IEAGHG 7th Post Combustion Capture Conference

25th to 27th September 2023 Pittsburgh, PA, USA

Emission measurement tests to study the potential for performance improvement of the absorber emissions monitoring system (ACEMS) prototype.

Actor Chikukwa*[a], Karol Michalski[a], Lars Hovdahl[a], Kai Hjarbo[a], Thor Mejdell[a], Andreas Grimstvedt[a], Merete Wiig[a], Kai Vernstad[a], Aslak Einbu[a]

[a]*SINTEF Industry: Richard Birkelands vei 3, 1 etg, 7034 Trondheim, Norway*

Abstract

Recent years have shown that climate change-related problems and happenings around the globe (due to creased levels of greenhouse gases - GHGs) cannot be ignored anymore. Scientists and other stakeholders around the world are working full-scale on a multifaceted approach to find and implement sustainable solutions for GHG mitigation. The set of potential measures is diverse and includes CCS, in which case, post-combustion carbon-capture (PCC) technology with amine-based solvents is among the front runners (high TRL), especially for application in industrial flue gases CO2 capture. Emissions to the atmosphere from PCC technologies are thus a key issue of concern i.e., there is need to ensure that what is emitted is safe and or in compliance with levels permitted by authorities at all times. The topic of appropriate constant online emissions monitoring technologies therefore becomes pertinent.

Currently, there exist a wide variety of commercially available industrial online analyzers for monitoring most of the common gas components (e.g., CO2, amines, NH3, etc.) from amine-based CO2 capture plants down to ppm levels. However, for the environmentally adverse trace components in the ppb levels or lower; there are currently no affordable existing commercially available industrial online analyzers covering this niche for online monitoring of gas trace analytes emissions from amine-based PCC plants.

SINTEF has been working on an alternative concept (based on SINTEF patent No. PCT/EP2011/073557, [Einbu et al., 2012]) that seeks to address the issues caused by methods that involve excessive heating of the sample as well as the costs. This prototype instrument has been named "ACEMS", which stands for Absorber Continuous Emission Monitoring System. Though still in developmental stages compared to the final/anticipated product, the prototype has been successfully demonstrated for emission monitoring SINTEF's Tiller CO2 capture facility. However, demonstration results show/reveal that some aspects (e.g., sampling frequency, automation, widen trace analytes list, etc.) still need improvement. This is in part, the objective for the parametric tests discussed in this study.

* Corresponding author. Tel.: +47 93238290
E-mail address: Actor.Chikukwa@sintef.no

An example of the preliminary results for a trace analyte (NPYR) in the ppb level (ACEMS vs standard impingers) of the parametric tests is presented in figure 1. In the ppm range, the ACEMS also performs well for the degradation product, pyrrolidine. These results show that the ACEMS instrument performs in good agreement with the standard in impingers.

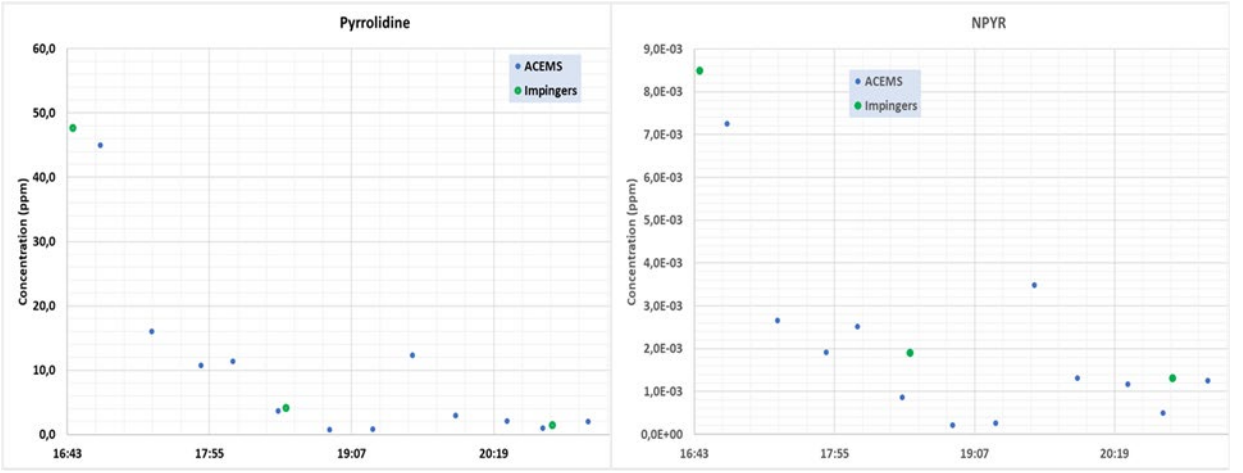

Figure 1: Example of results showing performance of ACEMS prototype (ppb level) instruments vs. the standard (impingers).

This study has also shown that the ACEMS has the advantage (over standard impingers) to perform frequent sampling. This gives it the unique ability to track & study the response of trace analytes in dynamic situations or processes. Furthermore, equipped with automated sampling capability, the ACEMS instrument will significantly reduce the amount of manual labor, save time and lower cost involved in manual gas sampling using standard impingers

***Keywords**:* post-combustion capture; emission measurements; online monitoring; nitrosamines; degradation products

---

References

Einbu A, Hjarbo K, Brunsvik A, Zahlsen K and Wittgens B : *Demonstration of a novel instrument for online monitoring of absorber emissions to air,* June 2021

Wittgens B.; Einbu A.; Brunsvik A.; Zahlsen K. *Establish sampling and analytical procedures for potentially harmful components Post combustion amine-based CO2 capture. Online open report. https://ccsnorway.com/hse-studies/(Accessed 9 Feb 2021).*

Acknowledgements

1. This project is funded through the ACT programme (Accelerating CCS Technologies), ACT 3 Project No 327341. Financial contributions made by the Research Council of Norway (RCN), Ministerie van Economische Zaken en Klimaat the Netherlands, Department for Business, Energy & Industrial Strategy (BEIS) UK, Forschungszentrum Jülich GmbH, Projektträger Jülich (FZJ/PtJ) Germany, Department of Energy (DOE) USA and Department of Science and Technology (DST) India are gratefully acknowledged. Cash contribution from Norwegian industry partners to the Research partners in Norway is also acknowledged.
2. The REALISE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 884266;