

4. VAJA: SIMULACIJA KONTINUIRNEGA BIOPROCESA

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1. OSNOVE

Imamo bioreaktor, kjer je $F_v = F_{iz}$, zato je $\frac{dV}{dt} = 0$. Zaradi poenostavitve predpostavimo idealno pomešanje $c(v \text{ reaktorju}) = c_{iz}$.

$$\frac{d(cV)}{dt} = F_v c_v - F_{iz} c_{iz} \pm rV \quad (\pm \text{ zaradi tega, ker je odvisno ali pišemo bilanco za S ali P})$$

Glede na to, da je v stacionarnem stanju $\frac{d(cV)}{dt} = c \frac{dV}{dt} + V \frac{dc}{dt} = 0$ ($dV=0$, $dc=0$), velja

$$F_v c_v = F_{iz} c_{iz} \pm rV$$

{Example BIOREACT}

{Fermentation in a bioreactor either batch, fedbatch or continuous.}
{The flow rates F0 and F1 need to be set correctly for each reactor type.}

{Flow rates are initially set to zero. They can be switched on by changing their values. A chemostat would have F0=F1, a batch reactor F0=F1=0 and a fedbatch F1=0}

{A steady state X-D curve for a chemostat can be made using the Parametric Run feature, but the statement F1=F0 needs to be activated in the program by removing the brackets. Make sure the steady state is actually reached.}

{Biokinetic parameters}

UM=0.3 {Specific growth rate, 1/h}
KS=0.1 {Monod saturation constant, kg/m3}
K1=0.003 {Non-growth associated product constant, 1/h}
K2=0.008 {Growth associated product constant, kg product/kg biomass}
Y=0.8 {Yield constant, kg biomass/kg substrate}

{Feed and flow conditions}

SF=10 {Substrate conc. in feed, kg/m3}
F0=0.1 {Feed flow rate, m3/h}
F1=0 {Outlet flow rate, m3/h}

METHOD Auto
STARTTIME=0
STOPTIME=50

2. NALOGA

S pomočjo računalniške simulacije kontinuirnega procesa s spreminjanjem D poiskati vrednost, pri kateri izpiramo biomaso, določiti stacionarne vrednosti X in S, ter čas, potreben za vzpostavitev stacionarnega stanja.

3. APARATURA

Računalnik in program Berkeley Madonna.

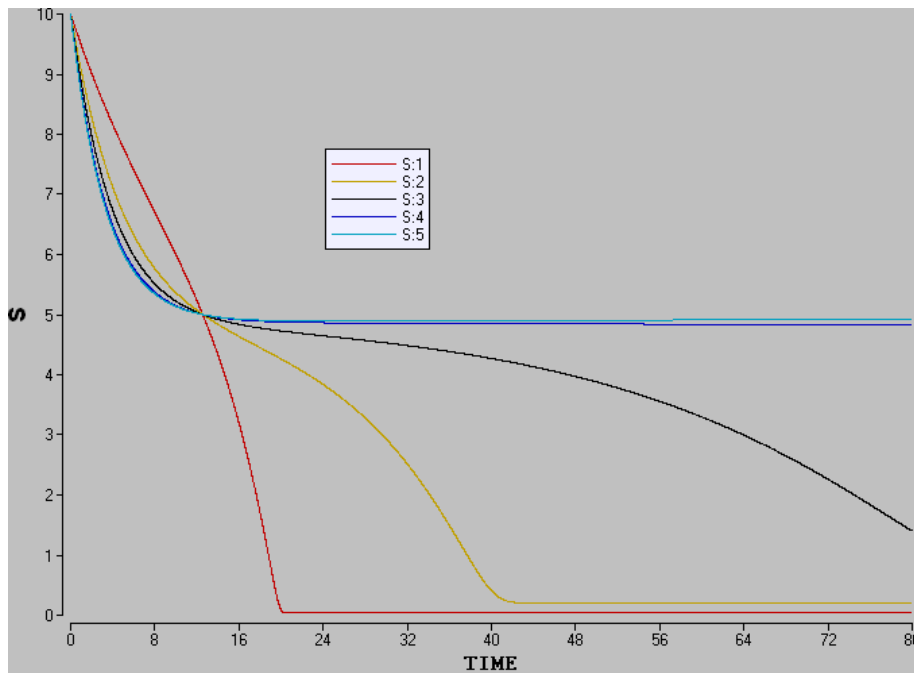
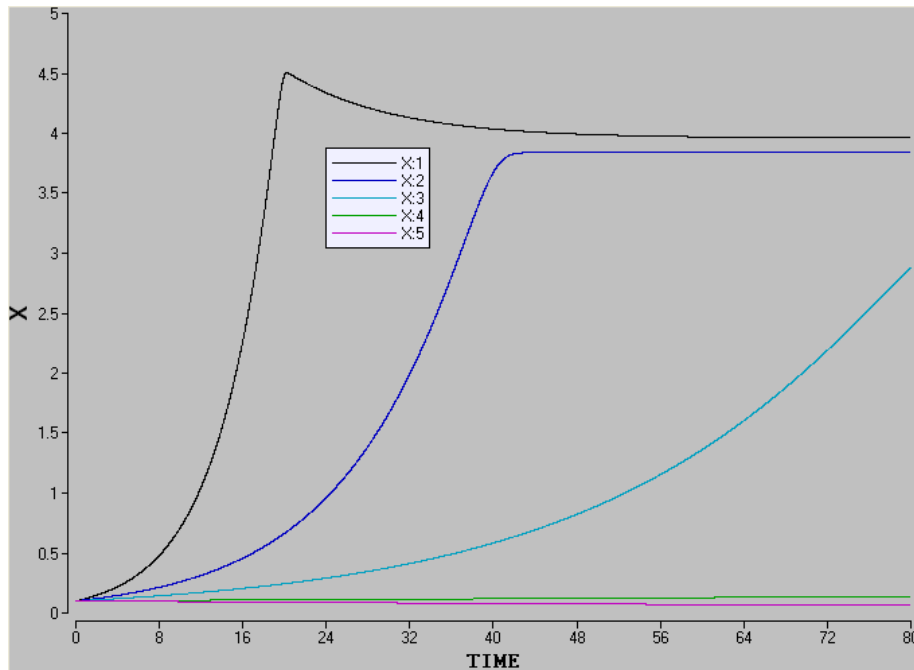
4. MERITVE IN IZRAČUNI

$$F_0 = F_1$$

spreminjali smo F_0 :

krivulja	1	2	3	4	5
$F_0 = F_1 =$	0,1	0,2	0,25	0,29	0,30

Ker je $D = F/V$, smo z večanjem F (pri konstantnem V) torej večali tudi D



Vidimo, da se z večanjem F_0 začne izpiranje biomase (X), najhitreje je to pri $F_0 = 0.3$. Ko pride do izpiranja biomase, pride tudi do izpiranja substrata.