CHE 304

Transport Phenomena III

Quiz # 3

Name

ID #

Air (Component B) flows in a concentric cylinder. The diameters of the cylinders are D_1 and D_2. The inner surfaces of both cylinders are coated with Naphthalene (Component A) layer which has sublimation pressures of P_{As}. The partial pressure of Naphthalene is P_{Ai} at the inlet of the cylinder and P_{Ao} at the outlet of the cylinder. The cylinder length is L. Write the governing mass transfer equations for Naphthalene and state all assumptions. Also, write appropriate boundary conditions to solve for the composition profile of Naphthalene.
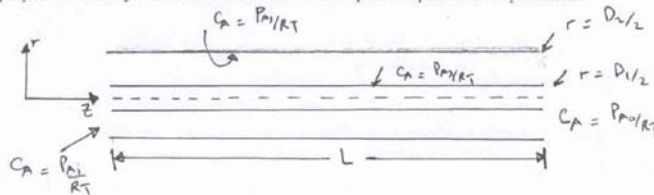
A: Naphthalene , B: Air

Assumptions: 1) S.S. , 2) No rxn , 3) No variation of C_A in the θ-direction

4) Constant T and P , 4) Constant D_{AB}.

M.B. For comp. A:

$$\frac{\partial^2 C_A}{\partial r^2} + \frac{1}{r}\frac{\partial C_A}{\partial r} + \frac{\partial^2 C_A}{\partial z^2} = 0$$

Boundary Conditions

1) $r = D_1/2$, $C_A = \dfrac{P_{Ai}}{RT}$

2) $r = D_2/2$, $C_A = \dfrac{P_{As}}{RT}$

3) $z = 0$, $C_A = \dfrac{P_{Ai}}{RT}$

4) $z = L$, $C_A = \dfrac{P_{Ao}}{RT}$