1st Post Combustion Capture Conference

Monitoring and impacting gaseous emissions in post combustion carbon capture

Jan Mertens[a]*, Marie-Laure Thielens[a], Jacob Knudsen[b] and Jimmy Andersen[b]

[a] Laborelec, Rodestraat 125, 1630 Linebeek, Belgium
[b] DONG Energy, Amerikavej 7, DK-6700 Esbjerg, Denmark

Keywords: Inorganic and organic gaseous emissions,Fourier Transformed Infra Red (FTIR)

1. Introduction

Post Combustion Carbon capture is vulnerable to gaseous emissions as a result of the volatility of the used solvents and their degradation products as well as mechanical conveyance of these organics with the flue gas stream.. The monitoring of these emissions is of crucial importance for obvious environmental reasons but not straightforward since the system is water saturated. This study presents a monitoring system capable of measuring these emissions. The system is used to research plant operation setting that can impact these emissions.

2. Material and Methods

The study presents novel work with respect to on-line emission data from a post-combustion carbon capture pilot plant of both inorganic and organic components. The emissions are monitored at the Esbjerg coal fired power plant in Denmark. The system is composed of an extractive hot and wet system sampling system preventing condensation throughout the sampling probe, heated sampling line, heated pump as well as inside the analyser (at 180 °C). The heated probe is installed at the exit of the absorber (downstream of the washing section). The analysis uses Fourier Transformed Infra Red (FTIR) spectroscopy for measuring inorganic and organic components and a Zirconium sensor for measuring the O_2 concentration. In parallel and during short periods, (i) a Flame Ionization Detector

* Corresponding author. Tel.: +32 473 337022; fax: +32 382 05 40.
E-mail address: jan.mertens@laborelec.com.

(FID) is used in order to measure Total Organic Carbon concentrations and (ii) manual measurements of selected components are carried out.

3. Results

The results obtained with the FTIR are in-line with the FID measurements and with the solvent refilling needs of the plant. The manual measurements show different results in function of the sampling and analysis technique used and thus do not always concur with the on-line FTIR measurements.

Linking the plant operational data with on-line emission data identified two important operational settings that control the organic emissions from a post combustion carbon capture plant to a large extend: (i) flue gas temperature at the top of the absorber (downstream of the washing section) and (ii) flue gas temperature difference over the washing section. As a result of this latter, a negative correlation is found between the CO_2 coming into the plant and the amine emissions. A positive correlation between NH_3 and the O_2 content entering the pilot plant suggests that oxidative degradation occurs to differing extends depending on the solvent system.

4. Conclusions

The study presents successful on-line measurements. However, more research is needed in the field of emission monitoring for both the on-line as for the manual methods. Thorough research is needed on the manual sampling and analysing techniques in order to avoid conflicts between different techniques. For the on-line measurements, the FTIR technology is evaluated as being suitable at the ppm level but more research is needed on monitoring emissions at low concentration levels (ppb or even ppt).