DEGRADATION AND KINETICS STUDY OF ABSORPTION OF CO_2 IN ALKANOLAMINES

Rahul Bhosale[1,2] and Vijaykumar V. Mahajani[1]
[1]Chemical Engineering Department
Institute of Chemical Technology (ICT)
Mumbai – 400019
[2]Chemical and Biological Engineering Department
South Dakota School of Mines and Technology
Rapid City, SD 57701

ABSTRACT

Higher level of CO_2 in the environment is one of the major causes for global warming. Currently the concentration of CO_2 in the environment is 384 ppmv, and environmentalists predict that it will reach to 450-550 ppmv by the end of year 2050. The drastic increase in CO_2 levels is due to emissions from various industries, for instance, the chemical industry. To mitigate CO_2 emissions, processes such as adsorption, membrane separation, and chemical absorption-regeneration process (CARP) are conventionally followed. Of all of these, CARP, which involves absorption of CO_2 in alkanolamines, is potentially attractive because of higher absorption capacity and subsequent ease of solvent regeneration. However, during solvent regeneration, the degradation of alkanolamines in the presence of CO_2 is unavoidable. As an attempt to investigate more stable solvents, accelerated degradation studies were performed in a high pressure reactor at 150 ^oC over six industrially used alkanolamines. Thermal stability of these alkanolamines was compared based on % degradation observed during the course of solvent regeneration. Based on these results, monoethanolamine (MEA) and ethylaminoethanol (EAE) were found to be more stable than other alkanolamines. Effectiveness of these stable solvents was analyzed in terms of CO_2 absorption capacity, and the kinetics of the process was studied in a stirred cell reactor. Though MEA is mostly used in chemical industries for CO_2 absorption, we observed that EAE is a better solvent exhibiting slightly higher absorption rates. Experimental findings of degradation and kinetics study will be presented in detail.