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## Radiolytic decomposition of sulfonamide antibiotics: implications to the kinetics, mechanisms and toxicity

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**Abstract:** Abuse of antibiotics and consequent formation of resistance genes has aroused public concerns on environmental issues. Herein, we employed electron beam (EB) approach to deal with three kinds of sulfonamides, for studying the treatment efficiency and removal mechanisms to these widely used drugs. The results suggested EB could efficiently decompose the parent compounds of sulfonamides, the degradation processes followed pseudo-first-order kinetics, and dose constant  $k$  decay exponentially with their initial concentration. The radiolysis efficiency of these sulfonamides with the sequence of sulfathiazole (STZ) > sulfamethoxazole (SMX) > sulfamethazine (SMZ). The highest decomposition efficiencies were achieved in purewater compared to tapwater and surfacewater solutions. Acidic solutions facilitated sulfonamides radiolytic decomposition. An appropriate amount of 5 mM H<sub>2</sub>O<sub>2</sub> enhanced sulfonamides degradation. Removal efficiencies were also influenced by inorganic anions in the order of NO<sub>2</sub><sup>-</sup> > SO<sub>3</sub><sup>2-</sup> > CO<sub>3</sub><sup>2-</sup> > NO<sub>3</sub><sup>-</sup> > HCO<sub>3</sub><sup>-</sup> > Cl<sup>-</sup> > SO<sub>4</sub><sup>2-</sup>. Hydroxyl radicals were the dominant species, which was proven by radical scavenging studies. Removal of total organic carbon and total nitrogen were also determined to evaluate the mineralization degrees of sulfonamides. The formation of three ionic products and the

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