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The Caprolactam Business Must Change: New Production Plants Cannot Be Justified

Abstract

The present condition of the caprolactam production industry, and the dynamic changes in the caprolactam world market are critically overviewed. A forecast is made based on the trends in development of new production capacities.

Key words: caprolactam, industry, production capacity, demand, nylon.

Restructuring of the caprolactam business is urgently required, according to DSM Fibre Intermediates. The current average industry margin is unsustainable, the supply buffer too high and many production plants are too small to remain commercially viable. A number of economically unjustified new plants also threaten the industry's long-term profitability.

Speaking at the World Fibres and Feedstocks Conference held recently in Singapore, Sim van der Linde, business development manager of DSM Fibre Intermediates, noted that the price of caprolactam (currently around US\$1200/tonne) has fallen steadily over the past decade. Further, rock-bottom prices at the end of 2002 resulted in a cutback in production, mainly due to prolonged plant closures.

What is more, margins have not improved because benzene prices have reached high levels recently. Consequently, the average industry margin is at a historic low, which has had a negative impact on the whole business chain.

The caprolactam buffer - the difference between production capacity and demand - is currently too high. Demand has been growing steadily since the early 1990s, and in 2000 caprolactam capacity increased in anticipation of further growth. However, demand dipped in 2001 due to the global economic downturn. As a result, the supply buffer has increased to historically high levels and the utilisation rate has nose-dived.

As a result, plans to restart idle plants have been shelved and a number of smaller plants have closed, including temporary shutdowns in China and Japan, and the probably permanent closure of Enichem in Italy (see Table 1).

Although caprolactam is a global product, many caprolactam plants are simply

too small. There are few plants with an annual capacity above 200,000 tonnes, but a large number with less than 100,000 tonnes, particularly in Eastern Europe, the CIS, India, China and Latin America. Some 12 plants represent 50% of global capacity. Many smaller plants have difficulties from a cost point of view.

Global caprolactam production amounted to 3.7 million tonnes in 2002, with more than 40% (1.6 million tonnes) produced in Europe and the Middle East. Asia consumed 1.8 million tonnes of caprolactam, yet produced less than 1.2 million tonnes, with most of the deficit being supplied from Europe.

Asia is the most dynamic caprolactam market, with China, Taiwan and Korea together representing 70% of Asian demand. China shows the largest growth in consumption, and is increasing imports of both nylon polymer and fibre. Meanwhile, Taiwan is showing a significant increase in caprolactam and nylon capacity. In Korea and Japan, the nylon industry is shifting from fibres towards engineering plastics and film, while in Thailand, India and Indonesia, nylon markets are reviving after the Asian crisis.

DSM Fibre Intermediates is one of the world's leading producers of caprolactam, the raw material used to produce nylon-6. A member of the Nylon-6 Promotional Group (NPG-6), DSM has been committed to the caprolactam and nylon business for more than 50 years, and presently has a capacity of more than 500,000 tonnes at plants in the Netherlands, the USA and China. Expansion at its plant in China will increase capacity there to 140,000 tonnes by 2005.

Nylon-6 is a versatile material that is used in numerous applications, principally as fibres for apparel and furnishing textiles, industrial yarns and floor cover-

ings, as well as resins for engineering plastics, principally in the electronics and automotive industries, as well as films for food packaging.

Nylon-6 provides a unique set of properties for textile fibres, including the following:



Figure 1. DSM's caprolactam plant in Nanjing, China; detail.

Table 1. Caprolactam plant closures, 1992-2003. Source: DSM Fibre Intermediates.

Plant	Capacity, kt	Date of closure
Rustavi, Georgia	50	1992
Chirchik, Uzbekistan	80	1994
Snia, Italy	20	1999
Agrobiochim, Bulgaria	25	2000
Fibrex, Romania	25	2001
Evergreen, USA	45	2001
CPDC, Taiwan	60	2001
Shijiazhuang, China	50	Q4 2001 - Q3 2002
Toray, Japan	90	Q1 2002 - Q3 2002
Enichem, Italy	120	2003
Ube, Japan	20	2003

softness and elasticity in hosiery; comfort and strength in cotton/nylon fabrics; elegance and durability in silk-like fabrics; and strength and light weight in sportswear, outdoor fabrics and military outfits.

Nylon-6 is also the most competitive material for bias-ply tyres, and has a number of benefits over both aluminium and nylon-66 when used in air inlet manifolds. Further, the use of nylon-6 film for food packaging, as well as in medical and industrial applications, is growing rapidly.

With an overall growth rate of around 2% a year, nylon-6 will continue to focus on specialities while cheaper materials will be used for commodities. Future market growth will largely be located in Asia, particularly China.

But if demand increases as predicted, and if the industry wants to achieve a reasonable operating rate, there is only room for about 100,000 tonnes of additional capacity. Several de-bottlenecking projects are planned, including the DSM/Nanjing plant in China, the Ube facility in Spain, and the Žilina plant in Slovakia, which together will add sufficient capacity for the anticipated growth in demand. However, on top of this, two new plants are planned, with the 120,000 tonnes plant of Capro Corp in Korea already under construction.

The demand developments indicate that there is no room for any new plants. If these new plants are added to the supply equation, then the overall utilisation rate will remain below reasonable levels, with

consequent low prices and low margins. New plants would, therefore, be responsible for a continuing overcapacity and cannot be justified. The additional capacity required can be covered by existing facilities.

As a result, DSM expects mergers or alliances between existing producers, the closure of smaller, non-competitive plants, restrictions on additional capacity, and more co-operation along the nylon-6 business chain, both upstream and downstream.

Changes in the caprolactam industry are both foreseen and needed to sustain the business. Our faith in nylon-6 is unaffected by these developments, but co-operation and innovation are the keys for supplying speciality, non-commodity markets. Nylon-6 remains the most competitive choice for many demanding applications.

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Figure 2. DSM's caprolactam plant in Nanjing, China.