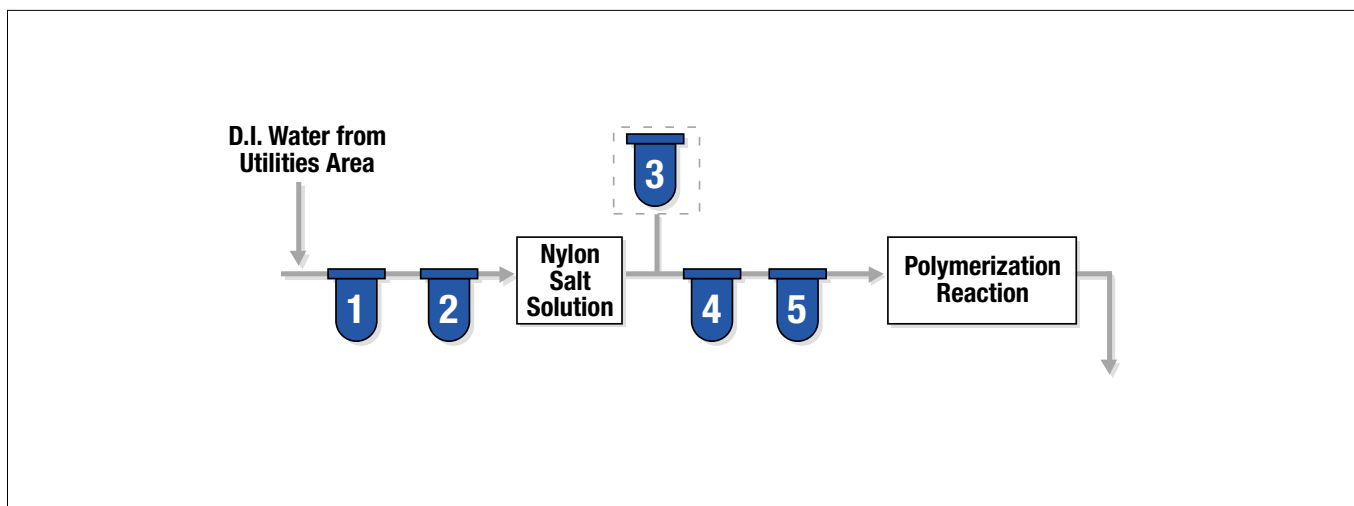


DI Water and Nylon Salt Filtration for Nylon 66 Fiber Production



Background

The Nylon 66 fiber industry has always looked at methods to optimize production, reduce fiber breaks, and improve fiber characteristics and yields. The trend is towards manufacturing finer denier and high strength fibers. This concentrated effort leads to investigating various fluid feed streams to determine their cleanliness levels and to categorize the size and type of contaminants typically present.

DI water, the major component in the preparation of nylon salt, is a significant source of contaminant. Removing extrinsic particles can directly enhance polymer quality uniformity and increase spin pack life. Thus, filtering various feed streams is an integral step in the Nylon 66 production process.

Findings

Optical microscope and X-ray emission spectroscopy, conducted by Pall staff scientists, revealed that the typical particle size found in the fluid streams ranged from submicron to greater than 40 μm . However, 90% of these fell within the 1 to 10 μm range. The major contaminants in DI water and nylon salt solution were iron, silica and polymeric particles. Typically, the concentration of iron (the major contaminant) is 10-20 ppm.

Conventional 1 μm nominal rated cartridges may be found in these Nylon 66 plants. Such filters are very ineffective in removing particles less than 10 μm in size. Contaminants typically occur as pipe scale, dirt and resin fines.

Solution

Pall's investigation revealed that replacing cotton wound cartridges with Pall Profile® II and/or Ultipor GF Plus® 2-40 μm absolute rated cartridges consistently removed the finer particles usually found in the fluid streams. Pall recommends using a two stage filtration system for DI makeup water. We recommend at the first stage prefiltering with either Ultipor GF Plus® or Profile® II filters rated at 5 μm absolute, followed by an Ultipor GF Plus® 2 μm absolute polishing filter at the second stage.

The contamination levels in the nylon salt solution can vary widely. In some instances, plate and frame filters followed by disposable polishing filters are used. For highly contaminated salt solutions, we recommend Pall Profile II filters staged down sequentially to meet the needs for improved product quality and spin performance. Profile II 40 μm absolute rated cartridges can be used to replace plate and frame or leaf filters followed by Profile II 5 μm absolute elements to replace nominally rated 2-5 μm cotton filters. Final filtration of the nylon salt solution is recommended using Profile II 2 μm absolute filters.

Table 1 outlines types of contaminant found in each of the feed streams at specific points in the process and recommends the Pall filter media needed to adequately optimize fluid quality.

Benefits

Since installing Pall filters, Nylon 66 fiber producers have experienced higher production rates, improved fiber quality, while reducing maintenance costs and system downtime. Ultipor GF Plus® and Profile® II filters maintain low, clean pressure drop, high dirt holding capacity and long service life. The reduced particle concentration in the nylon salt solution gives the added benefit of increased spin pack life. Refer to Polymer Processing Application Guide #3 for further production information.

These two photomicrographs below, shown at 100X magnification, represent effluent samples of nylon salt obtained from systems utilizing a conventional 1 µm nominal rated string wound filter (see Figure 1), and Pall's 2 µm absolute rated filter (see Figure 2). [Equal volumes of samples were drawn down on 0.8 µm absolute rated analysis membranes (14.6 µm/division).]

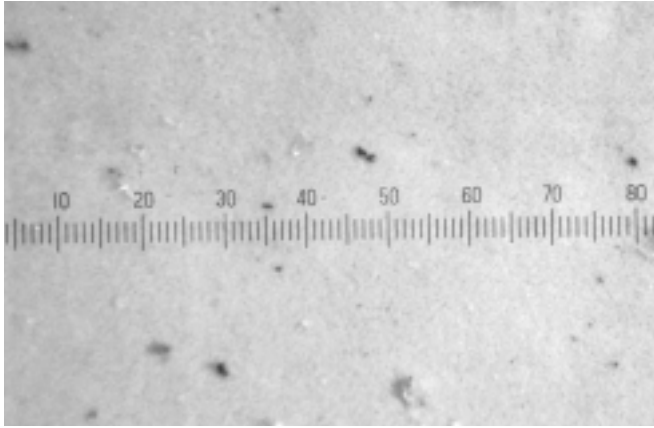


Figure 1.
Effluent Sample of Nylon Salt Filtered Using Conventional 1µm Nominal Rated String Wound Filter.

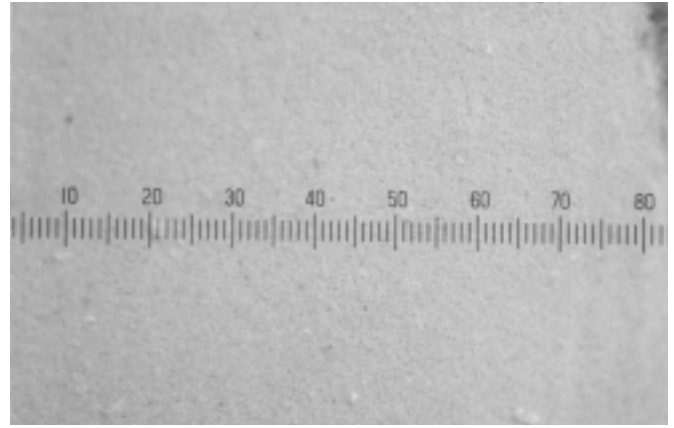


Figure 2.
Effluent Sample of Nylon Salt Filtered Using Pall's 2µm Absolute Rated Filter.

Table 1.

Filter Position	Application	Recommended Removal Level (Absolute µm)	Recommended Filter Element	Typical Contaminant	Typical Filter Used
1	DI water from utility house	5 µm	Profile® II Ultipor GF Plus®	Fe, Si (5-30 µm)	1-10 µm cotton wound (~10-70 µm absolute)
2	DI water point of use	2 µm	Ultipor GF Plus®	Fe, Si (1-10 µm)	1-5 µm cotton wound (~10-30 µm absolute)
3	Nylon salt prefilter	40 µm	Profile® II	Fe, Si (>20 µm)	Plate and frame or pressure leaf (>40 µm)
4	Nylon salt prefilter	5 µm	Profile® II	Fe, Si (5-50 µm)	2-5 µm cotton wound (~10-30 µm absolute)
5	Nylon salt polishing filter	2 µm	Profile® II	Fe, Si (1-20 µm)	1 µm cotton wound (~10 µm absolute)



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