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C1Po1D-02 [26]: Distillation Based CO₂ Removal from Natural Gas for Small and Medium Sized Plant

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The removal of excess CO₂ from natural gas to levels as low as 50 ppm is essential for the safe and reliable operation of liquefied natural gas (LNG) transport and delivery systems. Current chemical purification techniques, which are suitable for large processing plants, might not be suitable for small or mid-size plants which are expected to operate in future LNG delivery networks. The feasibility of purification of natural gas (NG) from CO₂ down to a concentration of 50 ppm by multi-stage distillation is studied. A three-column distillation system is proposed that can purify NG to lower than 50 ppm concentration of CO₂, while avoiding CO₂ freezeout. The columns include a 30-stage demethanizer, in which high purity methane is obtained in the distillate by separating the impurities from natural gas including CO₂; a 50-stage extractive column where the azeotrope between CO₂ and ethane is broken; and a 50-stage solvent recovery column that recovers a mixture of heavy hydrocarbons suitable for recycling as a solvent back into the extractive column. The proposed system avoids CO₂ freezeout by utilizing a multi component feed of some heavier hydrocarbons added to natural gas; propane, butane and pentane additives are injected into stage 20 of the demethanizer column alongside the raw feed. Furthermore, arrangements are made to break the CO₂-ethane azeotrope, which may occur in the bottoms stream of the demethanizer by administering a solvent stream in the extractive column. The proposed system can operate in a closed loop arrangement where the bottoms stream that leaves the recovery column can be recycled and injected into the extractive column for azeotrope prevention.

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