Operational Experience of HiPACT™ Process

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Abstract

This paper is an update from the presentation in the GHGT-10[1] and GHGT-11[2].

The HiPACT™ technology, jointly developed by JGC and BASF, is an advanced CO_2 capture technology that contributes to economical CCS (Carbon dioxide Capture and Storage) implementation in natural gas processing plants. The solvent has excellent stability against thermal degradation, which enables operation at high pressure and elevated temperatures during solvent regeneration to reduce CO_2 compression costs downstream. The solvent also has a higher CO_2 absorption capacity than commercially available solvent technologies, which results in decreased solvent circulation rates and lower AGRU (Acid Gas Removal Unit) capital and operating costs.

NIS, Naftna Industrija Srbije, is one of the largest vertically integrated energy companies in south-eastern Europe, owned by the government of the Republic of Serbia (29.87%) and Russia's Gazprom Neft (56.15%). Its principal activities are exploration, production and refining, and sales and distribution of a broad range of petroleum products, as well as the implementation of energy projects. To meet the technical requirements of the national gas distribution network in Serbia, NIS invested in a HiPACT™ unit at one of its Oil and Gas Preparation and Transportation compounds located in Elemir[3] . Figure 1 shows the photo of the HiPACT™ plant.

The HiPACT™ unit is part of the gas processing plant and supplies pipeline gas to the public grid (Selbiagas). The plant is designed to process 500,000 – 800,000 Sm^3/day of natural gas, with 18-50 percent of CO_2. Figure 2 shows the process flow of the HiPACT™ unit. The HiPACT™ unit is designed to produce gas with a maximum specification of 3% CO_2. Capturing the CO_2 from raw natural gas also means producing off-gas containing high amounts of CO_2. In-line with NIS's commitment to minimize its CO_2 emission foot print, this acid off-gas leaving the amine unit (containing >99% CO_2) is returned to the ground. This stream at 3.2 bara is dried in a glycol unit and then compressed to 63 bara, before being sent back to a reservoir, around 12 km from the plant site.

This commitment to minimize the CO_2 emission foot print also comes with higher energy requirements. The two largest energy consumers at the plant are amine solvent regeneration and the compressor. By using the latest innovations currently available on the market, including HiPACT™ technology, NIS is able to reduce this consumption to within feasible CAPEX and OPEX requirements.

Construction of the unit was completed in December 2014, followed by a commissioning period of 180 days. The gas was first introduced in January 2015 and continued for a trial run period (approved by the authorities in order to demonstrate correct plant performance), lasting until July 2015. The plant was then successfully commissioned and has been in commercial operation since.

From a CO_2 capture technology perspective, especially regarding HiPACT^{TM} technology provided by BASF and JGC, NIS had learned the following:

- The unit is user-friendly, not difficult to operate, and forgiving
- Even though the solvent has a higher vapor pressure compared to MDEA, with appropriate design measures and good operational practice, solvent loss is within the expected and acceptable range (10 – 15% of holding volume per year)
- The solvent is stable when exposed to high temperatures (due to the higher operating pressure in the regenerator section)
- So far, no major issues have been experienced in the plant and NIS hopes to continue such good operation in the future

Based on successful installation of the HiPACT^{TM} first commercial plant, BASF and JGC accelerate promotion of the technology to CCS in natural gas processing and CO_2-EOR which requires high pressure CO_2 as an injection fluid.

This paper/presentation will detail and share i) operational experience with the HiPACT^{TM} unit and ii) economic evaluation including compressor section.

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Reference

[1] Tsukasa Kumagai, Torsten Katz et al. “HiPACT – Advanced CO_2 Capture Technology for Green Natural Gas Exploration”, GHGT-10 (2011)
[2] Koji Tanaka, Takehiko Komi, Torsten Katz et al. “Demonstration test result of High Pressure Acid gas Capture Technology (HiPACT)”, GHGT-11 (2013)
[3] Nikola Vukoje, Gatot Joyowardoyo “Operational Experience of High Pressure Acid-gas Capture Technology (HiPACT^{TM})”, GPA Europe 2017

Figure 1 The HiPACT™ plant in Elemir, part of the gas processing plant

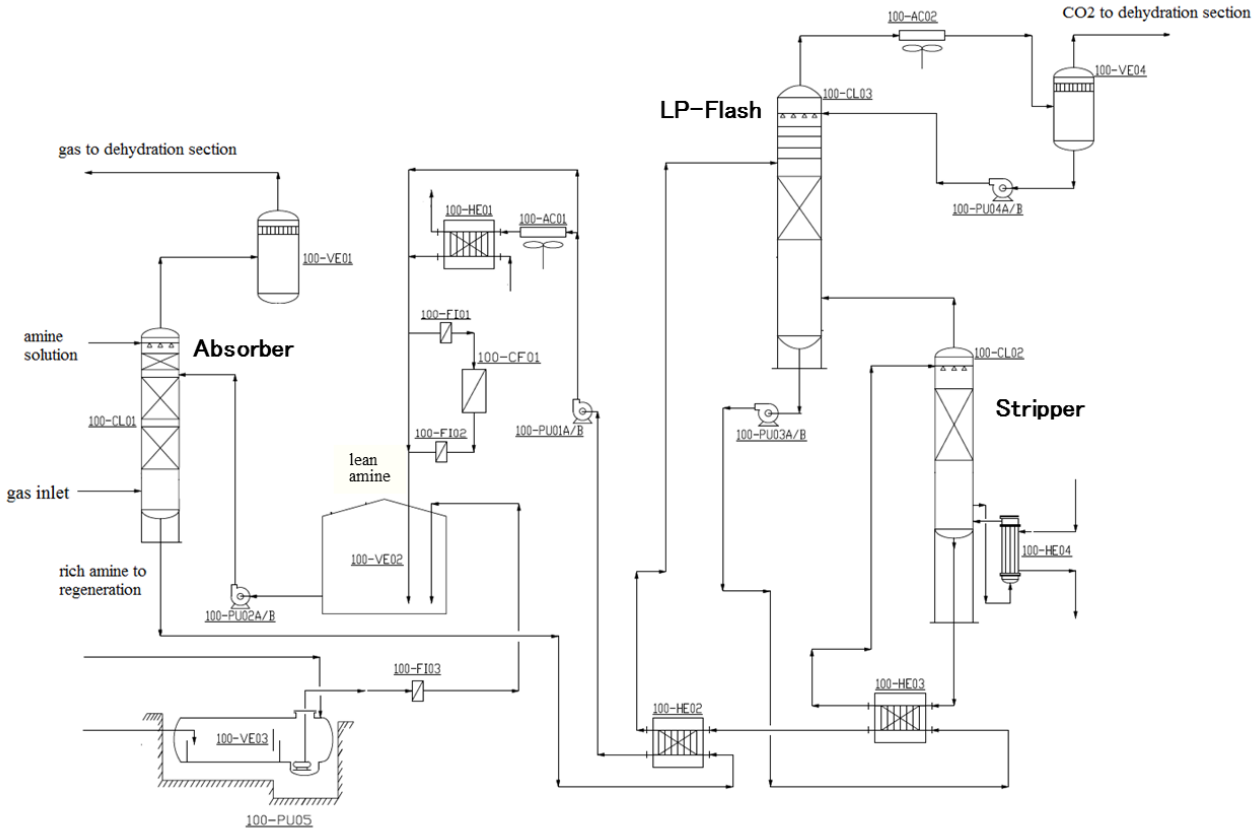

Figure 2 Process Flow of the HiPACT™ unit