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Simultaneous analysis of opioid analgesics and their metabolites in municipal wastewaters and river water by liquid chromatography-tandem mass spectrometry

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Highlights

- LC-MS/MS method for the determination of 27 opioid analgesics was developed
- Keeping SPE catridges at -20 ^{o}C was the best way to ensure stability of opioids
- Opioid analgesics are common constituents of municipal wastewater and river water
- Metabolites of opioids contributed significantly to the overall mass balance
- Conjugated opioids may represent a significant percentage of the total concentration

Abstract

Although published literature provides a clear demonstration of widespread occurrence of opioid analgesics (OAs) in the aquatic environment, analytical methods suitable for a systematic study of this pharmaceutical class, which would include a broad spectrum of opioid analgesics and their metabolites, are still missing. In this work, a comprehensive multiresidue method for quantitative analysis of 27 opioid analgesics and their metabolites, including 2 morphine glucuronide conjugates, was developed and validated for three matrices: raw wastewater (RW), secondary effluent (SE) and river water. The method comprised different classes of opioid analgesics, including natural opiates (morphine and codeine), their semi-synthetic derivatives (hydrocodone, hydromorphone,