Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Electronic Supplementary Information

Reverse Trojan-horse effect decreased wastewater toxicity in the presence of inorganic nanoparticles

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Experimental Section

Combination index (CI) for determining combined toxicities. The response to combined toxicities exposure in *Anabaena* CPB4337 test was estimating using the median-effect equation (Chou and Talalay, 1984) based on the mass-action law:

$$\frac{fa}{fu}=\left(\frac{D}{Dm}\right)^{m} \tag{1}$$

where *fa* is the fraction affected by a certain dose, *D*, expressed as concentration of toxicant, *fu* is the unaffected fraction ($fa = 1\text{-}fu$), D_m represent the dose for 50% effect (median effect-dose, EC_{50}), and *m* is the coefficient of the sigmoidicity of the dose-effect curve: m = 1, m > 1, and m < 1 indicate hyperbolic, sigmoidal, and negative sigmoidal dose-effect curve, respectively. Therefore, the method takes into account both the potency (*Dm*) and shape (*m*) parameters. Eq.1 may be arranged as follows:

$$D = Dm\,\left(\frac{fa}{1-fa}\right)^{1/m} \tag{2}$$

The D_m and *m* values for each individual nanoparticle and wastewater, or mixture were determined by the median-effect plot: x = log (*D*) versus y = log (*fa*/*fu*), which is based on the logarithmic form of Eq. (1). In the median effect plot, *m* is the slope and log (D_m) is the x-intercept. The conformity of the data to the median-effect principle can be ready assessed by the linear correlation coefficient (*r*) of the data to the logarithmic form of Eq.2. These parameters were then used to calculate doses of individual compounds and their combinations required to produce various effect levels according to Eq. (1). Combination index values (CI) for each effect level were calculated according to the general CI equation (Chou, 2006):

$$^{n}(CI)_{x} = \sum_{j=1}^{n}\frac{(D)_j}{(D_x)_j} = \sum_{j=1}^{n}\frac{(D_x)_{1-n}\left(\dfrac{[D]_j}{\sum_{1}^{n}[D]}\right)}{(D_m)_j\left(\dfrac{(fa_x)_j}{[1-(fa_x)_j]}\right)^{1/mj}} \tag{3}$$

where $^{n}(CI)_x$ is the combination index for n chemicals at x% inhibition; $(D_x)_{1-n}$ is the sum of the dose of n chemicals that exerts x % inhibition in combination, ($[D]_j/\sum_{1}^{n}[D]$) is the proportionality of the dose of each of n chemicals that exerts x % inhibition in combination; and $(D_m)_j\,(fa_x)_j/[1-(fa_x)_j]^{1/mj}$ is the dose of each drug alone that exerts x % inhibition. From Eq. (3), CI < 1, CI = 1 and CI > 1 indicates synergism, additive effect and antagonism, respectively (Chou 2006).

Apparent octanol-water distribution coefficient. The pH-dependent or apparent octanol-water distribution coefficient, D_{ow}, which considers the dissociation constant of acidic or basic solutes, pK_a, and the current pH of wastewater, can be derived from the Herderson-Hasselbalch equations (Scheytt et al., 2005). For acidic and basic compounds, the equations are as follows:

$$D_{ow} = \frac{K_{ow}}{1+10^{pH-pK_a}}$$ (acidic, dissociated in basic form)

$$D_{ow} = \frac{K_{ow}}{1+10^{pK_a-pH}}$$ (basic, protonated in acidic form, pK_a of the conjugate acid)

In the case of compounds with two pK_a, both acidic or both basic, the apparent partition coefficient can be calculated from the following equations:

$$D_{ow} = \frac{K_{ow}}{1+10^{pH-pK_{a1}}+\left(10^{pH-pK_{a1}}\right)\left(10^{pH-pK_{a2}}\right)}$$ (two acidic groups)

$$D_{ow} = \frac{K_{ow}}{1+10^{pK_{a1}-pH}+\left(10^{pK_{a1}-pH}\right)\left(10^{pK_{a2}-pH}\right)}$$ (two basic groups)

For compounds in which acidic and basic groups coexist, the following equation stands if pKa(base) > pKa(acid):

$$D_{ow} = \frac{K_{ow}}{1+10^{pH-pK_a(acid)}+10^{pK_a(base)-pH}}$$

In this case, the compound can be neutral for a certain pH interval. Conversely, if pKa(acid) > pKa(base) the compound is always charged, with a pH zone in zwitterionic form and D_{ow} does not apply.

For neutral substances, $D_{ow} = K_{ow}$.

Transmission electron micrographs of cyanobacterial cells. High-resolution transmission electron microscopy (TEM) images were taken on a JEOL JEM 1400 microscope operating at 100 kV in combination with energy dispersive X-ray spectroscopy (EDS). TEM samples were prepared as follows. *Anabaena* CPB4337 cells were exposed to the EC_{50} of each nanoparticle or wastewater dilution, and to binary combinations with a fixed ratio for 24 h. Non-exposed cyanobacterial cells (control) and exposed cells were collected by centrifugation, washed three times in phosphate buffer 0.1 M, pH 7.2 for 10 min, and fixed using 4% paraformaldehyde and 2.5% glutaraldehyde in phosphate buffer for 4h at 4 °C. The samples were subsequently rinsed three times with phosphate buffer and stored at 4 °C overnight. Postfixation was performed on 1 mm 2% agar blocks using 1% osmium tetroxide in distilled water for 1 h at room temperature. The samples were rinsed with three more times and dehydrated through a graded acetone series of 30-50-70-80-90-95-100% for 15 min. Infiltration and embedding of Spurr-resin was conducted by increasing resin concentrations in acetone (25%, 50%, 75% and 100%). The samples were subsequently embedded in pure resin at room temperature overnight. Finally, polymerization resin polymerization tool place at 60˚C for 48 h. The sectioned samples in semi-thin (0.5 µm) and ultra-thin sections (60 nm) were stained with uranyl acetate and lead citrate.

Staining and observation of lipid droplets. The staining of lipid droplets was performed using borondipyrromethene difluoride (Bodipy) 505/515 as described Cooper et al. (2010). *Anabaena* CPB4337 cells were stained in vivo with a 50 µM aqueous solution of Bodipy 505/515 dissolved in DMSO (1%) to achieve a final concentration of 1.5 µM (0.03

% DMSO). Upon addition of the fluorochrome, *Anabaena* cells were incubated in the dark for 20 min at room temperature prior to visualization. Bodipy 505/515 fluorescence was visualized using confocal fluorescence microscope (Espectral Leica TCS SP5) with excitation at 488 nm. The emission filter was settled at 665 nm for chlorophyll fluorescence and at a window of 510-550 nm for Bodipy 505/515 fluorescence. Images were acquired with a Leica Confocal Software (LCS Lite). All comparative images were obtained under identical microscope and camera settings.

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Table S1. Properties of studied nanomaterials. Average particle diameter (DLS) and ζ-potential of suspensions in water, AA/8+N and wastewater at pH 8 after 24 in contact.

Particle	Concentration (mg/L)	Water*		AA/8+N		Wastewater	
		d (nm)	ζ-potential (mV)	d (nm)	ζ-potential (mV)	d (nm)	ζ-potential (mV)
Wastewater	-	-	-	-	-	91 ± 3	-13.2 ± 0.2
AA/8+N	-	-	-	180 ± 35	-23.4 ± 0.8	-	-
SiO_2	10	443 ± 78	-27.9 ± 0.7	307 ± 12	-28.3 ± 1.2	508 ± 43	-19.0 ± 1.0
	100	692 ± 28	-26.5 ± 0.3	742 ± 51	-27.9 ± 0.3	766 ± 46	-19.5 ± 0.6
SiO_2-NH_2	10	486 ± 30	-28.9 ± 1.3	190 ± 38	-13.1 ± 0.7	669 ± 74	-17.7 ± 1.1
	100	650 ± 50	+3.7 ± 0.6	449 ± 50	+6.6 ± 0.5	713 ± 47	-16.6 ± 0.4
TiO_2	10	132 ± 7	+5.7 ± 0.6	158 ± 59	-16.3 ± 0.4	539 ± 57	-18.1 ± 0.6
	100	445 ± 96	+42.5 ± 2.1	591 ± 85	-18.3 ± 0.4	674 ± 83	-13.6 ± 0.1
Fe_3O_4	10	27.3 ± 2.5	+32.4 ± 0.3	408 ± 20	-26.1 ± 0.6	687 ± 54	-17.5 ± 1.2
	100	38.6 ± 4.5	+42.6 ± 0.8	2380 ± 196	-19.0 ± 0.3	2458 ± 224	-16.1 ± 0.3

* Minor peaks occasionally detected in the tens of nanometer range.

Table S2. Wastewater characterization parameters (0.45 μm filtered samples).

Parameters	value	Anions and cations	(mg/L)
pH	7.8	Nitrate	0.38
Turbidity (NTU)	1.4	Chloride	125.5
Conductivity (mS/cm)	1.23 ± 0.03	Sulphate	143.7
COD (mg/L)	49.2 ± 1.2	Fluoride	<0.80
NPOC (mg/L)	17.2 ± 0.5	Nitrite	<0.10
Alkalinity (mg $CaCO_3$/L)	286	Bicarbonate	348.4
Total-P (mg/L)	0.1	Sodium	95.3
Total-N (mg/L)	2.3	Potassium	23.4
		Magnesium	14.3
		Calcium	49
		Ammonium	68.4

Table S3. Concentrations of pollutants in wastewater and physicochemical properties of pollutants contained in wastewater.

No.	Compound	Concentration (ng/L)	CAS Number	Molecular formula	log K_{ow}	$pK_a(1)$	$pK_a(2)$	Acid/Base	log D_{ow}*	Main use
1	4-Aminoantipyrine (4-AA)	137	83-07-8	$C_{11}H_{13}N_3O$	-0.07	4.2		Weakly basic	-0.07	Metabolite of aminopyrine
2	N-acetyl-4-aminoantipyrine (4-AAA)	1050	83-15-8	$C_{13}H_{15}N_3O_2$	-0.13	5.0		Weakly basic	-0.13	Metabolite of metamizole
3	N-formyl-4-aminoantipyrine (4-FAA)	904	1672-58-8	$C_{12}H_{13}N_3O_2$	-0.41	5.0		Weakly basic	-0.41	Metabolite of aminopyrine
4	Antipyrine	49	60-80-0	$C_{11}H_{12}N_2O$	0.38	1.4		Weakly basic	0.38	Analgesic
5	Atenolol	421	29122-68-7	$C_{14}H_{22}N_2O_3$	0.16	9.6		Basic	-1.65	β-blocker
6	Azithromycin	184	83905-01-5	$C_{38}H_{72}N_2O_{12}$	4.02	8.7		Basic	3.03	Antibiotic
7	Bezafibrate	170	41859-67-0	$C_{19}H_{20}ClNO_4$	4.25	3.6		Acidic	0.06	Antilipemic
8	Caffeine	255	58-08-2	$C_8H_{10}N_4O_2$	-0.07	0.8		Neutral	-0.07	Stimulant
9	Carbamazepine	167	298-46-4	$C_{15}H_{12}N_2O$	2.45			Neutral	2.45	Antiepileptic
10	Carbamazepine epoxide	41	36507-30-9	$C_{15}H_{12}N_2O_2$	1.58			Neutral	1.58	Metabolite of carbamazepine
11	Ciprofloxacin	273	85721-33-1	$C_{17}H_{18}FN_3O_3$	0.28	6.1	8.7	Zwitterionic	n.a.	Antibiotic
12	Citalopram	162	59729-33-8	$C_{20}H_{21}FN_2O$	3.74	9.7		Basic	1.83	Antidepressant
13	Clarithromycin	169	81103-11-9	$C_{38}H_{69}NO_{13}$	3.16	9.0		Basic	1.94	Antibiotic
14	Diatrizoic acid	1185	117-96-4	$C_{11}H_9I_3N_2O_4$	1.37	3.4		Acidic	-2.83	Diagnostic agent
15	Diazepam	25	439-14-5	$C_{16}H_{13}ClN_2O$	2.82	3.4		Weakly basic	2.82	Anxiolytic
16	Erythromicin	140	114-07-8	$C_{37}H_{67}NO_{13}$	3.06	8.9		Basic	1.93	Antibiotic
17	Famotidine	30	76824-35-6	$C_8H_{15}N_7O_2S_3$	-0.64	6.7		Weakly basic	-0.67	Antiulcer
18	Fenofibric acid	455	42017-89-0	$C_{17}H_{15}ClNO_4$	4.00	3.1		Acidic	-0.70	Metabolite of fenofibrate
19	Furosemide	528	54-31-9	$C_{12}H_{11}ClN_2O_5S$	2.03	3.8		Acidic	-1.97	Antihypertensive
20	Gemfibrozil	625	25812-30-0	$C_{15}H_{22}O_3$	4.77	4.5		Acidic	1.67	Antilipemic
21	Hydrochlorothiazide	783	58-93-5	$C_7H_8ClN_3O_4S_2$	-0.07	8.6	10.2	Basic	-3.33	Antihypertensive
22	Indomethacin	35	53-86-1	$C_{19}H_{16}ClNO_4$	4.27	4.5		Acidic	0.97	Anti-inflammatory
23	Iopamidol	703	60166-93-0	$C_{17}H_{22}I_3N_3O_8$	-2.42	10.7		Neutral	-2.42	Contrast agent
24	Ketoprofen	241	22071-15-4	$C_{16}H_{14}O_3$	3.12	5.9		Acidic	1.25	Anti-inflammatory
25	Lincomycin	8	154-21-2	$C_{18}H_{34}N_2O_6S$	0.20	7.6		Basic	-0.01	Antibiotic
26	Mepivacaine	26	96-88-8	$C_{15}H_{22}N_{20}$	1.95	7.7		Basic	1.70	Anesthetic
27	Metoclopramide	32	364-62-5	$C_{14}H_{22}ClN_3O_2$	2.62	9.3		Basic	1.20	Antiemetic
28	Metoprolol	84	37350-58-6	$C_{15}H_{25}NO_3$	1.88	9.7		Basic	-0.03	β-blocker
29	Metronidazole	391	443-48-1	$C_6H_9N_3O_3$	-0.02	2.5		Weakly basic	-0.02	Antibiotic

30	Naproxen	207	22204-53-1	$C_{14}H_{14}O_3$	3.18	4.2		Acidic	-0.47	Anti-inflammatory
31	Nicotine	368	54-11-5	$C_{10}H_{14}N_2$	1.17	3.1	8.0	Basic	0.76	Stimulant
32	Ofloxacin	291	82419-36-1	$C_{18}H_{20}FN_3O_4$	-0.39	6.1	8.2	Zwitterionic	n.a.	Antibiotic
33	Paraxanthine	184	611-59-6	$C_7H_8N_4O_2$	-0.22	10.8		Weakly basic	-0.22	Metabolite of caffeine
34	Pentoxifylline	371	6493-05-6	$C_{13}H_{18}N_4O_3$	0.29	0.28		Basic	0.29	Vasodilator
35	Pravastatin	138	81093-37-0	$C_{23}H_{36}O_7$	0.59	4.7		Acidic	-2.51	Antilipemic
36	Primidone	345	125-33-7	$C_{12}H_{14}N_2O_2$	0.91	12.3		Weakly acidic	0.91	Antiepileptic
37	Propanolol	57	525-66-6	$C_{16}H_{21}NO_2$	3.48	9.4		Basic	1.87	β-blocker
38	Propyphenazone	20	479-92-5	$C_{14}H_{18}N_2O$	1.94	0.9		Neutral	1.94	Analgesic
39	Ranitidine	591	66357-35-5	$C_{13}H_{22}N_4O_3S$	0.27	2.3	8.2	Diprotic base	-0.28	Antiacid
40	Sotalol	61	3930-20-9	$C_{12}H_{20}N_2O_3S$	0.24	8.3	9.8	Diprotic base	-2.27	Antiarrhythmic
41	Sucralose	974	56038-13-2	$C_{12}H_{19}Cl3O_8$	-1.00	11.8		Neutral	11.8	Sweetener
42	Sulfamethoxazole	300	723-46-6	$C_{10}H_{11}N_3O_3S$	0.89	1.8	5.6	Anfiprotic	-1.31	Antibiotic
43	Sulfapyridine	204	144-83-2	$C_{11}H_{11}N_3O_2S$	0.35	2.3	8.4	Anfiprotic	0.25	Antibiotic
44	Theophylline	87	58-55-9	$C_7H_8N_4O_2$	-0.02	8.8		Basic	-1.07	Bronchodilator/ Vasodilator
45	Trimethoprim	303	738-70-5	$C_{14}H_{18}N_4O_2$	0.91	7.1		Basic	0.83	Antibiotic
46	Venlafaxine	338	93413-69-5	$C_{17}H_{27}NO_2$	3.20	9.4		Basic	1.59	Antidepressant

* wastewater at pH 7.8

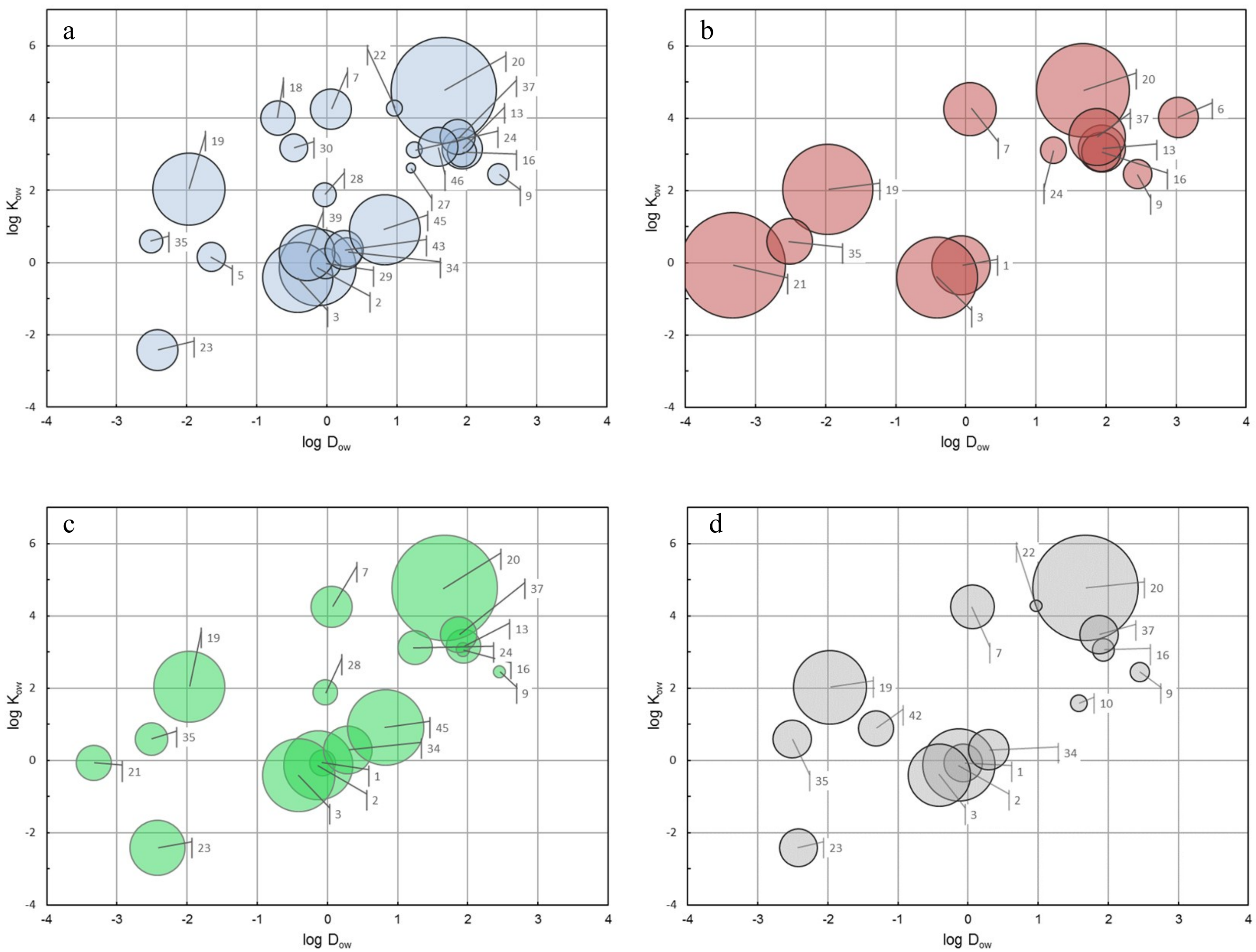

Fig. S1. Amount adsorbed (size of bubble proportional to the amount adsorbed in μg/g) as a function of D_{ow}, and K_{ow} (Table S3). The results are shown for compounds significantly adsorbed with respect to the experimental error. Compounds numbered as in Table S3. a) SiO_2, b) SiO_2-NH_2, c) TiO_2, d) Fe_3O_4.

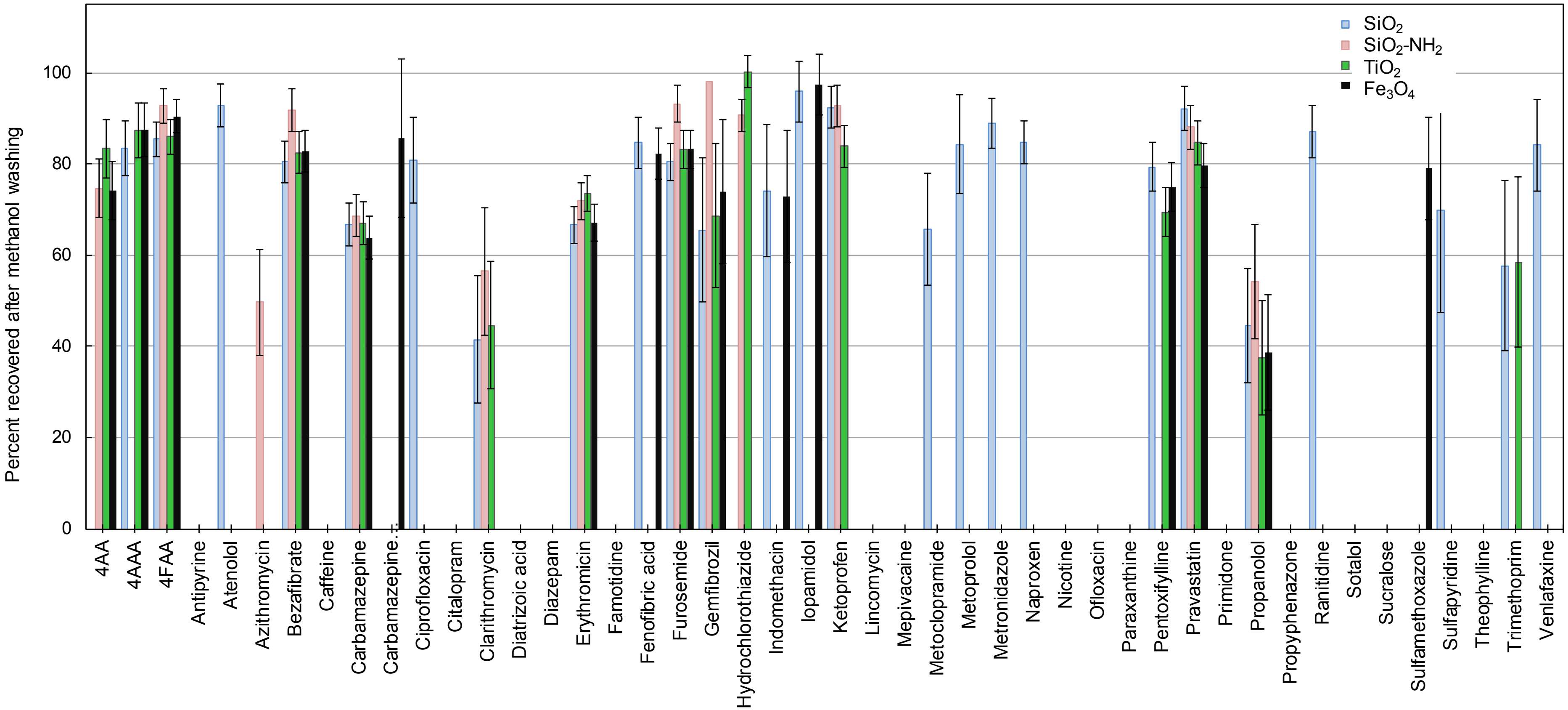

Fig. S2. Percent recovery of wastewater pollutants after washing the filter two times with methanol as indicated in the text. (The results are showed only for compounds significantly adsorbed in the nanoparticles.)

Table S4. Dose-effect relationship parameters obtained using the computer software CompuSyn for wastewater (WW), individual nanoparticles and binary mixtures.

		Dose-effect parameters		
Drug combo		*Dm*	*m*	*r*
	WW	1.08	0.98	0.97
SiO_2-wastewater	SiO_2	402	0.41	0.95
	WW-SiO_2	628	0.49	0.92
	WW	1.08	0.92	0.97
SiO_2-NH_2-wastewater	SiO_2-NH_2	440	0.33	0.93
	SiO2-NH2-WW	244	0.58	0.94
	WW	1.00	0.99	0.97
TiO_2-wastewater	TiO_2	17.8	0.66	0.95
	TiO_2-WW	12.7	1.08	0.98
	WW	1.20	0.75	0.93
Fe_3O_4-wastewater	Fe_3O_4	36.9	0.66	0.98
	Fe_3O_4-WW	17.1	0.66	0.95

The parameters *m*, *Dm* and *r* are the antilog of *x*-intercept, the slope and the linear correlation coefficient of the median-effect plot, signifying the shape of the dose-effect curve, the potency (EC_{50}), and the conformity of the data to the mass-action law, respectively. *Dm* and *m* values are used for calculating the CI values (Eq. 3, experimental section in this ESI).

Table S5. Toxicity reported in the literature for the wastewater pollutants identified in this work

Compound	Taxon	Species	Toxicological endpoint	EC_{50} (mg/L)	Ref.
Atenolol	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	1304	Escher et al.[1]
	Algae	*Desmodesmus subspicatus*	Photosynthetic yield (24 h)	1335	Escher et al.[1]
			Growth inhibition (72 h)	620	Cleuvers[2]
Azithromycin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (15 min)	N.E	Harada et al.[3]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (96 h)	0.019	Harada et al.[3]
Bezafibrate	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (15 min)	178.73 (162.06–197.12)	Rosal et al.[4]
			Bioluminescence inhibition (30 min)	172.73 (155.52–191.85)	Rosal et al.[4]
		Anabaena CPB4337	Bioluminescence inhibition (1 h)	37.28 (32.60–41.79)	Rosal et al.[4]
			Bioluminescence inhibition (24 h)	7.62 (7.01–8.41)	Rosal et al.[4]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	N.E. 60	Isidori et al.[5]
			Growth inhibition (72 h)	> 100	Minguez et al.[6] Villain et al.[7]
Caffeine	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	671.90	Calleja et al.[8]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	N.E. 150	Zarrelli et al.[9]
Carbamazepine	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	87.42	Jos et al.[10]
				52.5 (49.2–56.1)	Kim et al.[11]
			Bioluminescence inhibition (15 min)	78.44	Jos et al.[10]
				52.2 (45.8–59.5)	Kim et al.[11]
			Bioluminescence inhibition (30 min)	> 81	Ferrari et al.[12]
			Bioluminescence inhibition (60 min)	64.27	Jos et al.[10]
		Synechococcus leopoliensis	Growth inhibition (96 h)	33.6	Ferrari et al.[13]
	Algae	*Chlorella vulgaris*	Growth inhibition (24 h)	110.93	Jos et al.[10]
			Growth inhibition (48 h)	36.62	Jos et al.[10]
		Pseudokirchneriella subcapitata	Growth inhibition (72 h)	> 100	Minguez et al.[6] Villain et al.[7]
			Growth inhibition (96 h)	> 100	Ferrari et al.[12]
		Desmodesmus subspicatus	Growth inhibition (72 h)	74	Cleuvers[14]
Ciprofloxacin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	> 5.9	Hernando et al.[15]
			Bioluminescence inhibition (15 min)	> 5.9	Hernando et al.[15]
			Bioluminescence inhibition (30 min)	> 5.9	Hernando et al.[15]
		Microcystis aeruginosa	Growth inhibition (5 d)	0.017 (0.014-0.020)	Robinson et al.[16]
			Growth inhibition (7 d)	0.005 (0.004-0.006)	Halling-Sorensen et al.[17]
		Anabaena flos-aquae	Growth inhibition (72 h)	0.102	Ebert et al.[18]
	Algae	*Chlorella vulgaris*	Growth inhibition (96 h)	20.6	Nie et al.[19]
		Pseudokirchneriella subcapitata	Growth inhibition (72 h)	2.97 (2.41-3.66)	Halling-Sorensen et al.[17]
				6.7	Yang et al.[20]
				18.7 (16.2-21.2)	Robinson et al.[16]

		Desmodesmus subspicatus	Growth inhibition (72 h)	> 0.008	Ebert et al.[18]
Citalopram	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (48 h)	1.6	Christensen et al.[21]
Clarithromycin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	NE 100	Isidori et al.[22]
		Anabaena flos-aquae	Growth inhibition (72 h)	0.121	Baumann et al.[23]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	0.002 (0.0019–0.0028)	Isidori et al.[22]
				0.046	Yang et al.[20]
				0.23 (0.18-0.29)	Minguez et al.[6] Villain et al.[7]
			Growth inhibition (96 h)	0.011	Yamashita et al.[24]
		Desmodesmus subspicatus	Growth inhibition (72 h)	0.371	Baumann et al.[23]
Diazepam	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	9965.91	Calleja et al.[8]
	Algae	*Tetraselmis chuii*	Growth inhibition (96 h)	16.5 (16.45–16.47)	Nunes et al.[25]
Erythromicin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	> 100	Hernando et al.[15]
			Bioluminescence inhibition (15 min)	> 100	Hernando et al.[15]
			Bioluminescence inhibition (30 min)	> 100	Hernando et al.[15]
				N.E. 100	Isidori et al.[22]
		Microcystis aeruginosa (NIES-44)	Growth inhibition (6 d)	0.023	Ando et al.[26]
		Microcystis wesenbergii (NIES-107)	Growth inhibition (6 d)	0.023	Ando et al.[26]
		Synechococcus sp. (PCC 7002)	Growth inhibition (6 d)	0.23	Ando et al.[26]
		Synechococcus leopoliensis (IAM M-6)	Growth inhibition (6 d)	0.16	Ando et al.[26]
		Anabaena cylindrica (NIES-19)	Growth inhibition (6 d)	0.035	Ando et al.[26]
		Anabaena variabilis (NIES-23)	Growth inhibition (6 d)	0.43	Ando et al.[26]
		Anabaena flos-aquae (ATCC 29413)	Growth inhibition (6 d)	0.27	Ando et al.[26]
		Nostoc sp. (PCC 7120)	Growth inhibition (6 d)	0.2	Ando et al.[26]
	Algae	*Chlorella vulgaris*	Growth inhibition (72 h)	33.8 (31.3–36.4)	Eguchi et al.[27]
		Pseudokirchneriella subcapitata	Growth inhibition (72h)	0.02 (0.016–0.026)	Isidori et al.[22]
				0.0366 (0.0358–0.0399)	Eguchi et al.[27]
Fenofibric acid	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (15 min)	1.86 (1.64–2.08)	Rosal et al.[4]
			Bioluminescence inhibition (30 min)	1.72 (1.48–1.96)	Rosal et al.[4]
		Anabaena CPB4337	Bioluminescence inhibition (1 h)	10.82 (8.46–13.35)	Rosal et al.[4]
			Bioluminescence inhibition (24 h)	10.85 (6.16–13.16)	Rosal et al.[4]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	> 100	Minguez et al.[6]
Furosemide	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	N.E. 200	Isidori et al.[28]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	N.E. 70	Isidori et al.[28]
Gemfibrozil	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	64.59	Zurita et al.[29]
			Bioluminescence inhibition (15 min)	45.06	Zurita et al.[29]
				35.34 (33.22–37.66)	Rosal et al.[4]
			Bioluminescence inhibition (30 min)	29.07 (26.77–31.37)	Rosal et al.[4]

		Anabaena CPB4337	Bioluminescence inhibition (1 h)	8.44 (7.81–9.24)	Rosal et al.[4]
			Bioluminescence inhibition (24 h)	4.42 (4.06–4.57)	Rosal et al.[4]
	Algae	*Chlorella vulgaris*	Growth inhibition (24 h)	194.76	Zurita et al.[29]
			Growth inhibition (48 h)	160.96	Zurita et al.[29]
			Growth inhibition (72 h)	150.20	Zurita et al.[29]
		Pseudokirchneriella subcapitata	Growth inhibition (72 h)	15.19 (13.32–17.32)	Isidori et al.[5]
			Growth inhibition (72 h)	7.00 (6.26–7.42)	Minguez et al.[6] Villain et al.[7]
Lincomycin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	N.E. 100	Isidori et al.[22]
		Synechococcus leopoliensis	Growth inhibition (96 h)	0.195	Andreozzi et al.[30]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	0.07 (0.05–0.10)	Isidori et al.[22]
			Growth inhibition (96 h)	1.51	Andreozzi et al.[30]
Metoprolol	Algae	*Desmodesmus subspicatus*	Growth inhibition (72 h)	7.3	Ferrari et al.[13]
				7.9	Cleuvers[2]
Metronidazole	Algae	*Chlorella sp.*	Growth inhibition (72 h)	38.8	Lanzky and Halting-Sørensen[31]
		Pseudokirchneriella subcapitata		39.1	Lanzky and Halting-Sørensen[31]
Naproxen	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	44.4	Villain et al.[7]
			Growth inhibition (96 h)	31.82 (27.86–36.33)	Isidori et al.[32]
		Desmodesmus subspicatus	Growth inhibition (72 h)	625.5	Cleuvers[33]
Nicotine	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5min)	37.64	Calleja et al.[8]
Ofloxacin	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	> 90.00	Cleuvers[14]
		Microcystis aeruginosa	Growth inhibition (5 d)	0.021 (0.018-0.024)	Robinson et al.[16]
		Synechococcus leopoliensis	Growth inhibition (96 h)	0.016	Cleuvers[14]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	12.1 (10.4-13.7)	Robinson et al.[16]
				1.44 (1.08–1.80)	Isidori et al.[22]
			Growth inhibition (96 h)	4.74	Cleuvers[14]
Propanolol	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	81	Escher et al.[1]
		Synechococcus leopoliensis	Growth inhibition (96 h)	0.668	Cleuvers[14]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	1.86	Villain et al.[7]
			Growth inhibition (96 h)	7.40	Cleuvers[14]
		Desmodesmus subspicatus	Photosynthetic yield (24 h)	4.1	Escher et al.[1]
			Growth inhibition (72 h)	5.8	Ferrari et al.[13]
				0.7	Cleuvers[2]
Ranitidine	Bacteria	*Pseudomonas putida*	Growth inhibition (128 min)	374	Bergheim et al.[34]
Sulfamethoxazole	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	74.2 (46.4–118.7)	Kim et al.[11]
			Bioluminescence inhibition (15 min)	78.1 (24.0–25.4)	Kim et al.[11]
			Bioluminescence inhibition (30 min)	> 84.00	Cleuvers[14]

				23.3 (16.9–32.2)	Isidori et al.[22]
				> 100	Białk-Bielińska et al.[35]
		Synechococcus leopoliensis	Growth inhibition (96 h)	0.027	Cleuvers[14]
	Algae	*Chlorella vulgaris*	Growth inhibition (48 h)	0.98	Borecka et al.[36]
			Growth inhibition (72 h)	1.51 (1.05–2.19)	Borecka et al.[36]
		Pseudokirchneriella subcapitata	Growth inhibition (72 h)	0.52 (0.36–0.74)	Isidori et al.[22]
			Growth inhibition (96 h)	0.15	Cleuvers[14]
		Scenedesmus vacuolatus	Growth inhibition (24 h)	1.54	Białk-Bielińska et al.[35]
Sulfapyridine	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (30 min)	> 50	Białk-Bielińska et al.[35]
	Algae	*Chlorella vulgaris*	Growth inhibition (48 h)	1.93 (1.25–2.90)	Borecka et al.[36]
			Growth inhibition (72 h)	1.00 (0.73–1.34)	Borecka et al.[36]
		Scenedesmus vacuolatus	Growth inhibition (24 h)	5.28	Białk-Bielińska et al.[35]
Theophylline	Bacteria	*Vibrio fischeri*	Bioluminescence inhibition (5 min)	2486.26	Calleja et al.[8]
Trimethoprim	Bacteria	*Vibrio fischei*	Bioluminescence inhibition (30 min)	> 0.28	van der Grinten et al.[37]
		Microcystis aeruginosa	Growth inhibition (7 d)	112 (100–126)	Halling-Sorensen et al.[17]
		Microcystis aeruginosa (NIES-44)	Growth inhibition (6 d)	150	Ando et al.[26]
		Microcystis wesenbergii (NIES-107)	Growth inhibition (6 d)	> 200	Ando et al.[26]
		Synechococcus sp. (PCC 7002)	Growth inhibition (6 d)	> 200	Ando et al.[26]
		Synechococcus leopoldensis (IAM M-6)	Growth inhibition (6 d)	> 200	Ando et al.[26]
		Anabaena cylindrica (NIES-19)	Growth inhibition (6 d)	> 200	Ando et al.[26]
		Anabaena variabilis (NIES-23)	Growth inhibition (6 d)	11	Ando et al.[26]
		Anabaena flos-aquae (ATCC 29413)	Growth inhibition (6 d)	> 200	Ando et al.[26]
		Nostoc sp. (PCC 7120)	Growth inhibition (6 d)	53	Ando et al.[26]
	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (24 h)	> 9	van der Grinten et al.[37]
			Growth inhibition (72 h)	110 (64–192)	Halling-Sorensen et al.[17]
				80.3 (74.4–86.7)	Eguchi et al.[27]
				40	Yang et al.[20]
				56.01 (45.82-69.10)	Minguez et al.[6]
Venlafaxine	Algae	*Pseudokirchneriella subcapitata*	Growth inhibition (72 h)	47.58 (42.49–54.01)	Minguez et al.[6]

NE=No effect at “x” (mg/L)

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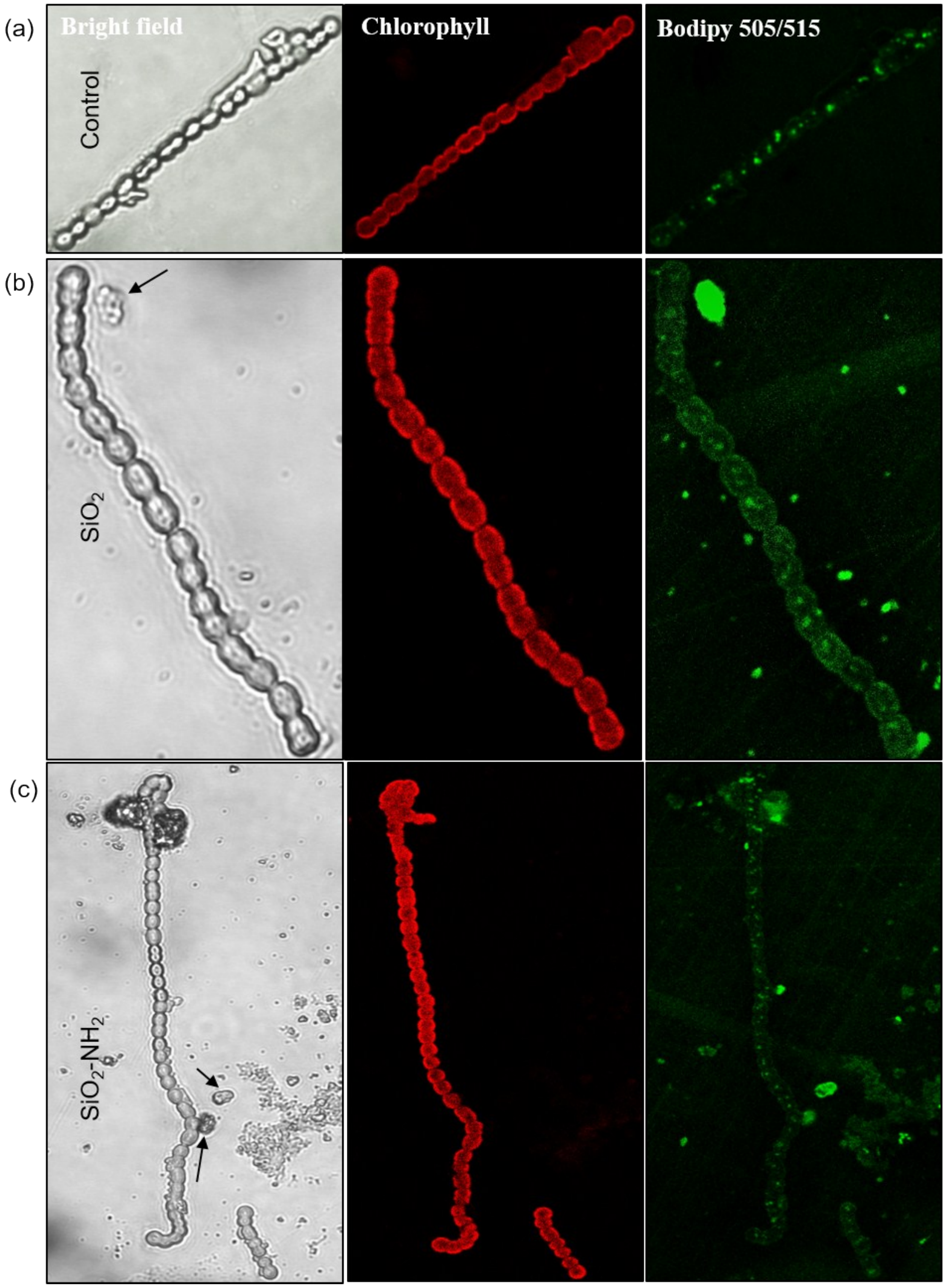

Fig. S3. Staining and visualization of lipid droplets. Representative confocal images of *Anabaena* sp. PCC 7120 CPB4337 cells (a) non exposed and cells exposed to (b) 451.5 mg/L of SiO_2, and (c) 442.6 mg/L of SiO_2-NH_2 nanoparticles. Images are (left to right) bright field,chlorophyll fluorescence (red), and Bodipy 505/515 fluorescence (green). Arrows indicate single cells detached from filaments.