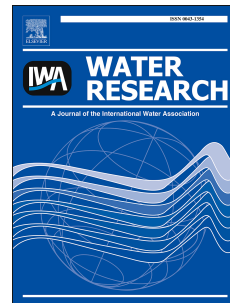


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Base-catalyzed hydrolysis and speciation-dependent photolysis of two cephalosporin antibiotics, ceftiofur and cefapirin

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1 **Base-catalyzed hydrolysis and speciation-dependent photolysis** 2 **of two cephalosporin antibiotics, Ceftiofur and Cefapirin**

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11 12 **Abstract**

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

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