

Perfect dissolving technology for very good fiber quality

The MasterConti by List AG, Arisdorf/Switzerland, enables fiber producers to decouple the production of the spinning solution from the subsequent spinning process and provides the flexibility to process a broad variety of raw materials.

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Fiber, filament, flies and foil are the final products of a complex process of mixing, dissolving, spinning, washing and drying of raw material. Many specialists believe that spinning, the phase when the fiber is created, is the only processing step responsible for the final fiber quality. This belief falls short as the fiber quality is also dependent on the dissolving step prior to spinning. Only completely

dissolved raw material can create a uniform, homogeneous and bubble free spinning solution. A solution that is further processed using adjusted spinnerets. It is also imperative that both the dissolving and spinning processes can be flexibly adjusted to different kinds of raw material (i.e. cellulose).

Optimizing by decoupling

By decoupling the production of the spinning solution (i.e. dissolving) from the subsequent spinning process, the MasterConti technology enables fiber producers to process a variety of raw materials and optimize the operating parameters for each step without limiting the following step. It is a successful adaptation of the Dry Processing Technology by List operating in the concentrated phase with viscosities up to 100,000 Pas.

Fig. 1 shows the MasterConti cellulose dissolving system. Operation is divided into 2 steps: mixing is handled in the pre-mixer, while dissolving occurs in the dissolver. Dilution is incorporated in the discharge section of the dissolver without additional equipment.

The result is a continuously produced spinning solution with very high dissolvable cel-

lulose content: in a laboratory system, a spinning solution with 28% cellulose content was achieved, while the cellulose content in a pilot plant ranged from 16-18% before being re-diluted to 8-13% in order to feature the perfect cellulose content for the spinning process. In addition, as the very narrow particle distribution in Fig. 2 shows, the spinning solution is extremely homogenous and the impairment of the raw material quality marginal (only 3% reduction of the degree of polymerization).

Applying the principles of high viscosity processing allows a higher mechanical energy input during the dissolving of cellulose in NMMNO. Therefore, the process is much more efficient and the production capacities can be considerably increased: Fiber capacities of up to 100 tons/day/line are possible. This is remarkable progress for more ecologically produced fibers such as lyocell versus traditional viscose.

Very good fiber quality

From a producer's perspective, the decisive criterion to judge any technology is the quality of the final product that will be sold on the market. In this case, a homogenous spinning solution must lead to very good fiber or filament qualities for different applications. Table 1 shows the properties of fibers that were spun from spinning solution produced during pilot tests done in 2014 and 2015 with the MasterConti technology.

Fig. 1
MasterConti technology (List)

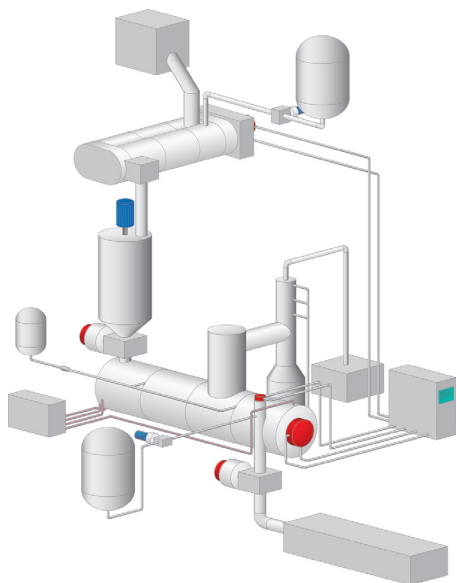


Table 1
Fiber properties produced with LIST MasterConti technology

	Staple fiber	Filament 1	Filament 2	Filament 3
Titer [dtex]	1.3	1.5	1.7	4
Length [mm]	38			
Average tenacity [cN/tex]	47	57	43	45
Average elongation at break [%]	12	8	7	9
Average modulus [cN/tex]	1550	1600		
Loop strength (dry) [cN/tex]	7	6		

Fig. 2
Particle distribution in spinning solution produced with List MasterConti

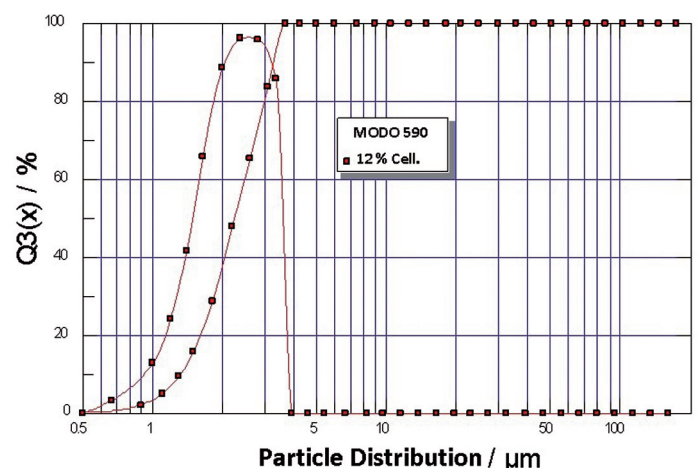


Table 2
Features of MasterConti technology

	Feature	Benefit
Product quality	High shear rate during dissolving	Creates very homogeneous spinning solution
Raw material	Adjustable penetration time	Dissolves difficult raw materials to reduce raw material costs
Spinning	Integrated back-degassing system	Eliminates bubbles before spinning
Process efficiency	Very low specific energy consumption	Reduces OPEX cost
Less solvent degradation	Reduced process temperature	Solvent recycling rate >99.5 % possible
Production flexibility	Separate dissolving from spinning processes	Provides the flexibility to process nonwovens, staple and filaments from the same spinning dope
Process productivity	Accurate temperature control	Ensures uniform production rate during the spinning process
Safety	Horizontal dissolver partly filled	Flushing with water stop possible exo-thermal reactions

Special fiber applications

The MasterConti not only produces a perfect spinning solution for the production of large capacities of staple fibers used in the textile industry, but also for more functionalized and valuable fibers with additives that are also incorporated with List technology. Additionally, spinning of filaments is possible to produce technical filaments with special properties and precursors for cellulose-based carbon fibers. Table 2 provides an overview of features and benefits of the MasterConti technology.

References

- [1] Gupta, V.B.; Kothari, V.K.: *Manufactured Fibre Technology*, p. 127, Springer Publishing, 1997
- [2] Diener, A.; Tretzack, O.: *Continuous masterbatch for the cellulose fiber industry*, *Chemical Fiber International* 61 (2011) 138