SUPPLEMENTARY

Supplementary Tables

Table S1: Performance of CLASS V1 - Unit A, v1 water quality indicators (n=number of samples)

Parameter	v1 – Inlet	v1 – Effluent	Removal
Turbidity (NTU)	58 (30-120) (n=17)	34 (5-96) (n=17)	44%
TSS (mg/L)	75 (52-126) (n=22)	48 (30-70) (n=18)	37%
pH	7.5 (7.0-8.0) (n=22)	7.2 (6.6-8.2) (n=18)	--
Total Alkalinity ($CaCO_3$/ mg/L)	903 (740-1105) (n=21)	360 (133-168) (n=18)	58%
COD (mg/L)	549 (297-784) (n=21)	413 (250-516) (n=14)	34%
TKN (mg N/L)	165 (127-216) (n=20)	110 (44-172) (n=15)	42%
NH3 (mg N /L)	154 (126-187) (n=17)	82 (38-139) (n=14)	45%
Phosphorus (mg/L)	16 (8-23) (n=20)	5 (1-10) (n=18)	68%
Calcium (mg/L)	90 (24-164) (n=22)	40 (4-88) (n=18)	52%
Magnesium (mg/L)	5 (1-11) (n=21)	3 (1-4) (n=170	33%
BOD (mg/L)	223 (48-485) (n=14)	158 (5-480) (n=14)	10%
Coliform (CFU/ml)	1.81e4 (n=19)	<1 (n=18)	100%

Table S2: Performance of CLASS V1 - Unit B, v1 water quality indicators (n=number of samples)

Parameter	V1 – Inlet	V1 – Effluent	Removal
Turbidity (NTU)	48 (16-86) (n=24)	5 (0-15) (n=23)	89%
TSS (mg/L)	62 (15-120) (n=26)	9 (0-29) (n=26)	85%
pH	7.1 (6.3-8.1) (n=29)	5.2 (3.7-6.9) (n=28)	--
Total Alkalinity ($CaCO_3$/ mg/L)	284 (153-411) (n=29)	12 (0-88) (n=28)	96%
COD (mg/L)	376 (118-660) (n=26)	269 (102-440) (n=27)	24%
TKN (mg/L)	85 (60-147) (n=27)	13 (0-46) (n=28)	85%
NH3 (mg/L)	68 (44-88) (n=28)	9 (0-65) (n=29)	87%
Phosphorus (mg/L)	8 (4-12) (n=29)	4 (2-7) (n=29)	49%
Calcium (mg/L)	38 (11-109) (n=29)	13 (0-82) (n=29)	66%
Magnesium (mg/L)	1.8 (0.2-7.3) (n=27)	0.5 (0-1.5) (n=27)	67%
BOD (mg/L)	340 (60-870) (n=21)	35 (0-120) (n=20)	73%
Coliform (CFU/ml)	1.22e4 (n=24)	<1 (n=26)	100%

Table S3: Indian Standard Methods used by external lab (T.S. Stanes) for water quality assessment testing parameters.

Parameter	**Unit**	**Standard**
Color	Hazen	IS 3025 (Part 4) 1983
Turbidity	NTU	IS 3025 (Part 10) 1984
Total Suspended Solids	mg/L	IS 3025 (Part 17) 1984
Total Dissolved Solids	mg/L	IS 3025 (Part 16) 1984
pH (direct)	--	IS 3025 (Part 11) 1983
Alkalinity (as CaCO3)	mg/L	IS 3025 (Part 23) 1986
Conductivity	ms/cm	IS 3025 (Part 14) 2013
Chloride (as Cl)	mg/L	IS 3025 (Part 32) 1988
Calcium	mg/L	IS 3025 (Part 40) 1991
Phosphorus	mg/L	IS 3025 (Part 31) 1988
Nitrogen Ammonia (as N)	mg/L	IS 3025 (Part 34) 1988
Nitrate Nitrogen (as NO3)	mg/L	IS 3025 (Part 34) 1988
Nitrite Nitrogen (as NO2)	mg/L	IS 3025 (Part 34) 1988
Total Kjeldahl Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988
Total Nitrogen (as N)	mg/L	IS 3025 (Part 34) 1988
Chemical Oxygen Demand	mg/L	IS 3025 (Part 58) 2006
Biological Oxygen Demand	mg/L	IS 3025 (Part 44)
E. Coli (colony count)	CFU/ml	IS 5887 P1 : 1976
Coliforms (colony count)	CFU/ml	IS 5401 P1 : 2012
E. Coli (MPN)	MPN/100ml	IS 1622 : 1981
Coliforms (MPN)	MPN/100ml	IS 1622 : 1981

Table S4 Measured volume of sludge accumulated in CLASS settling chambers. Total area 3.1 m2.

	Months	Date range and system version	Sludge Volume (m^3)
Unit A	12	Oct 2015 - Oct 2016, v1*	0.57*
Unit A	12	Mar 2018 - Mar 2019, v2	0.31
Unit B	12	Oct 2015 - Nov 2016, v1	0.25
Unit B	16	Nov 2017 - Mar 2019, v2	0.36
* No sump in this system			

Table S4 reports the total sludge volume, which occupies a total area of settling tanks of 3.1 m^2. A measurement height of sludge accumulation in the CLASS settling tanks were conducted just before desludging after 12 or more months of operation at the end of test period for v1 and v2. The measurement was conducted using a custom-made hollow transparent tube and custom endcap. Different sludge heights were measured across the 3 compartments of the settling tanks and the volume of accumulated sludge accumulated was calculated by multiplying the area of each compartment by the corresponding measured sludge height.

The most sludge accumulation (0.57 m^3) occurred, not surprisingly, in Unit A when the apartment building toilet effluent were connected directly to settling tanks, with no sump during testing of v1. Once the sump was installed, the two units accumulated sludge at a similar rate, corresponding to an average height of 8-12 cm out of a total tank height of 1.3 meters, that is approximately a modest 10% over a period of 12-16 months.

It is noted that this data does not account for accumulation in the sump, which was not measured and not desludged during the entire testing period from October 2015. It does also not include accumulation in the digester after the settling tanks, which were desludged.

Table S5: Biological pre-treatment (inlet: Bio In, and outlet: Bio Out) and ECR outlet water quality for the CLASS v2 prototypes at site A and site B (n=number of samples). Removal for biological pre-treatment (Bio Removal) and biological pretreatment coupled with ECR (Bio + ECR Removal) calculated by averaging removals for each set of measurements. Target effluent threshold and removal values according to the ISO 30500 standard (19) were indicated (ISO 30500) when relevant.

Parameter	Bio In	Bio Out	Bio Removal	ECR Out	Bio + ECR Removal	ISO 30500
Color (Hazen) Unit A	311 (150-500) (n=7)	111 (83-150) (n=6)	59%	3 (0-10) (n=4)	99%	--
Color (Hazen) Unit B	176 (100-200) (n=7)	43 (15-100) (n=10)	70%	2 (0-5) (n=8)	99%	--
Turbidity (NTU) Unit A	132 (78-196) (n=6)	<1 (0-1.5) (n=6)	100%	<1 (0-0.8) (n=4)	100%	--
Turbidity (NTU) Unit B	36 (21-66) (n=8)	0 (n=10)	100%	0 (n=9)	100%	--
TSS (mg/L) Unit A	478 (292-733) (n=5)	13 (7-22) (n=6)	98%	1 (0-3) (n=3)	100%	≤30
TSS (mg/L) Unit B	79 (41-134) (n=8)	6 (0-13) (n=11)	92%	3.5 (0-11) (n=9)	97%	≤30
pH Unit A	7.3-8.7 (n=7)	5.2-6.2 (n=5)* 7.8-8.4 (n=3)**	--	5.4 (3.7-7.2) (n=3)* 8 (3.3-10.1) (n=37)**	--	6.0-9.0
pH Unit B	6.0 -7.7 (n=44)	3.6-7.3 (n=48)* 5.9-7.0 (n=20)**	--	5.6 (3.1-8.1) (n=35)* 8.4 (4-9.6) (n=85)**	--	6.0-9.0
Alkalinity (mg $CaCO_3$/L) Unit A	1003 (770-1325) (n=6)	18 (10-28) (n=4)* 308 (205-450) (n=3)**	98% 74%	5 (0-10) (n=2)* 330 (175-485) (n=2)**	99% 73%	--

Alkalinity	468 (313-805)	48 (5-110) (n=7)*	39%	7.5 (0-25) (n=4)*	100%	--
(mg $CaCO_3$/L) Unit B	(n=7)	96 (43-170) (n=3)**	79%	122 (0-203) (n=4)**	82%	
COD (mg O_2/L) Unit A	788 (432-1376) (n=31)	157 (56-620) (n=35)	80%	62 (40-116) (n=11)	90%	≤50, ≤150[#]
COD (mg O_2/L) Unit B	365 (156-622) (n=23)	46 (8-87) (n=26)	87%	33 (3-60) (n=14)	90%	≤50, ≤150[#]
Total N (mg N/L) Unit A	210 (184-291) (n=6)	92 (60-125) (n=4)*	55%	104 (n=2)*	54%	70%
		44 (22-65) (n=2)**	84%	53.9 (n=1)**	73%	
Total N (mg N/L) Unit B	104 (94-114) (n=5)	29 (28-30) (n=2)*	71%	25.0 (n=1)*	--	70%
		46 (40-52) (n=3)**	57%	28.5 (21.4-36.3) (n=3)**	74%	
NH_3 (mg N/L) Unit A	213 (160-330) (n=47)	47 (20-71) (n=20)*	75%	59 (31-74) (n=3)*	70%	--
		20 (1-55) (n=36)**	91%	10 (0-39) (n=21)**	96%	
NH_3 (mg N/L) Unit B	81 (30-150) (n=40)	20 (0.2-56) (n=31)*	79%	23 (0-58) (n=16)*	75%	--
		12 (0.8-20) (n=15)**	85%	1.3 (0-9) (n=12)**	98%	
Total P (mg P/L) Unit A	23.7 (20.2-28.7) (n=5)	26.6 (20.5-37.8) (n=7)	5%	21.5 (10.9-33.4) (n=4)	31%	80%
Total P (mg P/L) Unit B	12.1 (7.3-15.3) (n=8)	11.3 (6.2-15.9) (n=11)	13%	8.3 (2.6-11.3) (n=9)	32%	80%
***E. Coli* (CFU/ml) Unit A**	4.4 10^4 ($2.2 \cdot 10^3$-$1.6 \cdot 10^5$) (n=5)	202 (<10-450) (n=6)	--	BDL (n=4)	--	≤0.1
***E. Coli* (CFU/ml) Unit B**	$7.3 \cdot 10^3$ ($3.6 \cdot 10^2$-$3.7 \cdot 10^4$) (n=8)	1265 (<10-8200) (n=9)	--	BDL (n=9)	--	≤0.1

* pre-addition of sodium bicarbonate in biological pre-treatment and ECR at CC 45 A/m^2.

** post-addition of sodium bicarbonate in biological pre-treatment and ECR at CV 90 A/m^2.

see Table 1 for the details on the two limits.

Supplementary Figures

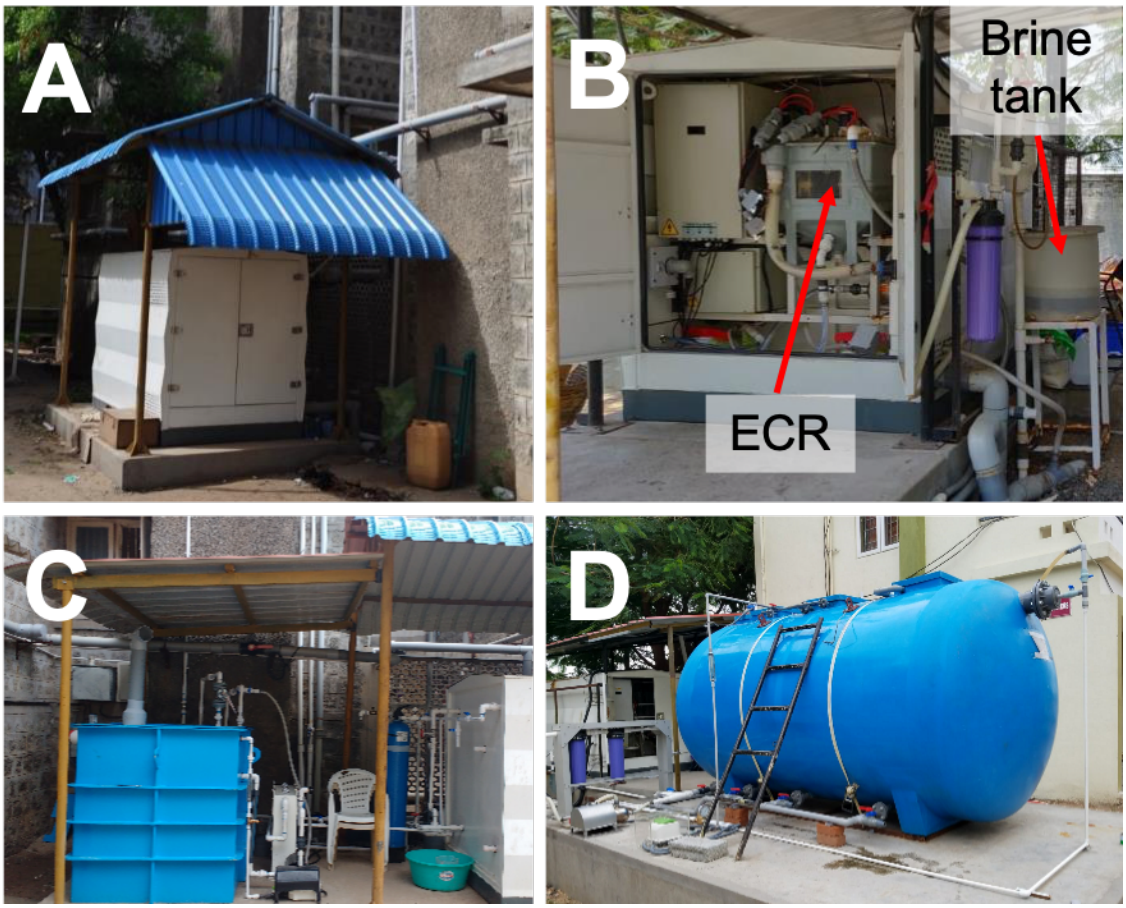

Figure S1: Demonstration of biological pretreatment (C,D) with electrochemical disinfection (A,B) where, (A) Picture of the CLASS system (B) CLASS with open doors showing the ECR and with brine tank. (C) The SBR at site A. (D) The Ecosan digester at site B.

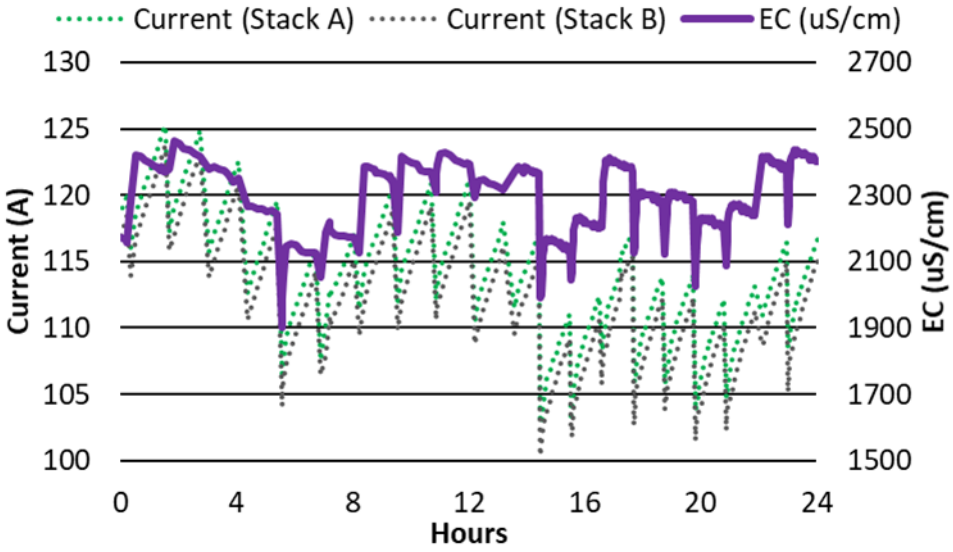

Figure S2: Typical 24hr trace of the current supplied to the electrodes and electrical conductivity of the water inside the ECR at Unit B during the September-December 2018 period.

Figure S3: Microscope images of typical parasite isolated from wastewater. (Left) Free living helminth eggs (sp.); (Middle) Free living larvae. (Right) Free living Protist (Vorticella sp.)