Ultra-violet treatment as a strategy for destruction of degradation products from amine based post combustion CO_2 capture.

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Amine-based post-combustion capture (PCC) of CO_2 is widely considered the most promising available technology for reducing CO_2 emissions from stationary point sources, such as coal-fired power stations, in the mid-term. Despite being an established technology, having been used for decades to remove CO2 from small scale-commercial process such as natural gas sweetening, there are many challenges that must be overcome before large scale implementation of the process can be realised. Some of these challenges include:

- Capital costs
- Solvent regeneration energies
- Solvent degradation (oxidative and thermal) in the presence of O_2 and other flue gas contaminants, such as NO_x and SO_x, and
- Emissions i.e. potential of solvents and solvent degradation products to be released into the atmosphere and their environment impact.

Recently, the propensity of amine-based solvents to form deleterious materials in the presence of NOx, such as nitramines, N-centered organic oxides and nitrosamines, has become evident. The formation and emission of these materials from the PCC process has not been previously investigated. The entrainment of these degradation products in the scrubbed flue gas and subsequent release to the environment is an issue that requires attention, particularly because of their potential impact.

Given the potential magnitude of the widespread large-scale application of amine-based PCC technology globally, there is a need to obtain a greater understanding of the chemistry involved in the solvent degradation process for effective implementation of emission reduction strategies. There are a number of mitigation methods available that can reduce emissions from an amine-based PCC plant, including the removal of NOx from the flue gas stream prior to the absorption process and minimisation of gaseous emissions by a water wash. However, these methods would have an impact on the capital cost of the PCC process. One approach that is currently under consideration is the UV treatment of the solvent liquor, gaseous emissions and/or wash water for the destruction of materials such as nitramines, N-centered organic oxides and nitrosamines that can form during the PCC process. In this paper we present an invention for the reduction of these materials by UV treatment in an operating amine-based PCC plant.