Measurements of Benzene Destruction Efficiency In a Lab-Scale Flare

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Abstract

In the upstream oil and gas sector, produced raw natural gas is generally saturated with water vapour that must be removed prior to transport. This is done using a glycol dehydrator, which uses pure liquid glycol to absorb the water vapour. However, trace amounts of hydrocarbons (including benzene which is a known human carcinogen) are also absorbed by the liquid glycol. When the saturated glycol is regenerated to be fed back through the dehydrator, the water vapour and hydrocarbons are released as waste gases. This waste gas is typically condensed and vented from the still of glycol dehydrators. The concentration of benzene in the still vent will be much higher than it was the raw gas stream, typically on the order of 1 percent. To reduce emissions the still waste gases can be flared, and since benzene is included in the waste gases it is important to know how much benzene escapes the flaring process. To be able to estimate this, the Destruction and Removal Efficiency (DRE) is needed. Unfortunately, there is a lack of information on the DRE of benzene in flares.

The goal of this research project is to determine the DRE of benzene in a flare burning compositions representative of waste gas streams from glycol dehydrators. This will be accomplished by injecting vapourized benzene into flares at the Carleton University Flare Facility (CUFF), using gas compositions representative of glycol dehydrator still gas. The combustion products are analyzed by a Baseline-Mocon 9100 series Gas Chromatograph (detection limit of 0.5 ppb with an accuracy of 5%) to quantify benzene concentrations and then determine the DRE. Initial experiments have been performed using simulated glycol dehydrator still gas compositions, which showed a very high (nearly 100%) DRE. Currently work is being done to verify the accuracy of the gas chromatograph, the uncertainties in the method, and to test more realistic compositions based on measured glycol dehydrator still gas compositions.