# **BIOWIN VERSION 5.3**

## **NEW FEATURES + USABILITY IMPROVEMENTS**

### **GRANULAR SLUDGE SEQUENCING TANK**

A **Granular Sludge Sequencing Tank** (GSST) element is available to represent this process in BioWin configurations. The modeling approach uses BioWin's one-dimensional dynamic biofilm model to mimic the granular sludge. A one-dimensional layered solids flux model is applied for modeling settling of non-granular flocculent mixed liquor solids during unaerated/unmixed periods. These models are integrated with the general ASDM in a variable volume unit that allows various phases of operation to be specified. The GSST model has been developed to balance pragmatic design elements with mechanistic modeling rigor, to provide quick solution times, and typical process performance predictions.



Granule diamete Net TSS Cond Granule TSS mass % TSS in granules Granule settled volume Granule settled volume OUR - Total Air flow rate	r 0.82 mm 5 6.97 kg/m3 5 52963 kg 5 79 % 9 1641.93 m3 9 16.42 % 8.15 mg0/L/hr 2242.90 m3/hr (200, 100)	Ammonia N Nitrate N Nitrite N Soluble PO4-P Volatile suspended solids Total suspended solids Dissolved O2	Centre 31.93 0 27.41 33083 43224 0	Surface 31.93 0 27.39 32915 42118 0 pH	Bulk 7.09 mgN/L 4.38 mgN/L 0.03 mgN/L 6.38 mgP/L 1148 mg/L 1698 mg/L 1.38 mg/L 7.05
Local kinetic parameters Local biofilm parameters Local diffuser parameters	Local settling parameters	GSST			

Most GSST technology implementations employ a repeated batchfed process. The microorganisms responsible for the majority of the carbon, nitrogen and phosphorous removal grow in dense granules rather than conventional activated sludge flocs. These granules settle rapidly, eliminating the need for separate settling tanks. The granules have a layered structure that may be more aerobic on the outside and anoxic or anaerobic towards the centre. This structure allows the granular sludge to simultaneously remove carbon, nitrogen and phosphorous from the wastewater in a single reactor/settler.



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## **NEW FEATURES + USABILITY IMPROVEMENTS**

## **DEFAULT PARAMETER CHANGES**

#### **Biofilm Attachment / Detachment Rates**

Particulate attachment and detachment rates have a major role in establishing biofilm thickness, dynamics, and system activity, similar to SRT in activated sludge. EnviroSim performed numerous model calibrations of these types of systems to measured BOD, ammonia, NO<sub>x</sub> and biofilm growth profiles from full-scale and pilot-scale plants. Through this extensive testing, we have revised the default biofilm attachment and detachment rates.

#### **OHO Dissolved Oxygen Half Saturation Coefficient**

In full-scale systems, lower levels of mixing intensity as well as other non-idealities often result in some degree of denitrification occurring at low DO levels. To reflect this with its default parameter set, in BioWin 5.3 the default OHO  $K_{00}$  has been increased from 0.05 mgO<sub>2</sub>/ L to 0.15 mgO<sub>2</sub>/L.

### **ELEMENT ENHANCEMENT -TRICKLING FILTER**

Hydraulic loading may impact the area available for gas transfer. If the wetting rate is too low then not all of the media will be "wet" so the gas transfer area will be reduced. On the other hand, if the hydraulic loading rate gets too high then it is possible that the air spaces between the media become filled with liquid, which also will reduce the available gas transfer area. The Hydraulic Loading Factor attempts to account for these less-than-optimal conditions. The Hydraulic Loading Factor is determined by a two-sided continuous switching function.

In BioWin 5.3 we improved the continuous switching function of the Hydraulic Loading Factorso that the trickling filter more accurately calculates the available area for gas transfer at extreme low or high loading rates.



## **USABILITY FEATURE**

#### Multiply a Column by a Factor

Users may now multiply a column of values by a factor. This is done by right clicking on the "Value" column and selecting "Multiply column" from the pop-up window. In the example below, the initial state variable concentrations in a variable volume bioreactor are multiplied by a factor of 2 to increase the starting concentrations in the mixed liquor.

	Editing Variable Volume Bioreactor			×
		1	1	1 1
	Dimensions   Operation   Outflow Initia	al values   P	Power   Mode	el   Monitor items
	Initial concentrations		Initial liq	uid hold-up
	C Default G User defin	ned		% of full 65.00
	Selecting "User defined" means the values below 1.) The start of a simulation (if "From seed" is se 2.) Now, if the box below is checked. Set these values now (replacing the current	w will be used elected). nt values when	from: n you dick OK).	
	State variable	Units	Value	1.0
	Ordinary heterotrophic organisms (OHO)	mgCOD/L	1860.000	Сору
	Methylotrophs	mgCOD/L	0.730	Copy All
	Ammonia oxidizing biomass (AOB)	mgCOD/L	35.560	Paste
	Nitrite oxidizing biomass (NOB)	mgCOD/L	20.580	Paste special
	Anaerobic ammonia oxidizers (AAO)	mgCOD/L	0.840	Paste from file
	Polyphosphate accumulating organisms (PAO)	mgCOD/L	0.640	r usce montrine
	Propionic acetogens	mgCOD/L	0.200 P 0.180 N 0.050	Print Ctr
	Methanogens - acetoclastic	mgCOD/L		Multiply column
	Methanogens - hydrogenotrophic	mgCOD/L		maniply column
	Endogenous products	mgCOD/L	623.580	
	Slowly bio. COD (part.)	mgCOD/L	120.930	
	Slowly bio. COD (colloid.)	mgCOD/L	0.200	
	1			1
B Mult	tink column		×	OK Cancel
-	apiy column		~	
Multiply	column			
	column number 2 🚖 Value			
Multiply (				



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