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Review

Process intensification for post-combustion CO_2 capture with chemical absorption: A critical review

Meihong Wang [a,*], Atuman S. Joel [a], Colin Ramshaw [a], Dag Eimer [b], Nuhu M. Musa [a]

[a] Process/Energy Systems Engineering Group, School of Engineering, University of Hull, HU6 7RX, UK
[b] Telemark Technological Research and Development Centre (Tel-Tek), Norway

HIGHLIGHTS

- Assessment of main barriers for deploying post-combustion CO_2 capture (PCC) process.
- Evaluation of different process intensification technologies for use in PCC process.
- Rotating packed bed attracted great interest due to high mass transfer capability.
- Process flow diagram for intensified carbon capture using solvents process proposed.
- Preliminary technical and economic analysis for the intensified capture process.

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ABSTRACT

The concentration of CO_2 in the atmosphere is increasing rapidly. CO_2 emissions may have an impact on global climate change. Effective CO_2 emission abatement strategies such as carbon capture and storage (CCS) are required to combat this trend. Compared with pre-combustion carbon capture and oxy-fuel carbon capture approaches, post-combustion CO_2 capture (PCC) using solvent process is one of the most mature carbon capture technologies. There are two main barriers for the PCC process using solvent to be commercially deployed: (a) high capital cost; (b) high thermal efficiency penalty due to solvent regeneration. Applying process intensification (PI) technology into PCC with solvent process has the potential to significantly reduce capital costs compared with conventional technology using packed columns. This paper intends to evaluate different PI technologies for their suitability in PCC process. The study shows that rotating packed bed (RPB) absorber/stripper has attracted much interest due to its high mass transfer capability. Currently experimental studies on CO_2 capture using RPB are based on standalone absorber or stripper. Therefore a schematic process flow diagram of intensified PCC process is proposed so as to motivate other researches for possible optimal design, operation and control. To intensify heat transfer in reboiler, spinning disc technology is recommended. To replace cross heat exchanger in conventional PCC (with packed column) process, printed circuit heat exchanger will be preferred. Solvent selection for conventional PCC process has been studied extensively. However, it needs more studies for solvent selection in intensified PCC process. The authors also predicted research challenges in intensified PCC process and potential new breakthrough from different aspects.

Contents

* Corresponding author. Tel.: +44 01482 466688; fax: +44 01482 466664.
E-mail address: Meihong.Wang@hull.ac.uk (M. Wang).

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