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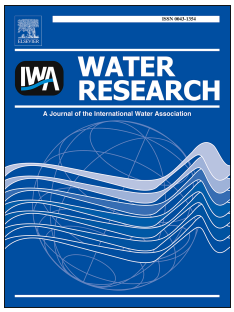

Base-catalyzed hydrolysis and speciation-dependent photolysis of two cephalosporin antibiotics, ceftiofur and cefapirin

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Base-catalyzed hydrolysis and speciation-dependent photolysis of two cephalosporin antibiotics, Ceftiofur and Cefapirin

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Abstract

Lately, special attention has been given to veterinary cephalosporin antibiotics due to their broad activity spectrum and significant consumption. Indeed, the determination of hydrolytic and photolytic kinetics provides a better comprehension of the undesired persistence of cephalosporins in aqueous matrices. In this work, the two widely used veterinary antibiotics ceftiofur (CEF) and cefapirin (CEPA) showed high instability under alkaline conditions, degrading in few minutes at pH >11. In buffered solutions at neutral pH and natural temperature (T = 22 ± 1°C), both drugs presented moderate stability (t½ = 3 d, CEPA and 1.4 d, CEF). Our study also demonstrated that CEPA and CEF speciation did not significantly influence the direct photolysis rates. Using a simulated water disinfection set-up (λ = 254 nm), all ionic species of CEF and CEPA presented fast and similar pseudo-first order degradation rates, kapp 0.0095 ± 0.0004 and 0.0092 ± 0.001 mJ cm-2, respectively. Furthermore, using surface water in hydrolysis experiments, CEF demonstrated significant matrix-dependent stability with a half-life (t½ = 14.7 d) tenfold higher than in buffered solutions. In contrast, CEPA presented a very similar hydrolysis rate in river water (t½ = 4.2 d) and a subtle faster photo-degradation rate in this same matrix (kapp 0.0128 ± 0.001 mJ cm-2),