## Supplementary Material

**Table S1 Physicochemical properties of target PhACs**

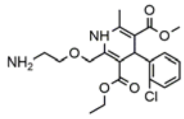
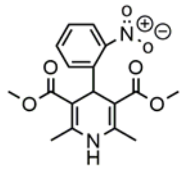
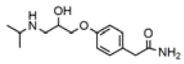
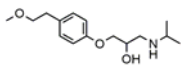
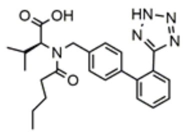
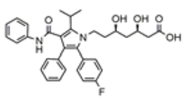
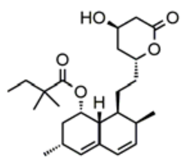
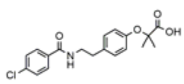
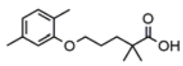
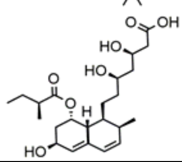
| Class | Compounds | CAS NO. | Molecular formula | MW | $pK_a$ | $logK_{OW}$ | Structure |
|---|---|---|---|---|---|---|---|
| Antihypertensive drugs | | | | | | | |
| Calcium channel blockers | Amlodipine (AML) | 88150-42-9 | $C_{20}H_{25}ClN_2O_5$ | 408.9 | -- | 3.00 |  |
| Calcium channel blockers | Nifedipine (NIP) | 21829-25-4 | $C_{17}H_{18}N_2O_6$ | 346.3 | -- | 2.20 |  |
| Beta-blockers | Atenolol (ATE) | 29122-68-7 | $C_{14}H_{22}N_2O_3$ | 266.3 | 9.6 | 0.23 |  |
| Beta-blockers | Metoprolol (MET) | 37350-58-6 | $C_{15}H_{25}NO_3$ | 267.4 | 9.6 | 1.88 |  |
| Vasoconstriction receptor | Valsartan (VAL) | 137862-53-4 | $C_{24}H_{29}N_5O_3$ | 436.0 | -- | 3.65 |  |
| Lipid regulators | | | | | | | |
| Cholesterol lowering statin drugs | Atorvastatin (ATO) | 134523-00-5 | $C_{33}H_{35}FN_2O_5$ | 558.7 | 4.18 | 6.36 |  |
| Cholesterol lowering statin drugs | Simvastatin (SIM) | 79902-63-9 | $C_{25}H_{38}O_5$ | 418.6 | 13.2 | 4.68 |  |
| | Bezafibrate (BZB) | 41859-67-0 | $C_{19}H_{20}ClNO_4$ | 361.8 | 3.6 | 4.25 |  |
| | Gemfibrozil (GEF) | 25812-30-0 | $C_{15}H_{22}O_3$ | 250.3 | 4.7 | 4.77 |  |
| Competitive inhibitor | Pravastatin (PRA) | 81093-37-0 | $C_{23}H_{36}O_7$ | 425.0 | -- | 3.10 |  |

**Table S2 Detailed information of three WWTPs**

| Content | A | B-1 | B-2 | B-3 | C |
|---|---|---|---|---|---|
| Location | Guangzhou | | Foshan | | Foshan |
| Population served | 1500000 | | 338900 | | 237000 |
| Q($m^3$/d) | 550000 | | 250000 | | 200000 |
| Service area($km^2$) | 104.6 | | 32.9 | | 17 |
| Secondary treatment | Inverted $A^2$ /O | A/O | $A^2$/O | Improved $A^2$/O | Unitank |
| HRT (h) | 8.0 | 7.0 | 6.6 | 8.1 | 8.0 |
| Influent COD (mg/L) | 195.9 | 147.2 | 151.6 | 154.3 | 84.7 |
| Influent BOD (mg/L) | 91.4 | 54.4 | 64.6 | 68.3 | 40.6 |
| Influent SS (mg/L) | 101.9 | 56.7 | 83.1 | 92.5 | 47.0 |
| Influent ammonia ($NH_3$–N) (mg/L) | 28.5 | 16.2 | 17.5 | 16.8 | 15.3 |
| Influent TN (mg/L) | 32.6 | 20.4 | 20.9 | 21.5 | 19.3 |
| Influent TP (mg/L) | 3.4 | 2.0 | 2.3 | 2.6 | 2.2 |
| Effluent COD(mg/L) | 14.7 | 12.5 | 15.1 | 12.4 | 12.4 |
| Effluent BOD (mg/L) | 2.1 | 1.3 | 1.9 | 0.7 | 2.0 |
| Effluent SS (mg/L) | 9.4 | 5.8 | 5.4 | 7.0 | 5.4 |
| Effluent ammonia ($NH_3$–N) (mg/L) | 1.5 | 0.8 | 1.7 | 0.2 | 1.2 |
| Effluent TN (mg/L) | 13.2 | 11.8 | 11.8 | 12.1 | 11.4 |
| Effluent TP (mg/L) | 0.5 | 0.5 | 0.3 | 0.8 | 0.7 |

**Table S3 Parameters of electrospray ionization tandem mass spectrometry for target PhACs**

| PhACs | Retention time (min) | Precursor ion (m/z) | Product ion (m/z) | Polarity (ESI) |
|---|---|---|---|---|
| AML | 16.6 | 409.1 | 206.0/238.0 | + |
| NIP | 17.8 | 347.1 | 315.0/254.0 | + |
| ATE | 2.16 | 267.1 | 190.0/145.0 | + |
| MET | 10.8 | 268.4 | 132.9/116.0 | + |
| VAL | 18.6 | 434.2 | 349.9/178.6 | - |
| ATO | 19.3 | 559.3 | 440.1/250.0 | + |
| SIM | 20.2 | 419.1 | 199.0/153.2 | + |
| BZB | 18.2 | 362.2 | 318.1/273.7 | - |
| GEF | 7.8 | 251.0 | 241.9/128.9 | + |
| PRA | 17.7 | 447.2 | 327.0/143.0 | + |

**Table S4 Correlation coefficients ($r^2$), limits of detection (LOD, S/N=3) and recovery efficiencies of 10 PhACs**

| PhACs | $r^2$ | LOD（ng/L） | Recovery in this study (%) | Recovery in references (%) |
|---|---|---|---|---|
| AML | 0.9981 | 0.12 | 2 | -- |
| NIP | 0.9997 | 0.12 | 67 | 75[1] |
| ATE | 0.9987 | 0.6 | 92 | 56[2], 69[3] |
| MET | 0.9996 | 0.6 | 47 | 63[4] |
| VAL | 0.9926 | 0.6 | 43 | -- |
| ATO | 0.9998 | 0.3 | 20 | 21[5] |
| SIM | 0.9757 | 0.1 | 33 | 51[5] |
| BZB | 0.9939 | 0.6 | 128 | 102[5] |
| GEF | 0.9922 | 0.1 | 25 | 52[5], 49[6] |
| PRA | 0.9986 | 0.5 | 61 | -- |

--: not applicable

[1] (Papageorgiou et al., 2016); [2] (Subedi et al., 2015); [3] (Yuan et al., 2015); [4] (Sun et al., 2014); [5] (Yan et al., 2014a); [6] (Kosma et al., 2014)

**Table S5 RQ values for the PhACs in the effluents of three WWTPs**

| PhACs | EC50(mg/L)[a] | | | Max. conc. in effluent (ng/L) | RQ | | |
|---|---|---|---|---|---|---|---|
| | Daphnia | Fish | Algae | | Daphnia | Fish | Algae |
| NIP | 3.88 | na[b] | na | 23.5 | 6.06e-03 | na | na |
| ATE | 33.4 | >100 | 620 | 5.9 | 1.77e-04 | <0.59e-04 | 0.95e-05 |
| MET | 8 | 116 | 7.9 | 615.27 | 7.69e-02 | 5.30e-03 | 7.79e-02 |
| VAL | 580 | na | 90 | 180.86 | 3.12e-04 | na | 2.01e-03 |
| PRA | 11 | 1.8 | NA | 123.66 | 1.12e-02 | 6.87e-02 | na |

a. The EC50 values of various aquatic organism for the PhACs are collected from literature (Huggett et al., 2002; Cleuvers, 2003; Cleuvers, 2005; Fraysse and Garric, 2005; Hernando et al., 2007; Christensen et al., 2009; Kim et al., 2009; Escher et al., 2011; Ginebreda et al., 2012).

b. na: not available

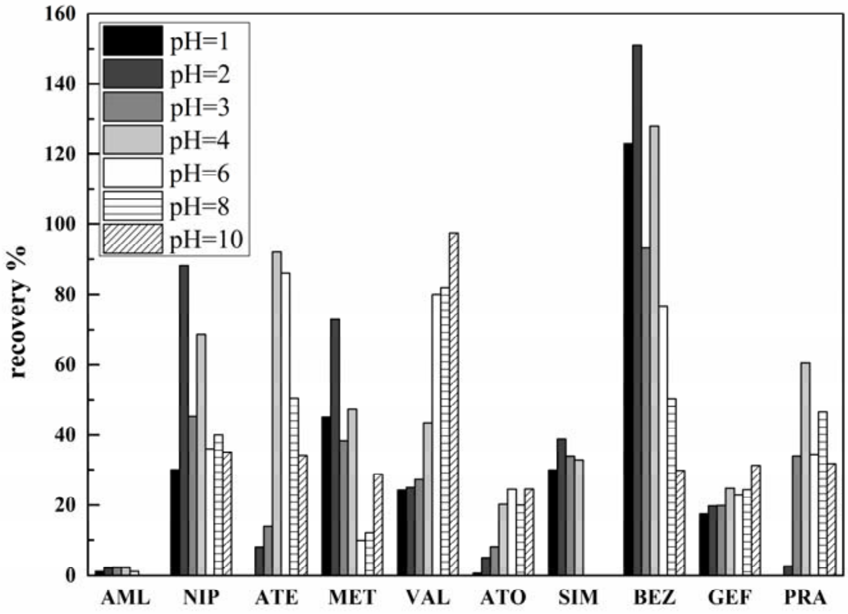
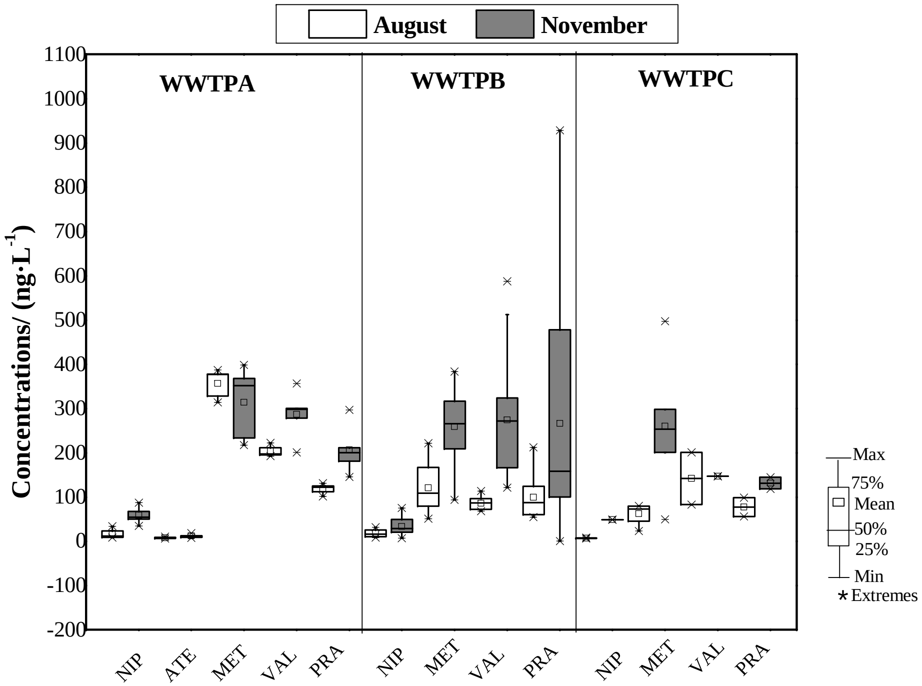



Fig. S1 Recovery efficiencies of the 10 PhACs at various pH for extraction




Detection frequency (%) in August

| PhACs | WWTPA | WWTPB | WWTPC |
|---|---|---|---|
| NIP | 83 | 50 | 57 |
| ATE | 83 | 0 | 0 |
| MET | 83 | 67 | 57 |
| VAL | 83 | 56 | 29 |
| PRA | 83 | 53 | 29 |

Detection frequency (%) in November

| PhACs | WWTPA | WWTPB | WWTPC |
|---|---|---|---|
| NIP | 83 | 50 | 57 |
| ATE | 83 | 0 | 0 |
| MET | 83 | 67 | 57 |
| VAL | 83 | 56 | 29 |
| PRA | 83 | 53 | 29 |

Fig. S2 Ranges of the PhACs concentrations in the influents of three WWTPs

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