

Operations in bacterial bioreactor train

Unit number	Type	Unit description
0.1	Solid/Liquid Separator	Primary Settling Tank (PST) settling raw wastewater, removing the bulk of the solids
0.2	Splitter	Settled, raw wastewater to bacterial and algal reactors
1.0	Mixing tank	Mixing supplementary substrate streams and providing buffer capacity to average flows and compositions
1.1	Reactor	Bacterial bioreactor
1.2	Product & Biomass recovery	Separates product & bacterial biomass from improved effluent (to algal reactor): this may occur within reactor
1.3	Downstream processing	Downstream processing for separation of bacterial product from biomass or residual biomass: for example, centrifugation, flotation
1.4	Splitter	Bacterial biomass to recycle and to Solids bioreactor

Streams in bacterial bioreactor train

Stream number	Stream description	Relation to process units	Relation to other streams Equations refer to mass balance (kg/day)
A1	Raw Wastewater A1	Into Unit 0.1: Primary Setting Tank, Separator	Incoming stream, volume and composition chosen by user.
A2	Raw Wastewater A2	Into Unit 0.1: Primary Setting Tank, Separator	Incoming stream, volume and composition chosen by user. (Optional stream)
A3	Raw Wastewater A3	Into Unit 0.1: Primary Setting Tank, Separator	Incoming stream, volume and composition chosen by user. (Optional stream)
A4	Raw Wastewater A4	Into Unit 0.1: Primary Setting Tank, Separator	Incoming stream, volume and composition chosen by user. (Optional stream)
A	Settled Raw Wastewater	Into Unit 0.2: Splitter	Mixed incoming stream, volume and composition a function of A1-A4, with solids removed. $A = A1-4 - U1$
B1	Settled Raw Wastewater	From Unit 0.2: Splitter Into Unit 1.0: Holding tank	$B1 = A - D2$ Composition same as A, D2.
B2	Supplementary Feed	Into Unit 1.0: Holding tank	Incoming stream, volume and composition set by user. (Optional stream)
B3	Supplementary Feed	Into Unit 1.0: Holding tank	Incoming stream, volume and composition set by user. (Optional stream)
B4	Supplementary Feed	Into Unit 1.0: Holding tank	Incoming stream, volume and composition set by user. (Optional stream)
B	Mixed Inflow Stream	From Unit 1.0: Holding tank Into Unit 1.1: Bacterial Bioreactor	$B = B1 + B2 + B3 + B4$ Composition composite
C1	Bacterial Broth	From Unit 1.1: Bacterial Bioreactor Into Unit 1.2: Separator	$C1 = B + C4 + C5 + C6$ Composition changed from B1
C2	Bacterial Biomass & Product	Main Solids Component from Unit 1.2 Into Separator Unit 1.3	Solids composition similar to Solids in C1. Volume low, wet biomass.
C3	Biomass	From Unit 1.3: Separator Into Unit 1.4: Splitter	Composition changed from C2, Volume also less.
C4	Bacterial Biomass Recycle	From Unit 1.4: Splitter Into Unit 1.1: Bacterial Bioreactor	$C4 = C3 - U2$ Composition same as C3.
C5	CO ₂	From Unit 1.1: Bacterial Bioreactor To Atmosphere	CO ₂ only
C6	H ₂ O	Between Unit 1.1: Bacterial Bioreactor and Atmosphere	H ₂ O only
D1	Improved Compliance Effluent	From Unit 1.2: Separator Into Unit 2.1: Algal Bioreactor	$D = C1 - C2$ 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.
U2	Bacterial Biomass	From Unit 1.4: Splitter Into Unit 4.1: Solids Bioreactor	$U2 = C3 - C4$ Composition based on bacterial biomass
V1	Bacterial Product Stream	From Unit 1.3: Separator Exit system	$V1 = B * \text{Bacterial bioproduct yield coefficient}$ Separation efficiencies Composition as specified by user