



IEAGHG 8th Post Combustion Capture Conference

16th to 18th September 2025 Marseille, France

New Insights from CESAR1 Solvent Testing at Technology Centre Mongstad (TCM): Thermal Reclaiming and Emissions Control

Ahmad Wakaa^{a*}, Sundus Akhter^a, Matthew Campbell^a

^a*Technology Centre Mongstad, 5954 Mongstad, Norway*

Abstract

The Technology Centre Mongstad (TCM) is a pioneering facility located in Mongstad, Norway. Established in 2012 through collaboration among major energy companies, including Gassnova (on behalf of the Norwegian State), Equinor, Shell, and TotalEnergies, TCM is dedicated to advancing carbon capture technologies. Serving as the world's largest facility of its kind, TCM provides a crucial platform for research, development and testing of different post combustion carbon dioxide capture (PCC) technologies. TCM's state-of-the-art infrastructure allows companies and researchers to test and optimize carbon capture and storage (CCS) technologies before commercialization.

In this abstract we will share results from the testing of the non-proprietary CESAR1 solvent, which is a mixture of water, amino-2-methylpropanol (AMP) and piperazine (PZ). The areas of investigation for this presentation are: (i) thermal reclaiming, (ii) and emission monitoring and mitigation during Residual fluid Catalytic Cracker (RFCC) flue gas operation. These learnings will be extracted from CESAR1 testing campaigns conducted at TCM in 2020, where the total testing time was around 6,000 hours. Previously TCM has shared other learnings about CESAR1 testing in various publications. ¹⁻⁴

The thermal reclaiming with CESAR1 has been conducted twice at TCM in 2020.⁴ Overall, the solvent has been refreshed by removing degradation products, heat stable salts and metals. Based on solvent analysis and inventory calculations before and after reclaiming it has been estimated that the removal rates were 93% - 95% for metals, 88% - 89% for HSS and 82% - 84% for other known degradation products. Solvent loss is estimated to be lower than approximately 5%. The long boil-off time at the end of reclaiming has been beneficial in terms of low solvent loss and low amine concentration in the waste. The performance of the solvent was also analysed before and after reclaiming with focus on CO₂ capture efficiency/ energy effect and emissions.

Emission control during RFCC flue gas operation is the last new learning that will be described in the presentation. The steps required for ensuring amine emissions are at an acceptable level while utilising a high aerosol concentration flue gas like RFCC will be demonstrated in this presentation. The impact of BDU (Brownian diffusion unit), process temperatures, packing and water washes configuration and others will be presented. RFCC flue gas emissions and control while using MEA solvent are described in a previous publication. ⁵

* Corresponding author: *E-mail address:* ahmad.wakaa@tcmda.com

References

1. Benquet, C.; Knarvik, A. B. N.; Gjernes, E.; Hvidsten, O. A.; Romslo Kleppe, E.; Akhter, S. In *First process results and operational experience with CESARI solvent at TCM with high capture rates (ALIGN-CCUS project)*, The 15th Greenhouse Gas Control Technologies Conference (GHGT-15), Abu Dhabi, 2021. SSRN: <https://ssrn.com/abstract=3814712> or <http://dx.doi.org/10.2139/ssrn.3814712>.
2. Akhter, S.; Wakaa, A.; Knarvik, A. B. N.; Gjernes, E.; Bernhardsen, I. M.; Shah, M. I. *CO₂ Capture from SMR type flue gas using CESARI solvent at Technology Centre Mongstad*. The 16th Greenhouse Gas Control Technologies Conference (GHGT-16), Lyon, France, 2022. SSRN: <https://ssrn.com/abstract=4284219> or <http://dx.doi.org/10.2139/ssrn.4284219>.
3. Hume, S.; McMaster, B.; Drageset, A.; Shah, M.; I.; Kleppe, E. R.; Campbell, M.; *Results from Cesar1 Testing at the Co₂ Technology Centre Mongstad. Verification of Residual Fluid Catalytic Cracker (RFCC) Baseline Results*. The 16th Greenhouse Gas Control Technologies Conference (GHGT-16), Lyon, France, 2022. SSRN: <https://ssrn.com/abstract=4280571> or <http://dx.doi.org/10.2139/ssrn.4280571>
4. Campbell, M.; Akhter, S.; Knarvik, A.; Muhammad, Z.; Akhter, S.; Wakaa, A.; *CESARI Solvent Degradation and Thermal Reclaiming Results from TCM Testing*. The 16th Greenhouse Gas Control Technologies Conference (GHGT-16), Lyon, France, 2022. SSRN: <https://ssrn.com/abstract=4286150> or <http://dx.doi.org/10.2139/ssrn.4286150>
5. Shah, M.; I.; Lombardo, G.; Fostås, B.; Benquet, C.; Kolstad M.; A.; and de Cazenove, T.; *CO₂ Capture from RFCC Flue Gas with 30w% MEA at Technology Centre Mongstad, Process Optimization and Performance Comparison*. The 14th Greenhouse Gas Control Technologies Conference, (GHGT-14), Melbourne, 2018. SSRN: <https://ssrn.com/abstract=3366149> or <http://dx.doi.org/10.2139/ssrn.3366149>