

Endocrine Disrupting Compounds in Lotic Ecosystems: A Review on Its Occurrence, Sources and Effects on *Chironomus riparius*

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Abstract

Water plays a vital and irreplaceable role in the entire ecological balance. The increased human population growth, complemented by an intensification of agriculture, industrial development and urbanization, triggered an increase in pressures on water resources and in its consequent degradation, being that rivers one of the most resources intensively used and disturbed by man. Recent research has revealed the existence of hundreds of organic contaminants named "Emerging Organic Contaminants". Within this vast group of contaminants, exists a class of xenobiotics capable of mimic hormones designated endocrine disrupting compounds. Since information, about this compounds is rare and spread out, the aim of our work is to examine the occurrence and sources of endocrine disrupting compounds and its effects in *Chironomus riparius*, an important aquatic insect used in ecotoxicological studies.

Rivers are one of the most intensively used and disturbed resources by man wherein pollution is a severe worldwide problem that urgently requires the implementation of plans and ideas for routine monitoring. Every day, two million tons of human waste is discharged into water courses, including industrial wastes and other chemicals such as agricultural pesticides and fertilizers. Even though water quality investigations have traditionally focused on nutrients, bacteria, metals and priority pollutants, recent research has revealed the existence of hundreds of new organic contaminants in wastewater and impacted urban surface waters. These compounds can be mentioned as "Emerging Organic Contaminants" (EOCs).

Emerging organic contaminants can be defined as naturally occurring, manufactured or manmade chemicals or materials which have now been discovered or are suspected to be present in several environmental compartments and whose toxicity or persistence are likely to alter the metabolism of a living being [7]. That said, Houtman [8] classified EOCs in three categories: (1) compounds newly introduced to the environment; (2) compounds that have only recently been detected in the environment due to improved detection techniques and (3) compounds that have been known for a long time but have only recently been shown to have adverse effects on living beings (e.g. hormones). Nowadays, more than 1000 emerging pollutants, their metabolites and transformation products, are listed as present in Europe's aquatic environment (<http://www.norman-network.net>).

Occurrence of EOCs can result from point (mainly urban and industry) and/or diffuse (agriculture) pollution. EOCs from urban or industrial WWTP are directly discharged into rivers where their environmental fate is of concern [9]. Rivers disperse EOCs to other water bodies, including aquifers, estuaries and marine systems. There is also direct discharge of wastewater to aquifers. This technique has been used in countries like Israel, Spain, US, Australia, South Africa and Japan [10-12]. EOCs discharged to groundwater may also occur through on-site (septic) waste treatment systems, threatening the groundwater.

The fact that most of this compounds are chemicals that are extrinsic to most of the organisms' normal metabolism, i.e., xenobiotics, it becomes important to understand the sources, occurrences and effects of the EOCs on behalf of understanding risks and developing monitoring and mitigation policies. Thus, the aim for this review is to examine the: (1) occurrence and sources of endocrine disrupting compounds, xenobiotics capable of mimic hormones, and (2) effects of a variety of endocrine disrupting compounds in *Chironomus riparius*, an important aquatic insect used in ecotoxicological studies mainly, due to its association with benthic sediments where many pollutants accumulate.

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