Dynamic Simulation and Control of MEA Absorption Process for CO₂ Capture from Power Plants

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Abstract

MEA absorption process is an approach for mitigation of CO₂ from flue gas that produces from power plant. CO₂ capture process is an inherent dynamic system that is affected by the variations occurring in the operating conditions of the power plant. A dynamic model for the complete MEA absorption process was developed to study the operability of this process in a dynamic fashion. A basic feedback control strategy based on Proportional-Integral (PI) controllers was developed and implemented using this dynamic model to study the closed-loop performance of this system under the effect of external perturbations. In order to achieve the main objective of CO₂ capture process and to satisfy the temperature constraint in the reboiler unit, the percentage of CO₂ absorbed in the absorber column and reboiler temperature were selected as the controlled variables in the present control strategy. The PI controllers tuning parameters were initially obtained using the Internal Model Control (IMC) method. The closed-loop performance of the process was improved by manually tuning the PI controllers using process knowledge and heuristics. The closed-loop test for disturbance rejection conducted in this study showed that the MEA process remained stable in the presence of changes in the flue gas flow-rate and comply with the controllability goals specified for this process.

Keywords: Dynamic simulation; Process Control; CO₂ capture; MEA absorption process; Fossil fuel power plant.

References


