Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.


# Supporting information

## Opportunities for rotating belt filters in novel wastewater treatment plant configurations

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## S1. Limits of quantification of OMPs

Table S1. Limit of quantification of OMPs in wastewater and sludge samples

| Compound | Wastewater samples | | Sludge samples | |
|---|---|---|---|---|
| | Liquid (ng/L) | Solid (ng/g) | Liquid (ng/L) | Solid (ng/g) |
| CTL, ERY, FLX, ROX | 0.3 | 1.2 | 3 | 1.2 |
| DZP, CBZ, SMX, TMP | 1.5 | 6 | 15 | 6 |
| E1, E2, EE2 | 1.5 | 6 | 15 | 6 |
| ADBI, AHTN, HHCB, TCS | 5 | 60 | 50 | 30 |
| IBP | 6 | 24 | 20 | 12 |
| NPX | 7.5 | 30 | 25 | 15 |
| DCF | 32 | 120 | 100 | 60 |

## S2. Occurrence of OMPs in the influent of Blaricum and Aarle-Rixtel WWTPs

Table S2. Total concentration of organic micropollutants in the influent of RBFs systems of Blaricum (WWTP 1) and Aarle-Rixtel (WWTP2)

| | Blaricum WWTP | Aarle-Rixtel WWTP |
|---|---|---|
| HHCB (μg/L) | 2.16 | 1.23 |
| AHTN (μg/L) | 1.33 | 0.95 |
| ADBI (μg/L) | 1.09 | 1.38 |
| IBP (μg/L) | 3.47 | 4.02 |
| NPX (μg/L) | 4.84 | 4.89 |
| SMX (ng/L) | 8.9 | <LOQ |
| TMP (ng/L) | 48 | 41 |
| ERY (ng/L) | 7.9 | 4.6 |
| ROX (ng/L) | 2.9 | <LOQ |
| FLX (ng/L) | 42 | 38 |
| CBZ (ng/L) | 235 | 32 |
| DZP (ng/L) | 33 | 1.7 |
| CTL (ng/L) | 97 | 96 |
| TCS (μg/L) | 1.21 | <LOQ |
| E1 (ng/L) | <LOQ | <LOQ |
| E2 (ng/L) | 57 | 55 |
| EE2 (ng/L) | 11 | <LOQ |

LOQ: limit of quantification

**S3. Occurrence of OMPs in the RBF sludge in Blaricum and Aarle-Rixtel WWTPs**

Table S3 shows the concentrations of OMPs sorbed on dewatered RBF sludge from Blaricum WWTP (WWTP1) and Aarle-Rixtel WWTP (WWTP2).

Musk fragrances HHCB and AHTN were the compounds that showed the highest concentrations in both RBF sludges (0.3-1.4 µg/g). They were measured in similar concentrations (0.5-21 µg/g) in sewage sludge.[1,2] The latter reported ADBI as the fragrance showing the lowest concentrations (LOQ-0.04 µg/g); in fact, in this study, ADBI was only detected in Aarle-Rixtel WWTP.

Regarding anti-inflammatory compounds, only IBP was detected in this study. Similar results were reported by other authors. [1,3] IBP concentration was similar in both sludges (104-128 ng/g), and it was in the same range than the reported by Nieto et al.[4] (44-144 ng/g) but slightly slower than the reported by Carballa et al.[1]

Regarding antibiotics, the concentration of TMP was similar in both sludges (20.9-21 ng/g), while SMX was only detected in Blaricum WWTP (5.24 ng/g). ERY and ROX ranged from 5.87 to 31.1 ng/g, and from 14.6 to 86.0 ng/g, respectively. The reported range of concentrations for anti-biotics in sludge varies considerably. For instance, Gonzalez-Gil et al. [3] did not detect ERY, while Narumiya et al.[5] reported up 110 ng/g. The former reported 10-240 ng/g for TMP and 2-65 ng/g for ROX, what is in accordance with the reported concentration of this study.

Concerning endocrine disrupting compounds, none was detected in this study, which was also reported by Gonzalez-Gil et al.[3], except for hormones. E1 was detected in the sludge of Blaricum WWTP (29.9 ng/g), whereas E2 (35.0 ng/g) and EE2 (33.6 ng/g) were detected in the second WWTP. The concentration range of hormones reported for sewage sludge is quite wide (<LOQ-0.300 ng/g) [4,6], so the results of this study are in accordance with some values but out of range compared with others.

Table S3. OMPs sorbed concentrations in the dewatered sieved sludge in Blaricum (WWTP 1) and Aarle-Rixtel (WWTP2)

| **Parameter** | **Blaricum WWTP** | **Aarle-Rixtel WWTP** |
|---|---|---|
| HHCB | 1256 ± 89 | 412 ± 41 |
| AHTN | 1463 ±198 | 682 ± 43 |
| ADBI | <LOQ | 325 ± 51 |
| IBP | 128 ± 10 | 104 ± 1 |
| NPX | <LOQ | <LOQ |
| DCF | <LOQ | <LOQ |
| SMX | 5.24 ± 0.76 | < LOQ |
| TMP | 21.0 ± 2.7 | 18.4 ± 2.7 |
| ERY | 31.1 ± 0.3 | 6.89 ± 1.68 |
| ROX | 14.6 ± 2.9 | 103 ± 28 |
| FLX | 188 ± 8 | 64.6 ± 11.6 |
| CBZ | 144 ± 4 | 5.80 ± 0.56 |
| DZP | 284 ± 2 | 13.4 ± 5.1 |
| CTL | 55.9 ± 1.3 | 121 ± 33 |
| TCS | <LOQ | <LOQ |
| E1 | <LOQ | 29.9 ± 1.5 |
| E2 | 35.0 ± 6.5 | <LOQ |
| EE2 | 33.6 ± 5.8 | <LOQ |

LOQ: limit of quantification

## S4. Results of the $K_d$ test

OMPs of Group I (Figure S1) were only detected in the solid phase, so the limit of quantification (LOQ) in the liquid phase was used to calculate the $K_d$ values for these compounds. They showed the highest sorption affinity, which is agreement with literature. The OMPs included in Group II showed $K_d$ coefficients slightly lower than those reported in the literature for primary sludge regardless IBP (Figure S2). The higher values obtained in this study for IBP (log $K_d$: 1.8-2.1) compared with those reported in literature for primary sludge could be explained by the $pK_a$ of IBP ($pK_a$: 4.5–5.2) and the pH of RBF sludge (5.5), since for acidic compounds, higher $K_d$ values are expected under acidic conditions [7]. The compounds of Group III showed $K_d$ values in general one order of magnitude lower than those reported in literature.

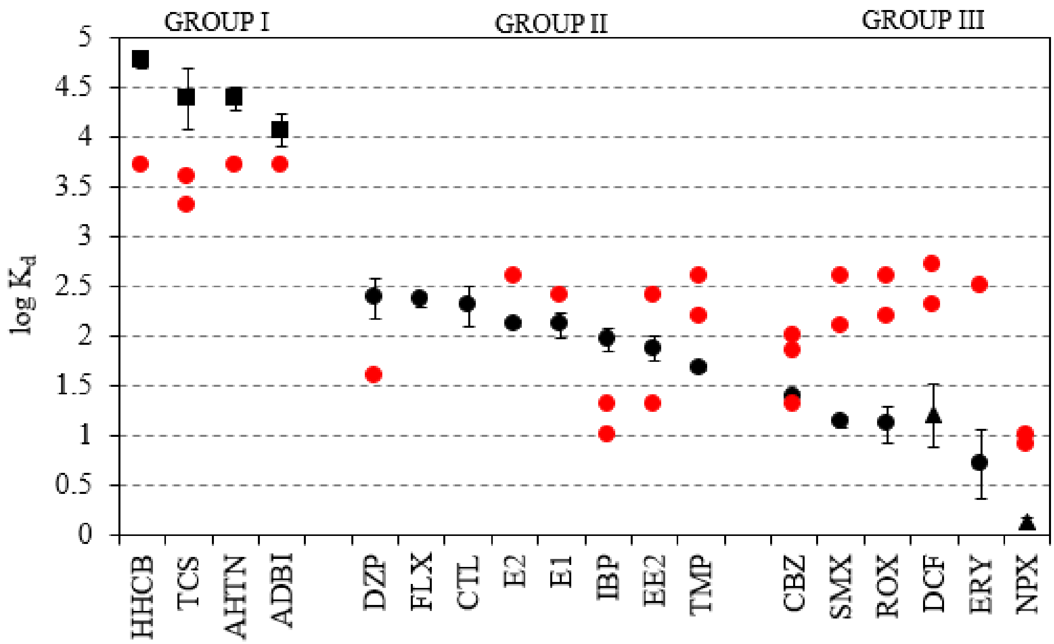


**Fig. S1.** OMPs partition (log $K_d$) between solid and liquid phase in sieved sludge. (■) minimum values calculated with the limit of quantification in the liquid phase (HHCB, AHTN, ADBI and TCS were only quantified in solid phase); (▲) maximum values calculated with the limit of quantification in the solid phase (NPX and DCF were only quantified in the liquid phase); and (●) average values for compounds quantified in the liquid and solid phases. (●) Refers to literature values for primary sludge [5,7–10]. Group I includes the most hydrophobic OMPs, with log $K_d$ >4, Group II, those with medium log $K_d$ values (1.5> log $K_d$ > 2.5) and Group III the most hydrophilic compounds (log $K_d$ >1.5).

## S5. Acknowledgements

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