**Simulation of the AMP process for the purification of a flue gas stream from a power plant**

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**Highlights**

* Carbon dioxide removal needs to be applied for climate change mitigation.
* AMP is a sterically hindered amine which can be used for CO2 removal.
* Simulation of non-precipitating aqueous AMP process for CO2 absorption.
* Future development of precipitating pseudo-solvents based on literature data for AMP.

**1. Introduction**

Carbon dioxide is the greenhouse gas which produces the strongest effect on global warming and several methods for its removal have been developed, with chemical absorption (usually by aqueous solutions of alkanolamines) being generally recognized as a suitable technology in particular when applied to treatment of gaseous streams as flue gases from power plants. The formation of solids upon CO2 absorption is a feature of many alternative amine systems and precipitation may actually be considered advantageous [1], as outlined in studies on potassium taurate [2,3], and by the UNO MK 3 process [4,5]. Notwithstanding these efforts, not enough attention has been paid on methodically outlining which particularities arise when moving from regular monophasic solvents to precipitating solvents. Issues such as increases in equipment complexity and sizing, the handling of viscous slurries, the shifting in rates of absorption upon precipitation are easily overlooked. Furthermore, the main energetic benefits of this process will be wasted if plant designers forget to adapt the typical absorption-desorption process structure to the specific context of precipitating solvents. With the aim of mapping the opportunities and challenges of employing precipitating solutions, a token solvent of aqueous 2-amino-2-methyl-1-propanol (AMP) has been selected. AMP is a sterically hindered primary alkanolamine with a tertiary carbon atom attached to the amino group. It presents good absorption capacity, absorption rate, selectivity and degradation resistance if compared to traditional amines [6]. Recently, Svensson et al. [7,8] have focused a lot of effort in developing a precipitating solvent based on AMP plus N-methyl-2-pyrrolidinone (NMP). For that reason, AMP is a good starting point for this analysis. In order to study this type of solvents, the first step, on which this work focuses, is to provide an accurate process design for a CO2 capture plant based on aqueous AMP, for which only few papers in the literature [6,9-12] can be found.

**2. Methods**

ASPEN Plus® has been employed as tool for simulation. The thermodynamic model has been selected considering that the system is strongly non-ideal because of the chemical reactions occurring in the liquid phase and generating ions and validated by comparison with experimental data. Kinetics and mass transfer have been taken into account for the simulation of the absorption and desorption units.

**3. Results and discussion**

The purification of a flue gas from a 500 MW coal-fired power plant has been considered for removal of 90% of carbon dioxide. The obtained results show that the profiles of the absorber are characterized by the same trends typical of the ones of traditional amines. Similar trends occur also in the regeneration section, though being the required energy different.

**4. Conclusions**

This works has focused on the study of AMP for use as solvent for the chemical absorption of carbon dioxide from flue gas of a 500 MW coal-fired power plant, which is removed with the aim of reducing the greenhouse gas emissions to the atmosphere. ASPEN Plus® has been validated and used for the simulation of the system, providing an accurate representation of the system, which can be used as a basis for the future developments of the work.

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