



TECH 2020S5: Nitric Acid

Nitric Acid is one in a series of reports published as part of NexantECA's 2020 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

Nitric acid is among the top five most important inorganic acids in the world. Because of its properties as a very strong acid and a powerful oxidizer, nitric acid is useful for the production of fertilizers, pharmaceuticals, insecticides, plastics, fungicides, synthetic fibers, and military and aerospace materials.

The Ostwald process, developed in the beginning of the 20th century, involves the production of nitric acid from the catalytic oxidation of ammonia with air. This process is currently used to manufacture almost all nitric acid (HNO₃) in the concentration range of 50 to 70 percent acid. Although nitric acid technology can now be considered quite mature, improvements continue to be made with respect to process, catalysts, equipment design and NO_x emissions.

This TECH report provides an updated overview of the technological, economic, and market aspects of nitric acid. The following issues are addressed in this report:

- What are the main routes for nitric acid production? Who are the major technology holders? What are some of the differences across the various technologies?
- How do the process economics compare across processes and different geographic regions?
- What is the major application for nitric acid? Which licensor has been the most active in recent years?

Commercial Technologies

The three common steps to most processes include: (1) oxidation of ammonia to nitric acid over a Pt/Rh catalyst; (2) oxidation of nitric oxide to nitrogen dioxide with excess oxygen; and (3) absorption of nitrogen dioxide in water to produce dilute (weak) nitric acid. Approximately 70 percent of the nitric acid sold commercially is concentrated where dilute nitric acid can be directly or indirectly concentrated.

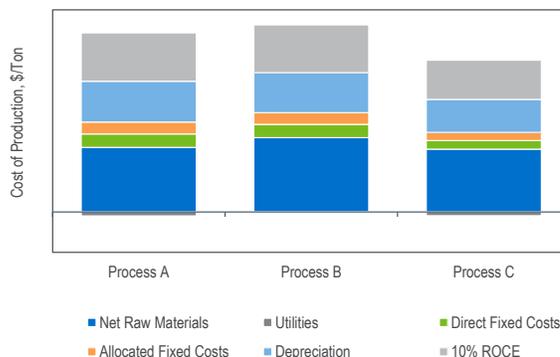
Processes may be classified according to pressures at which the oxidation and absorption reactions are carried out. The mono medium pressure, mono high pressure, and medium/high dual pressure processes dominate investments for nitric acid plants. Yet, dual pressure processes are used for newer nitric acid plants.

Process technology for nitric acid worldwide is offered by a handful of licensors that offer both mono and dual pressure processes. Based on the ammonia oxidation route, licensors utilize different feed ratios and pressures based on their individual processes.

Process Economics

Detailed cost of production estimates for various technologies are presented for USGC, Western Europe, China, and India locations. Estimates are developed for mono and dual pressure commercial routes to nitric acid. Sensitivity analyses on feed pricing, economy of scale, and capital investment were also developed. Additionally, a return on investment analysis for nitric acid production on a stand-alone facility or an ammonia and nitric acid complex over the last 5 years is provided for the routes and regions studied in this report.

Nitric Acid Production Costs



Market Overview

By far, the largest application of (weak) nitric acid is in fertilizer production (ammonium nitrate and nitrophosphate-type NP and NPK fertilizers), consuming between 75 to 80 percent of the nitric acid produced.

Nitric acid capacity is concentrated in fertilizer producing regions such as Europe and North America. On the other hand, in countries like China, the majority of the nitric acid is used in the chemical industry.

Reference lists of nitric acid plants for the major licensors are provided in this TECH report.



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- Chemistry
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- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

NexantECA serves its clients from over 10 offices located throughout the Americas, Europe, the Middle East, Africa, and Asia.

Americas

Tel: +1 914 609 0300
44 S Broadway,
5th Floor White Plains
NY 10601-4425
USA

Europe, Middle East & Africa

Tel: +44 20 7950 1600
1 King's Arms Yard
London EC2R 7AF
United Kingdom

Asia Pacific

Tel: +662 793 4600
22nd Floor, Rasa Tower I
555 Phahonyothin Road
Kwaeng Chatuchak
Khet Chatuchak
Bangkok 10900
Thailand

For more information. please contact
Technology@NexantECA.com or www.NexantECA.com