

Assumption in kinetic models of nitrogen transformation (Equations (2)–(6))

- Various forms of soluble forms of nitrogen species are in equilibrium with one another.
- The concentration of total ammonia and nitrate are lower than saturation concentration and close to K_s (saturation concentration when $\mu = \mu_{max}$, μ = velocity of reaction, K_s : concentration of substrate at which $\mu = \mu_{max}/2$) of microalga or bacterial species. Hence, the Michaelis–Menten equation can be simplified to a first order model. It is also assumed that all the substrates could not provide any inhibition or toxicity. Hence, the Michaelis–Menten equation is applicable for the present study. In our study we used mostly first-order and second-order kinetic models for nitrogen conversion and uptake.
- Ammonia volatilization would not change because of changes in agitations and concentration of microbial species.

Table S1. Goodness of fit of nitrate data with the simulated results using kinetic models.

Reactor	RMSE	Average % Error
A + S (12:12)	0.95	9.4
A 12:12	0.121	31
S 12:12	0	0
A + S (16:8)	0.42	2.84
A (16:8)	0.2	43
S 16:8	0.47	3.2
A 24:0	0.15	46

$$RMSE = \sqrt{\frac{\sum_{i=1}^{i=n} (x_i - y_i)^2}{n}}$$

$$\text{Average \% error} = [(x_i - y_i) * 100 / x_i] / n$$

Where x_i and y_i are the experimentally determined and simulated values, respectively. n is the number of data points.

Table S2. Kinetic coefficients obtained from kinetic study of nitrogen transformation in various reactors. A: microalga, S: sludge, 12:12, 16:8, 24:0: light:dark regime.

Kinetic Parameters	A + S (12:12 h)	A + S (16:8h)	A (12:12h)	A (16:8 h)	A (24:0 h)	S (12:12 h)	S (16:8 h)
Ammonia volatilization (m/hr)	2.04×10^{-2}	2.34×10^{-02}	3.90×10^{-02}	4.59×10^{-2}	5.08×10^{-02}	3.20×10^{-2}	1.86×10^{-02}
K_t (1/hr)	9.69×10^{-07}	3.03×10^{-06}	1.21×10^{-03}	1.34×10^{-3}	1.82×10^{-3}	4.09×10^{-4}	8.38×10^{-04}
K_b (L/mg-hr)	1.74×10^{03}	5.45×10^{03}	6.75×10^{07}	7.47×10^7	1.01×10^8	2.27×10^7	4.66×10^{07}
NH_4 oxidation (1/hr)	4.75×10^{-04}	1.20×10^{-03}	-	-		6.21×10^{-4}	2.84×10^{-04}
NH_4 uptake microalga (1/hr)	1.63×10^{-5}	2.41×10^{-5}	7.75×10^{-5}	1.44×10^{-4}	1.54×10^{-4}		
NO_3 uptake microalga (1/hr)	3.63×10^{-05}	3.24×10^{-5}	6.02×10^{-5}	5.64×10^{-5}	8.25×10^{-5}		

NO ₃ uptake bacteria (1/hr)	3.08×10^{-05}	1.65×10^{-5}	-	-	5.46×10^{-5}	3.59×10^{-05}
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Table S3. Kinetic coefficients obtained for pathogen inactivation.

Types of Pathogen	Photo Inhibition (s/mmol-m ² - hr)	DO+Light Inhibition (L- s/(mg-mmol- m ² - hr)	Microorganism- Pathogen Competition (L/mg-hr)	pH Inhibition (hr ⁻¹)	Natural Decay (hr ⁻¹)
HPC	2.22×10^{-05}	3.51×10^{-06}	3.64×10^{-05}	4.81×10^{-04}	3.62×10^{-02}
E. coli	2.20×10^{-05}	2.58×10^{-06}	3.56×10^{-05}	5.49×10^{-04}	2.94×10^{-02}
Salmonella	1.87×10^{-05}	2.46×10^{-06}	2.51×10^{-05}	4.12×10^{-04}	2.82×10^{-02}
Shigella	6.69×10^{-06}	9.36×10^{-07}	2.03×10^{-05}	3.06×10^{-04}	2.45×10^{-02}

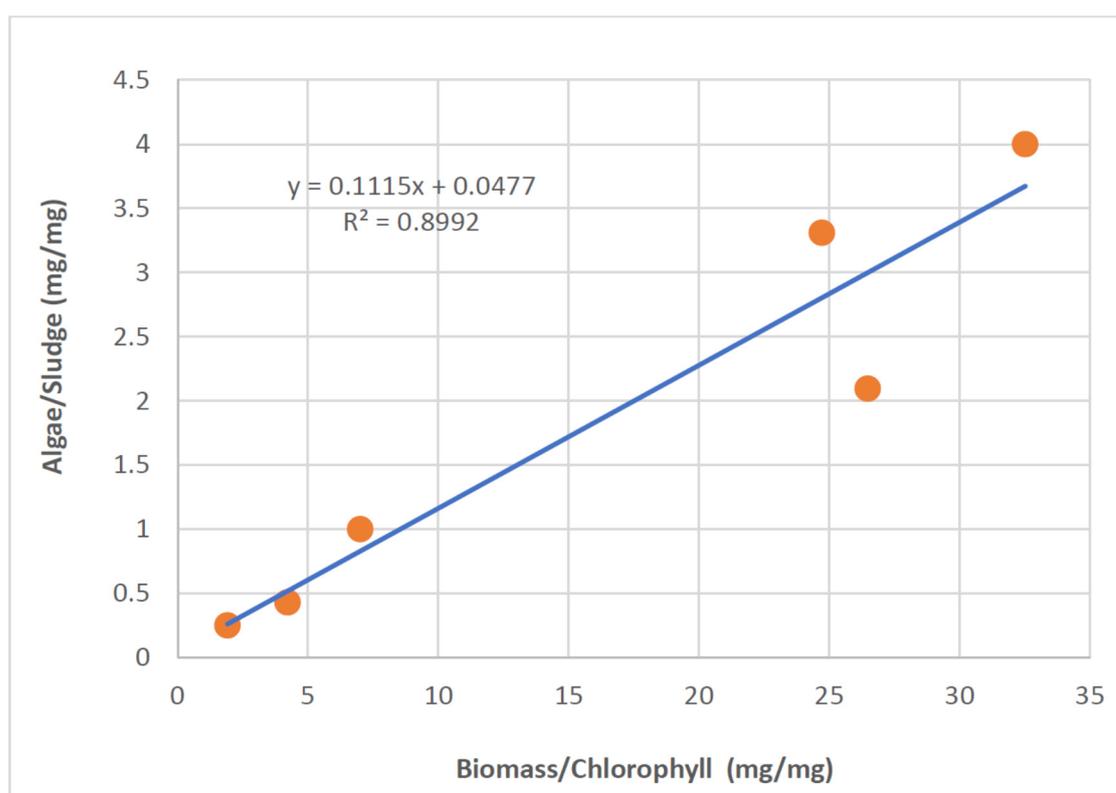
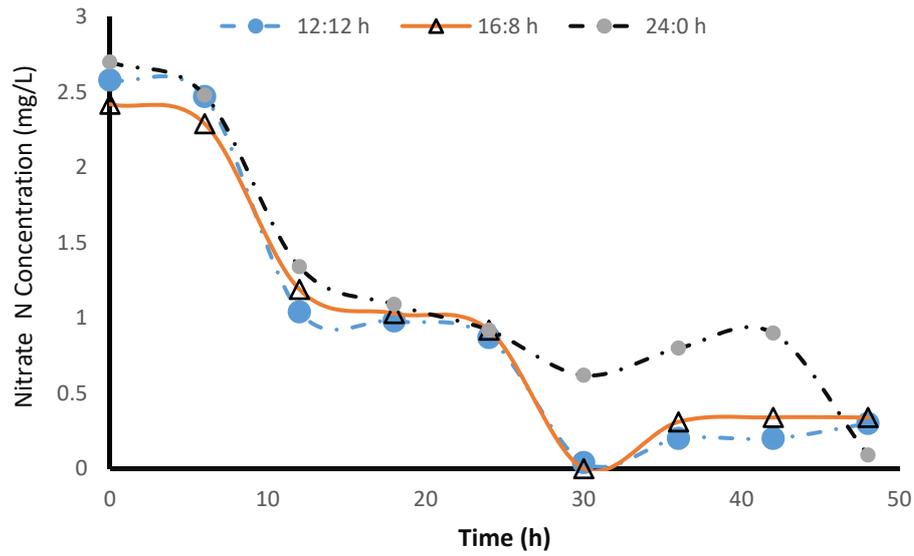
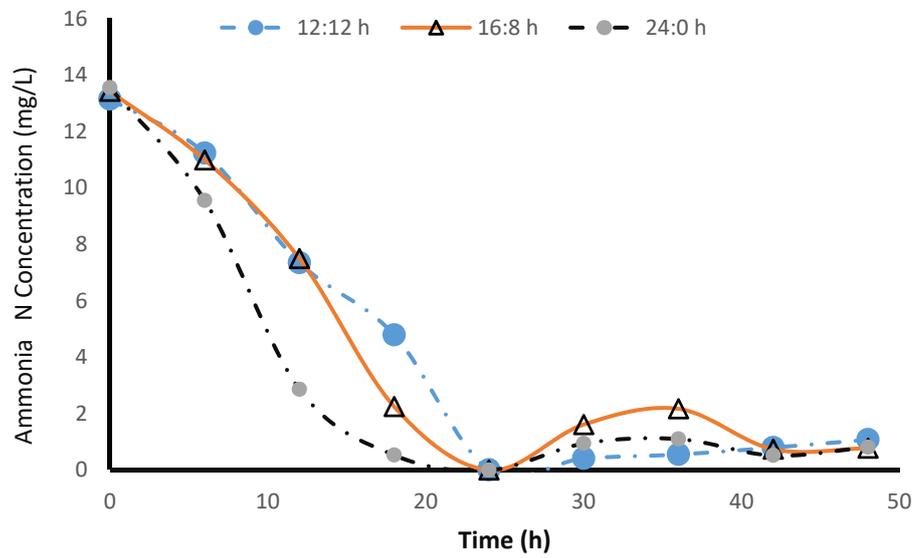


Figure S1. Standard curve used for estimating microalga and bacterial biomass present in a mixture.

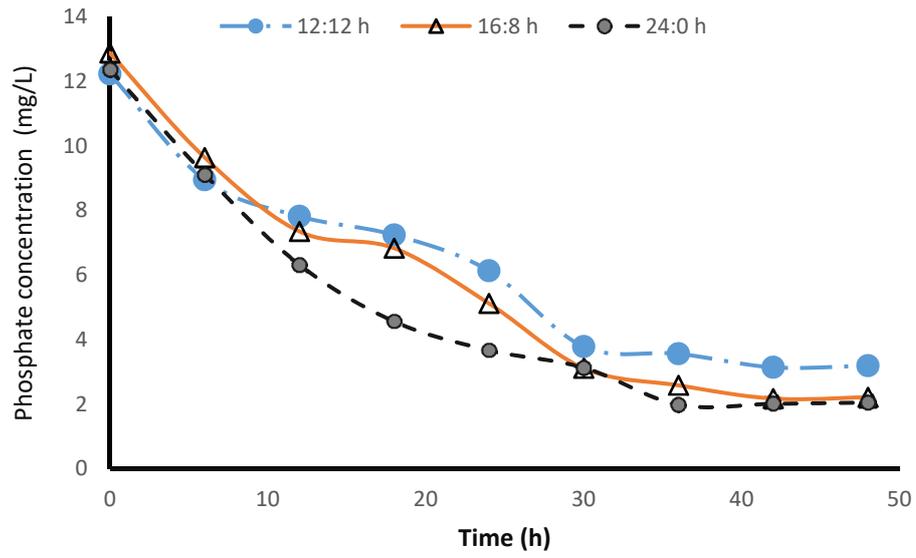


(a)

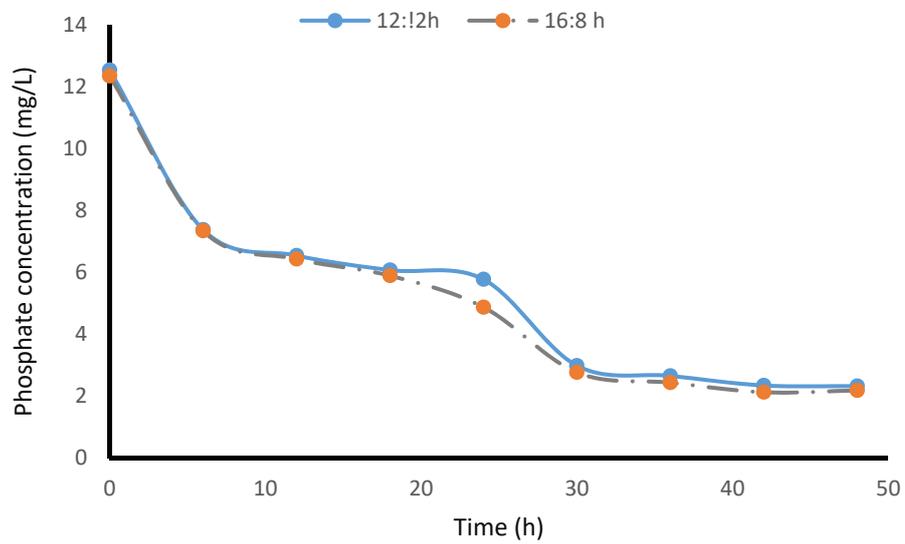


(b)

Figure S2. Nitrogen removal in microalga-based reactor (a) nitrate-N removal, (b) ammonia-N removal

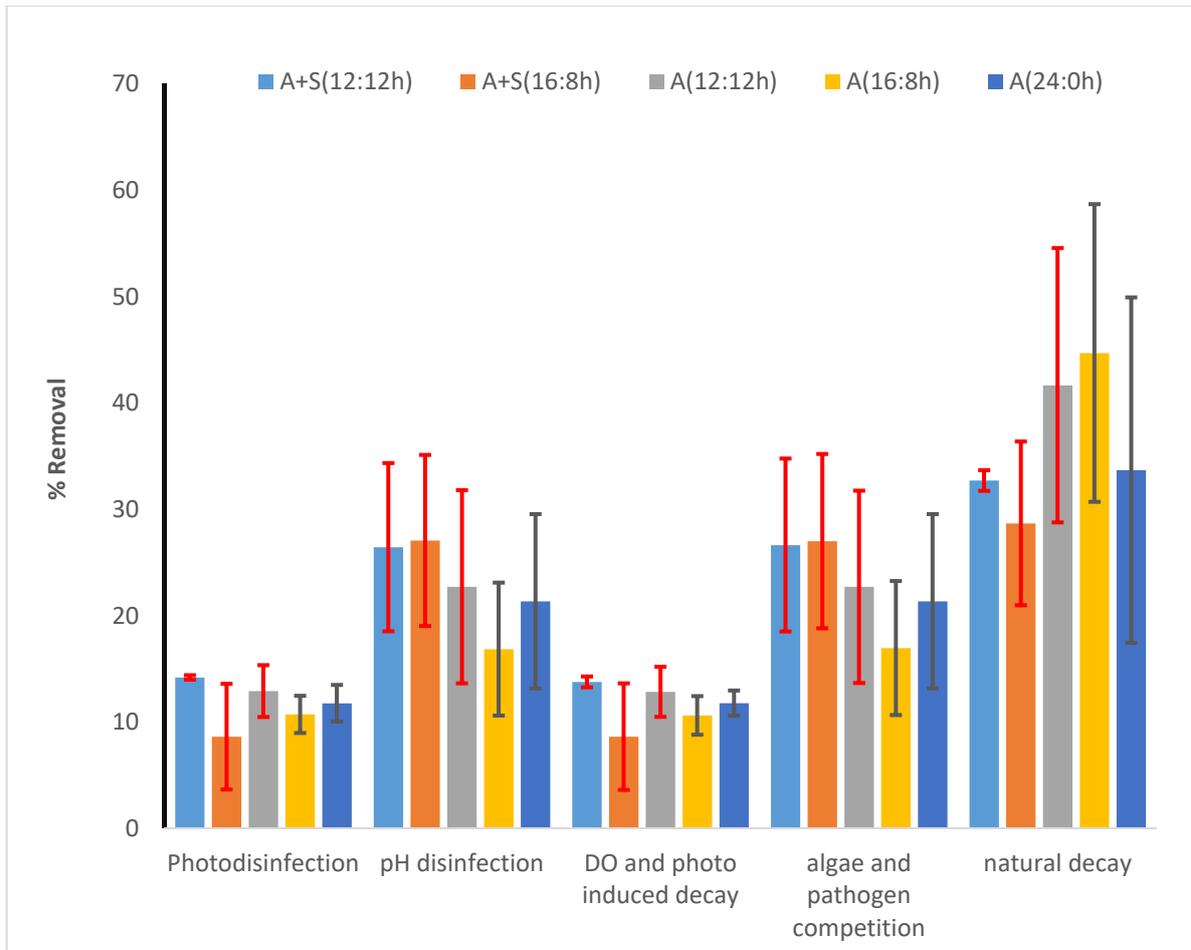


(a)

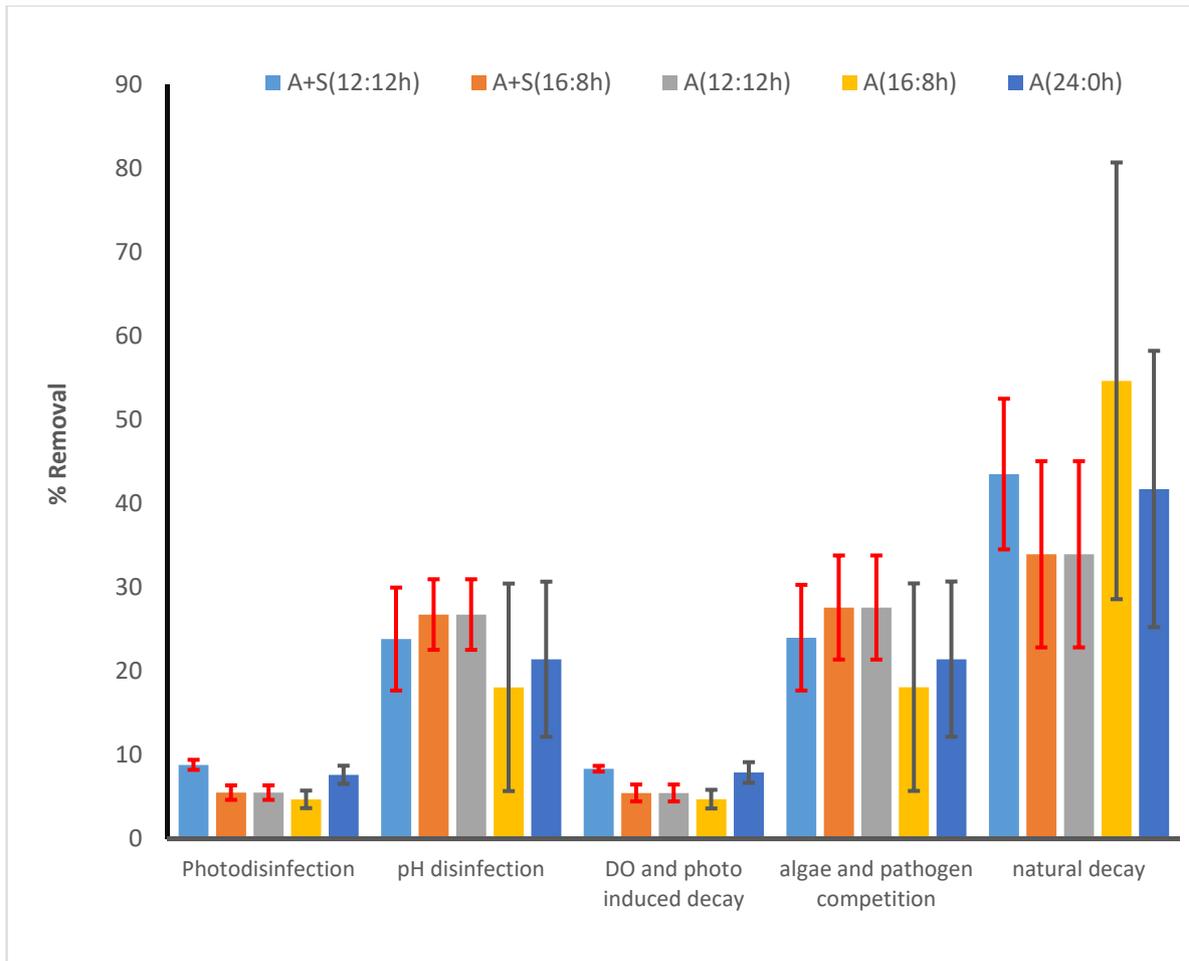


(b)

Figure S3. Phosphate removal in (a) microalga-based reactor and (b) microalga + sludge reactor.



(a)



(b)

Figure S 4. Contribution of various factors in the removal of (a) salmonella and (b) shigella. Vertical bars show the error bars. Vertical columns show the average value of each contribution over 48 h of the experiment. A + S: microalga + sludge reactor, A: microalga reactor, S: sludge reactor 12:12, 16:8, 24:0 h are the various light:dark regimes. Error bars showed the standard deviation of temporal changes in the kinetic coefficients.