Piriya Itsariwan 2014: Mass Transfer Correlation in a Reactor for H_2S Removal and Degradation of Iron EDTA Complex Solution. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Sunun Limtrakul, D.Sc. 122 pages.

The H_2S removal process via iron chelate solution consists of two steps; the removal reaction step in the riser and the solvent regeneration reaction step in the downcomer. An auto-circulating reactor is appropriate for H_2S removal due to the advantage of combining the two reaction step in a single reactor. Reactor analysis and design require kinetic and mass transfer information. The intrinsic kinetics were obtained from experimental data in a stirred cell type of reactor. The intrinsic kinetic rates are $-r_1 = 16.70 C_{H_2S} C_{Fe^{3+}}$ and $-r_2 = 0.166 C_{O_2} C^2_{Fe^{2+}}$ for removal and regeneration reactions, respectively, in S.I. units. These data were then used to measure the interfacialareas and the mass transfer coefficients of the liquid phase in an auto-circulating reactor for both removal (riser) and regeneration (downer) conditions. The correlations of interfacial areas in the riser and downcomer are $a_{rs} D_{rs} = 0.02\, Re_{rs}^{0.99}\, Re_{dn}^{0.03}$ and $a_{dn} D_{dn} = 0.11 Re_{rs}^{0.03}\, Re_{dn}^{0.65}$, respectively. Furthermore the correlations of the liquid phase mass transfer coefficients of H_2S in the riser and O_2 in the downcomer are $Sh_{rs} = 3.49\, Re_{rs}^{1.01}\, Re_{dn}^{0.08}$ and $Sh_{dn} = 5.07\, Re_{rs}^{0.11}\, Re_{dn}^{0.81}$, respectively. The data and the correlations reported here would be useful for design and scale-up of this type of reactor. Moreover, the effect of types of buffer solution on the degradation of Fe-EDTA solution was investigated. The results show that Fe-EDTA complex solution is partially degraded to μ-oxo dimer, [Fe(III)-EDTA-O-Fe(III)-EDTA]$^{4-}$ and other Fe-EDTA complex such as Fe(III)-NTA, Fe(III)-ED3A and Fe(III)-IDA in the removal and regeneration steps. The degradation of Fe-EDTA solution in the system using sodium citrate as a buffer solution is minimum comparing to using tris-(hydroxymethyl) aminomethane, and sodium hydroxide.

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