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Input of pharmaceuticals through coastal surface watercourses into a Mediterranean lagoon (Mar Menor, SE Spain): Sources and seasonal variations



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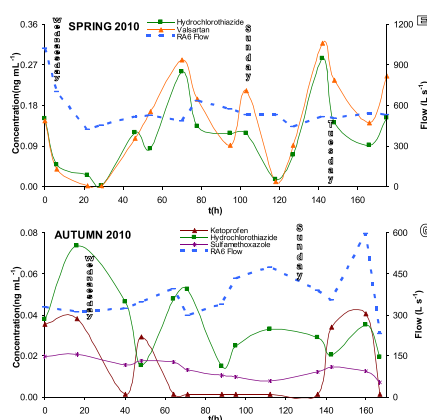
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HIGHLIGHTS

- 56 pharmaceuticals were detected in surface waters
- The major pharmaceuticals source was effluent from the Los Alcázares WWTP
- Antibiotics, psychiatric drugs and anti-hypertensives were the most persistent
- Macrolides and β -blockers showed seasonal variations
- 11 kg year⁻¹ of pharmaceuticals accessed the Mar Menor through El Albujón watercourse

GRAPHICAL ABSTRACT



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ABSTRACT

The seasonal occurrence and distribution of 69 pharmaceuticals along coastal watercourses during 6 sampling campaigns and their input through El Albujón watercourse to the Mar Menor lagoon were determined by UPLC–MS–MS, considering a total of 115 water samples. The major source of pharmaceuticals running into this watercourse was an effluent from the Los Alcázares WWTP, although other sources were also present (runoffs, excess water from irrigation, etc.). In this urban and agriculturally influenced watercourse different pharmaceutical distribution profiles were detected according to their attenuation, which depended on physicochemical water conditions, pollutant input variation, biodegradation and photodegradation rates of pollutants, etc. The less recalcitrant compounds in this study (macrolides, β -blockers, etc.) showed a relevant seasonal variability as a consequence of dissipation processes (degradation, sorption, etc.). Attenuation was lower, however, for diclofenac, carbamazepine, lorazepam, valsartan, sulfamethoxazole among others, due to their known lower degradability and sorption onto particulate matter, according to previous studies. The maximum concentrations detected were higher than 1000 ng L⁻¹ for azithromycin, clarithromycin, valsartan, acetaminophen and ibuprofen. These high concentration levels were favored by the limited dilution in this low flow system, and consequently some of them could pose an acute risk to the biota of this watercourse. Considering data from 2009 to 2010, it has been estimated that a total of 11.3 kg of pharmaceuticals access the Mar Menor lagoon annually through the El Albujón

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