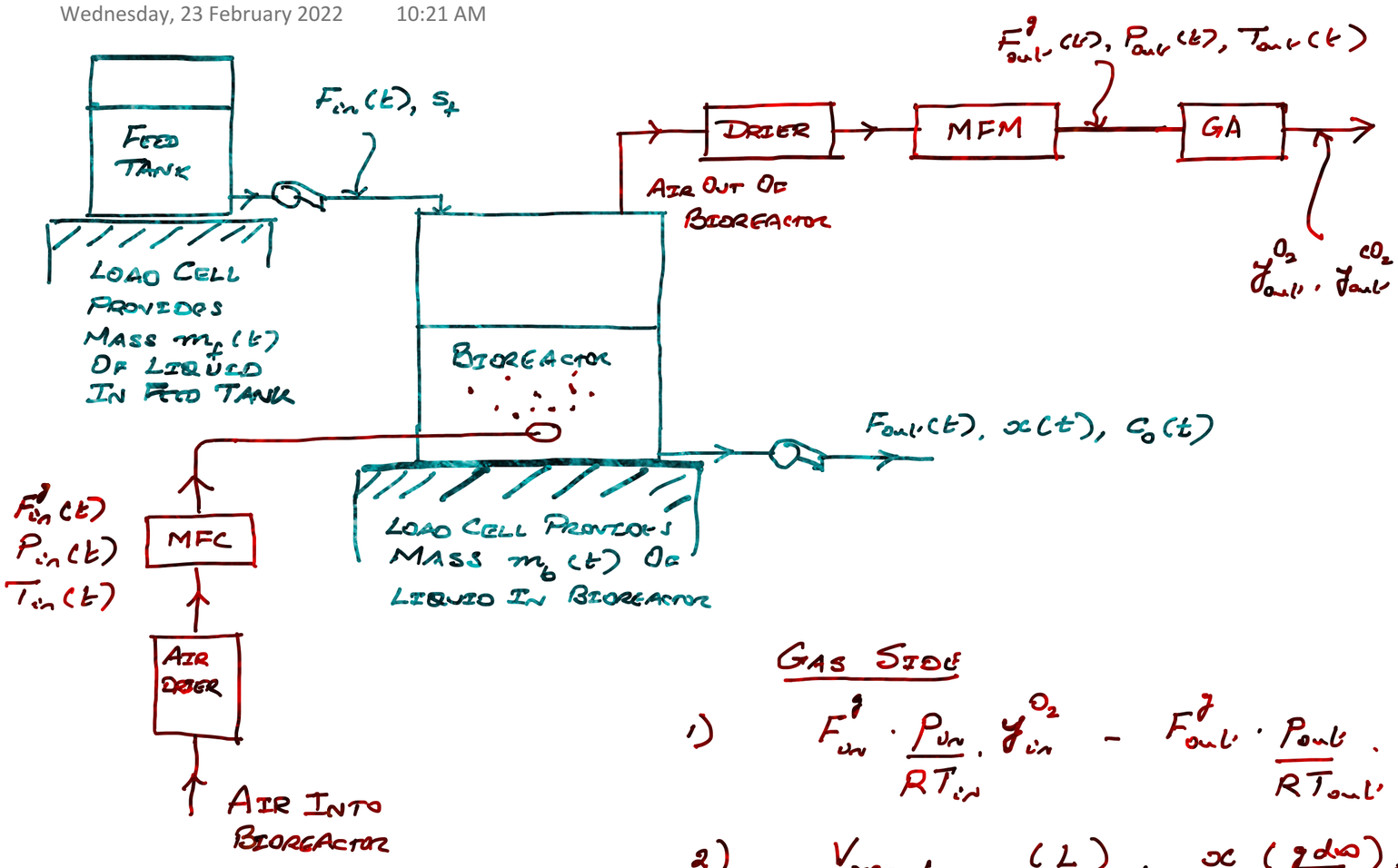
Bioreactor setup

Wednesday, 23 February 2022 10:21 AM



GAS SIDE

1) $F^g_{in} \cdot \frac{P_{in}}{RT_{in}} \cdot y^{O_2}_{in} - F^g_{out} \cdot \frac{P_{out}}{RT_{out}} \cdot y^{O_2}_{out} \cdot \frac{\text{mols } O_2}{h}$

2) $V_{reactor}$ (L), x ($\frac{gdw}{L}$), F_{in} ($\frac{L}{h}$).

3) $R_{O_2} \frac{\text{mols } O_2}{h - L} = \frac{(1)}{V_{reactor}}$

$r_{O_2} \frac{\text{mols } O_2}{gdw - h} = \frac{R_{O_2}}{x} \frac{(\frac{\text{mols}}{h - L})}{(\frac{gdw}{L})}$

$r_{CO_2} \frac{\text{mols } CO_2}{gdw \cdot h} = \frac{R_{CO_2}}{x}$.

4) $Y_{xO_2} \triangleq \frac{r_{O_2}}{\mu} \frac{(\frac{\text{mols}}{h \cdot gdw})}{(\frac{gdw}{h \cdot gdw})}$

$= D \triangleq \frac{F_{in}}{V_{reactor}}$

$0 = \frac{dx}{dt} = \underbrace{\mu x}_{\frac{gdw}{h - L}} - Dx$

$\mu \times x$

$\frac{gdw}{h \cdot gdw} \quad \frac{gdw}{L}$

Similarly,

$Y_{xc,CO_2} \triangleq \frac{r_{CO_2}}{\mu} = \frac{r_{CO_2}}{D}$.

5) $Y_{xs} \triangleq \frac{r_S}{\mu} \cdot \frac{\frac{g \text{ of substrate}}{h - gdw}}{\frac{gdw}{h - gdw}}$

$= D$

$= \frac{D(S_f - S)/x}{D}$

$= \frac{S_f - S}{x}$

$0 = \frac{dS}{dt} = D(S_f - S) - r_S \cdot x$

$\Downarrow$

$r_S = \frac{D(S_f - S)}{x}$

6) $Y_{xp} \triangleq \frac{r_p}{\mu}$

$= \frac{Dp/x}{D}$

$= \frac{P}{x}$.

$0 = \frac{dp}{dt} = \underbrace{r_p \cdot x}_{\frac{gprod}{h - L}} - Dp$

$Y_{xs} S + Y_{xO_2} O_2 + NH_3 \xrightarrow{\mu} X + Y_{xCO_2} CO_2 + Y_{xp} \cdot P$