

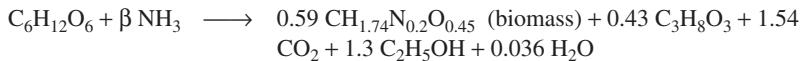
- 7.2.** The growth of baker's yeast (*S. cerevisiae*) on glucose may be simply described by the following equation:



In a batch reactor of volume  $10^5$  l, the final desired yeast concentration is 50 gdw/l.

Using the above reaction stoichiometry:

- Determine the concentration and total amount of glucose and  $(\text{NH}_4)_2\text{SO}_4$  in the nutrient medium.
  - Determine the yield coefficients  $Y_{X/S}$  (biomass/glucose) and  $Y_{X/O_2}$  (biomass/oxygen).
  - Determine the total amount of oxygen required.
  - If the rate of growth at exponential phase is  $r_x = 0.7$  gdw/l-h, determine the rate of oxygen consumption (g  $\text{O}_2$ /l-h).
  - Calculate the heat-removal requirements for the reactor (recall eq. 6.26).
- 7.3.** The growth of *S. cerevisiae* on glucose under anaerobic conditions can be described by the following overall reaction:



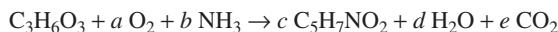
- Determine the biomass yield coefficient  $Y_{X/S}$ .
  - Determine the product yield coefficients  $Y_{\text{EtOH}/S}$ ,  $Y_{\text{CO}_2/S}$ ,  $Y_{\text{C}_3\text{H}_2\text{O}/S}$ .
  - Determine the coefficient  $\beta$ .
- 7.4.** Aerobic growth of *S. cerevisiae* on ethanol is simply described by the following overall reaction:



- Determine the coefficients  $a$ ,  $b$ ,  $c$ , and  $d$ , where RQ = 0.66.
  - Determine the biomass yield coefficient,  $Y_{X/S}$ , and oxygen yield coefficient,  $Y_{X/O_2}$  (gdw/g  $\text{O}_2$ ).
- 7.5.** Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by the following reaction.



- Determine  $a$ ,  $b$ ,  $c$ ,  $d$ , and  $e$  if RQ = 0.9.
  - Determine the yield coefficients,  $Y_{X/S}$  and  $Y_{X/O_2}$ .
  - Determine degree of reduction for the substrate and bacteria.
- 7.6.** Aerobic degradation of an organic compound by a mixed culture of organisms in waste water can be represented by the following reaction.



- Determine  $a$ ,  $b$ ,  $c$ ,  $d$ , and  $e$ , if  $Y_{X/S} = 0.4$  g X/g S.
- Determine the yield coefficients  $Y_{X/O_2}$  and  $Y_{X/\text{NH}_3}$ .
- Determine the degree of reductions for the substrate, bacteria, and RQ for the organisms.