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## Fedbatch Process

batch process:		
growth rate		0,6 h <sup>-1</sup>
number of doublings		5
Fedbatch process:		
growth rate		0,1 h <sup>-1</sup>
3 doublings in feed phase		3
Final cell mass		250 g

Calculate the total process time, the duration of batch and fed-batch phase and the start cell mass

Be prepared to discuss pro and contra of this type of cultivation compared to batch and continuous mode

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Mathematical derivation of doubling time based on exponential growth function

$$X_1 = X_0 * e^{(\mu t)}$$

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Michaelis Menten kinetics - explain the following statement

$$K_m = [S] \text{ when } V_o = \frac{V_{max}}{2}$$

Reaction order in Michaelis Menten kinetics - zero, first or second order kinetics ? Explain and describe which type is valid under which condition.

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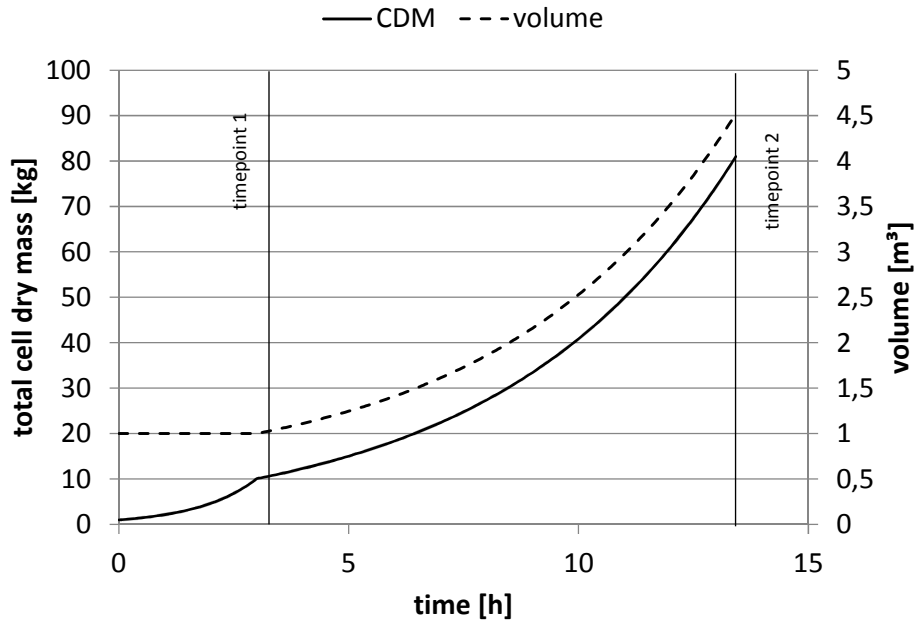


Figure xx: Courses of total CDM and volume in an *E. coli* cultivation in a bioreactor, the glucose yield coefficient in this process is 0,3 g/g

Give a detailed description of the process shown in the Figure - what information can be derived from the figure (which type of process, duration, cell density....?)

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Calculate all missing values – a task that should be easy as this example is from basics in process engineering. To make it a little bit more challenging – you should optimize the process in order to reduce the total process time – what is possible?

Keep in mind that there are limitations - which limitations can occur?

You will have to defend your results – maybe colleagues of you do not believe in your strategy

biomass batchstart (inoculum)	[kg]	4
number of doublings in batch		
growth rate in batch	[h <sup>-1</sup> ]	
batch duration	[h]	8
biomass at end of batch = start of feed	[kg]	
cell density at the end of batch	[g/L]	15
batch volume	[m <sup>3</sup> ]	
number of doublings in feed		4
growth rate in feed	[h <sup>-1</sup> ]	0.2
duration feed	[h]	
final cellmass at the end of the process	[kg]	1200
cell density at the end of process	[kg/L]	0.04
total volume at the end of process	[m <sup>3</sup> ]	
glucose yield coefficient $Y_{x/s}$	[g/g]	0.3
total demand glucose (incl.inoculum)	[kg]	
price glucose	[€/lb]	2.42
cost for glucose in medium	[%]	45
total costs medium	[€]	