbon-based POE or POU device. TOC levels less than approximately 2 parts per million (ppm) will have a marginal impact. TOC levels greater than 2 ppm will shorten the length of time an activated carbon-based unit will last. TOC levels greater than 5 ppm can have a significant impact on the life of the unit.

Until regulatory agencies investigate which PPCPs and EDCs are hazardous at parts-per-trillion levels in drinking water, using a POE or POU device can provide added comfort for consumers. *wqp*

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Figure 1. Chemicals Commonly Detected in Drinking Water

Substance	Use	Class
Atenolol	Blood pressure medication	Pharmaceutical
Atrazine	Herbicide	EDC
Bisphenol A	Plastics	EDC
Carbamazepine	Seizure medication	Pharmaceutical
DEET	Insect repellent	Personal Care
Estrone	Hormone	EDC
Ibuprofen	Painkiller	Pharmaceutical
Gemfibrozil	Cholesterol medication	Pharmaceutical
Linuron	Pesticide	EDC
Meprobamate	Anxiety medication	Pharmaceutical
Metolachlor	Herbicide	EDC
Naproxen	Painkiller	Pharmaceutical
Nonylphenol	Surfactant	EDC
Phenytoin	Seizure medication	Pharmaceutical
Sulfamethoxazole	Antibiotic	Pharmaceutical
TCEP	Biochemistry/molecular biology	EDC
TCP	Flame retardant	EDC
Triclosan	Antibiotic/antifungal	EDC
Trimethoprim	Antibiotic	Pharmaceutical

Standards & Regulations

The overwhelming majority of EDCs and PPCPs that may be present in drinking water are not regulated. The levels found in drinking water are usually low, but the human health risks associated with these low levels may not be fully understood. Because conventional municipal water treatment does not remove parts-per-trillion levels of these chemicals completely, point-of-entry (POE) and point-of-use (POU) water treatment devices can help fill the void.

Currently, NSF/ANSI Standard 53, "Drinking Water Treatment