**INGLES PARA INGENIEROS**

**UNIVERSIDAD DE ANTIOQUIA**

**MICROPOLLUTANTS**

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**ABSTRACT**

The presence of emerging contaminants in our water resources is a concern for the health and the environment.

Progress in laboratory analysis is increasingly highlighting their presence in the aquatic environment at extremely low concentrations, in the order of one nanogram per litre or microgram per litre (hence the term micropollutants). Some of these substances are liable to have potentially chronic direct or indirect effects on ecosystems, These emerging contaminants include pharmaceuticals, personal care, surfactants, industrial additives, plasticizers, pesticides and a variety of chemical compounds that are even in low concentrations can alter endocrine functions in wildlife including birds, fish, mammals, reptiles and mollusks.

Can enter riverine systems through a variety of inputs, including urban and rural waste streams from households, industries and farming activities. it is for this reason they have come to currently be a serious problem

**INTRODUCTION**

The major source of water pollution is sewage emissions, with potential pollutants including chemicals. Measures taken to prevent water pollution have made the presence of some of these decreases in water sources.

But the number of hazardous chemicals that can reach the environment is very broad, and there are some as micropollutants. It has been shown that these compounds are persistent, toxic, everywhere and have been detected in plants wastewater treatment, these plants are not designed to treat these substances, so a high proportion of these compounds do not suffer changes and come with high toxicity to the aquatic environment. Therefore it is necessary to identify and control these dangerous pollutants and particularly the development of new technologies is necessary.

**JOB CORPS**

**WHAT ARE MICROPOLLUTANTS?**

Organic or inorganic substances due to their toxicity, persistence and bioaccumulation may induce a negative effect on living and / or environmental ones.

These are natural or synthetic substances that are found in low concentrations (of the order of mg / L or ng / l, which are not removed by secondary treatment plant treatment) and having difficulties for analytical determination.

**¿WHAT IS THE ORIGIN OF MICROPOLLUTANTS?**

The presence of these compounds is primarily due to the following activities:

* Agricultural practices (use of pesticides, fertilizers, etc...).
* Origin and urban solid waste landfills (pharmaceutical products, personal care, etc.)
* Activities of the industrial sector, in which a large number of organic compounds (solvents, degreasers, pigments, preservatives, cleaning agents, etc...) Are used.

In Europe there have been about 10,000 potentially hazardous substances are occurring constantly increases, European legislation currently includes 56 micropollutants although there are many more.

They can be grouped into 3 main families depending on the source:

* **PHARMACEUTICALS AND PERSONAL CARE PRODUCTS**

Antibiotics, hormones, cytostatic agents, immunosuppresive, halogenated compounds (darkness of x-ray) and heavy metal drugs.

* **PESTICIDES**
* **HOUSEHOLD AND INDUSTRIAL PRODUCTS**

Detergents: nonylfenoles, alkylphenols.

Biocides,

PVC and phthalates bisphenol

PBDEs (polybrominated diphenyl ethers) and PCBs (polychlorinated biphenyls)

Polyaromatic hydrocarbons (PHAs), dioxin, among others.

**BEGINS TO OBSERVE ITS INFLUENCE ON THE ENVIRONMENT:**

* Genetic mutations in fish and seabirds
* Tumors and lesions in fish
* Presence of fertilizers in the water
* Changing water characteristics (odor, taste, color, turbidity, etc.)
* Some of these micropollutants when they have their degradation may lead to the formation of "breakdown products" whose toxicity can be greater, equal or smaller than the original compound.

**DETERMINE HOW?**

Its control is performed by gas chromatography techniques and infrared. For the determination of trihalomethanes and pesticides the gas chromatograph is used with electron capture detector, nitrogen-phosphorus and flame. For the determination of phenols and polycyclic aromatic hydrocarbons and investigation of unknown substances present in the water a gas chromatograph is used with mass detector. The determination of dissolved or emulsified hydrocarbons is performed by an infrared spectrophotometer.

**EFFECTS OF MICROPOLLUTANTS IN WASTEWATER TREATMENT**

**EMERGING CONTAMINANTS?**

Micropollutants are emerging pollutants, this implies that chemicals or materials are characterized by a perceived or real threat , potential for human health and other living things in small concentrations , and the lack of the regulations.

Throughout history plants wastewater treatment are designed for the removal of organic matter and pollutants regulated. However, the study of new and emerging contaminants, require advanced treatments for safe introduction of wastewater into the environment. Here lies the problem, the current WWTP are not designed to treat these substances, so that a high proportion of these compounds and their metabolites are left unchanged, plus some are endocrine disruptors; therefore requires a change

**ENDOCRINE DISRUPTORS**

As stated earlier emerging contaminants are endocrine disruptors, the term endocrine disruptor define a diverse and heterogeneous group of chemicals that disrupt the endocrine system. Chemicals supplant natural hormones, disrupting the normal processes of reproduction and development. Also called xenoestrogens and xenobiotics, highlighted in its action on the balance in the balance of estrogen, androgen and progestin.

The distruptores found in cosmetics, shampoos, plastics, as well as preservatives and pesticides. These are released into the environment as a result of different manufacturing processes and the use of some consumer products.

The mechanisms of action of endocrine disruptors studied to date include hormone mimicry and antagonism to the action of hormones

**IN THEIR EFFECTS INCLUDE:**

* Cancers in male and female reproductive organs.
* Malformations of fallopian tubes, uterus and cervix.

* Masculinization of females and feminization of males.
* Alterations of bone density and structure.
* Some inhibit or alter the growth of bacteria, mold and mildew.
* Abnormal hormone levels in blood.
* Reduced fertility.
* Altered sexual behavior.
* Modification of the immune system.
* No testicular descent.

The presence of disrupters in water intended for consumption and wastewater vital make a review of the purification conditions necessary for removal. Low removal of these compounds in the treatment plants are due to be recalcitrant, ie, are those who, having a very stable structure chemically resist attack by microorganisms or any degradation mechanism, whether biological or chemical.

**TREATMENT OF MICROPOLLUTANTS**

**Processes that affect them:**

**BIODEGRADATION:**

Due to the metabolic activity of the microorganisms.

Degradation rates depend heavily on the redox state (Scott and Morgan, 1990).

Some show micropollutants degradation only under a particular redox state. (Barbieri et al, 2011; Grünheid et al, 2005)

**ADSORPTION**

Mass transfer of dissolved species to a solid surface. The microcontaminantes orgánicos show great variability in their behavior. Tend to adsorb on non-polar organic matter, the cationic and anionic surfaces respectively negatively and positively charged.

**PHARMACEUTICALS AND COSMETICS AS CONTAMINANTS (PPCPs)**

Cosmetics and Pharmaceutical Compounds are a diverse group of chemicals that include human and veterinary drugs, hormones and other products used in the formulation of cosmetics. These substances deserve special attention because of the possible adverse effect resulting from the fact that the associated compounds such biological effects may be extended to organisms living in the various environmental compartments affected by discharges

**CONCLUSIONS**

* Today micropollutants are still ignored and they are not monitored. Its adverse effects on living organisms have been reported in various studies, and this has encouraged the study of these contaminants and potential removal options with new systems of wastewater treatment . Of the different treatment that have been implemented so far, are activated carbon and membranes which have proven to be the most efficient.
* So are several studies that show the great potential of advanced systems for the removal of emerging contaminants, which are mainly used as a pre and / or post treatment for water with higher biodegradability, but economic issues limited their application.
* Today most water treatment plants do not have these types of systems, so these pollutants are being dumped into the atmosphere , which is why the importance of implementing various technologies to achieve a good treatment of these compounds and improved the environment

**LITERATURE**

* http://www.quimicaviva.qb.fcen.uba.ar/v10n2/garcia.html
* http://www.ingenieria.unam.mx/~revistafi/ejemplares/V14N2/V14N2\_art11.pdf
* http://www.h2ogeo.upc.es/seminarios/2012/Seminario%20Cristina%20Valhondo.pdf
* http://www.degremont.es/es/images/pdf/microcontaminantes-%20degrmont-%20aeas%202013.pdf
* <http://www.iagua.es/noticias/entrevistas/14/02/03/entrevista-julen-cabero-44584>

**ANNEXES**

**ORIGIN OF MICROPOLLUTANTS**

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**ENDOCRINE DISRUPTORS**

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**INTERVIEW**

<http://www.iagua.es/noticias/entrevistas/14/02/03/entrevista-julen-cabero-44584>

Julen Cabrero, Industrial Engineering of Bilbao ETSII and Proposal Manager for large projects and Head of Energy Efficiency for the Iberia-Africa area Degremont, during the presentation "emerging micropollutants. Technologies and means for processing"

**What are micropollutants? Where did they come from?**

**R.** Organic substances whose toxic, persistent and bioaccumulative properties may have a negative effect on the environment and/or organisms.

These are substances that are found in very low concentrations. So far, for example, when a Wastewater Treatment Plant's core values input pollution (BOD, COD, SS, nitrogen and phosphorus) are in the range of mg / L is designed. When we speak of micropollutants, the order of magnitude is 1.000 times or a million times smaller. We're talking about concentrations ug / l ng / l.

The origin of these compounds is varied, but we can group them into three groups. On the one hand, pharmaceuticals and personal care products, such as some antibiotics, hormones, immunosuppressant’s, drugs .. Another group would be the compounds from agricultural practices, such as pesticides, fertilizers ... and finally, industrial and household products such as detergents, lubricants, paints.

**What conditions cause the waters? What are the consequences of this pollution to ecosystems and living beings?**

**R.** the consequences that can occur are the accumulation of contaminants in the ecosystem, a gouache and chronic toxicity to aquatic organisms, loss of habitats and biodiversity and also a threat to human health.

**What are the solutions proposed by Degremont to detect and remove them?**

**R.** - Since year 2000, we are developing, alone or in conjunction with other organizations such as universities, various research projects focused on the detection and removal of these compounds.

The question is well posed because besides knowing how to remove them, it is important to know how to detect given the nature and size of the substances.

During these years, we have worked in both the methodology of sampling and analysis and in the most appropriate treatments for removal.

With respect to detection, we have developed a procedure on how to collect the samples, what type of material is used, how to clean the material, etc.. Then, to perform the analysis we also follow a series of compounds mainly filter processes, a concentration by extraction and high performance liquid chromatography.

With regard to treatment, we must analyze what micropollutants are treated in each case and from there decide which is the best solution. Treatment can be very effective with a type of substance but not so good with others, so you have to study each particular case

**What other programs conducted Degremont for the decontamination of water? Do you plan to participate in research of this type in the future?**

**R.** - Research and innovation are integral to our understanding of water treatment and has been so throughout the history of Degremont. Innovation is essential if we are to respond to the different problems.

The Amperes program between 2005 and 2009, with the aim of developing methodologies for sampling and analysis micropollutant and obtain efficiency values of different treatments in existing wastewater treatment plants.

The following program, between 2009 and 2012, was named Armistiq, and the goal we set was to get the best lines of treatment in cases study to determine optimum operating conditions and to assess the environmental impact of these processes.

Regarding micropollutants, as I said before, we began investigations in 2000. We can divide these years of research into three phases: the first phase of knowledge acquisition; a second optimization of the treatment; and a third treatment and industrialization

At present we are working on what we call the ground tomorrow, with specific programs both in treatment of drinking water and wastewater treatment.