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Fluoroquinolones: a preliminary study on optimized extraction and chromatographic methods

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Abstract

Background: Fluoroquinolones (FQs) are a widely prescribed class of antibiotics, used in both human and veterinary medicine, commonly administered for prophylactic and therapeutic purposes [1]. Due to their extensive use and excretion in both unmetabolized form and metabolites, FQs and their metabolites persist in aquatic environments. As a result, these compounds are frequently detected in surface and groundwater worldwide, with concentrations ranging from ng L^{-1} to µg L^{-1}. This persistence contributes significantly to the spread of antibiotic resistance among microbial populations, posing risks to both ecosystems and human health [1,2]. Therefore, monitoring water matrices is crucial for assessing both ecological risks and potential human health impacts [2]. **Objective:** This study aimed to optimize a sample preparation procedure and develop an enantioselective method for the analysis of FQs, namely Ciprofloxacin, Enrofloxacin, Nadifloxacin, *N*-Desmethyl Ofloxacin, Ofloxacin, and Ofloxacin *N*-oxide in aqueous samples. Solid-phase extraction (SPE) was employed for sample preparation, followed by an enantioselective analytical method based on high-performance liquid chromatography (HPLC), coupled with a fluorescence detector (λ_{Ex}: 290 nm, λ_{Em}: 460 nm), except for Nadifloxacin that was analysed using a UV detector (λ = 291 nm). **Methods:** Different conditions were tested using Oasis® MAX Extraction cartridges (Waters) for sample preparation, and different mobile phases were assessed to optimize the chromatographic separation on a Lux® 3 µm Cellulose-2 chiral column. **Results:** The performance of MAX cartridges under different conditions was assessed based on recovery efficiency. The method demonstrated high efficiency, with recoveries higher than 70% for most of the FQs, except for Ofloxacin *N*-oxide and *N*-Desmethyl Ofloxacin. Optimal separation conditions were achieved using the aforementioned chiral column, under reverse elution mode. **Conclusions:** The optimized analytical method will be employed to quantify the levels of FQs in ecotoxicological assays. Further method validation is required to ensure accurate quantification of their presence in culture media samples.

Keywords: antibiotics; environmental contaminants; enantioselective methods

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