HW4_4

February 23, 2022

1 HW 4

1.1 Problem 4

Determine average diffusivity using the Higbie model,

$$k_c = 2\sqrt{\frac{D_{AB}}{\pi t_c}}$$

or

$$D_{AB} = \pi t_c \frac{k_c^2}{4}$$

where

$$k_c = \frac{N_A}{c(x_{A_i} - x_{A_b})} = \frac{N_A}{c_{A_i} - c_{A_b}}$$

t_c is found by

$$t_c = \frac{V}{\dot{v}}$$

N_A is found by dividing the rate of absorption by the surface area of the stream. c_{A_i} is given as the solubility and $c_{A_b} = 0$

```python
import numpy as np
flowRate = np.array([.143,.568,1.278,2.372,3.571,5.143])    #cm3/sec
absorb = np.array([1.5,3,4.25,6.15,7.2,8.75])               #mol/sec
absorb = absorb*10**-6
d = 1                                                        #diam cm
l = 7                                                        #len cm
cai = 100/1000000                                            #conc␣
 ↪at interface mol/cm3
V = np.pi*d**2/4*l                                           #vol of␣
 ↪jet cm3
tc = V/flowRate                                              #cont␣
 ↪time s
A = np.pi*d*l                                                #surf␣
 ↪area cm2
flux = absorb/A                                              #NA mol/
 ↪cm2/sec
```

```
kc = flux/cai                                                            #coeff␣
    ↪cm/sec
DAB = np.pi*tc*kc**2/4
print(np.average(DAB))
```

1.3550868117475628e-05

$D_{AB_{avg}} = 1.355e - 5$