Contents lists available at ScienceDirect

Chemical Engineering Research and Design

journal homepage: www.elsevier.com/locate/cherd

Assessment of new and improved solvent for pre-elimination of BTEX emissions in glycol dehydration processes

Usama Eldemerdash[a,b,*], *Khairiyah Kamarudin*[b]

[a] *Department of Basic Engineering Sciences, Benha Faculty of Engineering, Benha University, Egypt*
[b] *Department of Chemical Engineering, Universiti Teknologi PETRONAS, 31750 Tronoh, Perak, Malaysia*

ARTICLE INFO

Article history:
Received 1 May 2016
Received in revised form 27 August 2016
Accepted 21 September 2016
Available online 11 October 2016

Keywords:
Monoethylene glycol
Natural gas
Dehydration
Desiccant
BTEX
Hydrocarbon emissions

ABSTRACT

Emission of benzene, toluene, ethylbenzene, and xylene (BTEX) from natural gas dehydration units was highlighted as an acute environmental impact. Furthermore, recent stringent environmental regulations addressed a pressing need of knowledge to eliminate hydrocarbon's emissions from glycol dehydrators. The primary objective of this study is to combine the minimization of BTEX emissions with an efficient dew point control. However, the approach in this research emphasis on the cause of the BTEX emissions rather than the post treatment process. Chemically modified monoethylene glycol (mMEG) is proposed as a new solvent to replace triethylene glycol (TEG) in the dehydration process. The results of this study showed a significant improvement in the dehydration performance together with the elimination of (BTEX) emissions. The results demonstrated that mMEG could produce gas water content of 0.16 ppm (7.6×10^{-3} lb/mmscf) and near zero level of BTEX. This investigation suggests that using mMEG can solve the environmental issue of BTEX in the natural gas dehydration process.

1. Introduction

The efficient control of water and hydrocarbon dew points in the natural gas streams has been getting a close attention to preventing the drop of liquids and the formation of hydrates. There are three primary methods for natural gas dehydration, which are direct cooling, adsorption, and absorption. The latter method is the most commonly used in gas processing units (Isa et al., 2013; Kohl and Nielsen, 1997). In the glycol dehydration process, glycol is used as a liquid desiccant to remove water content from the gas stream (Carroll, 2009). Many factors have led to the widespread use of glycols for gas dehydration such as high hygroscopicity, excellent thermal performance, low vapor pressure and availability at moderate cost (Kohl and Nielsen, 1997). An important feature of sales gas is the water and hydrocarbon dew point. The gas dew point will decrease as the water content is reduced (Arubi and Duru, 2008; Salamat, 2009). The acceptable water content in a gas transmission line is 6–10 lb/mmscf equivalent to a gas dew point of 15–29 °F (−2 to −9 °C) at 1000 psia (Collie et al., 1998). Furthermore, the difference in properties of the glycols will affect the overall efficiency of the process. Properties of different glycols shown in Table 1. Triethylene glycol (TEG) dehydration units are common for natural gas dehydration (Mohammad et al., 2014, 2015). However, TEG was proven to be the most efficient solvent for natural gas dehydration (Hemat et al., 2015). The most critical drawback in the usage of TEG is the emission of a significant amount of volatile organic compounds; mainly benzene, toluene, ethylbenzene and xylene (BTEX) compounds. This study primarily focuses on modified monoethylene glycol (mMEG) as a potential alternative to TEG with the aim to overcome the problem of BTEX emissions and maintain high efficiency of the process.

1.1. BTEX emissions from natural gas dehydration units (NGDU)

BTEX compounds are irritants and have narcotic effects (Christensen, 2009). Major environmental concern about NGDU is because of the emissions of BTEX to the atmosphere. Recent developments in environmental regulations led to rising to the challenge of process selection

* *Corresponding author at*: Department of Basic Engineering Sciences, Benha Faculty of Engineering, Benha University, Egypt.
E-mail addresses: usama.nour@bhit.bu.edu.eg, usama59@gmail.com (U. Eldemerdash).
http://dx.doi.org/10.1016/j.cherd.2016.09.030