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SPATIAL VARIATION IN NET UPTAKE [OR RELEASE] OF ANTIBIOTICS IN EFFLUENT DOMINATED STREAMS

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ABSTRACT: Many studies have shown the occurrence of antibiotics and degradation products in streams; however, this unique study evaluated the uptake [or release] of these chemicals on a whole reach basis. This study examined net changes in antibiotic concentrations downstream from a wastewater treatment plant (WWTP) effluent discharge and applied the solute spiraling theory to estimate net uptake length (S_{net}), net mass transfer coefficient (vf_{net}), and net uptake rate (U_{net}) of antibiotics from Mud Creek, Spring Creek, and Decatur Branch in northwest Arkansas, USA. Water samples were collected during August and September 2006 and analyzed for multiple antibiotics representing five classes (beta-lactams, macrolides, quinolones, sulfonamides, and tetracyclines). Measurable concentrations of several antibiotic residuals and degradation products (macrolides, quinolones, and sulfonamides) were detected downstream from the effluent discharge at all three stream reaches. Six (azithromycin, erythromycin, erythromycin-H_20, ciprofloxacin, ofloxacin and trimethroprim) of the seven detected antibiotics and degradation products at Mud Creek were significantly retained within the reach. At Spring Creek, five (azithromycin, erythromycin, erythromycin-H_2O, tylosin and ofloxacin) of the seven antibiotics and degradation products detected were significantly retained in the stream reach; however, at Decatur Branch four (azithromycin, tylosin, roxithromycin and sulfamthoxazole) of the seven detected were significantly released. Retention within the stream reach was likely due in-stream processes, but it was interesting to find that antibiotic residuals could also be released in stream reaches downstream from WWTPs.

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