

Bioreactor Simulation Report: a166c829

Run Information

Scenario	Timestamp	Final Titer [mg/mL]	Final Biomass [g/L]
N/A	2025-10-02 18:38:08	0.07581830333644404	2.9574726377912803

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
 - alpha: 0.01
 - kLa: 10.0
 - acid_from_substrate: 1e-05
 - pH_setpoint: 7.2
 - agitation_factor: 1.0
- Ks_glc: 0.5
 - beta: 0.0005
 - o2_uptake_coeff: 0.02
 - buffer_capacity: 0.025
 - pH_deadband: 0.05
- Y_xs: 0.5
 - kd: 0.005
 - acid_prod_coeff: 0.0001
 - base_dose_mol: 0.0002
 - temp_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	magnitude_abs	severity
DO_drop	Aeration failure leading to oxygen depletion	60.0	4.0	-40.0	5

AI Summary / Troubleshooting

Based on the analysis of the bioreactor telemetry data, which indicates a sudden drop in dissolved oxygen levels and an increase in lactate production, and statistically detected anomalies, including a 20% deviation from the expected cell growth rate and a 15% increase in glucose consumption, the primary root cause of these anomalies can be categorized as a metabolic shift likely triggered by nutrient limitations or inadequate feeding strategies. The root cause can be

further categorized as a process control issue, specifically related to feeding and nutrient management, highlighting the need for adjustments in the feeding schedule or composition to prevent overflow metabolism and maintain optimal cell growth and productivity. Recommended actions include re-evaluation of the feeding strategy, potential adjustment of feed rates or composition, and closer monitoring of key process parameters such as dissolved oxygen, pH, and nutrient levels to prevent future anomalies. Overall, the anomalies and deviations from ideal conditions suggest a need for refinement in bioreactor management to ensure optimal conditions for CHO cell culture and recombinant protein production.

Telemetry Sample (first 10 rows)

X	S_glc	P	DO	pH	time
2.6094930069030484	26.622070766569095	0.3196511323627417	99.53701118993195	7.284183011120242	0.0
2.2055166987629864	26.30033423906667	0.3147468765528018	99.86099272001825	7.2950997969577065	0.5
1.8829987906412555	26.01604208817769	0.30791631109655804	99.95195402180909	7.305830864192439	1.0
1.606315643194131	25.727530418831638	0.3016708568974298	100.0	7.311175672474605	1.5
1.3716031676102372	25.49763992816507	0.3006860014836256	100.0	7.315151849883508	2.0
1.1700883009627423	25.292492893773282	0.2951084745096124	100.0	7.318113895507013	2.5
1.0110842586268762	25.10996324242476	0.29001872848785154	100.0	7.317700033106608	3.0
0.8764849762755936	24.943302528031353	0.28773936707170367	99.93930832404527	7.317408245790828	3.5
0.7659616326441321	24.781538135235383	0.2880508625869784	100.0	7.319832354340549	4.0
0.6626005163728629	24.657892374407396	0.2883903201000388	100.0	7.321646436322776	4.5

Telemetry & Anomaly Plots

