PSA-SPUR: An Advanced Adsorption Process for Heavy Component Recovery and Its Application for On-board Carbon Capture

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Up to now, carbon capture researches and commercialisation projects have been focused mostly on fossil fuel power stations and industrial plants that feature single CO_2 emission sources of very large scales. To achieve the net zero emission target, however, it is essential to curtail substantially the CO_2 emission from all the CO_2 emission sources regardless of their scales including maritime shipping sector[1]. The amine capture units that are often chosen for decarbonising power plants may not be best suited for capturing CO_2 from ships, the CO_2 emissions of which are much smaller than those of power plants. It is well known that adsorption processes are competitive over other separation processes for industrial application of small to medium scales [2].

A PSA-SPUR system is an advanced adsorption process designed for recovering the heavy component from a gas mixture, not necessitating unrealistically low pressures for desorption. The novel adsorption process is capable of achieving the high CO_2 purity and recovery targets at the same time, without having to operate the process within a very narrow window of operating conditions for good performance. In this study, the PSA-SPUR system was designed for its application for ship-based carbon capture and optimised for the best performance using the unique Equilibrium Theory model [3,4]. The theoretical results were validated by experimental campaign using the lab-scale six-column Pressure Swing Adsorption rig.

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References

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