**Test Case 1:**

Lo-Cat is a gas treating process that removes hydrogen sulfide out of gas streams and converts to solid sulfur. In this process, chelated iron Fe(3+) EDTA solution is used as a reactant. A simple representation of the reaction is

H2S(g-l) + 2Fe+++ 🡺 2H+ + S0 + 2Fe++

Find the rate of absorption of H2S for the following process conditions. Partical pressure of H2S in the gas phase = 0.05 atm, concentration of Fe+++ in the liquid = 60 mol/m3

The kinetic parameters and physico – chemical properties are as follows:

DA = 1.44 x 10-9 m2/s DB = 0.54 x 10-9 m2/s

Henry’s law constant = 1950 Pa m3/mol

Reaction rate constant = 9 m3/mol s

The mass tranfer coefficient kL = 2 x 10-4 m/s for liquid film

Ignore the effect of gas side resistance as an approximation.

Solution

 = 2.56 mol/m3





(note ν = 2 here) All units are in S.I. here and therefore consistent. Solving Eq. (6) for bi, iteratively one finds bi = 0.5085. Hence the concentration of Fe+++ at the interface is only 50% of that in the bulk liquid.

Hence the enhancement factor is



Rate of absorption of H2S = φ kL A\*

= 3.12 x 2 x 10-4 x 2.56 = 0.0016 mol/m2s

Differential equations are as follows:

Boundary conditions:

X = 0, , (non-volatile liquid)

X = , ,