

# Production of Nitric Acid

## CATALYST COSTS IN MODERN PROCESSES

The present production of about 25 million tons per year of nitric acid gives this intermediate a key position in the world's fertiliser industries. Almost all this acid is derived from ammonia by a route that is by now very well known and established: the ammonia is oxidised to nitric oxide by air or oxygen on passing through a rhodium-platinum alloy gauze pad, the resulting nitric oxide is further oxidised to nitrogen dioxide by excess air or oxygen, and the dioxide is regeneratively absorbed by water to form nitric acid.

Although every individual stage of the overall process is relatively simple, there exists a number of variables in each to make possible a wide range of combinations of operating conditions. Specific combinations of these have led to the development of a range of proprietary nitric acid processes that are now offered to the chemical industry under licence, mainly through chemical plant contractors. Prospective plant operators thus have to evaluate the economic and technical features of the available competing processes against the background of their individual local operating conditions. Since the final selection of a particular process is inevitably based on economic considerations, the complex interdependence of the numerous process operating variables, and the plant capital investment and operating costs makes this task a formidable one.

Brief descriptions of the salient technical and operating cost features of ten of the currently available nitric acid processes have been compiled in a recent publication (1). The information presented has been based on data provided by the process licensors, and does not necessarily represent individual operators' experience. A flowsheet, technical description and analysis of estimated operating costs is provided for each proprietary process.

Nine of the ten processes described use platinum alloy gauzes in the ammonia oxidation stage, and between them they account for almost all the nitric acid produced. The tenth process, offered by C. & I. Girdler, uses a non-platinum metal catalyst in the ammonia oxidation stage. Comparing data given for all ten processes, the cost of this catalyst appears to be the same as for conventional platinum alloy gauzes, while the total cost of the nitric acid made by this process is given as substantially higher than the average cost for the other conventional processes.

The role of platinum in the catalytic stage of nitric acid production has earlier been reviewed in detail in this journal (2); it is clear from the data now presented that platinum catalyst costs contribute from 1.0 to 6.7 per cent of the total operating costs, with the average contribution being only 2.7 per cent. The lower catalyst costs are incurred in plants operating at or near atmospheric pressure in the oxidation stage. Such plants—with the absorption stage operating at elevated pressures—are favoured where high ammonia cost necessitates the highest possible conversion yields, or where the cost of power for the increased compression required by high pressure oxidation systems is particularly high.

An important feature that was omitted from the compilation of process information is the effect on operating costs of having an efficient platinum alloy recovery system. One such system, using gold-palladium catchment gauzes, is now gaining acceptance in the industry and has been described in this journal (3).

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### References

- 1 *European Chemical News*, January 30th, 1970, Nitric Acid Supplement
- 2 H. Connor, *Platinum Metals Rev.*, 1967, **11**, 2-9 and 60-69
- 3 H. Holzmann, *Ibid.*, 1969, **13**, 2-8