Predicting environmental concentrations of carbamazepine and oxcarbazepine and their main metabolites in a coastal system

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**Predicted environmental concentrations of carbamazepine, oxcarbazepine and their main metabolites in a coastal system**


- a: UMR 5569 Hydrosciences Montpellier, Université Montpellier 1, Montpellier, France
- b: IFREMER, Laboratoire Environnement et Ressources du Languedoc-Roussillon (LER-LR), Sète, France
- c: Laboratoire de Pharmacologie Médicale et Toxicologie, Hôpital Lapeyronie, Montpellier, France
- d: EPOC - UMR 5805 CNRS, Talence, France

**Introduction**

Pharmaceuticals are widely released in aquatic environment through treated wastewaters. They reach coastal zone indirectly via streams or directly though marine outfalls however data concerning this contamination in coastal waters are scarce.

Environmental Risk Assessment (ERA) of pharmaceuticals have been conducted mostly in surface waters and not has been performed in coastal zone. The first step of ERA is to evaluate the exposure through predictive environmental concentration (PEC) values. The aim of this study was to predict the occurrence of some pharmaceuticals in a coastal area subjected to treated wastewater (TWW) reject through a marine outfall (Fig 2). Among pharmaceuticals, Carbamazepine, Oxcarbazepine and their main metabolites (Fig 1) were chosen. CBZ has been proposed as an indicator of wastewater contamination and has been already detected in Mediterranean (Munaron et al., 2011).

Prediction was performed based on local pharmaceuticals consumption recording and a review of pharmacokinetics data. PECs values were estimated in TWW and at the marine outfall and compared with MECs obtained by direct quantification and with POCIS implementation.

**Materials and methods**

**PEC**

Medical care consumption data (g of CBZ and OxCZ sales per month)

Pharmacokinetics data (% of excreted forms : parents compounds and metabolites)

% elimination in STEP, flux effluent

PEC effluent : Sales (g) * % excreted/ % elimination*flux

PEC coastal zone : PEC/100 (TGD, 2003)

**MEC**

MEC effluents :

24h homogenate effluents sampling (n=8)

Filtration, SPE OASIS HLB, analysis LC-MS (Ledlercq et al., 2009)

MEC coastal zone : POCIS implementation for one month near the submarine outfall (n=6)

Analysis as described by Munaron et al. (2011)

**Results - Discussion**

**Table 2: PEC in coastal zone (ng/L)**

<table>
<thead>
<tr>
<th>Molecule</th>
<th>CBZ</th>
<th>OxCB</th>
<th>10-OHCbz</th>
<th>Cbgluc</th>
<th>OxCZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBZ</td>
<td>0.7</td>
<td>0.92</td>
<td>3.3</td>
<td>10.17</td>
<td></td>
</tr>
<tr>
<td>OxCB</td>
<td>0.6</td>
<td>0.8</td>
<td>3.4</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>Cbgluc</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td></td>
</tr>
<tr>
<td>OxCZ</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3: concentrations in POCIS in ng/g of sorbent**

<table>
<thead>
<tr>
<th>POCIS Sorbent</th>
<th>CBZ</th>
<th>OxCB</th>
<th>10-OHCbz</th>
<th>Cbgluc</th>
<th>OxCZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6-1.8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
</tbody>
</table>

**Fig. 2: Study area and sampling points (56-59)**

**Fig. 3: Deviation from the mean of CBZ and OxCBZ from January to June 2011**

**Fig. 4: Metabolits excretion percentages of absorbed dose of CBZ(A) and OxCBZ (B)**

**Fig. 5: PEC and MECs in treated wastewater effluents**

**Conclusion**

Further studies have to be performed for PEC estimation in coastal area including a hydrodynamic numeric model, which take into account diffusion, advection in seawater.

**References**


Acknowledgments

We wish to thank Agence Régionale de Santé Languedoc Roussillon (ARS LR) for its partnership and its assistance for the acquisition on medical care data without which this work would have been impossible.