

Occurrence, fate and antibiotic resistance of fluoroquinolone antibacterials in hospital wastewaters in Hanoi, Vietnam

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Abstract: Occurrence and behavior of fluoroquinolone antibacterial agents (FQs) were investigated in hospital wastewaters in Hanoi, Vietnam. Hospital wastewater in Hanoi is usually not treated and this untreated wastewater is directly discharged into one of the wastewater channels of the city and eventually reaches the ambient aquatic environment. The concentrations of the FQs, ciprofloxacin (CIP) and norfloxacin (NOR) in six hospital wastewaters ranged from 1.1 to 44 and from 0.9 to 17 $\mu\text{g l}^{-1}$, respectively. Total FQ loads to the city sewage system varied from 0.3 to 14 g d^{-1} . Additionally, the mass flows of CIP and NOR were investigated in the aqueous compartment in a small wastewater treatment facility of one hospital. The results showed that the FQ removal from the wastewater stream was between 80 and 85%, probably due to sorption on sewage sludge. Simultaneously, the numbers of *Escherichia coli* (*E. coli*) were measured and their resistance against CIP and NOR was evaluated by determining the minimum inhibitory concentration. Biological treatment lead to a 100-fold reduction in the number of *E. coli* but still more than a thousand *E. coli* colonies per 100 ml of wastewater effluent reached the receiving water. The highest resistance was found in *E. coli* strains of raw wastewater and the lowest in isolates of treated wastewater effluent. Thus, wastewater treatment is an efficient barrier to decrease the residual FQ levels and the number of resistant bacteria entering ambient waters. Due to the lack of municipal wastewater treatment plants, the onsite treatment of hospital wastewater before discharging into municipal sewers should be considered as a viable option and consequently implemented. ?? 2008 Elsevier Ltd. All rights reserved.

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