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CO_2 removal from coal syngas in a pilot gasification plant

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Abstract

Carbon dioxide separation technologies are of prime importance for the prevention of global warming and climate change. The separation of CO_2 can be achieved by a variety of techniques, including membrane separation, low temperature distillation, adsorption and absorption. The chemical absorption of CO_2 into monoethanolamine (MEA) solutions is one of the most favoured method for the capture of carbon dioxide in fossil fuel power plants. The reactions between amines and CO_2 brings some advantages such as high absorption rate even with low pressure. Moreover, a benefit of chemical absorption into amine solution is that the chemical reaction can be reversed at higher temperatures and MEA recycled. However, this technology presents several disadvantages, mainly due to the thermal efficiency losses in the solvent regeneration phase. This involves the need of a further development of this scrubbing technologies.

In this context, Sotacarbo is studying a CO_2 absorption process, which has been tested in a pilot platform built up in the Sotacarbo Research Centre in Carbonia, Italy. The process treats a syngas flow of about 20 Nm^3/h from a double-stage COshift process and takes place in an innovative bubbling reactor. The absorption experiments have been performed in 5 M monoethanolamine (MEA) solution at about atmospheric pressure and at 30 °C.

This paper reports the analysis of the preliminary experimental results obtained in the CO_2 separation section. As concern the process performance, the effect of the chemical reactions has been evaluate in terms of the enhancement factor, defined as the ratio between the absorption flux when reaction occurs to that which would occur if there is no reaction. The experimental results have been compared with the predictions of an absorption-rate/kinetics model.

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