Abstract

Nitric acid consumption in the United States in 2016 was roughly 8.0 million metric tons/year on a 100% nitric acid basis, and was expected to grow at an average annual rate of 2.8% during 2013–18. In this review, we look at the production of 60 wt% concentration nitric acid on a 100% basis by Kellogg Brown & Root (KBR) Weatherly dual-pressure new process technology. In IHS Chemical’s Process Economics Program (PEP) Review 2016-15, Nitric Acid KBR Weatherly Single-Pressure Process (September 2016), we look at the same production rate for 60 wt% concentration nitric acid on a 100% basis by KBR Weatherly single-pressure process technology.

Our prior work on nitric acid production was presented in IHS Chemical (formerly SRI Consulting) PEP Review 82-3-3, Concentrated Nitric Acid (Espindesa Technology), published in May 1983.

The focus of this report includes capital and production costs for 658 metric tons/day of 60 wt% concentration nitric acid (100% basis) product. Lastly, an interactive module is included—the iPEP Navigator for nitric acid, which provides a snapshot of the process economics and allows the user to select the units and global region of interest.
Contents

1 Introduction 5
2 Industry status 6
3 Process review 9
   Process chemistry 10
   Ammonia conversion 10
   Process description 10
   Section 100—Nitric acid dual-pressure process 12
   Process features 17
   Utilities 18
   Materials of construction 18
   Waste streams 18
   Off-site storage 18
   Cost estimates 18
   Fixed capital costs 18
   Production costs 19
   Comparison of KBR Weatherly dual- versus single-pressure process technology 22
   Single-pressure nitric acid process description 22
   Economic aspects 24
   Capital cost comparison 24
   Variable and production cost comparison 26

Appendix A—Process flow diagram 29

Tables

Table 1 World consumption and average annual growth rate 6
Table 2 World annual capacity for nitric acid as of May 2014 7
Table 3 Nitric acid plant activity 7
Table 4 KBR Weatherly nitric acid plants by global region 7
Table 5 Nitric acid (KBR Weatherly technology)—Design basis and assumptions 11
Table 6 Nitric acid process—Stream flows 13
Table 7 Nitric acid process—Waste stream 15
Table 8 Nitric acid process—Major equipment 16
Table 9 Nitric acid process—Utilities summary 17
Table 10 Nitric acid process—Total capital investment 20
Table 11 Nitric acid process—Production costs 21
Table 12 Mono-pressure versus dual-pressure process parameters 24
Table 13 Comparison of product values for nitric acid (60 wt%) 28
Figures

Figure 1 Nitric acid dual-pressure process block flow diagram 9
Figure 2 Nitric acid single-pressure block flow diagram 23
Figure 3 Total fixed capital for single pressure 25
Figure 4 Total fixed capital for dual pressure 25
Figure 5 Total production costs for single pressure 26
Figure 6 Total production costs for dual pressure 27
Figure 7 KBR Weatherly nitric acid process—Process flow diagram 30