CO2 Mass transfer model for carbonic anhydrase-enhanced aqueous MDEA solutions

In this study a CO2 mass transfer model was developed for carbonic anhydrase-enhanced MDEA solutions based on a mechanistic kinetic enzyme model. Four different enzyme models were compared in their ability to predict the liquid side mass transfer coefficient at temperatures in the range of 298 to 328 K, solvent concentrations in the range 15 to 50 wt%, CO2 partial pressures up to 50 kPa, solvent loading between 0 and 0.5 mole CO2 per mole MDEA and enzyme concentrations up to 8.5 g/L. The reversible Michaelis Menten model (MR) and the simplified model with product inhibition by the bicarbonate ion (SP) were able to predict the mass transfer with an absolute average relative deviation of less than 15%. The MR model could account for every influence (solvent concentration, temperature, solvent loading, CO2 partial pressure) of the different process conditions on the mass transfer, whereas the SP model is limited to applications with low CO2 partial pressure such as CCS from coal burning power plants. Two other models that were also investigated are not suitable for implementation into an absorber column simulation, as they cannot describe the influence of changing solvent loading on the mass transfer.

General information

State: Published
Organisations: Department of Chemical and Biochemical Engineering, CERE – Center for Energy Resources Engineering, PROSYS - Process and Systems Engineering Centre, KT Consortium
Pages: 197-208
Publication date: 2018
Peer-reviewed: Yes

Publication information

Journal: Chemical Engineering Journal
Volume: 335
ISSN (Print): 1385-8947
Ratings:
  BFI (2018): BFI-level 2
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 2
  Scopus rating (2017): CiteScore 7.01
  Web of Science (2017): Impact factor 6.735
  Web of Science (2017): Indexed yes
  BFI (2016): BFI-level 2
  Scopus rating (2016): CiteScore 6.34
  Web of Science (2016): Impact factor 6.216
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 2
  Scopus rating (2015): CiteScore 5.68
  Web of Science (2015): Impact factor 5.31
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): CiteScore 4.92
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 1
  Scopus rating (2013): CiteScore 4.59
  Web of Science (2013): Impact factor 4.058
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): CiteScore 3.92
  Web of Science (2012): Impact factor 3.473
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 1