Supplementary Materials

Greening Urban Areas with Decentralized Wastewater Treatment and Reuse: A Case Study of Ecoparque in Tijuana, Mexico

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Supplementary Text

S1. Chemical Quality of Dissolved Organic Compounds in the Ecoparque Treatment Train

To provide additional information on proteinaceous and humic dissolved organic matter (DOM), three-dimensional excitation-emission matrix spectra (EEMs) were acquired for each filtered sample with a Horiba Aqualog benchtop fluorometer, and the instrument settings and corrections have been described at length in Wasswa et al. (2019) [76]. Indices, such as the fluorescence index (FI), which provides information on dominant microbial or terrestrial sources of DOM [77]), the humification index, which provides information about the content of more organic matter [78], and the specific ultraviolet absorbance (SUVA), a surrogate often used to indicate aromaticity [79], were calculated using the absorbance and fluorescence intensities acquired from the Aqualog fluorometer to evaluate the degree of biological processing of the organic constituents along the treatment train.

In addition to the decrease in organic matter content, the chemical quality of DOM changed along the treatment train, as organic matter was consumed or removed (Figure 2). The increase in SUVA indicates that DOM became increasingly more aromatic as treatment progressed. The more than two-fold increase in humification index (Figure 2) and removal of most of the soluble organic fraction (72% of sCOD; Supplemental Table 1) from influent to biofilter effluent is also consistent with the idea that labile organic compounds were preferentially removed in the biofilter, and removal continued through the treatment train. The preferential removal of labile components is expected and has been shown elsewhere [80]. In addition, Peaks B and T, related to the amino acids tyrosine and tryptophan, respectively, decreased more than any other peaks from influent to effluent (with ~89% decrease in peak intensities) and were instead high in the sludge samples (Figure 3), where these compounds presumably became concentrated. This change further reflects the removal of more labile, proteinaceous organic carbon. Wetland effluent had almost complete disappearance of Peaks B and T (Figure 3).

Supplementary Table

Table S1. List of all wastewater treatment plants in Tijuana[1] including their maximum capacity and treated volume.

	Wastewater Treatment Plant Name	Maximum Capacity (l/s)	Treated Volume (l/s)
1	Arturo Herrera	460.0	221.4
2	Binacional o Pitar	1100.0	1076.4
3	Club Campestre	20.0	20.0
4	Ecoparque	5.0	3.0
5	El Prado	56.0	12.9
6	Hacienda las Flores	2.5	1.3
7	La Morita	254.0	180.6
8	Las Delicias	30.0	24.3
9	Las Delicias 2	30.0	19.8
10	Los Valles	15.0	10.7
11	Natura	15.0	8.0
12	Pórticos de San Antonio	15.0	6.5
13	San Antonio de los Buenos	1100.0	919.4
14	San Antonio del Mar	2.5	3.4
15	San Pedro	67.0	6.6
16	Santa Fe	19.0	12.5
17	Villas del Cedro 1	18.0	12.0
18	Villas del Cedro 2	18.0	4.0

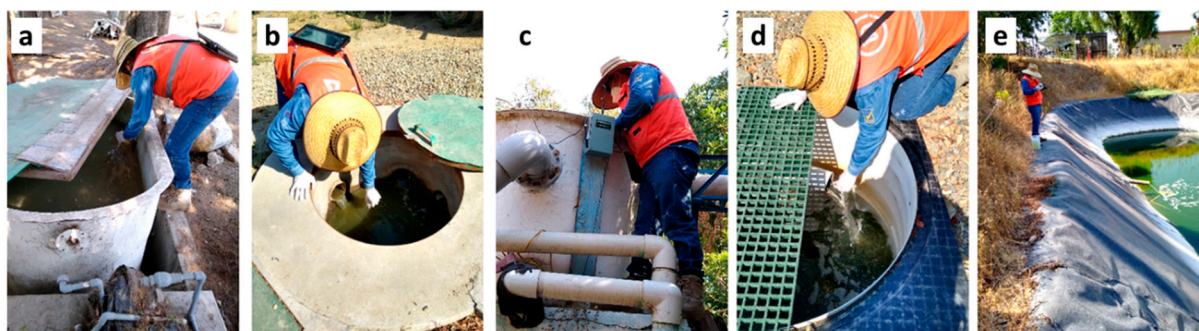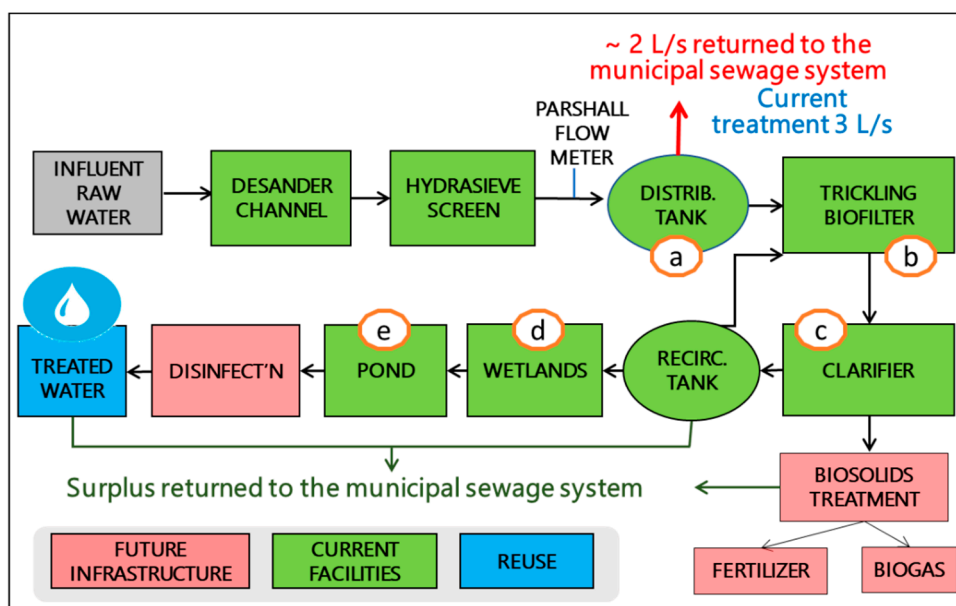[1] Source: CONAGUA, 2015 [56].

Supplementary Figures

Figure S1. Schematic of treatment train and photographs of sampling points for water quality analyses: (**a**) influent distribution tank, (**b**) biofilter effluent tank, (**c**) clarifier tank, (**d**) wetland effluent tank, and (**e**) maturation pond.
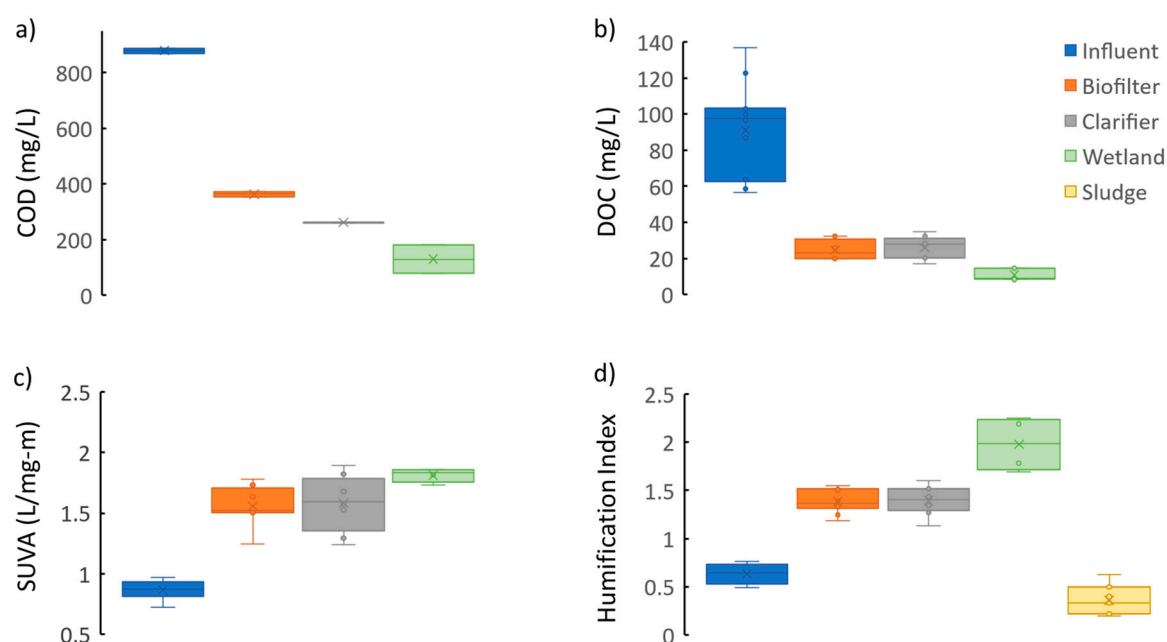
Figure S2. Box plots, showing mean (x), range (whiskers), exclusive median (box), inner points, and outliers of (**a**) COD concentration, (**b**) DOC concentration, (**c**) specific UV absorbance, and (**d**) humification index in influent (distribution tank), effluent of each main treatment unit (biofilter, clarifier, and wetland) at Ecoparque WWTP prior to treatment plant upgrade. Humification index values only available for clarifier waste activated sludge.
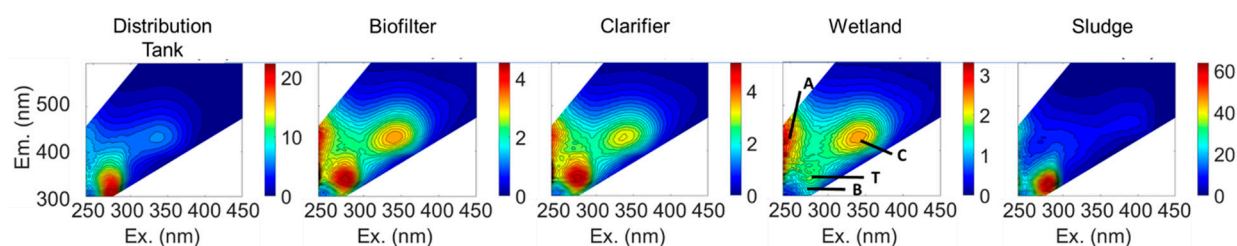

Figure S3. Representative EEMs showing excitation (Ex), emission (Em) wavelengths and intensities of emission (shown in the colorbar in Raman units) for influent (distribution tank), effluent of each main treatment unit (biofilter, clarifier, and wetland), and sludge at Ecoparque WWTP prior to treatment plant upgrade. The positions of ubiquitous peaks, A, B, C, and T are shown in the wetland EEM. Note the higher values of fluorescence intensities for distribution tank and sludge samples.

Levelling box at the maturation pond

Geotextil installation

Wetland with ABR and maturation pond

Figure S4. Photographs of installation of the maturation pond and its components.