Knovel®

REFINING & PETROCHEMICALS

Solution Story: Global Integrated Oil & Gas Company

How Knovel Helped an Engineering Team Increase Capacity, Avoid Shutdowns & Save Millions

How Knovel Helped an Engineering Team Increase Capacity, Avoid Shutdowns & Save Millions
A global engineering team was challenged to debottleneck production in a polypropylene plant. Using Knovel, the team successfully identified the best and most cost-effective approach for debottlenecking the plant. This increased capacity at a low cost and potentially resulted in an annual topline increase of tens of millions of dollars.

> **“ Knovel was utilized as a trusted resource for collaboration across a global team of engineers working on the project and was used to make key unit operations selection decisions for a highly complex manufacturing process.”**
>
> —Anoush Taline*, Principal Process Engineer and Team Lead

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Challenge

Improving Production Capacity

Anoush is a process engineer for one of the top producers of bulk petrochemicals, including polypropylene. In addition, her company is also the world’s leading licensor of polypropylene manufacturing technology. As part of the contractual agreement with customers who license their technology, Anoush is part of a global team of engineers that work closely with their customers for process design, scale-up and other operational support processes. This is important given the complexity of plant and manufacturing operations.

Typically, her company’s customers are looking for ways to increase production capacity by debottlenecking production, but without increasing CAPEX expenditure to do so.

Alongside the plant’s engineering team, Anoush’s team was challenged to undertake a debottlenecking project to optimize overall production without reducing yield. This would potentially reconfigure the plant’s equipment and production process to support new production capacity.

Solution

Finding an Inexpensive Way to Debottleneck the Plant

Anoush's team first examined the overall operating conditions of the facility. Her team conducted a comprehensive assessment of the current operating parameters and system settings with the design specifications of the process equipment.

After the initial evaluation was completed, her team turned to Knovel to help evaluate and identify cost effective approaches to debottlenecking the plant. The team determined that an increase in throughput through the reactor was the most practical approach, and that a decrease in reaction time would lead to an increase in the amount and variety of fine polymer particles being produced, which would optimize overall production.

Knovel was used by the team of engineers to make key unit operations selection decisions for a highly complex manufacturing process as it was deemed to be a comprehensive and valuable reference resource. Ultimately, cyclone separators and dryers were chosen and implemented to achieve the desired level of separation and filtering of polymers.

Correct selection of separation equipment was essential to prevent build-up of fine particles in piping and instrumentation (P&I) systems. Rapid build-up due to high capacity operations can result in unplanned (and very expensive) plant shutdowns.

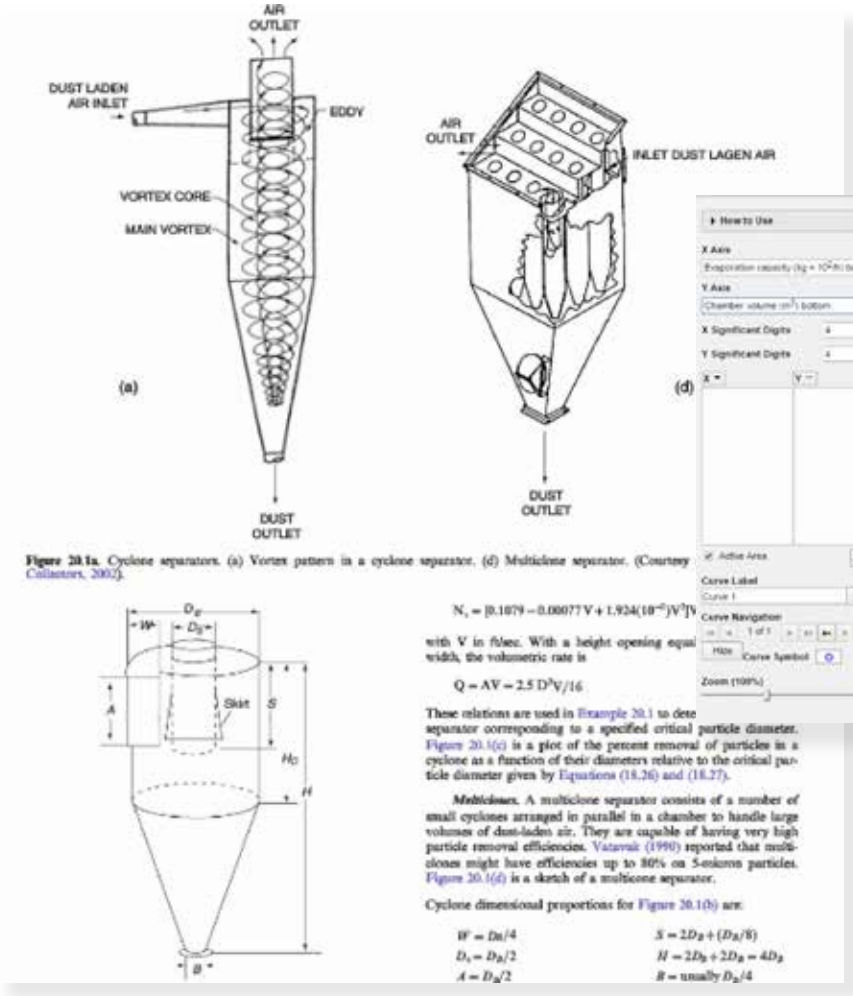


Figure 20.1a. Cyclone separators. (a) Vortex pattern in a cyclone separator. (d) Multiclone separator. (Courtesy Clarkstown, 2002).

$$N_c = [0.1879 - 0.00077\,V + 1.924(10^{-6})V^2]V$$

with V in ft/sec. With a height opening equal width, the volumetric rate is

$$Q = AV = 2.5\,D^2V/16$$

These relations are used in Example 20.1 to dete separator corresponding to a specified critical particle diameter. Figure 20.1(c) is a plot of the percent removal of particles in a cyclone as a function of their diameters relative to the critical particle diameter given by Equations (18.26) and (18.27).

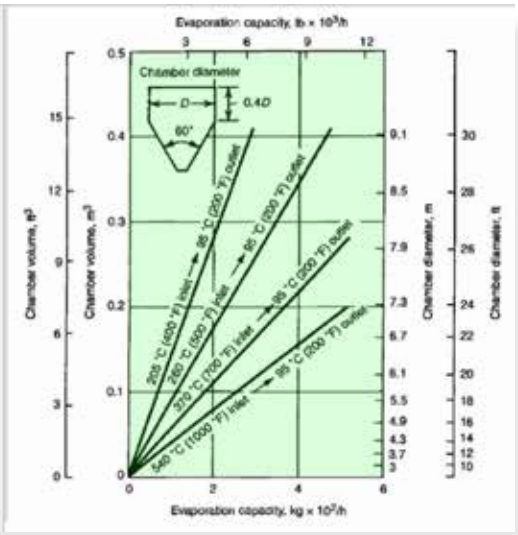
Multiclones. A multicione separator consists of a number of small cyclones arranged in parallel in a chamber to handle large volumes of dust-laden air. They are capable of having very high particle removal efficiencies. Vatavuk (1990) reported that multiclones might have efficiencies up to 80% on 5-micron particles. Figure 20.1(d) is a sketch of a multicone separator.

Cyclone dimensional proportions for Figure 20.1(b) are:

$W = D_1/4$ $\quad S = 2D_2 + (D_2/8)$

$D_1 = D_2/2$ $\quad H = 2D_2 + 2D_2 = 4D_2$

$A = D_2/2$ $\quad B =$ usually $D_2/4$



Business Impact

Increasing Capacity, Avoiding Shutdowns & Saving Millions

Typical capacity increase targets for large scale bulk polymer production facilities can be as high as 20%. Based on their models, it was expected that their solution would result in an annual topline increase of tens of millions of dollars.

Because of Knovel, choosing the right equipment was successfully achieved and the reduced threat of unplanned shutdowns would bolster profit margins in the long-term.

Knovel

Knovel helps oil & gas businesses minimize risk while maximizing output and efficiency by providing engineers access to technical reference materials and interactive tools for developing and managing projects with greater efficiency and certainty.

For more information about Knovel, visit elsevier.com/rd-solutions/oil-and-gas

Elsevier offices

ASIA AND AUSTRALIA
Tel: + 65 6349 0222

JAPAN
Tel: + 81 3 5561 5034

KOREA AND TAIWAN
Tel: +82 2 6714 3000

EUROPE, MIDDLE EAST AND AFRICA
Tel: +31 20 485 3767

NORTH AMERICA, CENTRAL AMERICA AND CANADA
Tel: +1 888 615 4500

SOUTH AMERICA
Tel: +55 21 3970 9300

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