

Life Cycle Analysis of Pilot-Scale Constructed Wetlands for the Treatment of Industrial Wastewater and Landfill Leachate from Municipal Solid Waste: A Comparative Assessment

Md. Kawser Alam¹, Md. Al Sadikul Islam², Tanveer Saeed², Sheikh Mokhlesur Rahman³ and Nehreen Majed^{2*}

¹Department of Environmental Engineering, Inha University, South Korea

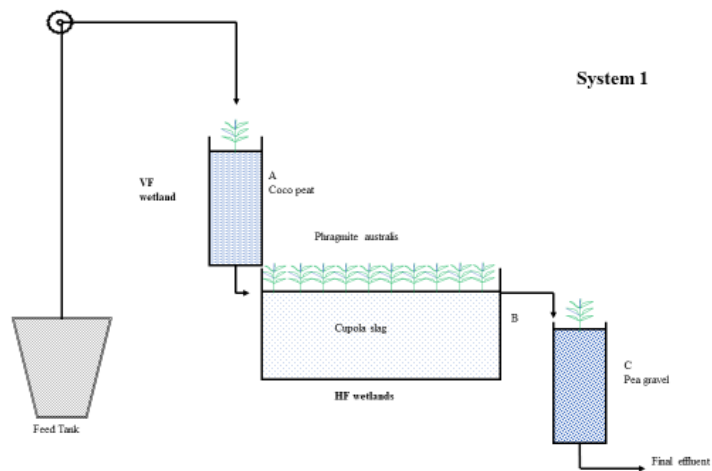
²Department of Civil Engineering, University of Asia Pacific, Dhaka, Bangladesh.

³Department of Civil Engineering, Bangladesh University of Engineering & Technology, Dhaka, Bangladesh.

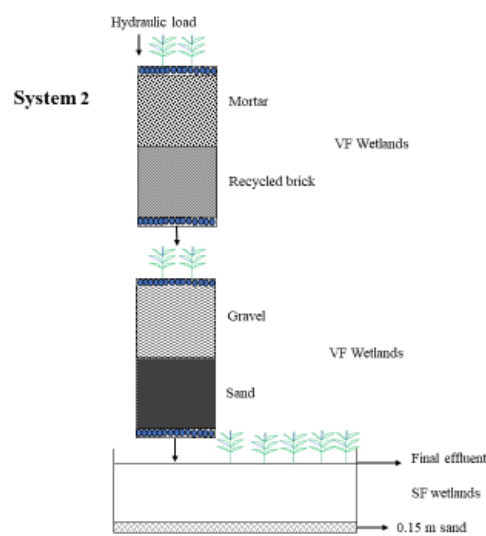
*Correspondence: nehreen-ce@uap-bd.edu; Tel.: + 88 01819206394

Supplementary Information

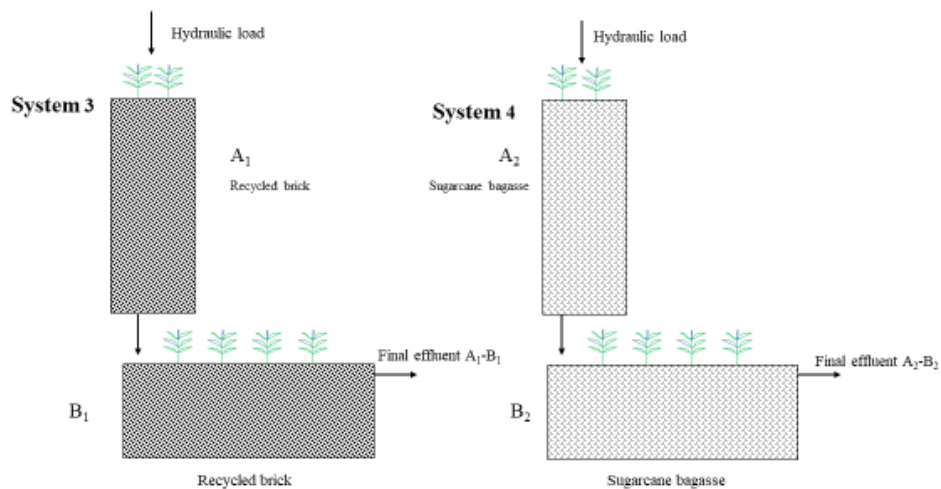
Supplementary Content	Description
Supplementary Figure S1	Flow Diagram of constructed wetland system (S1) for treatment of industry wastewater using construction materials
Supplementary Figure S2	Flow Diagram of constructed wetland system (S2) for treatment of industry wastewater using construction materials
Supplementary Figure S3	Flow Diagram of treatment of constructed wetlands (S3 and S4) for industrial wastewater treatment using construction materials and agricultural by products
Supplementary Figure S4	Supplementary figure 4. Flow Diagram of constructed wetland system (S5) for removal of nutrients from sewage without any flow direction controlling unit
Supplementary Table S1	Impact categories influenced by varying $\pm 10\%$ of selected inventory components



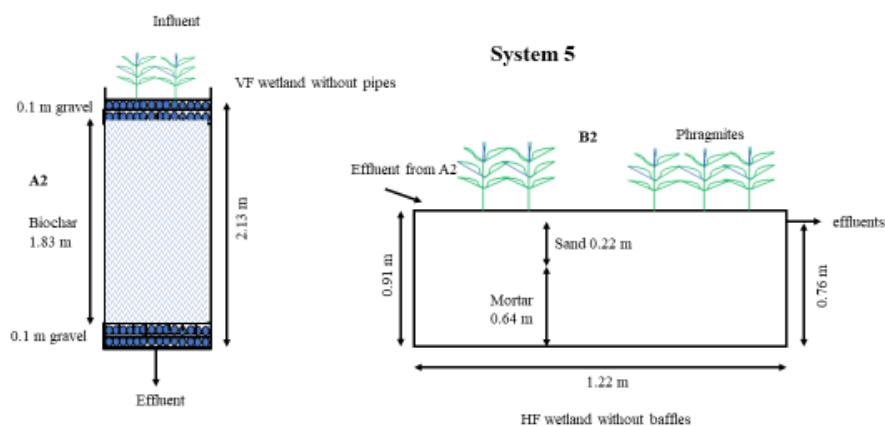
Supplementary Figure S1. Flow Diagram of constructed wetland system (S1) for treatment of industry wastewater using construction materials



Supplementary Figure S2. Flow Diagram of constructed wetland system (S2) for treatment of industry wastewater using construction materials.



Supplementary Figure S3. Flow Diagram of treatment of constructed wetlands (S3 and S4) for industrial wastewater treatment using construction materials and agricultural by products.



Supplementary Figure S4. Flow Diagram of constructed wetland system (S5) for removal of nutrients from sewage without any flow direction controlling unit.

Supplementary Table S1. Impact categories influenced by varying $\pm 10\%$ of selected inventory components

CWs	Parameters	Impact categories						
		Global warming	Terrestrial ecotoxicity	Freshwater ecotoxicity	Human carcinogen	Human non-carcinogen	Fossil scarc.	Freshwater Eutro.
S1	PVC	± 0.044	± 0.015	± 0.003	± 0.023	± 0.006	± 0.070	± 0.002
	Coco-peat	± 0.044	± 0.026	± 0.028	± 0.018	± 0.036	± 0.022	± 0.014
	Slag	± 0.416	± 0.733	± 0.934	± 0.922	± 0.910	± 0.342	± 0.353
	Gravel	± 0.063	± 0.119	± 0.013	± 0.033	± 0.035	± 0.065	± 0.017
	Electricity	± 0.127	± 0.032	± 0.005	± 0.007	± 0.006	± 0.172	± 0.004
	TP							± 0.611
S2	PVC	± 0.169	± 0.079	± 0.043	± 0.046	± 0.041	± 0.312	± 0.023
	Steel	± 0.440	± 0.524	± 0.775	± 0.903	± 0.780	± 0.299	± 0.798
	Mortar	± 0.120	± 0.088	± 0.045	± 0.012	± 0.050	± 0.064	± 0.068
	Brick	± 0.094	± 0.106	± 0.051	± 0.017	± 0.055	± 0.082	± 0.048
	Gravel	± 0.005	± 0.012	± 0.004	± 0.001	± 0.005	± 0.005	± 0.004
	Sand	± 0.065	± 0.165	± 0.057	± 0.018	± 0.068	± 0.073	± 0.053
	Electricity	± 0.060	± 0.028	± 0.017	± 0.003	± 0.009	± 0.086	± 0.004
	TP							± 0.000
S3	PVC	± 0.041	0.018	± 0.015	± 0.026	± 0.014	± 0.082	± 0.008
	Steel	± 0.136	± 0.151	± 0.352	± 0.642	± 0.339	± 0.102	± 0.358
	Brick	± 0.776	± 0.811	± 0.613	± 0.328	± 0.637	± 0.613	± 0.579
	Electricity	± 0.019	± 0.008	± 0.008	± 0.002	± 0.004	± 0.029	± 0.005

	TP						±0.043	
S4	PVC	±0.162	±0.087	±0.037	±0.038	±0.037	±0.310	±0.015
	Steel	±0.543	±0.742	±0.845	±0.940	±0.890	±0.381	±0.656
	Bagasse	±0.110	±0.068	±0.051	±0.016	±0.047	±0.044	±0.056
	Electricity	±0.083	±0.044	±0.020	±0.003	±0.010	±0.125	±0.009
	TP							±0.254
S5	PVC	±0.018	±0.012	±0.010	±0.017	±0.009	±0.060	±0.004
	Steel	±0.098	±0.163	±0.366	±0.701	±0.346	±0.120	±0.127
	Biochar	±0.145	±0.049	±0.032	±0.016	±0.033	±0.050	±0.040
	Mortar	±0.695	±0.711	±0.549	±0.249	±0.576	±0.666	±0.617
	Sand	±0.013	±0.045	±0.024	±0.012	±0.026	±0.026	±0.016
	Electricity	±0.013	±0.009	±0.008	±0.002	±0.004	±0.033	±0.003
	TP							±0.024