Pilot Plant in Dunkirk for demonstrating the DMX™ Process

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Abstract

CO2 Capture and geological Storage is now recognised as being one of the pathways that can be implemented to reduce CO2 emissions and fight global warming.

The DMX™ process [1, 2, 3] developed by IFP Energies nouvelles (IFPEN) and licensed by PROSERNAT is a second-generation CO2 capture process using a phase change solvent.

Main advantages of the DMX™ process are:
- Higher cyclic capacity than MEA: from 0.1 to 1 mol CO2/mol solvent which allows very low solvent flow rate and by consequence lower heat required for regeneration (less than 2.5 GJ/tCO2);
- No degradation of the DMX™ solvents (up to 160°C): so regeneration can be operated under pressure and CO2 may be produced at higher pressure (up to 6-7 bara);
- The DMX™ solvent is not corrosive: Carbon Steel may be used as material for the DMX™ process;
- Same CAPEX as for first-generation processes using amine-based solvents;
- But up to 30 % reduction in OPEX.

Experimentation on minipilots and techno-economic evaluation carried out within the OCTAVIUS & VALORCO projects [4, 5] have confirmed its potential in terms of reduction of energy penalty and operational costs for capturing CO2 respectively on coal power-station and blast furnace gas.

For a coal power station case, the DMX™ process allows 2 points reduction of the energy penalty compared to the MEA 30 % wt. reference process and gives lower cost of electricity and lower avoided CO2 cost: 42.6 €/tCO2 compared to 56.5 €/tCO2 for the MEA reference process.

Figure 1 summarises the techno-economic study carried out within the VALORCO project. It gives for the 3 considered steel mill cases (PowerStation, Blast furnace, and Top Gas Recycle) the impact of CO2 partial pressure and solvent on the CO2 production cost at 6 bara with a steam cost at 21 €/ton. Lower cost is obtained with the DMX™ process (less than 40 €/tCO2 for the Top Gas Recycle Case).

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So, DMX™ process is very promising but it needs now to be demonstrated in an industrial scale pilot plant.

ArcelorMittal, IFPEN and PROSERNAT are now considering this demonstration at the steel mill operated by ArcelorMittal in Dunkirk (France).

This paper will present the process study carried out to optimise the design of the pilot plant but also the evaluation study based on this design.

Capacity considered is 0.5 tCO₂ capture/h which is sufficient to upscale CO₂ capture on all the gas emitted by a blast furnace.

First experimentation plan will be also presented and explained. It will include a parametric study on absorption and regeneration pressure but also long test runs on real steel mill gas.

Planning of the demonstration and expected commercialisation will be also discussed.

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References


