



1st Post Combustion Capture Conference

Oxidative Degradation of 2-Amino-2-Methyl-1-Propanol

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1. Introduction

An amine based absorption-desorption process is generally accepted as the work horse of post-combustion CO₂ removal. Amine degradation during flue-gas clean-up is an issue of concern¹ and current investigations. 2-amino-2-methyl-1-propanol (AMP), as well as the blends of AMP and other amines are claimed to offer advantages over conventional alkanol amine solvents² and appear to be commercially attractive absorbents for CO₂ capture from fossil fuel fired flue gas. Although oxidative degradation of amines has been reported in the literature³, details are unclear and most of the studies have focused on traditional amines (i.e. MEA). Limited information is available concerning the oxidative degradation of AMP⁴. This study addresses oxidative degradation of AMP in the context of current amine degradation schemes.

2. Materials and Methods

All the chemicals used in this work were purchased from Sigma-Aldrich and used as received. The oxidative degradation experiments were performed in a 200mL glass autoclave with a stainless lock. The amines were degraded under pure oxygen (0.25-0.35 MPa) atmosphere at 100-140 °C for 384 hours while periodic samples were taken. Amine concentration in degraded samples was determined by cation-exchange chromatography (IonPac SCG1 with SCS1, mobile phase: 3mM MSA). Degradation products were identified by gas chromatography-mass

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spectrometry (GC-MS; column: DB-5MS, from 110 °C, hold for 1 minute and then temperature increase to 220 °C at a rate of 5 °C/min), gas chromatography-flame ionization detector (GC-FID; column: DB-FFAP, from 80 °C, hold for 1 minute and then temperature increase to 230 °C at a rate of 10 °C/min) and anion-exchange chromatography (IonPac AG15 with AS15, mobile phase: 10mM KOH for 4min and then stepped to 60mM at 9min).

3. Results and Conclusion

The oxidative degradation rate of AMP was close to that of N-methyldiethanolamine (MDEA) but less than that of monoethanolamine (MEA) under identical conditions. Various carboxylates, ammonia, acetone, 2,4-lutidine and 4,4-dimethyl-2-oxazolidone were the main degradation products of AMP. Degradation schemes will be proposed in terms of the identified products. The results indicate that the oxidative degradation resistance of AMP is not as high as expected according to the electron abstraction mechanism⁵. Furthermore, steric hindrance in AMP does not prevent oxazolidone formation. CO₂ is a further product formed during oxidative degradation of AMP.

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