Operations in algal bioreactor train

Unit number	Type	Unit description
2.0	Holding tank	Mixing supplementary substrate streams and providing buffer capacity to average flows and compositions
2.1	Algal Bioreactor	Algal bioreactor
2.2	Product & Biomass Recovery	Separates product + algal biomass from improved effluent (to macrophyte bioreactor)
2.3	Separator	Downstream processing: cell breakage
2.4	Separator	Downstream processing: separates lipids and water-based products
2.5	Splitter	Algal biomass to product stream (digestible algal biomass) and solids bioreactor

Streams in algal bioreactor train

Stream number	Stream description	Relation to process units	Relation to other streams Equations refer to mass balance (kg/day)
D1	Improved Compliance Effluent	From Unit 1.2: Separator Into Unit 2.0: Holding tank for Algal Bioreactor	D1 = C1 - C2 Composition same as dissolved composition C1
D2	Settled Raw Wastewater	From Unit 0.2: Splitter Into Unit 2.0: Holding tank for Algal Bioreactor	D2 = A - B1 Composition same as A, B1.
D3	Supplementary Feed	Into Unit 2.0: Holding tank for Algal Bioreactor	Incoming stream, volume and composition set by user. (Optional stream)
D4	Supplementary Feed	Into Unit 2.0: Holding tank for Algal Bioreactor	Incoming stream, volume and composition set by user. (Optional stream)
D5	Supplementary Feed	Into Unit 2.0: Holding tank for Algal Bioreactor	Incoming stream, volume and composition set by user. (Optional stream)
D	Mixed Inflow Stream	From Unit 2.0: Holding tank for Algal Bioreactor Into Unit 2.1: Algal Bioreactor	D = D1 + D2 + D3 + D4 + D5
E1	Algal Broth	From Unit 2.1: Algal Bioreactor Into Unit 2.2: Separator	E1 = D + E5 + E6 Composition changed from D
E2	Biomass & Product	From Unit 2.2: Product & Biomass recovery Into Unit 2.3: Downstream Processing	E2 = E1 – F1 Composition similar to solids component of E1
E3	Algal Product Stream	From Unit 2.3: Product & Biomass recovery Into Unit 2.4: Downstream Processing	E3 = E2 – E4 Composition changed from E2
E4	Biomass	From Unit 2.3: Product & Biomass recovery Into Unit 2.5: Splitter	E4 = E2 – E3 Composition changed from E2
E5	CO_2	From atmosphere Into Unit 2.1: Algal Bioreactor	CO_2 only
E6	H_2O	Between Unit 2.1: Algal Bioreactor and atmosphere	H_2O only
F1	Almost Compliant Effluent	From Unit 2.2: Separator Into Unit 3.0: Holding tank for Macrophyte Bioreactor	F1 = E1 - E2 Composition same as dissolved composition E1
U3	Algal Biomass Not To Product Streams	From Unit 2.5: Splitter Into Unit 4.0: Holding tank for Solids Bioreactor	Total algal biomass = U3 + W3 U3 = E1 – (F1 + W1 + W2 + W3) Composition same as W3
W1	Algal Bioproduct Stream	From Unit 2.4: Separator Exit system	W1 = D * Algal bioproduct yield coefficient * Separation efficiencies Composition as specified by user
W2	Algal Oil Stream	From Unit 2.4: Separator Exit system	W2 = D * Algal oil yield coefficient * * Separation efficiencies Composition as specified by user
W3	Algal Biomass (digestible 'waste')	From Unit 2.5: Splitter Exit system	W3 = D – (F1 + W1 + W2 + U3) Note U3 can be 0 Composition same as U3