BBL433, Enzyme Science and Engineering

Minor II 15 marks

Attention: You need to solve these two problems in a white sheet, submit the photo of the same by email. The below problem is unique to every students, the last two digit in Entry no is used as variable for solving. E.g., For an entry number 2017BB10020, XX is 20. Please use your own XX for solving the problem.

Deadline for submission for graduating students: 9th July 2020
Deadline for submission for others : 17th July 2020

1. Penicillin G is hydrolyzed with immobilized penicillin G acylase (PGA) from Bacillus megaterium in order to produce the β lactam nucleus 6-aminopenicillanic acid (6APA). CPBR and CSTR configurations have been proposed for the treatment of 100 g/L of penicillin G potassium salt ($C_{16}H_{17}KN_2O_4S$) solution. The product 6APA is a competitive inhibitor for PGA. The michaelis constant for penicillin G is 0.XX M and the 6APA inhibition constant is 0.25 M. Both the reactors are loaded with equal amount of enzyme and volume of the reactors are 2000 L and substrate is fed at 100 L/hr. $V_{max}$ = 30 mmol/L/hr. Calculate the state state conversion achieved in both the reactors and discuss the result. (7.5)

2. Invert sugar is produced from sucrose using two continuous reactor in series, both of them 5000 L in volume and immobilized with same amount of catalyst. A syrup with 200 g/L of sucrose is fed at a flow rate of XX L/hr. Mol wt sucrose = 342.3 g/mol. The kinetic parameters of the enzyme are $V_{max}$ = 200µm/L/min and $K_m$ = 68.5 mM.
   a. If one of the reactors is PBR and the other is CSTR, determine the right sequence of reactor (for maximum conversion).
   b. In what fraction the flow rate has to be adjusted in the second reactor to increase the performance of unfavorable sequence equal to the favorable sequence determined in part a.

   Hint: Remember when you solved for mass balance in CSTR and PBR the integration limit for conversion is zero to X. It is not the case here. (7.5)