Techno-economic analysis of absorption and adsorption processes for CO_2 capture and H_2 recovery in IGCC plant

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Carbon capture technologies, which are connected to storage technology, emerge as the effectual remediation processes to reduce CO2 emissions from coal power plants. Integrated Gasification Combined Cycle (IGCC) was selected to evaluate various capture processes. After screening process simulation for five single-stage carbon capture processes with respect to the thermal efficiency, the selected two dual-stage carbon capture processes (a-MDEA and Selexol) were evaluated for technical analysis including power generation, power consumption and thermal efficiency. The total exergy destruction and the impacts of exergy destruction on equipment were also discussed in detail. Finally we executed economic analyses considering capital cost and operating cost. In addition, an adsorptive cyclic purification process was developed to upgrade a CO2/N2 mixture captured as a feasibility study for a second capture unit or captured CO2 purifier. And, after CO2 capture process in the IGCC process, a PSA process to recover a massive amount of H2 at high pressure condition (30-35bar) was developed.