ENDOCRINE DISRUPTOR CHIEMICALS IN THE URBAN WATER CYCLE OF BOGOTA

Ciencia e Ingeniería del Agua y el Ambiente
Pontificia Universidad Javeriana
DIEGO FERNANDO BEDOYA RIOS

COLCIENCIAS

TODOS POR UN NUEVO PAÍS
PAZ EQUIDAD EDUCACIÓN

Pontificia Universidad JAVERIANA

CONCEPTUAL FRAMEWORK

¿EMERGING POLLUTANTS?

(Sauvé y Desrosiers, 2014)

Naturally occurring, manufactured or manmade chemicals or materials which have now been discovered or are suspected present in various environmental compartments and whose toxicity or persistence are likely to significantly alter the metabolism of a living being

(Halden, 2015)

A chemical for which there are increasing concerns regarding its potential risks to humans and ecological systems, including endocrine disruption and neurotoxicity.

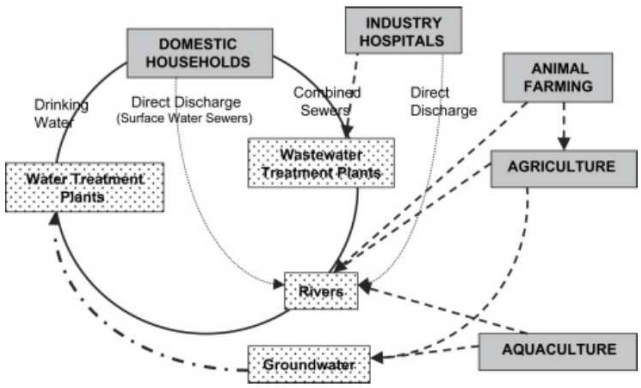
¿ENDOCRINE DISRUPTORS CHEMICALS (EDCs)?

(Fuhrman et al., 2015)

EDCs are substances that influence processes associated with the endocrine system and alter its functioning. The endocrine system is responsible for the release of hormones, chemicals which help control and connect the systems of the body, and thus plays a major role in the health of humans and wildlife. EDCs interfere with steroids such as estrogen, anti-androgen and androgen, as well as other hormone action.

¿How they get to the water?

(Khetan, 2014)



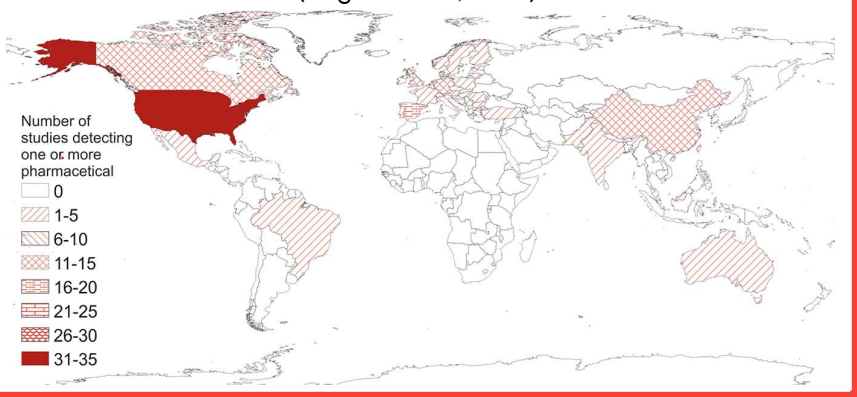
Emerging pollutants classification

(US EPA, 2008)

- Pharmaceutical and personal care products
- Hormones
- stimulants (Caffeíne)
- Illicit drugs (Naturals and synthetic)
- Plastificizers
- Pesticides
- Nanoparticles y nanomaterials

Ocurrence of emerging contaminants

(Hughes et al., 2012)

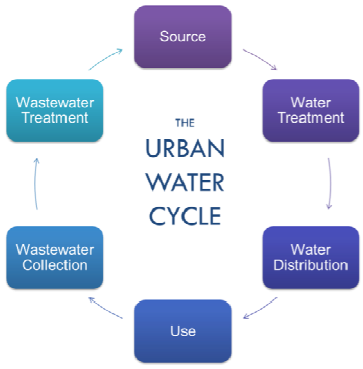


There are not many studies in low income countries, but actually that has improved

Ocurrence of EC in south america

1. Pesticide cholrpyrifos in Surface water Martinez-Zapata(2013); 1000 licit and illicit drugs in wastewater and surface waters from the area of Bogotá
2. Emerging pollutants in Zulia (pesticides) (Molina-Morales, 2009)
3. Studies of platificizers in drinking water, mainly phthalate esters (Loureiro,2001)
4. Ecololical risk for platificizers in Surface water(Merlo et al., 2011)

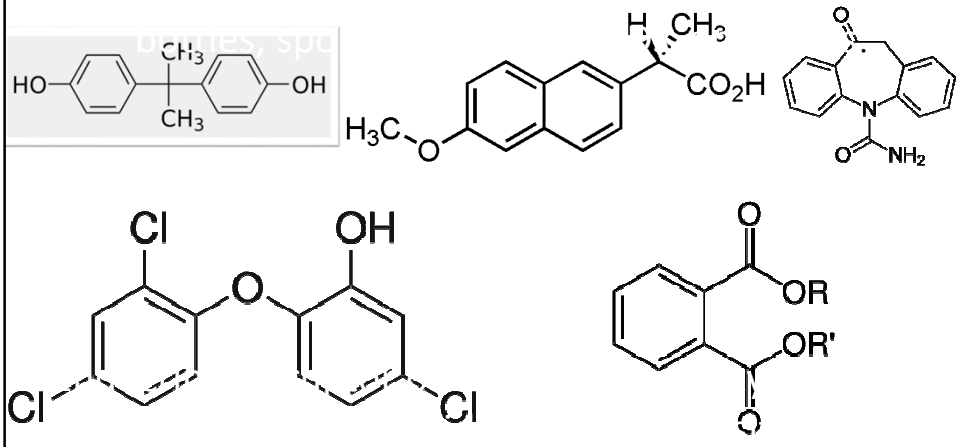
Urban water cycle



- ***Drinking water***
- ***Surface water***
- ***Wastewater***
- ***Runoff water***

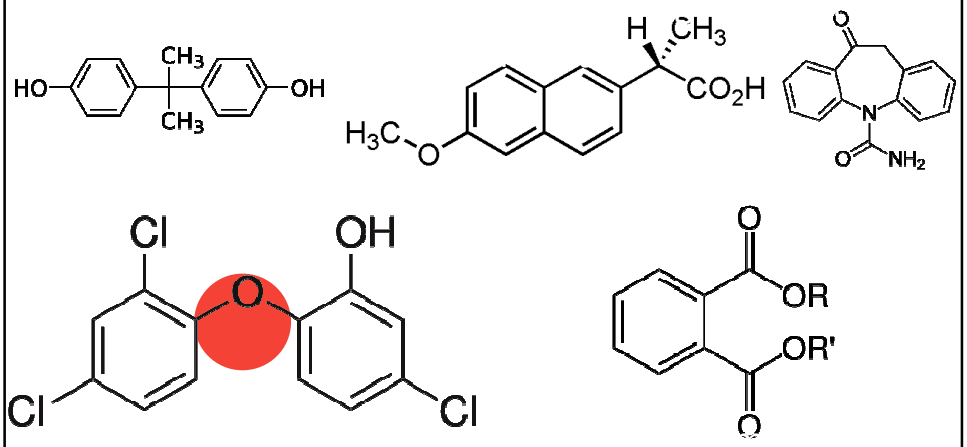
Effects of some emerging pollutants

BPA-based plastic is clear and tough, and is made into a variety of common consumer goods, such as water



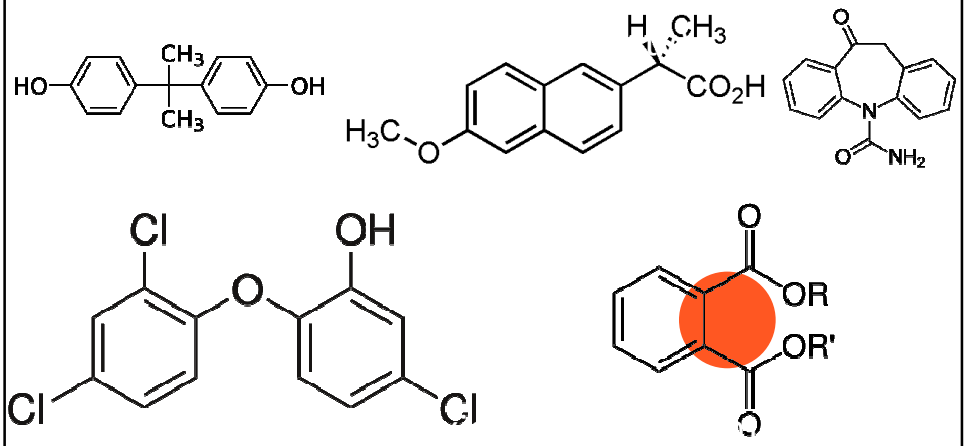
Effects of some emerging pollutants

found in some consumer products, including toothpaste,



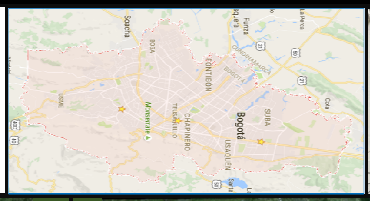
Effects of some emerging pollutants

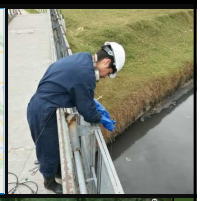
mainly used as plasticizers (substances added to



METODOLOGY

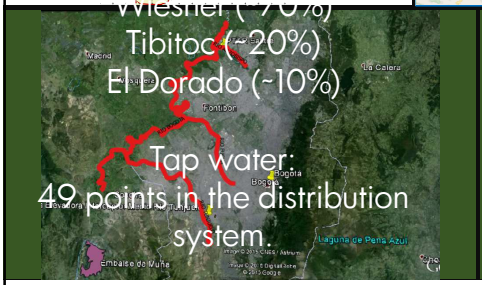
Ocurrence study in the urban water cycle

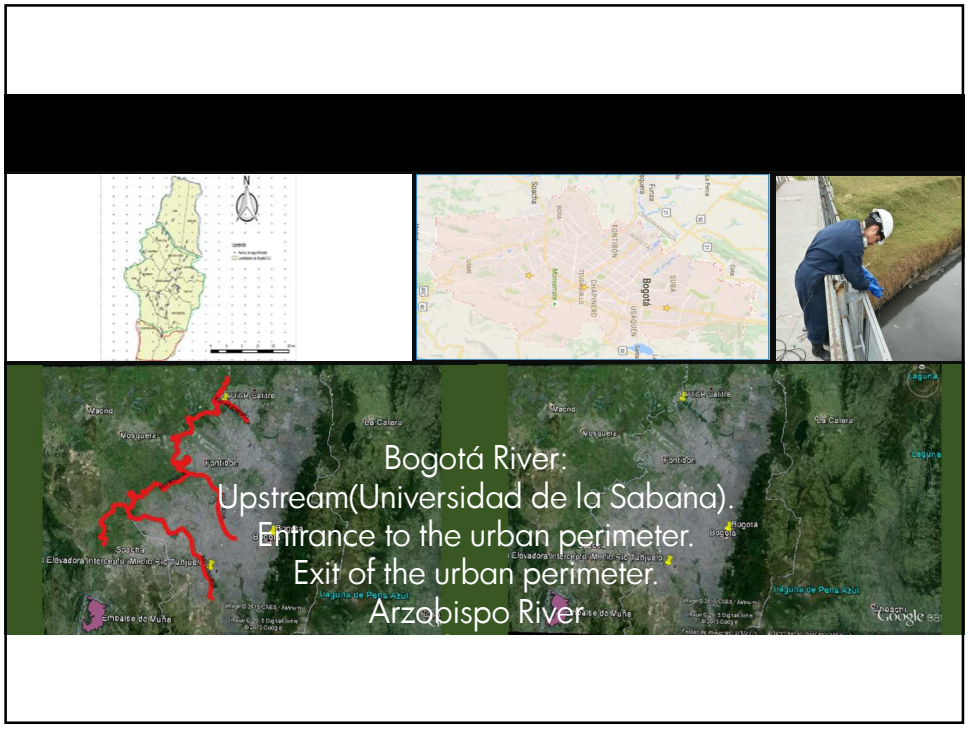


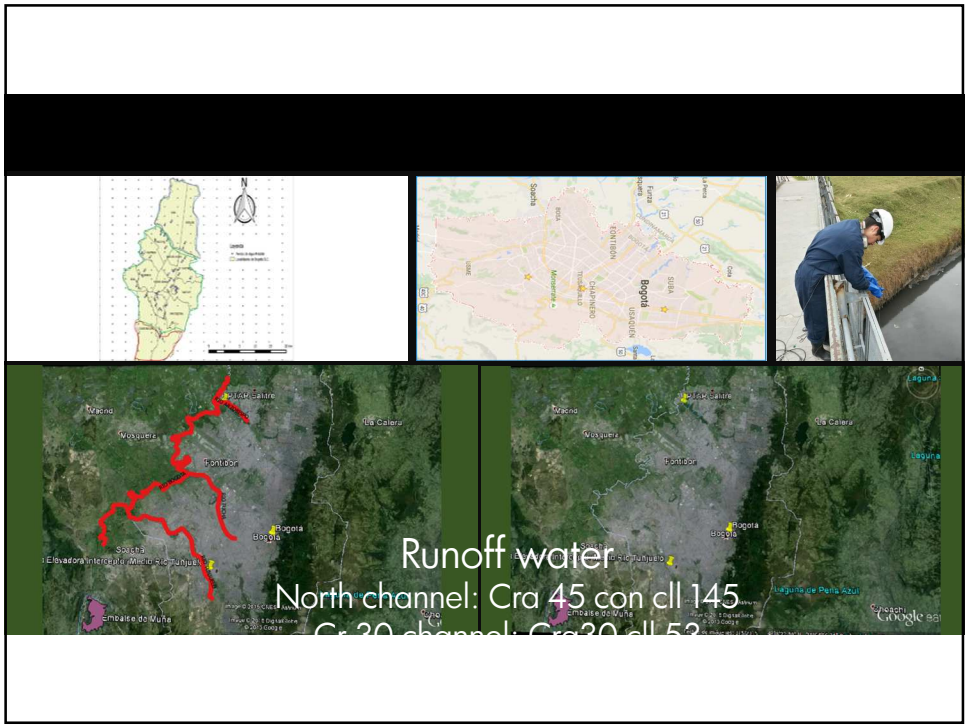


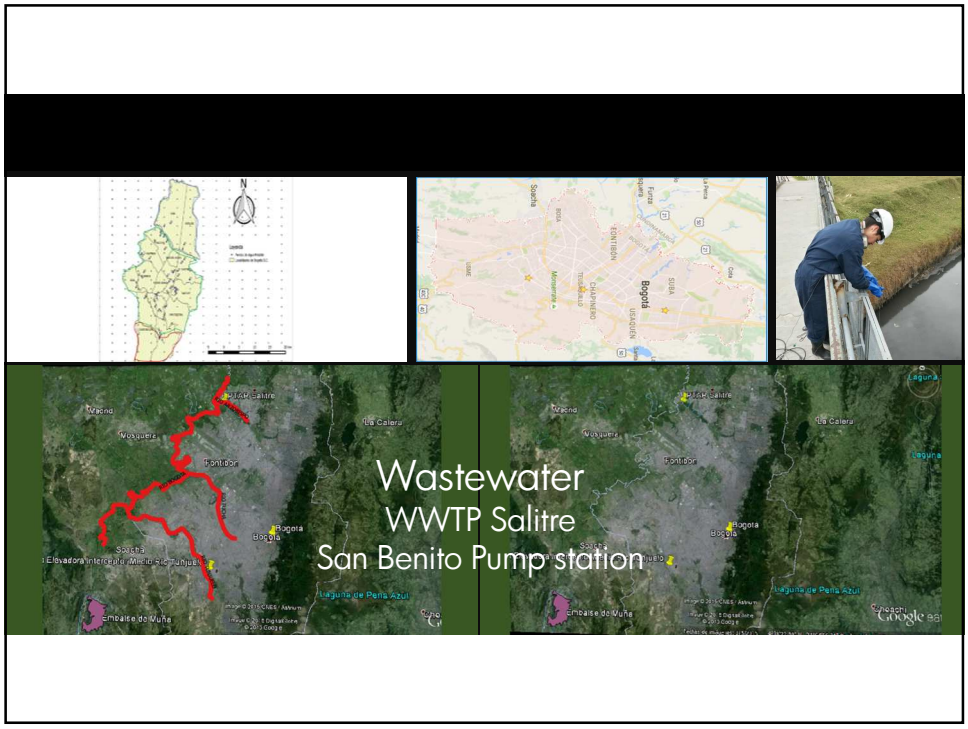
Wiesner (~70%)
Tibitoc (~20%)
El Dorado (~10%)

Tap water:
49 points in the distribution system.




Bogotá River:
Upstream(Universidad de la Sabana).
Entrance to the urban perimeter.
Exit of the urban perimeter.
Arzobispo River


Runoff water
North channel: Cra 45 con cll 145

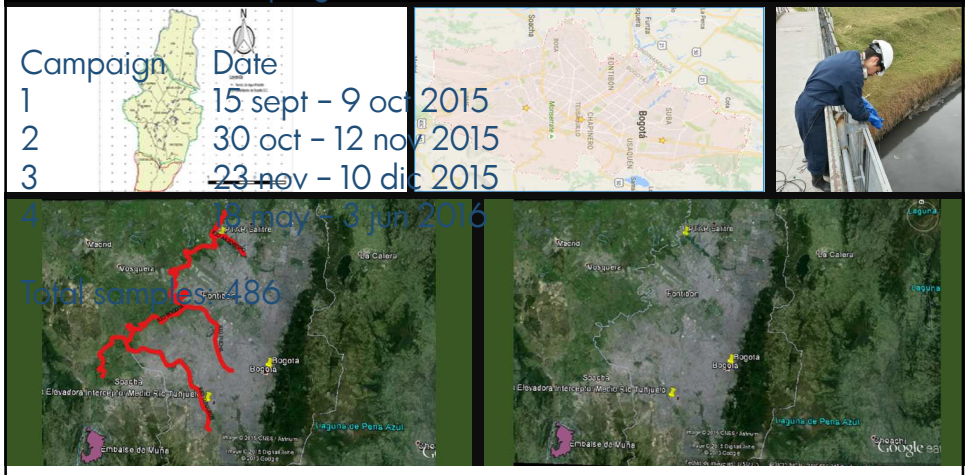


Monitoring summary

Campaigns: 4

Campaign	Date
1	15 sept – 9 oct 2015
2	30 oct – 12 nov 2015
3	~~23 nov~~ – 10 dic 2015
4	13 may – 3 jun 2016

Total samples: 486



Analyzed compounds

Phthalates	hormones	pharmaceuticals	Others plastificizers	Biocids	Alcaloids
Dimethylphthalate	Estrone	Fluoxetina	Bisphenol A	Triclosán	Caffeine
Diethylphthalate	Progesterone	Carbamazepine	4-Tert octylphenol		
2butoxiethylphthalate		Primidone			
Bis4-penthyl – 2-methylphthalate		Trimetoprim			
Dipenthylphthalate					
Din-hexilphthalate					
Bis2-ethyllhexylphthalate					

Instrumental analysis

Elution EthylAcetate

pH: 2- 4

Filtration: 0,45 um

Solid phase extraction (SPE)

GC/MS Analysis

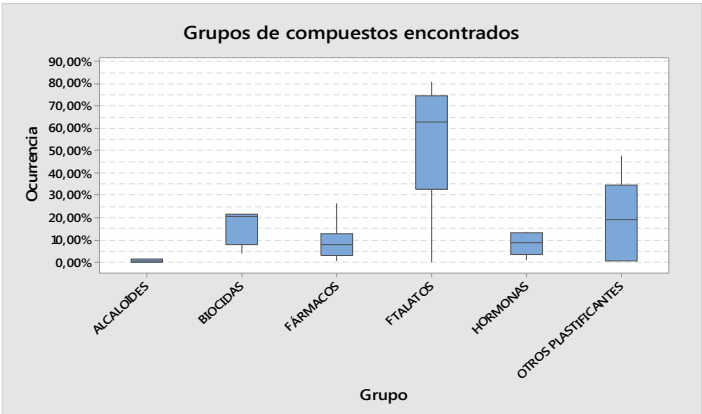
RESULTS

OCURRENCE IN THE URBAN WATER CYCLE

General Ocurrence (%)

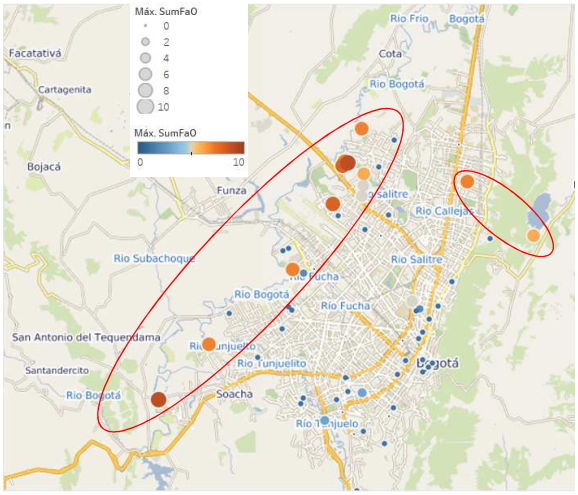
OCURRENCE IN THE URBAN WATER CYCLE

pharmaceuticals:Fluoxetine, Carbamazep., primidone, Trimetoprim
Others plastificizers: 4Tertoctylphenol, Bisphenol A
Hormonas: Progesterone, Estrone
Alcaloides: Caffeíne
Biocidas: Triclosan



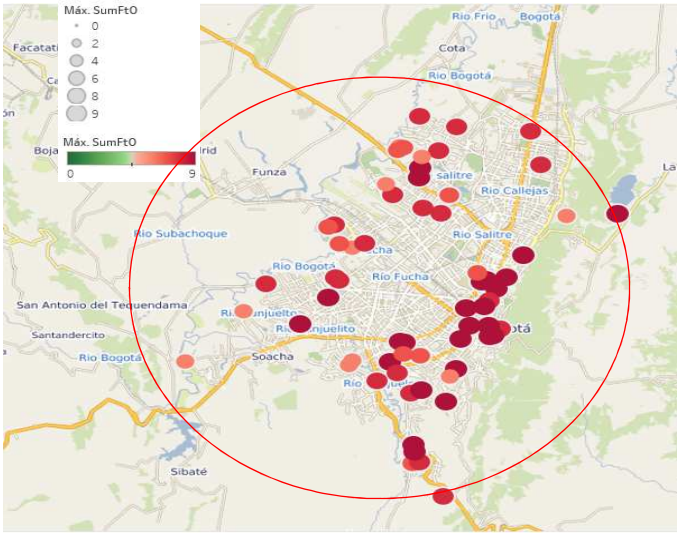
High occurrence of phthalates due to their wide extension in the environment (Jeddii et al., 2015)

Pharmaceuticals and other compounds



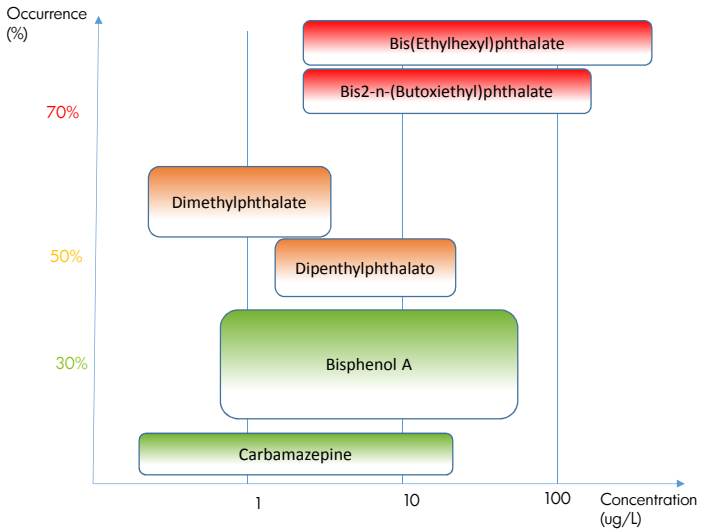
Higher concentrations of bisphenol A and carbamazepine in wastewater and surface water, similar to that found in other studies (Sanderson et al., 2013; Valcarcel et al., 2011)

Phthalates

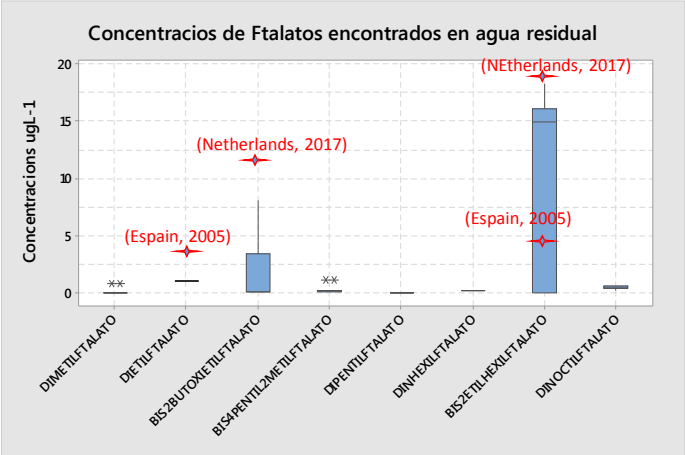


Present in all matrices and even more in drinking water (Domínguez-Morueco et al., 2014)

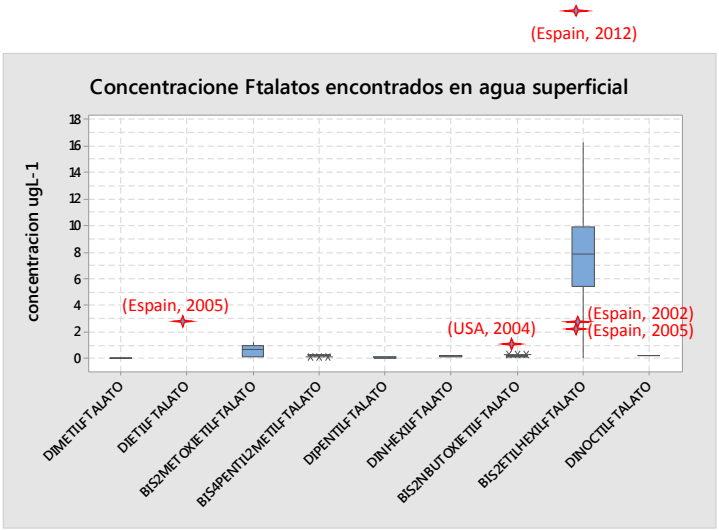
OCCURRENCE AND CONCENTRATION



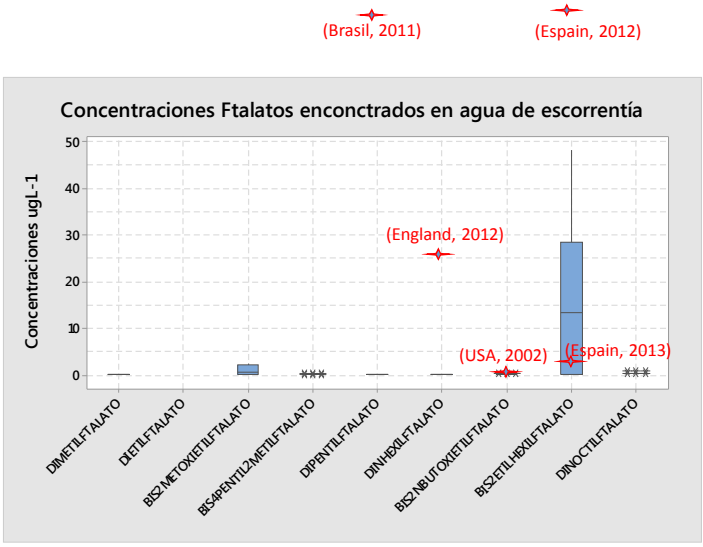
Concentracions phthalates in Waste water



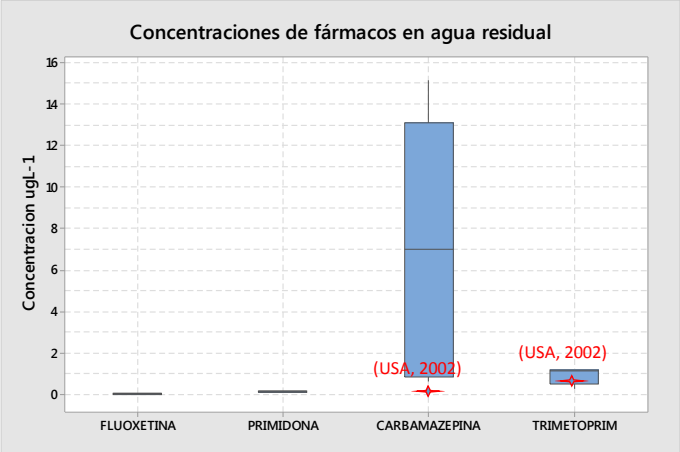
concentracions phthalates in Surface water



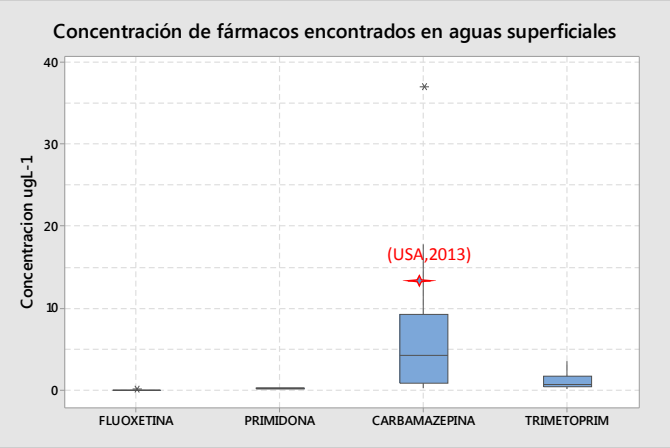
concentracions phthalates in Runoff water



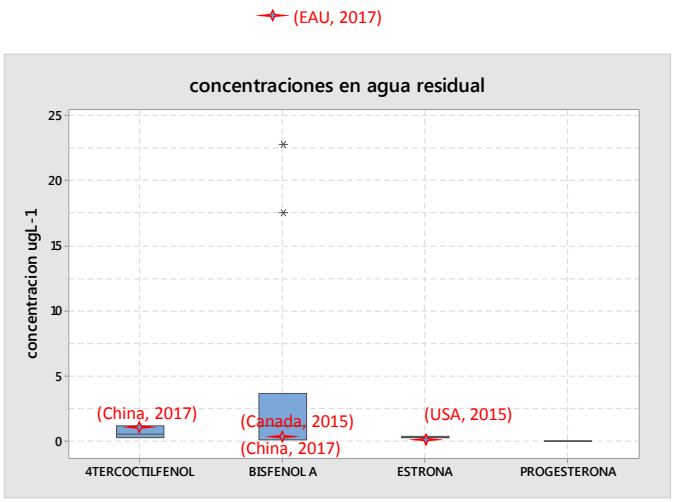
Concentracions pharmaceuticals in Waste water



Concentracions of pharmaceuticals in Surface water

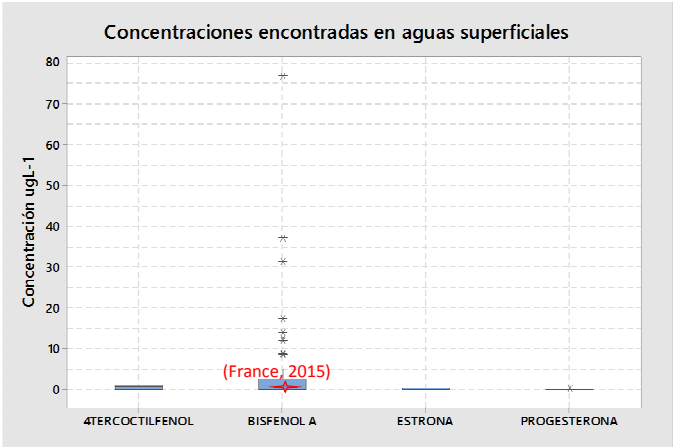


Concentracions plastificizers and hormones in waste waters

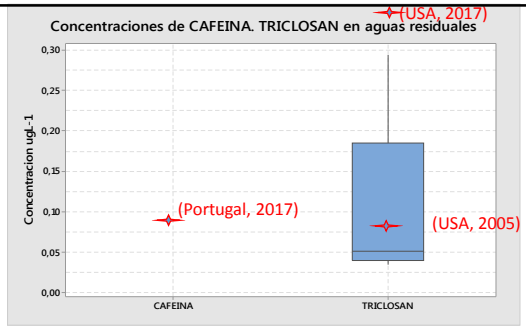


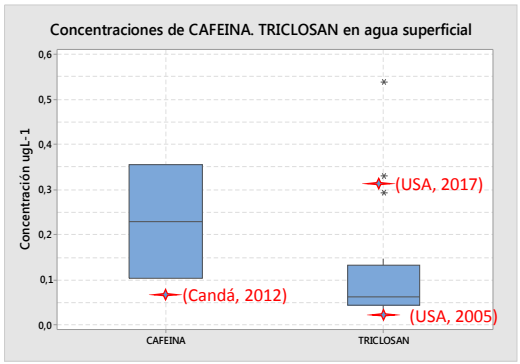
High risk like endocrine disruptors(Rajasärkkä et al., 2016; Omar et al., 2016)

Concentracions plastificizers y hormones is Surface waters

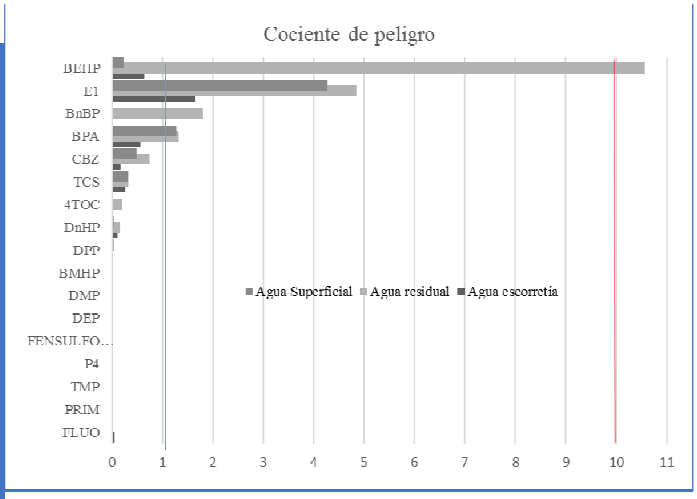


Concentracions others compounds





Ecological Hazard Quotient (HQ) ecological threat



Ecological Threat:
Bis2(EthylHexyl)Phthalate, Estrone, BisNButoxiethylphthalate, Bisphenol A, Carbamazepine, Triclosan, Tertoctylphenol, Dinhexylphthalato...

CONCLUSIONS

Section Subtitle

Preliminary conclusions

- Phthalates were present in all aquatic matrices. Some relevant HQs in Wastewater and Drinking waters
- In the drinking water these substances are associated with Endocrine Disruption(Doney, 2004; Ishfaq et al., 2016)
- Phthalates (WW, DW), Estrone (RW, WW, SW) and BPA (WW, SW) are the substances found with high HQs.
- Bisphenol A is a recognized endocrine disruptor that has been subject to regulation in several countries.

Publications

an accepted article, two submitted and another under construction

JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH, PART A
2017, VOL. 0, NO. 0, 1–9
https://doi.org/10.1080/10934529.2017.1401372

Taylor & Francis
Taylor & Francis Group

Check for updates

Study of the occurrence and ecosystem danger of selected endocrine disruptors in the urban water cycle of the city of Bogotá, Colombia

Diego F. Bedoya-Ríos [a], Jaime A. Lara-Borrero [a], Verónica Duque-Pardo[a], Carlos A. Madera-Parra[b], Eliana M. Jimenez[b], and Andrés F. Toro[b]

[a]Departamento de Ingeniería Civil, Facultad de Ingeniería, Pontificia Universidad Javeriana, Bogotá, D.C., Colombia; [b]Escuela de Ingeniería de los Recursos Naturales y del Ambiente – EIDENAR, Facultad de Ingeniería, Universidad del Valle, Cali, Colombia

ABSTRACT

Endocrine disruptors have been studied for their high occurrence in different environments including aquatic; however, in the context of developing countries, their occurrence, magnitude and potential threat have little information. This study involved the analysis of various components of the urban water cycle in the city of Bogotá, Colombia. As a result, it was found that the compounds with the highest occurrence are plasticizers such as phthalates and bisphenol A, whereas among the drugs, carbamazepine presented the highest concentrations (0.68–31.45 $\mu g\ L^{-1}$); the analysis of the threat coefficient (HQ) showed the importance of bis(2-ethylhexyl) phthalate (BEHP) and estrone (E1) that can reach surface waters from domestic and industrial discharges.

ARTICLE HISTORY
Received 14 July 2017
Accepted 21 October 2017

KEYWORDS
Emerging contaminants; endocrine disruptors; hazard ratio; occurrence; water pollution

Introduction

An EC or, preferably, a contaminant of emerging concern

THANK YOU VERY MUCH

o