

Quantification of fluoroquinolone antibiotics in coastal marine sediments of Gran Canaria island using a green methodology

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Abstract

Fluoroquinolones (FQs) are a class of antibiotics used in human and animal medicine for therapeutic purpose as against both gram-positive and gram-negative bacteria [1]. After their excretion, they are accumulated in wastewater treatment plants (WWTPs) because there are no mechanisms to eliminate them completely. In this way, the pollutants contained in the treated water can be deposited in coastal sediments around wastewater marine outfalls. FQs are resistant to microbial degradation and may be persistent in the environment [2]. Thus, to prevent the growth of resistant bacteria, monitoring FQ concentrations in different kinds of environmental samples is necessary [3], especially in solid samples, where they can be accumulated.

This work present an analytical green approach for the quantification of five FQs (levofloxacin, norfloxacin, ciprofloxacin, enrofloxacin and sarafloxacin) in sediments from coastal points of the south of Gran Canaria island (Spain) that had not been studied previously. The simple area is affected by a marine outfall discharging wastewaters.

We selected microwave assisted extraction (MAE) as extraction technique, replacing the organic solvents by micellar media as extraction agents, being then called Microwave-assisted micellar extraction (MAME). Micellar media are no toxic, biodegradable, less expensive than organic solvents and compatible with the mobile phase used in liquid chromatography (LC). Moreover they can enhance the signal of many compounds in fluorescence detection [4].

Analysis was performed using liquid chromatography with fluorescence detection and electrospray ionization–tandem mass spectrometry detection (LC-FD and LC-ESI-MS/MS, respectively). Under optimal conditions, we obtained recoveries greater than 73% with relative standard deviations below 8%. The limits of detection achieved using MAME-LC-ESI/MS/MS were between 0.15 and 0.55 ng g⁻¹ for the different FQs.

Four fluoroquinolones (levofloxacin, norfloxacin, ciprofloxacin and enrofloxacin) were found in the coastal marine sediments in concentrations between 0.81 and 34.3 ng g⁻¹, which means that the sediment absorbs the antibiotics dissolved in the effluent of the marine outfall, showing also that their accumulation was higher closer to the outfall and lower nearer to the coast.

References

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