
Question 41: Can you comment on the use of liquid and/or vaporized naphtha as feed and/or fuel to a hydrogen generation unit?

Ken Chlapik (Johnson Matthey Process Technologies)

Johnson Matthey has vast experience in direct reforming of naphtha feedstocks in SMR's for hydrogen production. The naphtha needs to be vaporized to be processed in the SMR based hydrogen plant. It takes less heat load to reform a mole of naphtha as compared to natural gas, but more CO_x will be produced, and the carbon formation potential is higher in naphtha which can have an average carbon content of C₆ and a tail to C₂₀. Because of this, each case needs to be evaluated for changes in feedstock purification, operating conditions such as S/C, reformer catalyst loading, the water gas shift section's ability to process the higher CO conversion demand, and PSA recovery or CO₂ purification issues to hydrogen purity.

At last year's 2013 AFPM Q&A's Hydroprocessing Principles and Practices session on "Benefiting from Emerging Hydrogen Sources" a case study was presented on changing to a naphtha feedstock as shown below. The case study highlighted a low or no value naphtha cut being available in the refinery. Johnson Matthey evaluated replacing the existing butane feed which had a much higher market value than the naphtha. The plant was able to put the changes in place after 3 months and pay back the costs of this change in months. As availability of naphtha grows from increased natural gas production and particularly in refiners that are more centrally located in North America, direct naphtha reforming in SMR based hydrogen plants presents an option to process this naphtha.

Naphtha Feedstock Change Case Study



- Johnson Matthey became aware that this refiner was selling off one of their naphtha cuts at a 'loss'.
- The possibility of feeding that naphtha through the hydrogen plant (HMU) to replace existing butane feed was reviewed
- Determined replacing top 30% of the SMR tubes with naphtha steam reforming catalyst
- This unplanned 'change' took place in the next turnaround, after just 3 months from the initial feasibility discussion

Process	• Refinery Hydrogen
Location	• Asia Pacific
Capacity	• 55MMSCFD
Catalyst	• KATALCO _{SM} 48-3Q/25-4Q/57-4Q

- Initial savings were based on operation with naphtha / butane / off gas mixed feed
- The refinery opted to release the butane and sell it at a higher value achieving even greater savings

Gopi Sivasubramanian (Foster Wheeler USA Corporation)

Foster Wheeler USA has designed plants with liquid naphtha feed stocks. The naphtha feed is vaporized. Besides the design issues that are to be accounted for the feed section, there are other areas of the plant that would require some modifications to handle.

Use of naphtha as fuel requires project/ site specific analysis with respect to safety/ firebox operations, design of fuel conditioning skid and burner system.

The Terrace Wall Reformer has been used for years in services with liquid or naphtha feeds using the split load of catalyst. The low flux of the inlet region of the cat tube and the countercurrent process to flue gas flow provide the ability to handle these feeds.

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