List

Concentrated dissolving for homogeneous spinning dope

In conventional spinning dope production, capacity is typically a function of the maximum processing viscosity the spinning plant can handle. Often the prior dissolving process step is limited by this fact.
In a typical wet spinning operation, dope viscosity ranges from 500-2500 Pa·s (zero shear viscosity at 95 °C) can be handled. For processors looking to meet rising demand with world-scale plants, the limitations imposed by high viscosity dope solutions are challenging and costly. List AG, Arisdorf/Switzerland, have now adapted the company's high viscosity processing technology in order to meet the difficult processing challenges of today's high-production fiber lines. The technology can easily handle 20,000-200,000 Pa·s (zero shear viscosity).

Dissolving system

The resulting solution, the List Dissolving System, is a highly variable system that provides operators wide flexibility with regards to processing environment and the ability to accommodate a variety of substances and solvents. The system leverages this flexibility by decoupling the spinning dope production from the spinning process. This enables processors to use the system's capabilities to optimize the specific operating parameters for each step. It can be deployed as a single or twin step system. Fig. 1 shows a simple 3D layout of a standard List cellulose dissolving system.
Operation is divided into 2 steps: mixing is handled in the pulper or pre-mixer while dissolving occurs in the dissolver. The technology allows for a high degree of customization in each step.

MasterConti technology

The net result of this design is the ability to continuously produce a concentrated spinning dope with the highest possible dissolvable cellulose content. Comparable to a continuous masterbatch process, this patented technology is known as MasterConti and was specifically designed to increase the efficiency and the capacity of each line.
As illustrated in Fig. 2, the highly concentrated spinning dope exits the mixing phase and enters a separate dilution phase where it is diluted to the desired viscosity. The degree of dilution can be adjusted such that the downstream spinning operates at maximum capacity and delivers optimal fiber quality.
The List dissolving system and MasterConti technology have proven successful in customer trials and scale-ups. During the production of cellulose spinning dopes, use of the MasterConti technology resulted in spinning dopes containing 24 wt.% cellulose in NMMNO. The concentrated spinning dope was then successfully diluted down to between 10-12 wt.% in preparation for spinning. Applying the principles of high viscous processing allows a higher friction energy input during the dissolving of cellulose in NMMNO, which leads to a disproportionately higher performance and a more homogeneous dope quality. The downstream spinning plant can be fed with a cellulose content of 12 wt.% or less. No limitations arise from the previous process steps.

Advantage

A key limiting factor in spinning capacity is related to viscosity, specifically the maximum pressure drop that can be handled by the spinning nozzles. By separating the dissolving and spinning stages, the List dissolving system with MasterConti technology allows for each process to occur at the optimum viscosity. The result, shown in Fig. 3, is a significant increase in fiber capacity per line, whether using wet or dry cellulose.
The table provides an overview of the features and benefits.

Fig. 1
Cellulose dissolving system (List)

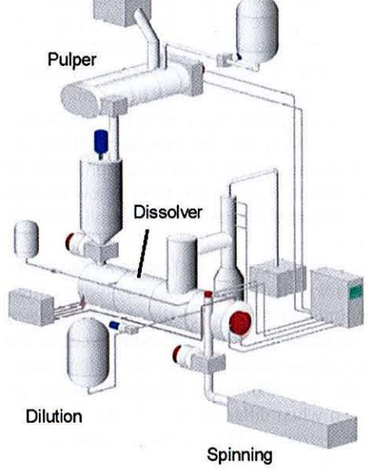


Fig. 2
Decoupling the dope production from spinning

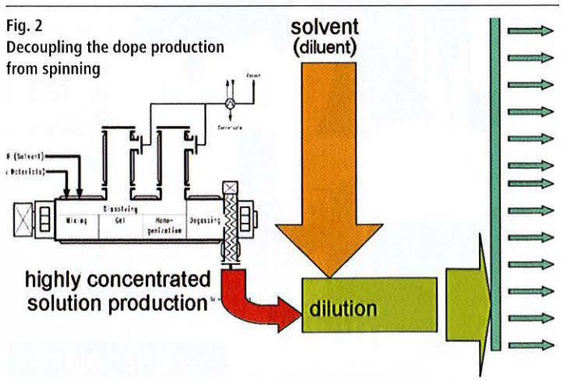
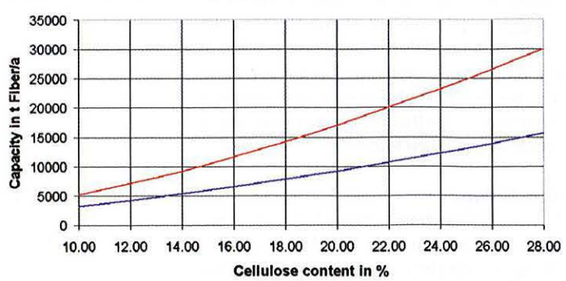


Fig. 3
Capacity as function of wet and dry cellulose content
Blue line 60 % NMMNO with dry cellulose (7 %)
Red line 80 % NMMNO with wet cellulose (50 %)



Overview of features and benefits

	Feature	Benefit
Product quality	High substance penetration	Creates homogeneous spinning dope
Raw material production	Adjustable shear rate	Dissolves difficult raw materials
Safety	Integrated back-degassing system	Eliminates bubbles during spinning
Process efficiency	Lowest specific energy consumption	Reduces OpEx cost
Production flexibility	Separate dissolving and spinning processes	Allows for Individual process optimization Provides the flexibility to process nonwovens, staple and technical fibers, filaments from the same spinning dope
Process productivity	Accurate temperature control	Ensures uniform production rate during the spinning process

Reference
[1] Gupta, V.B.; Kothari, V.K.: Manufactured Fibre Technology, p. 127, Springer Publishing 1997

MasterConti = trademark