

# COMPREHENSIVE ASSESSMENT OF ESTROGENIC CONTAMINATION OF SURFACE WATERS OF THE RIVER BASIN SUQUIA

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## Abstract

Estrogenic compounds are a class of pharmaceutical products harmful to the animals and a cause of environmental damage. The biological activity of these compounds is high, which are designed to operate at low concentrations. Therefore, even in low concentrations in the environment can have harmful effects on aquatic organisms and in humans, who might be consuming water or food contaminated with estrogen.

The generic term (estrogen) applies to any substance, natural or synthetic exert biological effects characteristic of ovarian estrogenic hormones, many anabolic and growth promoters in animals, which has led to its misuse in the commercial animal. Estrogen produced in the laboratory can be used as a type of birth control and the treatment of menopausal symptoms, menstrual disorders, osteoporosis and other health treatment.

There are three main forms of estrogen found in the human body, Estrone (E1), 17 beta-estradiol (E2) and estriol (E3). Estrone (E1) is the most common estrogen in greater quantities in postmenopausal women.

Over the last decades, residues of hormones E1, E2 and E3, have been reported mainly in river water and sediments due to the inevitable link to WWTP effluents discharging into the receiving waters. In this brief review, we provide an overview of sources, environmental concentrations in surface and ground water, and summarize the current knowledge on fate and behavior of these steroid compounds.

And we describe the first sampling campaign (surveys and water samples of the Suquia River) and we present a brief analysis of the surveys.

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**Keywords:** Stogenic hormones, synthetic oral contraceptives, micropollutants, toxicity, Suquia River

## Introduction

Estrogenic compounds are a class of pharmaceuticals harmful to animals and one of the causes of environmental damage. The biological activity of these compounds is high, which are designed to act at low concentrations. Therefore, even at low concentrations in the environment can have harmful effects on aquatic organisms and in humans, which might be contaminated in a number of ways (through contaminated food or drinking water, for example).

The generic term (estrogen) applies to any substance, natural or synthetic exert

biological effects characteristic of ovarian estrogenic hormones, many anabolic and growth promoters in animals, which has led to its misuse in commercial animal. Estrogen produced in the laboratory can be used as a type of birth control and to treat symptoms of menopause, menstrual disorders, osteoporosis and other conditions.

Studies in surface water courses have shown a high concentration of estrogen, this is because standard water treatment often fails to eliminate estrogen and synthetic compounds chemically related to the same, or inadequate management of biowaste determines being discharged to the river basin by altering the natural system.

The natural hormone and synthetic are often used in water and subsequently treated remains concentrations that can be harmful.

There are three major forms of estrogen found in the human body, estrone (E1), 17 beta-estradiol (E2) and estriol (E3).

Estrone (E1) is the estrogen most common in larger quantities in postmenopausal women.

Estradiol (E2) is the main estrogen in mammals during the reproductive years, and is produced by the ovaries. Estradiol is prescribed in this clinic consists predominantly percentage by birth control pills, there are also other indications including symptomatic relief of hot flashes, genitourinary symptoms, osteoporosis prophylaxis, psychological wellbeing and reducing coronary artery disease. High concentrations of E2 in source waters can have adverse health effects (renal failure, necrosis, and liver damage) in fish, even in very low concentrations. The main sources of high concentrations of E2 to the aquatic environment are sewage and animal waste. Estradiol is not soluble in water.

Estriol is the weakest of the three main estrogens. Estriol (E3) is the estrogen that is produced in large amounts during pregnancy and have a potential barrier properties against cancer cell production. Estriol is soluble in water. It is logical that estrogenic hormones excreted by women can find their way into the water supply plants through wastewater treatment.

In this research we study the presence, origin and concentration of the three main estrogen hormones in Suquia River Basin. Their objectives are:

Determine the presence, concentration and origin of estrone (E1), 17 beta-estradiol (E2) and estriol (E3) in Suquia River Basin.

- Gather information on the presence and origin of estrogens in watersheds and their effects on the ecosystem.
- Analyze the presence of estrogen in Suquia River basin and its seasonal variation.
- Determine the possible source of estrogens are present in the Rio Suquia

### **Main Text**

To carry out this project, we started with a collection of studies conducted in other parts of the world such as USA, Canada, England, Sweden, Holland, Spain and other countries. In these countries that are most advanced research and studied the effects of these hormones in water courses, produce on the aquatic ecosystem and humans.

The project encompasses the study of environmental estrogens (EA), they include not only natural but also estrogens including synthetics are birth control pills, patches, hormonal and a large number of compounds of different chemical structure and which only share their ability to affect the endocrine system of different organisms to mimifical whole or in part the action of physiological estrogen hormones. These compounds are known as xenoestrogens.

Xenoestrogens are present in a wide variety of products such as sunscreens (butylated hydroxyanisole), food preservatives, in some plastics (which contain phthalates) in pesticides (atrazine, DDT, methoxychlor ...) and all kinds of cosmetics, shampoos, gels, toothpastes,

beauty creams, deodorants, drugs and even some convenience foods, etc.. containing parabens or parabens. Parabens are ubiquitous components in the products we use in our toiletries and some medications and are of particular concern because they are cheap preservatives for industry and in many countries are free to use.

The physiological effects of estrogen are numerous: they regulate cell and tissue growth, reproduction, metabolism, immunity, maintain reproductive cycles and ensure a balance between the various systems and appliances.

The presence in the environment of estrogen and compounds with estrogenic effects can result in multiple effects. Basically we can summarize the effects of environmental estrogens (EA) on animals and man in the following:

- Abnormal levels of hormones in blood
- Reduced fertility
- Immune system disorders
- Feminization of male
- Cryptorchidism
- Decreased sperm count
- Tumors of the male and female genital tracts
- Malformations of the reproductive
- Alteration of the structure and bone density
- Development of estrogen-dependent tumors

The main consequence of all these effects is reduced reproductive capacity of the species concerned.

Importantly estrogens present in water can not be purged entirely of effluent treatment plants and sewage plants.

Recently, a study published in the reports of the U.S. Academy of Sciences revealed that only 5 ng / L (nanograms, or billionths of a gram per liter) of estrogen, ie more or less what is on the Out of the water treatment plants, could cause the demise of the entire population of minnows from the lake, also to sterilization feminization of males, in just two years ... have multiplied population surveys "feminized" fish rivers in industrial countries, from the Seine in France until the Potomac River in the United States.

In the Canary Islands, Spain found a direct link between increased breast diseases (cancer) with the content of xenoestrogens in water, because it is the European region with the highest rate of pesticide per hectare of cultivated soil.

The project is doing by completing the following steps:

### **Library Research**

Be collected history of worldwide research associated with the presence and origin of estrogens in surface water basins.

### **Sampling**

Water samples Suquia River Basin were take in the month of February and will be take in the month of August in order to know the variation in the concentration of estrogen in terms of climate variability. The sampling points are (Figure 1):

Point 1: Cosquín River before entering the lake.

Point 2: San Antonio River before entering the lake.

Point 3: Lake San Roque (at different depths).

Point 4: Suquia River at the outlet of Lake San Roque.

Point 5: Rio Suquia to match the intake Cordobesas Water.

Point 6: The Calera River before entering the city of Cordoba.

Point 7: Bridge 15 Cordoba.

Point 8: Bridge San Fe, Cordoba.

Point 9: Vado Sergeant Cabral, Cordoba.

Point 10: Plant Bajo Grande, Cordoba.

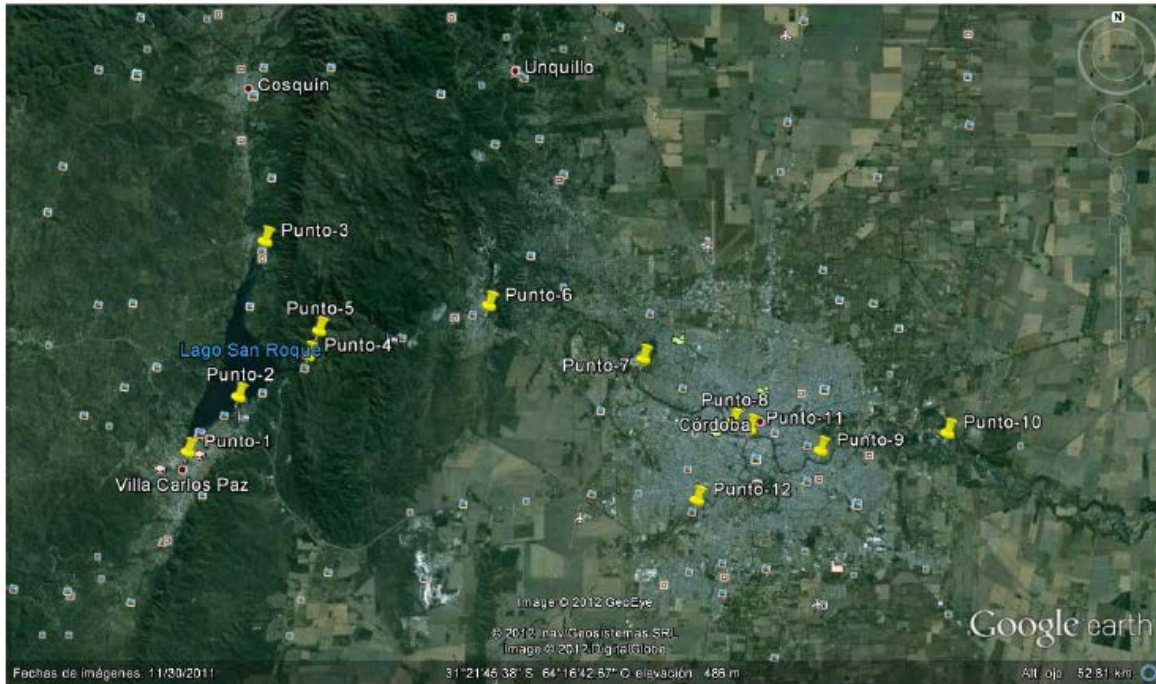
Point 11: 10 Km after Plant Bajo Grande.

Point 12: La Cañada stream before entering the municipal lands.

Point 13: La Cañada stream where it flows into the river Suquia.

Point 14: Sample of treated water from the city of Cordoba, which corresponds to the water treatment plant Suquia.

Point 15: Sample of treated water from the city of Córdoba that corresponds to that obtained Dam Los Molinos.



**Figure 1:** Sample points

### **Analysis Laboratory**

Of the samples collected were analyzed three estrogenic hormones, estrone (E1), 17 beta-estradiol (E2) and estriol (E3).

To determine the estrogen in Estrogen laboratory was used (E1/E2/E3) ELISA Kit and an ultraviolet spectrophotometer, 450 nm.

The ELISA is highly reproducible measurement, the coefficient of variation (CV) is mostly less than 10%. The quantitative analysis is 0.1 g / L to 3 g / L (ppb).

The test requires less amount of harmful solvents instrument analyzes.

With the ease of handling, the total time for measurement is only 2.5 hours.

### **Making pharmacological surveys**

It was survey 150 women from the city of Córdoba and other settlements Suquia River Basin to determine the consumption of birth control pills or using birth control patches.

### **Environmental Studies**

In order to complement the results of chemical analyzes and to determine the possible source of estrogen in Suquia River Basin the following studies are been developed:

- Assessment of land use in the basin of the River Suquia.

- Determination of effluent treatment systems domestic or presence of areas with septic tanks.
- Inventory slums near the river Suquia and assessment of their impact on the resource.
- Inventory poultry and possible discharge of effluents into the river.
- Determining pastoral areas near the river basin Suquía and feedlot cattle.
- Determination of agricultural areas to assess the possible contribution of xenoestrogens from pesticides.
- Determine points clandestine domestic effluents discharged by companies weather.

### Conclusions and recommendations

Conclusions that will be drawn to have a knowledge of the presence, concentration, origin and seasonal variation of estrogenic hormones, estrone (E1), 17 beta-estradiol (E2) and estriol (E3) in Suquia River Basin.

### Conclusion

Collected samples were analyzed in the first instance the contents of the three estrogenic hormones, estrone (E1), 17 beta-estradiol (E2) and estriol (E3) together.

To determine the estrogen in Estrogen laboratory was used (E1/E2/E3) ELISA Kit and an ultraviolet spectrophotometer, 450 nm.

The ELISA is highly reproducible measurement; the coefficient of variation (CV) is mostly less than 10%. The quantitative analysis is 0.1 g / L to 3 g / L (ppb).

The results obtained were:

Sample	Absorvance	Concentration
M1	0.927	-0.00496 ppb ( < 0.05 ppb)
M3	0.931	-0.00589 ppb ( < 0.05 ppb)
M4	0.895	0.00263 ppb ( < 0.05 ppb)
M7	0.933	-0.00635 ppb ( < 0.05 ppb)
M10	0.142	0.47216 ppb
7070	0.9	0.00143 ppb ( < 0.05 ppb)

Corresponding to Sample M10 taken downstream of the treatment plant effluent big bass showing a concentration ten times the limit of quantification of the technique. What we would indicate the presence of estrogen in the Rio Suquia, unable to be eliminated entirely by the treatment plant. Clarifying that there still scrubbing technology can eliminate them entirely when present in the water.

Because the work includes determining the origin of environmental estrogens are doing work related to:

- Assessment of land use in the basin of the River Suquía.
- Determination of effluent treatment systems domestic or presence of areas with septic tanks.
- Inventory slums near the river Suquia and assessment of their impact on the resource.
- Inventory poultry and possible discharge of effluents into the river.
- Determining pastoral areas near the river basin Suquía and feedlot cattle.

To complete the study and were surveyed about 500 women in the city of Córdoba, the survey contains a total of 103 questions divided into four main items habits, workplace characteristics, eating habits and characteristics of the place of residence. Making particular emphasis on the consumption of pills or patch anticonpetivas or use for that purpose. Surveys will be conducted to all women living in the catchment area of the river basin Suquia.

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