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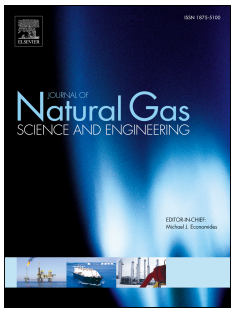

Design and implementation of an effective system for catalytic degassing of Claus-derived sulfur over monometallic and bimetallic nanosilica-based catalysts and optimization via RSM-CCD

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PII: S1875-5100(18)30348-2

DOI: 10.1016/j.jngse.2018.08.004

Reference: JNGSE 2676

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 11 April 2018

Revised Date: 22 July 2018

Accepted Date: 14 August 2018

Please cite this article as: Tari, F., Shekarriz, M., Zarrinpashne, S., Ruzbehani, A., Design and implementation of an effective system for catalytic degassing of Claus-derived sulfur over monometallic and bimetallic nanosilica-based catalysts and optimization via RSM-CCD, *Journal of Natural Gas Science & Engineering* (2018), doi: 10.1016/j.jngse.2018.08.004.

Design and implementation of an effective system for catalytic degassing of Claus-derived sulfur over monometallic and bimetallic nanosilica-based catalysts and optimization via RSM-CCD

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Abstract

In this article, molten sulfur containing 170ppmw of total hydrogen sulfide was subjected to catalytic degassing by monometallic and bimetallic heterogeneous catalysts. Accordingly, iron oxide/nanosilica catalyst showed excellent degassing outputs, as the cyclic catalytic degassing processes revealed that activity of this catalyst did not change significantly. This could be attributed to generation of iron sulfide species in the catalyst. The structured catalysts showed high surface area ($365 m^2/g$) and proper mechanical strength (0.81 MPa). Using RSM-CCD, residual content of hydrogen sulfide in molten sulfur at optimum catalytic degassing conditions by iron oxide/nanosilica (1ppmw) was located at 1.51 (weight percent of iron oxide in catalyst), 245 (time, min) and 12.850 (weight of charged catalyst in 1kg of sulfur, g). At these conditions, residual content of hydrogen sulfide in molten sulfur was also traced by application of cerium oxide/nanosilica and molybdenum oxide/nanosilica catalysts as about 54ppmw and 47ppmw, respectively. It was shown that addition of iron oxide to cerium oxide/nanosilica and molybdenum oxide/nanosilica catalysts improved their catalytic behavior and decreased the residual hydrogen sulfide content in molten sulfur to about 25ppmw and 35ppmw, respectively. The catalysts were subjected to characterization analyses including AAS, FESEM, EDS and BET.

Keywords: Sulfur Recovery Unit, Iron Oxide/Nanosilica, Design, Hydrogen sulfide, Degassing, Molten sulfur

1. Introduction

Today, natural gas refining industry has been significantly improved by emergence of the new catalysts [1], sorbents [2] and etc. As one of the main by-products of the gas refineries, sulfur is produced in Sulfur Recovery Units (SRU), which process sour gas flows mainly including hydrogen sulfide [3,4]. However, production of the elemental sulfur in gas refineries is