Bioreactor Simulation Report: 8bc3c1c4

Run Information

Timestamp	Final Titer [mg/mL]	Final Biomass [g/L]
2025-10-02 18:56:19	0.07377100269306579	2.8155937195105847

Input Parameters

SIMULATION_PARAMS:

dt	total_time	random_seed
0.5	100.0	42.0

INITIAL_STATE:

X	S_glc	P	DO	pH
0.1	20.0	0.0	100.0	7.2

Kinetics:

- **mu_max**: 0.04
- **Ks_glc**: 0.5
- **Y_xs**: 0.5
- **alpha**: 0.01
- **beta**: 0.0005
- **kd**: 0.005
- **kLa**: 10.0
- **o2_uptake_coeff**: 0.02
- **acid_prod_coeff**: 0.0001
- **acid_from_substrate**: 1e-05
- **buffer_capacity**: 0.025
- **base_dose_mol**: 0.0002
- **pH_setpoint**: 7.2
- **pH_deadband**: 0.05
- **temp_factor**: 1.0
- **agitation_factor**: 1.0

REACTOR_PARAMS:

V0	feed_start_h	feed_rate_g_L_h	feed_glc_conc
2.0	24.0	0.05	400.0

SENSOR_PARAMS:

sensor_noise_sigma	sensor_drift_rate	sensor_dropout_prob
0.001	0.0005	0.0

Faults Injected

type	description	start_h	duration_h	death_rate_multiplier	severity
contamination	Bacterial contamination increasing death rate	72.0	10.0	3.0	5

AI Summary / Troubleshooting

The bioreactor telemetry data indicates a sudden decrease in dissolved oxygen levels and an increase in glucose consumption rates, which are statistically detected anomalies that suggest a potential issue with the cell culture's metabolic activity. Root cause analysis reveals that the primary root cause of these anomalies is likely related to a nutrient limitation or an imbalance in the feeding strategy, categorized as a "Metabolic/Physiological" issue. To address

these anomalies, it is recommended to adjust the feeding schedule to ensure adequate nutrient supply and to monitor the bioreactor's pH and temperature levels to prevent any further deviations from the ideal conditions. The high-level categorization of the root cause is "Cell Culture Metabolic Issue", and immediate actions should be taken to prevent any negative impact on the cell culture's viability and productivity, such as adjusting the feed composition or rate, and closely monitoring the bioreactor's performance to quickly respond to any additional anomalies that may arise.

Telemetry Sample (first 10 rows)

X	S_glc	P	DO	pH	time
2.8093305851262755	28.470421692318645	0.5789813462693417	99.97797778643964	7.34202675060887	0.0
2.3994520656721647	28.156768482119386	0.5764109533212657	100.0	7.354528620360902	0.5
2.055743468224765	27.86401201031397	0.5716416354944516	100.0	7.358569117323557	1.0
1.7547600279400792	27.590452409837162	0.5648070873562565	100.0	7.3694728687019815	1.5
1.517803306741483	27.353845081908474	0.5608442435031468	100.0	7.372327454593688	2.0
1.321764369842385	27.146349743688095	0.5571739324153542	100.0	7.38235156766472	2.5
1.1471582735550128	26.975253757570094	0.5537788954933431	100.0	7.38455406794759	3.0
1.0036911841751455	26.80378689900189	0.5554543714571041	99.99863133598171	7.383575786552655	3.5
0.8902131303291578	26.651302150917488	0.5522708652172865	100.0	7.385494650740161	4.0
0.7889530746217345	26.50176798508764	0.5493345308035364	100.0	7.386936948405591	4.5

Telemetry & Anomaly Plots