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Further evaluation of potassium iodide's effect on oxidative and thermal degradation of MEA

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Abstract

Alkanolamine solvent degradation is the main problem currently faced in absorption-based CO_2 capture as it is responsible for solvent loss, equipment corrosion and an increased need for emission control. Ethanolamine (MEA) is the most studied solvent and despite the efforts to develop alternative high-performance solvents during the last decades, it still remains as one of the most reliable choices for post combustion capture [1]. Both oxidative and thermal degradation of MEA have been studied extensively, however there is still uncertainty regarding the proposed reaction mechanisms as well as the interactions between the identified degradation products [2]. The utilization of additives that inhibit degradation is one of the proposed mitigation techniques. Potassium iodide (KI) has been identified as a potential inhibitor, as it limits amine oxidation at absorption conditions, without requiring replenishment [3, 4]. However, testing in more realistic conditions where the solvent was circulated from absorber to stripper conditions indicated that the addition of KI could lead to increased thermal degradation [3, 5].
This work aims to determine whether KI increases the thermal degradation, or if in fact its inhibition of oxidative degradation causes less consumption of thermal degradation compounds. By addressing this, this study will contribute towards better understanding of the performance of inhibitors like KI as well as the interconnectivity of thermal and oxidative degradation. More specifically, oxidative degradation of already thermally degraded MEA will be monitored with and without the addition of KI. After that, isolated thermal degradation experiments of the oxidated samples will be conducted. Separate monitoring of each type of degradation will provide valuable insight into the oxidation inhibition mechanism of KI, and its effect on amine thermal stability at stripping temperatures.

Keywords: amine, absorption, degradation, inhibitor, KI

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