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The Effects of Steroids and Hormones on the Environment and Health, as Well as Current Removal Techniques

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Introduction

The biological and chemical impurities known as micro-pollutants, which include estrogens, progesterone, androgens, glucocorticoids and growth hormones in particular, enter natural aquatic ecosystems in trace amounts (ng/L) and cause major disturbances in both aquatic and terrestrial life. These trace elements have been observed and quantified in numerous studies as a result of the substantial advancements in analysis and detection techniques. The harmful consequences of these micro-pollutants in surface and coastal water are, however, mainly unclear due to the limited methodologies and control technologies available. The molecules of estrogens, progesterone, androgens, glucocorticoids and growth hormones have been chosen due to the frequency with which environmental waters contain these substances. The concentration of the chosen steroids and hormones ranges from 0.1 to 196 ng/L (estrogens), less than 0.1 to 439 ng/L (progesterone), 0.06 to 86 2 (androgens), less than 0.1 to 433 ng/L (glucocorticoids) and 26.6 ng/g to 100 ng/L (growth hormones) and their percentage of removal efficiency varies from less than 10% to 99 percent, as the measurement [1].

Description

The world's finite supply of freshwater is needed more and more since the population of the planet is expanding exponentially. Thus, safeguarding the benefits of readily available water resources is one of the most important environmental challenges of the twenty-first century. Today, there is a great deal of concern about the potential negative impact on human and ecological health caused by the production, use and disposal of numerous chemicals that offer advancements in business, agriculture, medicine and even basic household conveniences. Steroid hormone use in pharmaceutical and personal care products (PPCPs), cattle and agriculture has grown to be a hot button issue due to the considerable water resource pollution it causes [2].

Despite being first found in the 1990s, the presence of these steroid hormones acting as endocrine-disrupting chemicals (EDCs) in water resources has recently gained attention in the realm of environmental research and policy. Scientists have become interested in EDCs because they have a significant impact on how people and other animals reproduce regularly, how they develop and expand and how long aquatic organisms live. Due to their many modes of operation, toxic effects and negative effects on various species, pharmaceutical and personal care products (PPCPs) that include both natural and synthetic steroid hormones are known as contaminants of emergent concern (CECs) [3].

Three main techniques can be used to remove hormones and steroids today: physical removal technology, biodegradation of the substances and advanced chemical oxidation technologies. In most WWTPs, only 27% of the micropollutants can be eliminated, which is below the detection limit. Of the remaining 64% of compounds, fewer than 50% of them can be eliminated and the remaining portion cannot be removed at all, according to numerous studies. Different kinds of steroids and hormones have been found in the effluents of WWTPs in many nations, although at varying levels. The concentrations of the substances that have been detected range from g/L to ng/L and some studies have revealed that the pollutants have been found at concentrations that are considerably higher than their lethal limits.

Since most nations have not yet defined explicit limits for the targeted steroid and hormone chemicals in drinking water, environmentalists and the general public are concerned about their frequent occurrence in the raw water used to produce ordinary drinking water. The issue is how much of these compounds should be present in the water system before they have an impact on the finished product, from the standpoint of pure water consumption. At the concentrations now observed, it is unknown if steroids and hormones will have a long-term detrimental effect on the health of people, plants and aquatic habitats [4].

Adsorbents must be recycled or disposed of following the treatment:

Even though regeneration can be costly and energy intensive, it would be necessary to research and evaluate additional treatment technologies before disposal. The regeneration phases can occasionally be fairly challenging as well as having the drawback of losing adsorbent. Activated carbons have a larger capacity for adsorption, however there are still certain drawbacks to this technology. The cost of activated carbons will undoubtedly rise as more is required for any experiment because they are so expensive. The urgent need to research or create new materials that work as well as activated carbon while avoiding its drawbacks is caused by this.

Researchers and scientists have written a number of publications about this problem during the previous few decades. This problem can be solved in two different ways. These include the creation and application of new synthetic materials as well as the adaption of cheap, readily available and abundant natural materials in their raw or modified forms [5].

Conclusion

Concerns about water quality have become quite important, both domestically and abroad. The goal of the WWTP is to entirely eliminate steroid and hormone molecules that could harm both the environment and human health. Unfortunately, studies have revealed that the steroid and hormone removal technology now employed in the majority of wastewater treatment plants is insufficient. As a result, these potentially dangerous substances may infiltrate groundwater and occasionally surface water. Only a small subset of these compounds are covered by current legislation intended to reduce emissions to the environment. Because of this, the majority of steroids and hormones continue to violate accepted legal standards.

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Conflict of Interest

No potential conflict of interest was reported by the authors.

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