UOP MaxEne™ Process

PEP Review 2023-06

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Table of contents

Introduction 7

Summary 8

Economic aspects 8

Conclusion 13

Technology review 14

Paraffin separation from naphtha 16

- Cryogenic distillation process 16
- Urea adduct separation process 16
- Membrane separation process 16
- Adsorption separation process 16

Adsorption separation process 17

UOP MaxEne™ process 22

IsoFlex™ unit 23

Process economics 24

Process design basis 25

- Storage and transportation 26
- Material of construction 26

Case-1: Process economics for an integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (High N+A feed case) 27

Case-2: Process economics for an integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (High N+A feed case) 35

- Process description 35
- Process discussion 45
  - Process scheme 45
  - Capex estimates and utilities 45
  - Naphtha hydrotreater 45
  - Naphtha reforming (CCR) 46
  - Aromatics block 46
  - Naphtha cracker block 46
  - UOP MaxEne™ unit 47
- Cost estimates 47
  - Fixed capital costs 47
  - Production costs 48

Case-3: Process economics for an integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (low N+A feed case) 55

Case-4: Process economics for an integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (low N+A feed case) 58

Appendix A — Cited references 61

Tables

Table 2.1 Techno-economic comparison of an integrated aromatics and cracker complex with and without the MaxEne™ unit 9
Table 4.1 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit — Design bases and assumptions 25
Table 4.2 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (high N+A feed case) — Major stream flows 28
Table 4.3 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (high N+A feed case) — Utility summary 32
Table 4.4 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (high N+A feed case) — Total capital investment 33
Table 4.5 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (high N+A feed case) — Variable costs 34
Table 4.6 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (high N+A feed case) — Production costs 35
Table 4.7 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Major stream flow 38
Table 4.8 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Major equipment 43
Table 4.9 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Utility summary 45
Table 4.10 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Total capital investment 48
Table 4.11 Integrated aromatics and naphtha cracker complex with UOP MaxEne™ unit (high N+A feed case) — Total capital by section 49
Table 4.12 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Variable costs 50
Table 4.13 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (high N+A feed case) — Production cost 51
Table 4.14 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (low N+A feed case) — Total capital investment 55
Table 4.15 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (low N+A feed case) — Variable costs 56
Table 4.16 Integrated aromatics and naphtha cracker complex without the UOP MaxEne™ unit (low N+A feed case) — Production cost 57
Table 4.17 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (low N+A feed case) — Total capital investment 58
Table 4.18 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (low N+A feed case) — Variable costs 59
Table 4.19 Integrated aromatics and naphtha cracker complex with the UOP MaxEne™ unit (low N+A feed case) — Production cost 60

Figures

Figure 2.1 Effect of olefin mix byproduct prices on the net production cost 11
Figure 2.2 Comparison of PX production costs at various locations 12
Figure 3.1 Petrochemical feedstock and derivatives 14
Figure 3.2 n-Paraffin separation process [US 7960601] 19
Figure 3.3 Integrated n-paraffin separation and isomerization unit [WO 2021183323] 20

Figure 4.1 Effect of plant capacity on the capital investment 52
Figure 4.2 Effect of FRN feed price on the production cost and product value 52
Figure 4.3 Effect of benzene byproduct price on the production cost and product value 53
Figure 4.4 Effect of ethylene byproduct on the production cost and product value 53
Figure 4.5 Effect of operating level capacity on the production cost 54

Appendix B Figures

Figure 5.1 Block flow diagram of an integrated aromatics and naphtha cracker complex without the MaxEne™ unit (high N+A feed case) 66
Figure 5.2 Block flow diagram of an integrated aromatics and naphtha cracker complex with the MaxEne™ unit (high N+A feed case) 67
Figure 5.3 Process flow diagram for the MaxEne™ unit 68
Figure 5.4 Block flow diagram of an integrated aromatics and naphtha cracker complex without the MaxEne™ unit (low N+A feed case) 69
Figure 5.5 Block flow diagram of an integrated aromatics and naphtha cracker complex with the MaxEne™ unit (low N+A feed case) 70

Abstract

Fossil fuels (coal, crude oil or petroleum, natural gas liquids and natural gas) account for approximately two-thirds of the world's total energy production, while fossil fuel energy equivalents diverted to primary petrochemical production account for about 9% of the total energy demand (on an oil equivalent basis). With the chemical industry underpinning every economic sector, the global petrochemicals demand has increased during the 2010s, supplying key building blocks for the production of a wide variety of durable and nondurable consumer goods.

There are many different processes capable of producing the basic petrochemical building blocks, but steam crackers and refineries produce the largest share of olefins (ethylene, propylene and butadiene) and aromatics (benzene, toluene and xylene [BTX]), respectively. Refineries are often integrated with a downstream petrochemical complex or at least located near a petrochemical complex that can use the feedstock produced for chemical purposes. The steam cracking process can accept a variety of hydrocarbons (HCs), ranging from natural gas liquids (ethane, propane and butane) to petroleum liquids (naphtha and gasoil). However, gaseous feedstock (ethane, propane and butane) and light naphtha with high paraffin content are the preferred feedstock because of operational advantages, low downtime and higher olefin yields. For a similar reason, heavy naphtha with high naphthene content is the preferred feedstock for the catalytic reforming process.

The Process Economics Program (PEP) has covered the naphtha cracking and reforming processes in its earlier works. The PEP Report 129 series on *Advances in Catalytic Reforming* discusses the updates on the naphtha reforming process, while PEP Report 300 covers the *Unconventional Aromatics Processes* like aromatics from methanol, natural gas and biomass. The naphtha cracking process for olefin production is discussed in the PEP Report 29 series on *Ethylene* and mixed feed naphtha crackers can be found in the PEP Review 2021-04 *Mixed Feed Naphtha Steam Cracking* (December 2021), but these do not include the effect of feed optimization in an integrated aromatics and cracker complex.

The Honeywell UOP (UOP) MaxEne™ process is a new and innovative process that claims to simultaneously optimize the operations of naphtha steam crackers and catalytic reformers. The process separates the naphtha into a normal-paraffin (n-paraffin)-rich stream and an n-paraffin lean stream using UOP's MX Sorbex™ Technology. As per the company claim, the n-paraffin-rich stream in the steam cracker increases the combined yield of ethylene and propylene by up to 30% while reducing the coking by up to 50%, which can facilitate an increase in the throughput or extended run times between the decoking cycles. The lean n-paraffin stream in the naphtha reformer is claimed to improve selectivity and reduce coking because of lower severity operation, and the C_5+ yield can be increased by up to 6% including up to 3% more of total aromatics. The process also claims to reduce the coke formation on the catalyst by up to 25%, which can facilitate increases in the throughput. The first commercial-scale MaxEne™ unit began operation in early 2013 [15].

This review covers the techno-economic comparison of an integrated aromatics and naphtha cracker complex with and without a UOP MaxEne™ unit. The production economics is evaluated for an integrated complex with the capacity of 3.5 million metric tons per year (MMt/y) at a US Gulf Coast location. An iPEP Navigator® tool is also attached with the electronic version of this review. The interactive iPEP Navigator® module provides an economic snapshot for each process, allowing the user to select and compare the processes, units and regions of interest.

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