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Investigating the Androgenic Activity of Ozonation Transformation Products of Testosterone and Androstenedione

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Highlights

- Slight differences in chemical structure may result in large differences in bioactivity during ozonation.
- Testosterone and androstenedione are more recalcitrant than estrone and/or other estrogen hormones during ozonation.
- Initial increase in androgenicity with small applied ozone doses; activity linked to transformation products.
- Transformation products of androstenedione showed higher androgenic activity than those of testosterone at low ozone doses.

Abstract

This study investigates the impact of ozonation on the concentration of two androgen steroid hormones, testosterone and androstenedione, and on androgenic activity as measured using the YAS assay. While these compounds are remarkably similar in chemical structure and showed comparable removal profiles in the presence and absence of a hydroxyl scavenger (isopropanol), large differences between percent removal of target compounds using chemical analysis and percent removal of bioactivity was observed when small ozone doses were applied. The dynamic change and initial increase in bioactivity during ozonation can be attributed to transformation products. These results demonstrate the importance of combining chemical analysis and bioanalytical techniques not only to perform a comprehensive assessment of environmental risks but also as a tool to optimize treatment technologies proposed as a mean to mitigate the impact of contaminants of emerging concern.

Abbreviations

A, androstenedione; AUC, area under dose response curve; CEC's, contaminants of emerging concern; C_i , ozone concentration of stock solution; C_o , initial ozone concentration; DHT, dihydrotestosterone; EC_{50} , median effective concentration; ISO, isopropanol; K_{O_3} , ozone rate constant; LOD, limits of detection; O_3 , ozone; ONPG, ortho-Nitrophenyl- β -galactoside; OTP, ozonation transformation products; T, testosterone; V_x , volume of ozone stock solution; YAS, yeast androgen screen

Keywords

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