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Review

Amine degradation in CO_2 capture. I. A review

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ABSTRACT

Post-combustion CO_2 capture based on CO_2 absorption by aqueous amine solutions is the most mature gas separation technology. A main problem is amine degradation due to heat, CO_2, O_2, NO_x and SO_x. This review proposes to make a critical survey of literature concerning degradation, to list degradation products and to discuss mechanisms proposed by authors. Benchmark molecule is monoethanolamine (MEA) but diethanolamine (DEA), N-methyldiethanolamine (MDEA), piperazine (PZ) and 2-amino-2-methylpropan-1-ol (AMP) are also studied. Uses of other amines and amine blends are also considered. In the case of MEA, ammonia, N-(2-hydroxyethyl)-piperazin-3-one (HEPO) and N-(2-hydroxyethyl)-2-(2-hydroxyethylamino) acetamide (HEHEAA) are the main identified degradation products in pilot plants. Among lab studies, the most cited degradation products are ammonia, carboxylic acids, N-(2-hydroxyethyl)-formamide (HEF), N-(2-hydroxyethyl)-acetamide (HEA) and N-(2-hydroxyethyl)-imidazole (HEI) for oxidative degradation, and oxazolidin-2-one (OZD), N-(2-hydroxyethyl)-ethylenediamine (HEEDA) and N-(2-hydroxyethyl)-imidazolidin-2-one (HEIA) for thermal degradation. Numerous degradation products have been identified but some are still unknown. A lot of degradation mechanisms have been proposed but some are missing or need proofs. SO_x and NO_x effects are still few examined and much work remains to be done concerning volatile degradation products potentially emitted to atmosphere: their identification and their formation mechanisms need further investigations.

Contents

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