Supporting Information

Behaviours of Glucocorticoids, Androgens and Progestogens in a Municipal Sewage Treatment Plant: Comparison to Estrogens

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Water Sample Preparation. The water samples were analyzed according to the method reported by Chang et al. (*1*).1 L of water spiked with 50 ng of surrogate standards was extracted through an Oasis HLB (6 mL, 500 mg) cartridge, which was previously conditioned with 6 mL ethyl acetate, 6 mL acetonitrile and 12 mL distilled water at a flow rate of 5-10 mL/min. The cartridge was washed with 10 mL of distilled water, and then was dried under a flow of nitrogen. 15 mL of ethyl acetate and 6 mL of ethyl acetate/acetonitrile (1:1, v/v) were used to elute the analytes. The extracts were dried and redissolved in 0.2 mL of ethyl acetate and 1.8 mL of hexane. The mixed solutions were applied to silica cartridges (6 mL, 500 mg), which had been preconditioned with 4 mL water-saturated ethyl acetate and 4 mL hexane/ethyl acetate (90:10, v/v). After the cartridges were rinsed with 3 mL of hexane/ethyl acetate (90:10, v/v), the fraction (F1) containing eight androgens, nine progestogens, and six estrogens were eluted with 3 mL of hexane/ethyl acetate (38:62, v/v), and the fraction (F2) containing seven glucocorticoids were subsequently eluted with 3 mL of water-saturated ethyl acetate. For androgens, progestogens and adrenal steroids, F1 and F2 eluates were dried and reconstituted respectively with 0.5 mL of methanol for UPLC-ESI-MS/MS analysis. For estrogens, 0.2 mL of the methanol reconstituted solution of F1 was dried and redissolved with 1 mL hexane–methylene chloride (DCM) (1:1, v/v), and then passed through the preconditioned Florisil cartridges (6 mL, 1 g,). 10 mL of a mixture of hexane/DCM (1:1, v/v) were discarded and the fraction containing all estrogens was eluted with 6 mL of acetone/DCM (1:9, v/v). The solution was evaporated to dryness under a gentle stream of nitrogen and reconstituted with 0.2 mL of methanol for UPLC-ESI-MS/MS analysis.

Enzyme Treatment. The presence of conjugates of 21-HPT and MHPT was determined

indirectly by subjecting the same samples to enzymatic hydrolysis to produce free progestogens, measuring the concentrations of free compounds by LC-MS/MS analysis before and after enzyme treatment, and calculating the mass flux changes. Enzyme hydrolysis was carried out by adding 10 mL of 0.2 M acetate buffer (pH 5.2), 2 mL of 1 mg/mL ascorbic acid and 0.40 mL of β-glucuronidase and β-arylsuflatase (mixed) from Helix Pomatia (Roche Diagnostics GmbH, Mannhein, Germany) to 100 mL of water sample referring to the method which was used to estrogen conjugates (*2*). The water samples, including primary effluent and water in samples taken from the activated sludge system (anaerobic, anoxic and aerobic tank and return sludge), were incubated at 37 ^{o}C for 16 h. Calcium carbonate (200 mg), 0.68 mL of 37% formaldehyde, and surrogate standards (5 ng of NTD-$^{13}C_2$ and PGT-d_9) were added before HLB extraction followed by Silica cleanup. The deconjugation for the sludge sample from anaerobic and aerobic tanks was also carried out. Approximately 2 g of freeze-dried sludge were ultrasonically extracted with the mixture of methanol and acetonitrile (1:1, v/v). After being spiked with surrogate standards, the extracts were rotoevaporated and reconstituted by 100 mL. And then 50 mL was directly analyzed by the procedure as described in the "Sludge Sample Preparation" of this manuscript, while another 50 mL was hydrolyzed by enzyme treatment before being analyzed by the described procedure.

However, the contributions of conjugates of 21-HPT and MHPT to the total mass loads of these two compounds reported in this study may be underestimated by these data because free progestogens could have been biodegraded during the process and enzymatic hydrolysis might be incompletely efficient as exemplified by the deconjugation of estrogen conjugates in the same enzyme hydrolysis process (*3*).

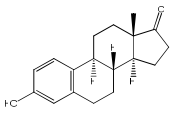
References

(1) Chang, H.; Wan, Y.; Hu, J. Y. Determination and Source Apportionment of Five Classes of Steroid Hormones in Urban Rivers. *Environ. Sci. Technol.* **2009**, 43, 7691–7698.

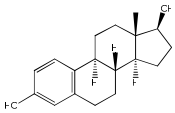
(2) Lee, S.; Kim, S.; Lee, H.; Chung, B. Estrogens and polyamines in breast cancer: their 41 profiles and values in disease staging. *Cancer Lett.* **1998**, 133, 47-56.

(3) Hutchinsa, S. R.; Whitea, M. V.; Hudsonb, F. M.; Fineb, D. D. Analysis of lagoon samples from different concentrated animal feeding operations (CAFOs) for estrogens and estrogen conjugates. *Environ. Sci. Technol.* **2007**, 41, 738-744.

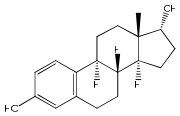
Estrogens



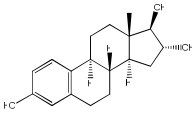
estrone (E1), N



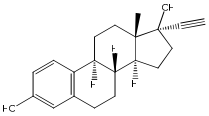
17β-estradiol (E2β), N



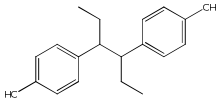
17α-estradiol (E2α), N



estriol (E3), N

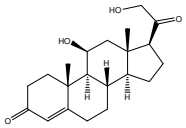


17α-ethynylestradiol (EE2), S

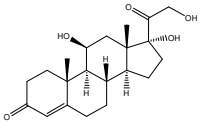


hexestrol (HEX), S

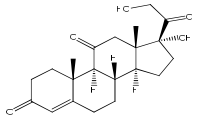
Glucocorticoids



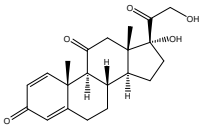
corticosterone (CORT), N



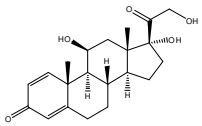
cortisol (CRL), N



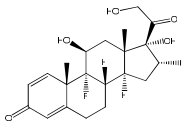
cortisone (CRN), N



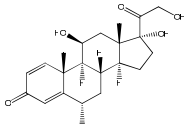
prednisone (PRE), S



prednisolone (PREL), S

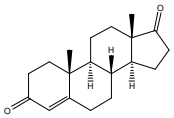


dexamethasone (DEX), S

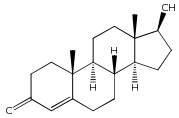


6α-methylprednisolone (MPREL), S

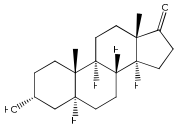
Androgens



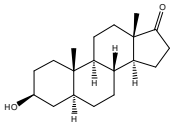
androstenedione (ADD), N



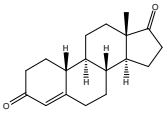
Testosterone (TTR), N



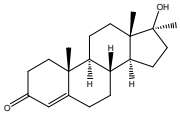
Androsterone (ADR), N



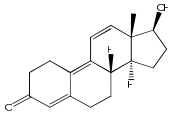
epiandrosterone (EADR), N



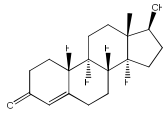
19-nor-4-androstene-3,17-diol (NAD), S



methyl testosterone (MTTR), S

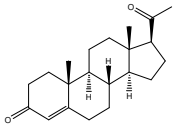


trenbolone (TBL), S

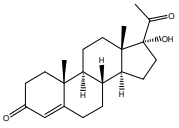


nandrolone (NDL), S

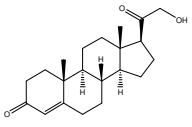
Progestogens



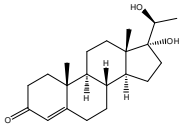
Progesterone (PGT), N



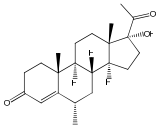
17α-hydroxyprogesterone (17-HPT), N



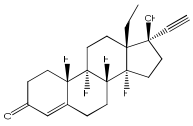
21α-hydroxyprogesterone (21-HPT), N



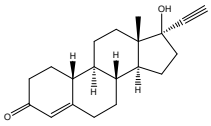
17α,20β-dihydroxy-4-pregnen -3-one (DPO), N



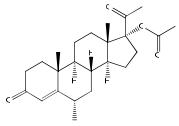
6α-methylhydroxyprogesterone (MHPT), S



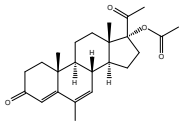
norgestrel (NGT), S



norethindrone (NTD), S



medroxyprogesterone acetate (MPA), S



megestrol acetate (MTA), S

FIGURE S1 Structures of Target Five Classes of Steroid Hormones (N: natural steroid; S: synthetic steroid)

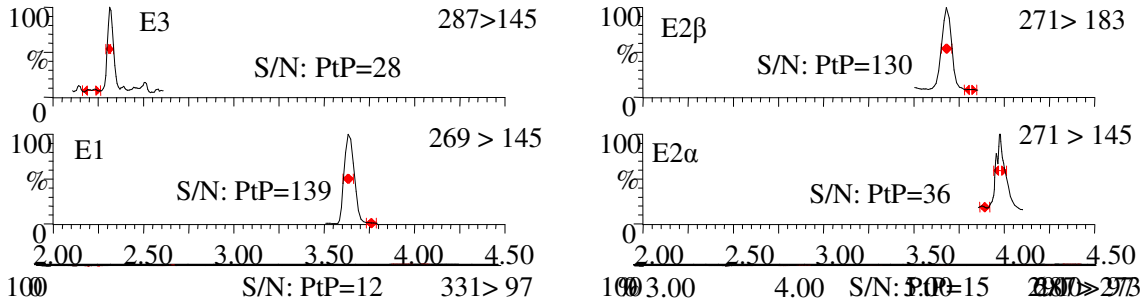


FIGURE S2. UPLC-MS/MS chromatograms of detected target steroids in field samples

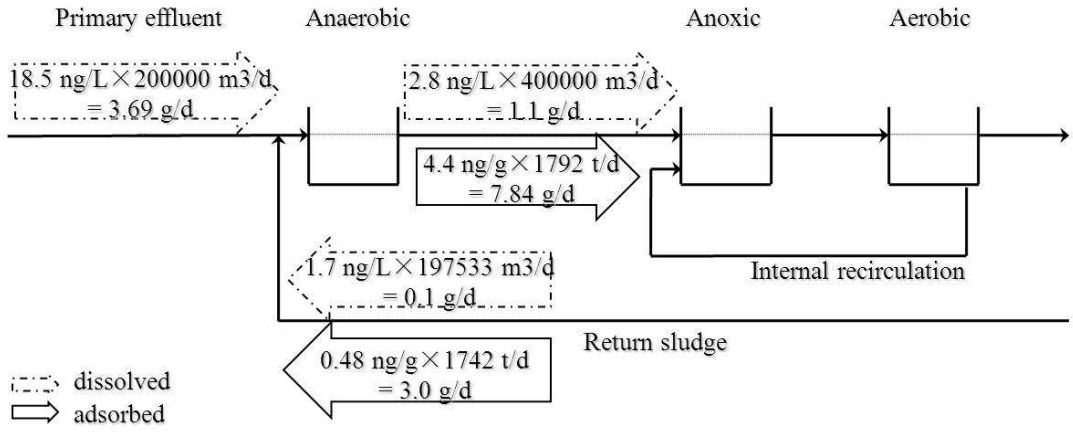


Figure S3. Mass flux of E2β (g/d) in anaerobic tank of the STP.

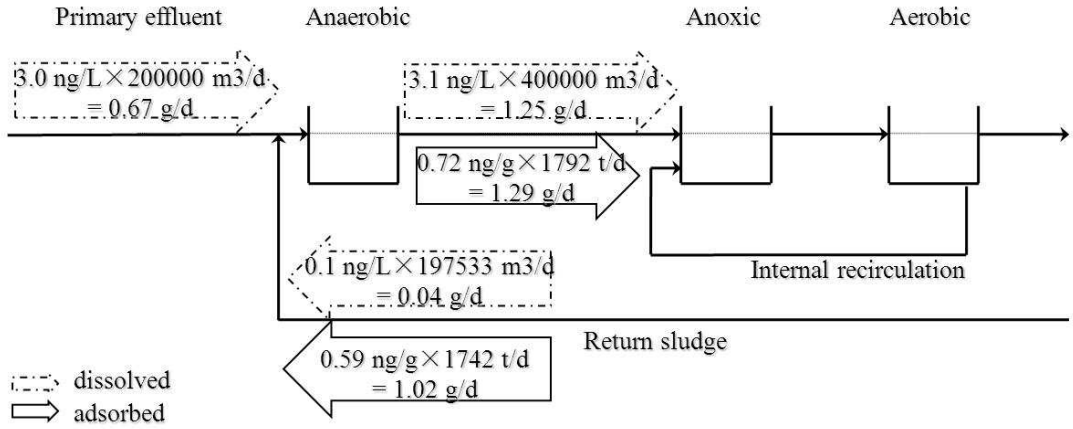


Figure S4. Mass flux of E2α(g/d) in anaerobic tank of the STP.

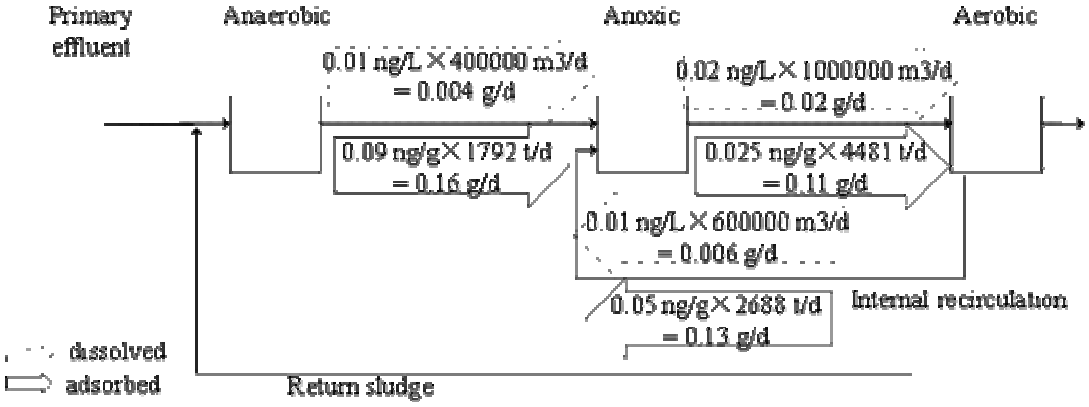


Figure S5. Mass flux of MPREL (g/d) in anoxic tank of the STP.

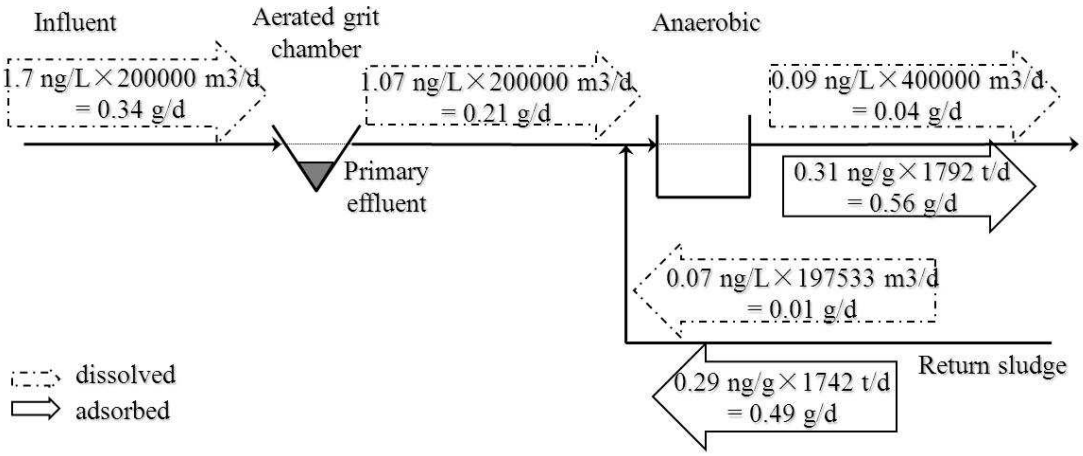


Figure S6. Mass flux of PREL (g/d) in aerated grit chamber and anaerobic tank of the STP.

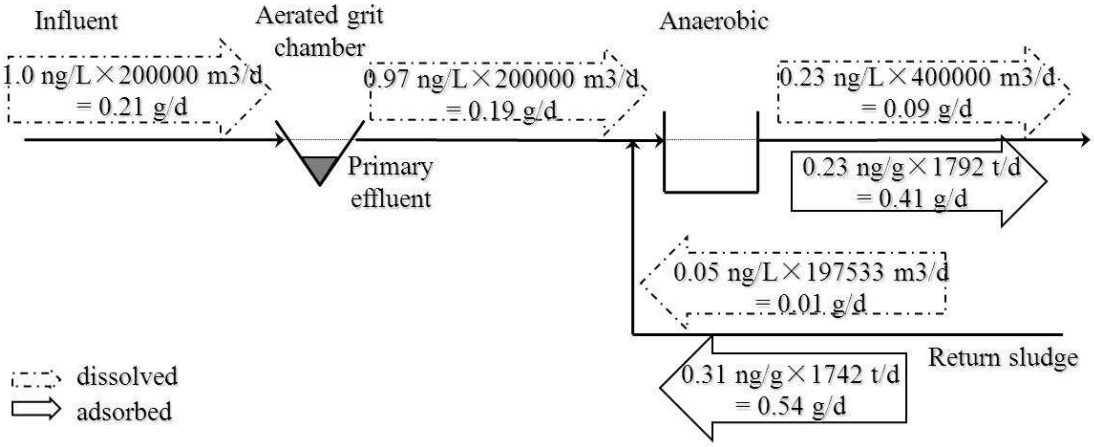


Figure S7. Mass flux of CORT (g/d) in aerated grit chamber and anaerobic tank of the STP.

TABLE S1 Gradient Conditions of Mobile Phase for LC

Androgens and Progestogens

Time (min)	%A (methanol)	%B (0.1% formic acid in water)	Gradient Curve
0.0	10	90	Initial
0.5	60	40	6
3.0	65	35	6
6.5	70	30	6
7.5	100	0	6
10.0	10	90	1

Glucocorticoids

Time (min)	%A（methanol）	%B（0.1% acetic acid in water）	Gradient Curve
0.0	10	90	Initial
0.5	30	70	6
4.0	50	50	6
6.0	90	10	6
7.0	100	0	6
8.0	100	0	6
10	10	90	1

Estrogens

Time（min）	%A（methanol）	%B（water）	Gradient Curve
0.0	10	90	Initial
0.5	50	50	6
6.0	80	20	6
7.0	100	0	6
8.0	20	80	6
10	10	90	1

TABLE S2 Multi-selected Reaction Monitoring (MRM) Conditions of the Target Steroid Hormones and Surrogates.

Steroid	MRM transition	Cone voltage (V)	Collision energy (eV)
Estrogens			
E3	287>145	60	40
	287>171		34
E1	269>145	64	40
	269 >183		36
E1-d_2	271 >147	56	28
E2α	271 >145	60	36
	271 >183		42
E2β	271> 145	60	36
	271 > 183		42
E2β-d_3	274 >185	58	52
EE2	295 > 145	52	50
	295 > 159		36
EE2-d_4	299> 147	30	21
HEX	269 > 134	28	16
	269 > 119		30
Androgens			
ADD	287 > 97	34	22
	287 > 109		26
ADR	291 > 255	16	16
	291 > 273		10
EADR	291 > 255	18	16
	291 > 273		10
MTTR	303 > 97	30	28
	303 > 109		28
NAD	273 > 83	34	24
	273 > 109		24
NDL	275 > 109	34	28
	275 > 83		26
TBL	271 > 199	40	24
	271 > 253		20
TTR	289 > 97	30	20
	289 > 109		24
$^{13}C_2$-TTR	291 > 99	40	22
Progestogens			
DPO	333 > 97	34	30
	333 > 109		34
17-HPT	331 > 97	34	24
	331 > 109		26

(continued)

Steroid	MRM transition	Cone voltage (V)	Collision energy (eV)
21-HPT	331 > 97	36	24
	331 > 109		26
MHPT	345 > 123	34	24
	345 > 97		24
MPA	387 > 327	26	38
	387 > 285		34
MTA	385 > 267	30	20
	385 > 325		14
NGT	313 > 245	31	16
	313 > 109		26
NGT-d_6	319 > 114	33	24
NTD	299 > 231	31	20
	299 > 109		26
$^{13}C_2$-NTD	301 > 109	31	26
PGT	315 > 97	32	24
	315 > 109		24
PGT-d_9	324 > 100	33	22
Glucocorticoids			
CRL	421 > 331	19	18
	421 > 361		12
CRL-d_2	423 > 333	18	22
COR	419 > 329	25	15
	419 > 359		10
DEX	451 > 361	27	16
	451 > 391		11
MPREL	433 > 343	23	12
	433 > 373		16
PRE	417 > 327	17	14
	417 > 357		10
PREL	419 > 329	25	15
	419 > 359		11
CRN	347>121	30	16
	347>329		26

TABLE S3 Recoveries (%) and Method Detection Limits (MDLs, ng/g) in Sludge Matrices

Estrogens

	E3	E1	E2β	EE2	E2α	HEX	E1-d_2	EE2-d_4	E2β-d_3
recoveries（%）	64±10	90±4	73±4	97±1	88±11	64±11	95±23	86±13	82±6
MDLs（ng/g）	0.1	0.1	0.2	0.3	0.2	0.1	0.9	0.2	0.1

Glucocorticoids

	PRE	CRN	CRL	PREL	DEX	CORT	MPREL	CRL-d_2
recoveries（%）	59±6	57±6	67±17	71±18	58±7	65±16	73±16	67±18
MDLs（ng/g）	0.05	0.1	0.05	0.2	0.02	0.07	0.05	0.4

Androgens

	NAD	TBL	ADD	NDL	TTR	MTTR	EADR	ADR	$^{13}C_2$-TTR
recoveries（%）	73±5	72±6	77±5	70±2	77±5	82±5	102±17	93±1	75±5
MDLs（ng/g）	0.08	0.1	0.1	0.08	0.1	0.05	13	2	0.05

Progestogens

	NTD	21-HPT	17-HPT	NGT	DPO	MHPT	MTA	MPA	PGT	d_9-PGT	$^{13}C_2$-NTD	d_6-NGT
recoveries（%）	74±5	63±4	81±5	77±5	72±3	85±4	78±7	79±3	83±6	71±5	64±2	64±1
MDLs（ng/g）	0.08	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.05	0.03	0.08	0.08

TABLE S4. Concentrations (n=3, dissolved ng/L; adsorbed ng/g) of Four Classes of Steroid Hormones along Treatment Processes of the STP in Beijing in July 2008. (a: one of three days' samples was detected; b: two of three days' samples were detected.)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
Estrogens												
E3	dissolved	26.2±2.3	12.4±0.7	2.7±0.3	<0.08	0.09±0.01	<0.08	0.2±0.2	<0.08	<0.08		
	adsorbed			1.7 ±0.2	1.8 ±0.2	1.1 ±0.2	1.1 ±0.2		0.80±0.18		0.65 ±0.42	2.0 ±0.8
E1	dissolved	56.2±6.7	67.1±0.1	29.3±16.8	14.0±1.4	4.2±0.6	4.2±0.6	12.0±0.8	14.3±3.2	16.8±2.9		
	adsorbed			10.7±1.2	14.4±1.1	12.8 ±0.4	12.8 ±0.4		11.6 ±2.6		11.7 ±0.8	2.9 ±1.8
E2β	dissolved	15.7±2.8	18.5±1.1	2.8±0.4	0.88±0.04	4.4±1.1	4.4±1.1	1.0±0.5	0.48±0.01	4.7±1.0		
	adsorbed			4.4 ±0.2	2.6 ±0.3	1.7 ±0.6	1.7 ±0.6		1.7±0.4		0.82±0.42	1.6 ±0.9
E2α	dissolved	3.6±0.7	3.0±0.2	3.1±0.8	0.32±0.07	0.46±0.25	0.46±0.25	0.55±0.47	<0.2	0.41±0.32		
	adsorbed			0.72±0.02	0.62±0.08	0.38±0.01	0.38±0.01		0.59 ±0.04		0.58±0.09	0.53 ±0.08
EE2	dissolved	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		
	adsorbed			<0.3	<0.3	1.6±0.5 [b]	1.6±0.5 [b]		<0.3		2.9 [a]	<0.3
HEX	dissolved	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
	adsorbed	<0.1	<0.1	<0.1	0.2±0.1	<0.1	<0.1		<0.1		<0.1	<0.1
Glucocorticoids												
PRE	dissolved	0.57±0.17 [b]	0.61±0.06	<0.05	<0.05	<0.05	<0.05	0.06±0.04	<0.05	<0.05		
	adsorbed			<0.05	0.14±0.04	0.13±0.06	0.13±0.06		0.16 ±0.06		0.13±0.03	0.13 ±0.08 [b]
CRN	dissolved	15.6±1.6	16.6±0.6	2.5±1.5	<0.1	<0.1	<0.1	0.24±0.04	<0.1	0.22±0.06		
	adsorbed			<0.1	0.37±0.05	0.20±0.01	0.20±0.01		0.19±0.05		0.31 [a]	0.55±0.02 [b]

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
CRL	dissolved	22.1±2.0	21.4±0.4	1.3±1.4	0.32±0.04	0.11±0.05	0.11±0.05	0.13±0.04	0.18±0.02	0.19±0.09		
	adsorbed			<0.05	0.08±0.02	0.05±0.02 [b]	0.05±0.02 [b]		0.05±0.03 [b]		<0.05	<0.05
PREL	dissolved	1.7±0.5	1.07±0.04	0.09±0.01	0.05±0.01	0.05±0.01	0.05±0.01	0.07±0.01	0.07±0.01	0.05±0.04		
	adsorbed			0.31±0.11	0.26±0.04	0.30±0.17	0.30±0.17		0.29±0.36		0.30±0.38	0.45±0.29
DEX	dissolved	0.81±0.19	0.52±0.03	0.26±0.41	0.036±0.01	<0.02	<0.02	0.03±0.01	<0.02	0.03±0.01		
	adsorbed			<0.02	0.07±0.05	0.07±0.10	0.07±0.10		0.06±0.07		0.06±0.05	0.09±0.07
CORT	dissolved	1.0±0.2	0.97±0.32	0.23±0.29	0.13±0.06	<0.1	<0.1	0.13±0.06	<0.1	<0.1		
	adsorbed			0.23±0.10	0.18±0.01	0.19±0.09	0.19±0.09		0.31±0.04		0.22±0.05	0.29±0.14
MPREL	dissolved	0.20±0.02	0.18±0.04	0.04 [a]	0.02±0.01	0.02 [a]	0.02 [a]	0.03±0.02 [b]	0.02 [a]	<0.02		
	adsorbed			0.09±0.01	<0.05	0.05±0.01 [b]	0.05±0.01 [b]		0.06±0.01		0.05±0.02	0.20±0.09
Androgens												
NAD	dissolved	1.4±0.4	1.2±0.3	0.7±0.2	0.25±0.09	0.16±0.03	0.16±0.03	0.46±0.09	0.16±0.07	0.2±0.1		
	adsorbed			0.32±0.10	0.30±0.05	0.42±0.24	0.42±0.24		0.23±0.07		0.30±0.10	0.30±0.15
ADD	dissolved	802±162	512±13	14.3±1.9	12.3±0.2	4.0±1.7	4.0±1.7	18.9±5.9	8.7±3.5	13.0±3.2		
	adsorbed			13.6±0.9	14.6±4.3	12.9±1.1	12.9±1.1		14.4±1.6		8.0±1.1	7.4±3.1
TTR	dissolved	62.7±7.3	17.1±12.8	0.85±0.18	0.75±0.12	0.33±0.14	0.33±0.14	1.2±0.2	0.69±0.05	1.2±0.2		
	adsorbed			4.0±1.2	2.2±0.4	2.1±0.3	2.1±0.3		1.9±0.1		1.9±0.3	1.7±0.3

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
EADR	dissolved	6344±644	3321±27	103±11	61±24	16.2±3.7	16.2±3.7	133±19	167±28	88.8±14.3		
	adsorbed			905±112	560±206	714±239	714±239		634±73		604±167	655±227
ADR	dissolved	2264±492	2107±203	22.7±0.7	17.0±0.3	4.0±2.4	4.0±2.4	17.1±8.0	24.9±9.1	24.0±6.5		
	adsorbed			51.4±10.4	36.3±20.2	38.7±12.3	38.7±12.3		44.7±9.8		32.8±29.8	32.1±11.1
MTTR	dissolved	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.19±0.02	0.27±0.17		
	adsorbed			0.30±0.06	0.23±0.01	<0.05	0.13±0.08		<0.05		0.17±0.03	0.07±0.02 [b]
TBL	dissolved	<0.2	<0.2	<0.2	0.6±0.4 [b]	<0.2	<0.2	<0.2	<0.2	<0.2		
	adsorbed			0.2±0.1 [b]	<0.1	<0.1	<0.1		0.2±0.1 [b]		<0.1	<0.1
NDL	dissolved	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08		
	adsorbed			<0.08	<0.08	<0.08	<0.08		<0.08		<0.08	<0.08
Progestogens												
NTD	dissolved	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
	adsorbed			0.20±0.12	<0.08	<0.08	<0.08		0.28±0.15		<0.08	<0.08
21-HPT	dissolved	0.75±0.09	0.89±0.09	0.16±0.04	0.12±0.05	0.053±0.004	0.053±0.004	0.21±0.06	0.08±0.02	0.14±0.04		
	adsorbed			0.9±0.1	0.65±0.14	0.7±0.4	0.74±0.42		0.58±0.08		0.28±0.09	0.44±0.11
17-HPT	dissolved	14.2±4.1	11.5±3.7	0.94±0.04	0.94±0.02	0.50±0.07	0.50±0.07	0.98±0.27	0.78±0.13	0.77±0.27		
	adsorbed			0.78±0.13	0.86±0.10	0.88±0.24	0.88±0.24		0.66±0.09		0.55±0.05	0.7±0.2
NGT	dissolved	<0.04	<0.04	<0.04	<0.04	0.21 [a]	0.21 [a]	<0.04	<0.04	<0.04		
	adsorbed			<0.05	<0.05	0.09±0.05 [b]	0.09±0.05 [b]		<0.05		0.61 [a]	

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
DPO	dissolved	4.8±1.8	2.7±0.4	0.36±0.02	0.28±0.01	<0.05	<0.05	0.4±0.1	0.13±0.05	0.19±0.07		
	adsorbed			0.42±0.07	0.34±0.03	0.48±0.11	0.48±0.11		0.32±0.04		0.24±0.17	0.40±0.26
MHPT	dissolved	0.58±0.09	0.39±0.01	0.50±0.02	0.54±0.05	0.44±0.05	0.44±0.05	0.73±0.06	0.50±0.03	0.6±0.2		
	adsorbed			0.13±0.01	0.27±0.02	0.30±0.03	0.30±0.03		0.13±0.02		0.18±0.02	0.17±0.09
MTA	dissolved	4.6±0.4	3.6±0.3	0.35±0.21	0.23±0.03	0.13±0.03	0.13±0.03	0.20±0.06	0.19±0.03	0.17±0.07		
	adsorbed			0.26±0.04	0.25±0.03	0.28±0.08	0.28±0.08		0.21±0.04		0.32±0.05	0.22±0.06
MPA	dissolved	1.08±0.06	0.4±0.1	0.26±0.08	0.3±0.1	<0.06	<0.06	0.06±0.03 [b]	<0.06	<0.06		
	adsorbed			0.08±0.01	0.06±0.01	0.17±0.07	0.17±0.07		0.13±0.05		0.17±0.06	0.18±0.03
PGT	dissolved	33.1±8.0	33.8±2.5	4.8±1.6	4.5±1.6	1.35±0.23	1.35±0.23	5.0±1.1	3.2±0.6	4.7±1.4		
	adsorbed			12.4±0.1	14.7±0.8	13.6±1.0	13.6±1.0		12.9±1.4		11.2±3.6	18.3±0.8

TABLE S5. Mass Flux (g/d) of Four Classes of Steroid Hormones along Treatment Processes of the STP in Beijing.

		influent	aerated grit chamber	anaerobic	anoxic	aerobic effluent	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
Wastewater characterization												
Water flow	m^3/d	200000	200000	400000	1000000	400000	600000	200000	197533	1991	——	——
TSS	mg/L	281	——	4481	4481	4481	4481	11	8904		——	——
COD	mg/L	476						41				
BOD_5	mg/L	229						9				
DO	mg/L					3.5						
VSS	$g{\cdot}L^{-1}{\cdot}d^{-1}$					0.14						
Total phosphate	mg/L	5.9						0.21				
Kjeldahl nitrogen	mg/L	57										
NH4-N	mg/L							0.67				
NO3-N	mg/L							10.8				
Mass flux of TSS	kg/d		——	1792267	4480667	1792267	2688400	——	1741827		29987	23067
Mass flux of Five Classes of Steroid Hormones												
Estrogens												
E3	dissolved	5.24	2.48	1.08	0.04	0.03	0.05	0.04	0.01	0.0001		
	adsorbed		0.00	3.06	8.09	1.98	3.02		1.39		0.02	0.05
	total	5.24	2.48	4.13	8.13	2.01	3.07	0.04	1.40	0.0001	0.02	0.05
E1	dissolved	11.24	13.43	11.73	13.98	1.69	2.53	2.40	2.81	0.04		
	adsorbed		0.33	19.17	64.72	22.90	34.35		20.30		0.35	0.06
	total	11.24	13.76	30.90	78.71	24.59	36.89	2.40	23.11	0.04	0.35	0.06

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic effluent	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
E2β	dissolved	3.14	3.69	1.11	0.88	1.74	2.61	0.19	0.10	0.01		
	adsorbed		0.00	7.84	11.57	2.94	4.40		3.01		0.02	0.04
	total	3.14	3.69	8.94	12.45	4.68	7.02	0.19	3.11	0.01	0.02	0.04
E2α	dissolved	0.72	0.67	1.25	0.32	0.19	0.28	0.11	0.04	0.001		
	adsorbed		0.01	1.29	2.78	0.68	1.02		1.02		0.02	0.01
	total	0.72	0.68	2.54	3.10	0.87	1.30	0.11	1.06	0.001	0.02	0.01
Glucocorticoids												
PRE	dissolved	0.11	0.12	0.01	0.03	0.01	0.02	0.02	0.005	0.0001		
	adsorbed		0.00	0.09	0.62	0.24	0.35		0.27		0.004	0.002
	total	0.11	0.12	0.10	0.64	0.25	0.37	0.02	0.27	0.001	0.004	0.002
CRN	dissolved	3.12	3.33	1.02	0.15	0.04	0.06	0.05	0.01	0.0005		
	adsorbed		0.01	0.09	1.64	0.35	0.53		0.32		0.003	0.01
	total	3.12	3.34	1.11	1.79	0.39	0.59	0.05	0.33	0.0005	0.003	0.01
CRL	dissolved	4.43	4.28	0.51	0.32	0.05	0.07	0.03	0.03	0.0004		
	adsorbed		0.00	0.04	0.38	0.09	0.13		0.09		0.001	0.0005
	total	4.43	4.28	0.55	0.70	0.13	0.20	0.03	0.12	0.0004	0.001	0.0005
PREL	dissolved	0.34	0.21	0.04	0.05	0.02	0.03	0.01	0.01	0.0001		
	adsorbed		0.00	0.56	0.54	0.82	0.49		0.49		0.01	0.01
	total	0.34	0.21	0.60	0.59	0.84	0.52	0.01	0.50	0.0001	0.01	0.01
DEX	dissolved	0.16	0.10	0.10	0.04	0.004	0.006	0.01	0.004	0.0001		
	adsorbed		0.00	0.02	0.31	0.12	0.18		0.11		0.002	0.002
	total	0.16	0.10	0.12	0.34	0.12	0.19	0.01	0.11	0.0001	0.002	0.002

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic effluent	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
CORT	dissolved	0.21	0.19	0.64	0.13	0.01	0.02	0.03	0.01	0.0001		
	adsorbed		0.00	0.41	0.82	0.34	0.51		0.54		0.005	0.01
	total	0.21	0.19	1.05	0.96	0.35	0.53	0.03	0.56	0.0001	0.005	0.01
MPREL	dissolved	0.04	0.04	0.004	0.02	0.01	0.01	0.01	0.003	0.00002		
	adsorbed		0.00	0.16	0.11	0.08	0.13		0.10		0.001	0.005
	total	0.04	0.04	0.17	0.13	0.09	0.14	0.01	0.11	0.00002	0.001	0.005
Androgens												
NAD	dissolved	0.28	0.23	0.27	0.25	0.07	0.10	0.09	0.03	0.0006		
	adsorbed		0.00	0.58	1.35	0.73	1.10		0.40		0.01	0.01
	total	0.28	0.23	0.85	1.60	0.80	1.19	0.09	0.44	0.0006	0.01	0.01
ADD	dissolved	160.33	102.40	5.72	12.28	1.60	2.39	3.79	1.68	0.03		
	adsorbed		0.08	24.36	65.03	23.11	34.67		25.01		0.23	0.18
	total	160.33	102.48	30.08	77.31	24.71	37.06	3.79	26.69	0.03	0.23	0.18
TTR	dissolved	12.55	3.84	0.34	0.75	0.13	0.20	0.23	0.14	0.003		
	adsorbed		0.02	7.13	9.77	3.83	5.74		3.25		0.06	0.04
	total	12.55	3.86	7.47	10.53	3.96	5.94	0.23	3.38	0.003	0.06	0.04
EADR	dissolved	1268.87	664.25	41.05	60.87	6.48	9.71	26.60	33.19	0.19		
	adsorbed		3.47	1623.17	2474.71	1265.78	1898.67		1191.64		19.1	15.86
	total	1268.87	667.72	1664.22	2535.58	1272.26	1908.38	26.60	1224.83	0.19	19.1	15.86
ADR	dissolved	452.70	421.38	9.08	16.98	1.59	2.38	3.42	4.96	0.06		
	adsorbed		0.48	91.52	159.02	69.14	103.72		77.69		1.2	0.74
	total	452.70	421.86	100.60	176.01	70.73	106.10	3.42	82.65	0.06	1.2	0.74

(continued)

		influent	aerated grit chamber	anaerobic	anoxic	aerobic effluent	internal recirculat.	effluent	return sludge	liquid of dehydrating	dehydrated sludge	excess sludge
Progestogens												
21-HPT	dissolved	0.15	0.18	0.06	0.12	0.02	0.03	0.04	0.02	0.0003		
	adsorbed		0.00	1.66	2.87	1.30	1.96		1.01		0.01	0.01
	total	0.15	0.18	1.72	2.99	1.33	1.99	0.04	1.02	0.0003	0.01	0.01
17-HPT	dissolved	2.84	2.30	0.38	0.94	0.20	0.30	0.20	0.15	0.003		
	adsorbed		0.00	1.40	3.82	1.56	2.34		1.14		0.02	0.02
	total	2.84	2.30	1.78	4.76	1.76	2.63	0.20	1.30	0.003	0.02	0.02
DPO	dissolved	0.96	0.55	0.14	0.28	0.01	0.02	0.07	0.03	0.0004		
	adsorbed		0.00	0.75	1.50	0.86	1.29		0.55		0.01	0.01
	total	0.96	0.55	0.89	1.78	0.87	1.31	0.07	0.58	0.0004	0.01	0.01
MHPT	dissolved	0.12	0.08	0.20	0.54	0.17	0.26	0.15	0.10	0.001		
	adsorbed		0.00	0.23	1.22	0.54	0.81		0.23		0.005	0.004
	total	0.12	0.08	0.43	1.79	0.71	1.07	0.15	0.33	0.001	0.005	0.004
MTA	dissolved	0.91	0.73	0.14	0.23	0.05	0.08	0.04	0.04	0.0004		
	adsorbed		0.00	0.47	1.09	0.50	0.76		0.37		0.01	0.01
	total	0.91	0.73	0.61	1.33	0.56	0.83	0.04	0.41	0.0004	0.01	0.01
MPA	dissolved	0.22	0.09	0.10	0.34	0.01	0.02	0.01	0.005	0.0001		
	adsorbed		0.00	0.15	0.29	0.29	0.44		0.22		0.005	0.004
	total	0.22	0.09	0.25	0.62	0.30	0.46	0.01	0.23	0.0001	0.005	0.004
PGT	dissolved	6.62	6.77	1.91	4.47	0.54	0.81	0.99	0.64	0.01		
	adsorbed		0.00	22.31	66.02	24.32	36.48		22.59		0.32	0.42
	total	6.62	6.77	24.22	70.49	24.86	37.29	0.99	23.24	0.01	0.32	0.42