



Purification of aqueous amine solvents used in post combustion CO₂ capture: A review

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ABSTRACT

The degradation of aqueous amine solvents used in CO₂ capture causes increasing costs and deterioration in long term performance. A very broad range of degradation products, formed by exposure of the amine solution to heat, oxygen and strong acids, have been reported over the past 50 years. To date, industry has generally relied upon purging, filtration, neutralization and thermal reclaiming to reduce the impact of these impurities. However, the high levels of oxygen, SO_x and NO_x in post combustion acid gas capture will mean that other technologies are likely to be more successful. These methods include ion exchange and electrodialysis. This paper will review the major degradation routes leading to corrosive and undesirable by-products as well as the main techniques reported in the literature to reduce the impact of the degradation products on the amine strength.

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1. Introduction

The increasing levels of carbon dioxide (CO₂) emissions (Anastasi et al., 1990; Earth System Research Laboratory, 2010) due to fossil fuel combustion have been demonstrated as a cause of climate change and a global average temperature rise (Le Treut, 2003; Marchal and Chappellaz, 2004; Michard, 2008). As one approach to greenhouse gas mitigation, research has been driven toward

capturing carbon dioxide from fossil fuel combustion (Pires et al., 2011; Steeneveldt et al., 2006). A number of capture techniques have been demonstrated to successfully capture CO₂ using chemical absorption. Absorption solvents can react with CO₂ to form carbamates, carbonates or hydrogen carbonates (Littel et al., 1992; Wang et al., 2011; Yang et al., 2008) and can also physically absorb the CO₂ following Henry's law (Ghosh et al., 2009; Oexmann and Kather, 2009). Once captured, the CO₂ is typically recovered by a reversal of the chemical reaction between CO₂ and amine, which is induced by a temperature increase, a reduction in pressure or both (Pires et al., 2011; Wang et al., 2011; Yang et al., 2008).

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