KINETIKA SUPSTRAT-NEODVISNOG RASTA MIKROORGANIZAMA

KINETIKA SUBSTRAT-NEODVISNOG RASTA...

- JAVLJA SE U SLUČAJU KAD JE OVISNOST RASTA O DRUGIM FAKTORIMA JAČA OD DJELOVANJA KONCENTRACIJE SUPSTRATA
- (npr. -SLOBODNI PROSTOR NA NOSAČIMA, -NA POVRŠINI PODLOGE;
- -LIMITACIJA NEPOZNATOM KOMPONENTOM U KOMPLEKSNOM SUPSTRATU)

KINETIKA SUBSTRAT-NEODVISNOG RASTA...

LOGISTIČKA JEDNADŽBA
(1938)

$$\mu = \mu_{max}\left(1 - \frac{X}{X_{max}}\right) \qquad 6\text{-}1$$

X = broj uništenih tr. jedinica !!!

CUI Q. i LAWSON G.J.

(*J.Theor. Biol*. 98, 645,1982)

$$\mu = \mu_{max} * X * \frac{1 - \dfrac{X}{X_{max}}}{1 - \dfrac{X}{X_{lim}}} \qquad 6\text{-}2$$

X/X_{lim} = (0....1) uspješnost korištenja supstrata

CUI Q. i LAWSON G.J.

(*J.Theor. Biol*. 98, 645,1982)

U sažetku originalnog rada (http://www.sciencedirect.com/)

$$\frac{dX}{dt} = \frac{\mu_c X\,(1\;-)\,\frac{X}{X_m}}{1-\frac{X}{X'_m}}$$

Integralni oblik: ??

$$\ln\frac{X}{X_o} - \ln\frac{X_m - X}{X_m - X_o} + \frac{X_m}{X'_m}\,\frac{X_m - X}{X_m - X_o} = \mu_c(t - t_o)$$

FRAME KELLY K. i HU W.S.

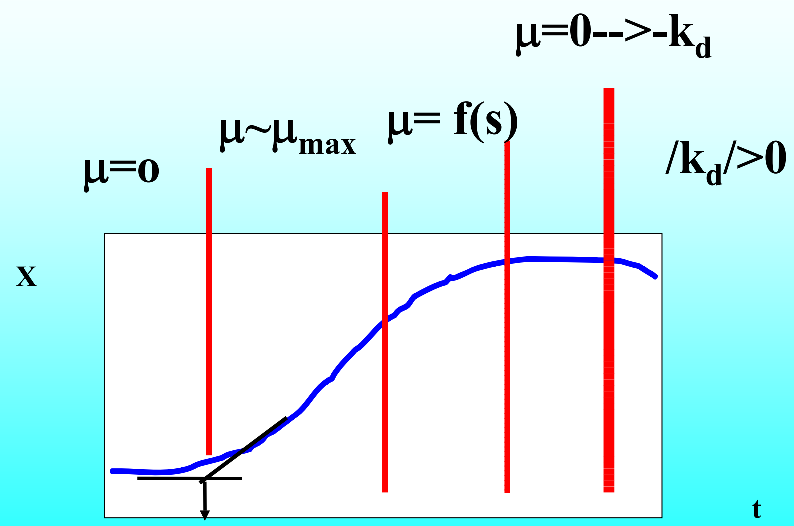
(*Biotech. Bioeng*. 32, 1061, 1988)

$$\mu = \mu_{max} * (1 - e^{-K(\frac{Xmax - X}{X}})) \qquad 6\text{-}3$$

problem prostornog ograničenja na slobodnoj površini u kulturi tkiva.

PRIMJENA MONOD-ove KINETIKE NA LAG-FAZU I STACIONARNU FAZU

Klasični tok krivulje rasta...



LODGE R.M.i HINSHELWOOD C.N. (*J. Chem. Soc.* 213, 1943)

HINSHELWOOD C.N. (*The Cem. Chin. of Bact. Cell* , Oxford Clarendon Press1946)

$$t_L = t - \frac{2,3}{\mu_{max}} * \log \frac{X}{Xo} \qquad 6\text{-}4$$

$$X = Xo * e^{\mu(t-tL)}$$

dalje...

$$t_L = \frac{K}{No - K}$$

No = početni ukupni broj

EDWARDS V.H.

(*Biotech. Bioeng.* 11, 99, *1969*)

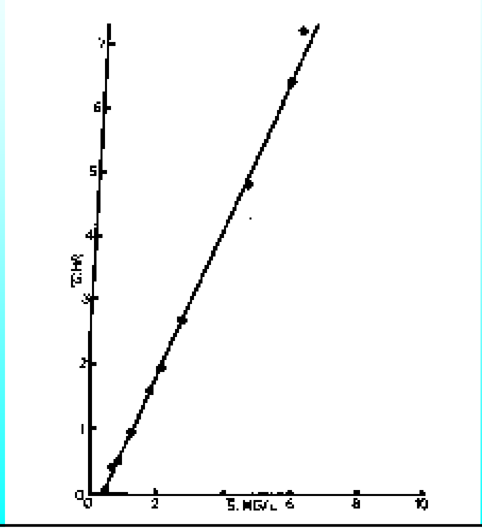
$t_L = 1.16 (S - 0.4)$ 6-5

Studij djelovanja maltoze na rast *Klebsiella aerogenes* u prisustvu glukoze (represija-diauksija), S = konc. glukoze!!- vidi graf

EDWARDS V.H.

(*Biotech. Bioeng.* 11, 99, *1969*)

trajanje lag faze



s= glukoza

BERGTER F. i KNORRE W.

(*Z. Algem. Biol.* 8, 613, 1972)

$$\mu = \mu_{max} * \frac{S}{Ks + S} * (1 - e^{-t/tL}) \quad 6\text{-}6$$

U LAG FAZI SU STUDIRANE TRANSKRIPCIJE RNA I REGULACIJA ENZIMA

DOGAĐAJ JE KOMPLEKSAN PA JE ZA DETALJNI OPIS POTREBNO IMATI STRUKTURIRANE MODELE

PAMMENT i sur. (*Biotech. Bioeng.* 20(11), 1375, 1978)

KENDALL D.G. (*J. Royal Stat. Soc.* B11, 230,1949)

$$\mu = \mu_{max} X \left(1 - \frac{X}{X_{max}}\right) \quad 6\text{-}7$$

Uzgoj *Chaetomium cellulolyticum* na piljevini

- STAC. F., SEK. METABOLITI

KINETIKA ENDOGENOG METABOLIZMA I ODUMIRANJA

PRETPOSTAVKA: POSTOJI POTREBA U STANICI ZA ODRŽAVANJEM SUSTAVA (OSMOTSKA BARIJERA, TRANSMEMBRANSKI POTENCIJAL, POPRAVKE DNA, ODRŽANJE MINIMALNE RNA, KONST. ENZIMI..). SUPSTRAT SE TROŠI I ZA TE SVRHE A NE SMAO ZA RAST MASE.

PIRT S.J.

(*Proc. Roy. Soc. B 163, 224, 1975*)

$$S \xrightarrow{\mu} X_v \xrightarrow{k_d} X_d$$ **model M-1**

S → X
S → metabolizam **model M-2**

za M-2 :

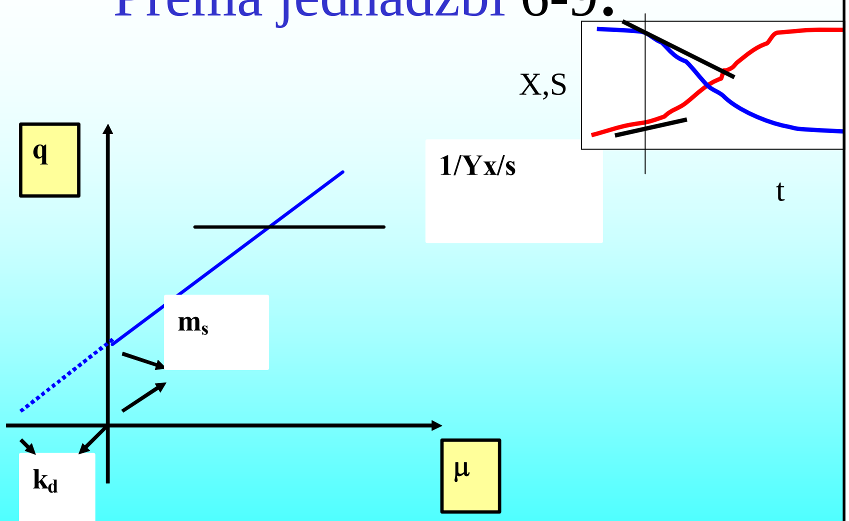
$$\frac{dS}{dt} = -\frac{1}{Y_{x/s}} * \mu X - m_s X \qquad 6\text{-}8$$

$$q_s = \frac{1}{Y_{x/s}} * \mu + m_s \qquad 6\text{-}9$$

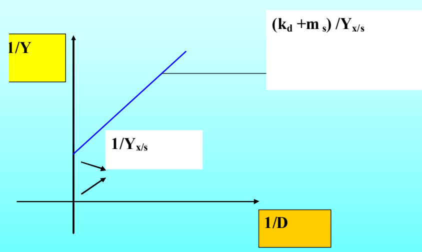
$$m_s = -\left(\frac{1}{X} * \frac{dS}{dt}\right)_e \quad \text{ENERG. ODRŽAVANJA}$$

$$\frac{dX}{dt} = \mu * X \quad / \, m_s = \text{konstanta} / \qquad 6\text{-}10$$

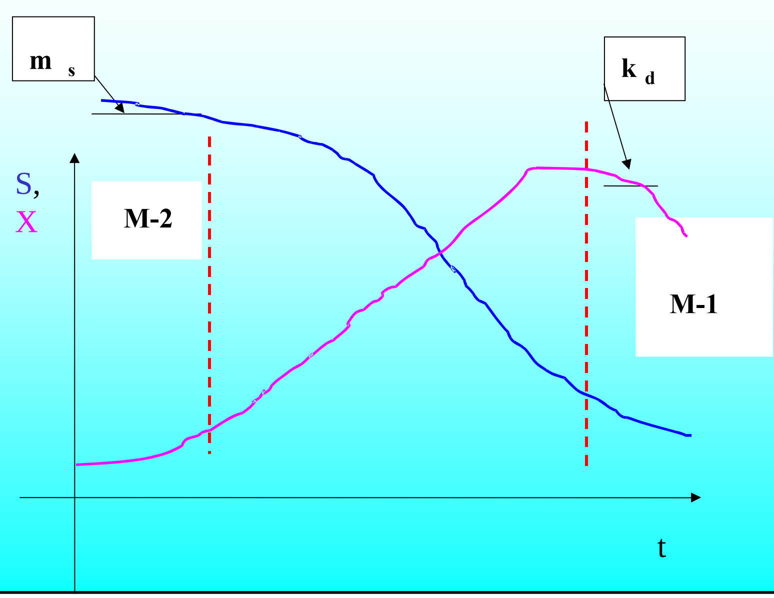
Prema jednadžbi 6-9:



ZA KONTINUIRANI UZGOJ:



određivanje u pokusu..



CHIU Y.S.i sur.

(*Biotechnol. Bioeng.14,179, 1972)*

k_D reprezentira endogeni metabolizam (m_s) !!!

$$k_D = -\frac{1}{X} * (\frac{dX}{dt})_D \qquad 6\text{-}13$$

$$\frac{dX}{dt} = (\mu - k_D)X \qquad 6\text{-}14$$

$$\frac{dS}{dt} = \frac{1}{Yx/s} * \frac{dX}{dt} \qquad 6\text{-}15$$

HUMPHREY A.E.

(*Am.Chem. Soc.Symp.Ser., 72, 1978*)

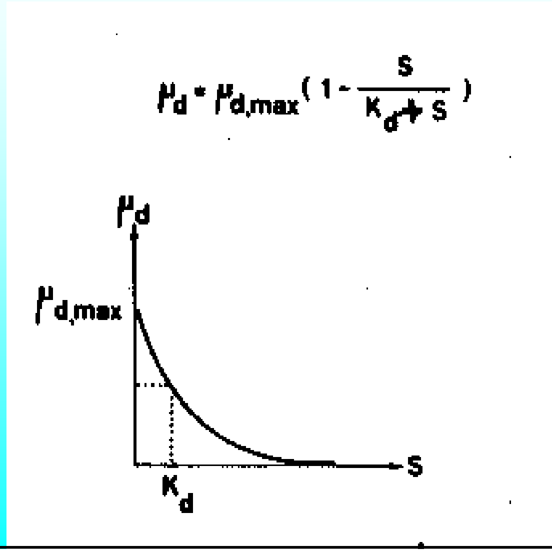
$$\mu_d = \mu_{d\ max} * (1 - \frac{S}{K_d + S}) \qquad 6\text{-}10$$

gubitak supstrata je krivac za "smrtnost"

$\mu_D = k_D$!!!

HUMPHREY A.E.

(*Am.Chem. Soc.Symp.Ser., 72, 1978*)



GUTHKE R. (ZIMET 1,30, 1980)

Zentralinstitut für Mikrobiologie und experimentelle Therapie

$$m_s = m_{smax} * \left(\frac{S}{K_e + S}\right) \qquad 6\text{-}11$$

GUTHKE R. (ZIMET 1,39, 1982)

$$S \nearrow Xv \text{----->} Xd, \quad S \searrow \text{metabolizam}$$

model M-3

$$\frac{dX}{dt} = (\mu - k_d) * X$$ /k_d nije konstanta/ 6-12

$$\frac{dS}{dt} = -\frac{1}{Y_{x/s}} * \mu X - m_s X$$ /m_s nije konstanta/ 6-13

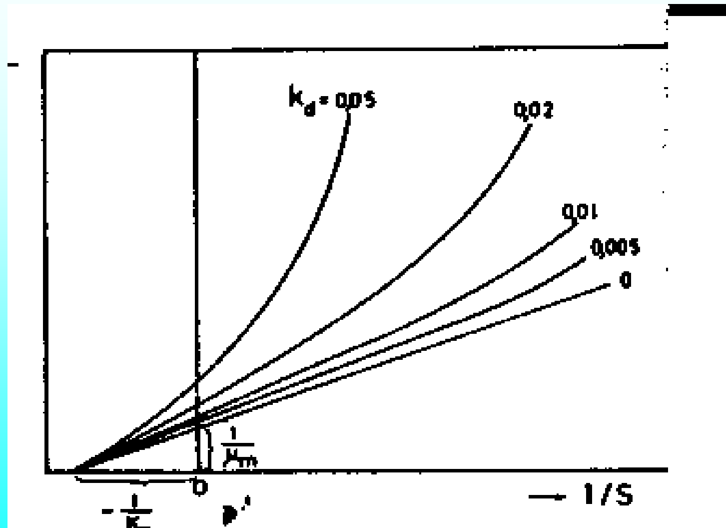
(ovisne o konc. S)

MOSER A. i STEINER W.(1975)

$$\frac{1}{\mu + k_d} = \frac{K_s}{\mu_{max}} * \frac{1}{S} + \frac{1}{\mu_{max}} \qquad 6\text{-}14$$

$$\mu = \mu_{max} \frac{S}{Ks + S} - k_d$$

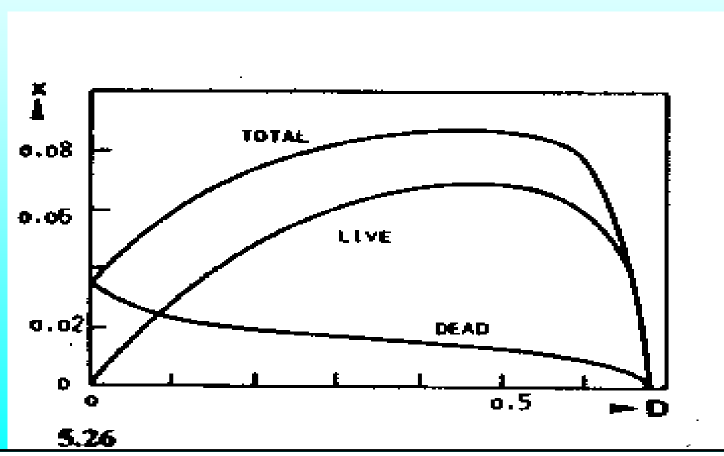
MOSER A. i STEINER W.(1975)



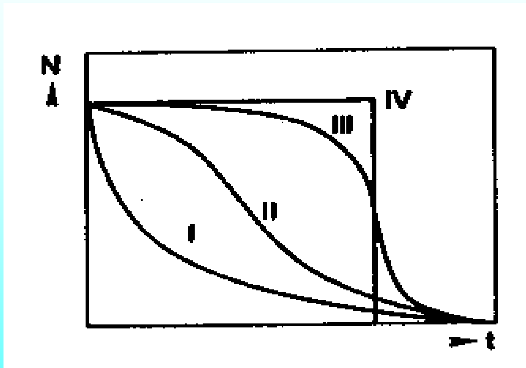
SINCLAIR C. G. i TOPIWALA H.H.

(*Biotechnol. Bioeng. 12, 1069,1970*)

$$k_d = k_d^o + k_e \qquad 6\text{-}15$$



SINCLAIR C. G. i TOPIWALA H.H.



I- **eksponencijalno umiranje**
II- **"nejednolikost u populaciji"**
III- **"nejednolikost u populaciji"**
IV- **"smrt odmah nakon dostignute kritične veličine"**