PALL Industrial Process

# Glycol Filtration For Polyester Production

## Background

The polyester film and fiber industry has relied on its well established polymer processing technology to keep pace with market and customer demands. The industry has always looked at methods to optimize production, reduce film or fiber breaks, and improve yields and end product characteristics. This industry is driven to manufacture thinner, higher quality films used for critical electronic applications as well as finer denier, high strength fibers. This concentrated effort lead to investigating various fluid feedstreams to determine their cleanliness levels and to categorize the size and type of contaminants typically present.

Pall Corporation, in cooperation with polyester producers through numerous evaluations, has identified major contaminants in ethylene glycol. It was determined that removing extrinsic particulate can directly enhance polymer film or fiber quality and increase on-stream life of the final melt filter. Thus, filtering various feedstreams became an integral step in the polyester film or fiber production process. Until recently, nominal rated string wound filters were utilized. Pall's finer filtration technology has proven instrumental in capturing fine particulate in polyester feedstreams.

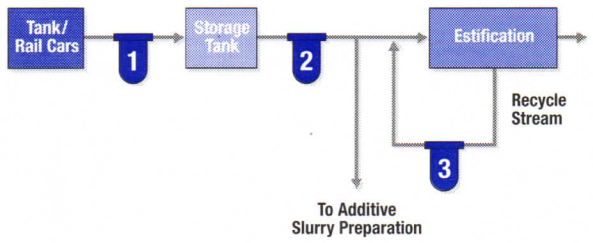
## Findings

Optical microscope and X-ray emission spectroscopy, conducted by Pall's staff scientists, revealed that the typical particle size found in the ethylene glycol stream ranged from submicron to greater than 50 µm. However, 90% of these are in the 1-10 µm size range. Major contaminants present are iron, silica and polymeric particles. Conventional 1µm nominal rated cartridges may be found in these polyester plants; such filters are very ineffective in removing particles less than 10 µm in size. These 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® 2-10 µm absolute rated cartridges consistently removed finer particles

**Ethylene Glycol in Polyester Film, Fiber and Resin Plants**




present in the ethylene glycol stream. Pall recommends filtering the ethylene glycol at three different positions in the process.

1. Virgin ethylene glycol typically arrives at a polyester manufacturing facility via rail cars. During transport and unloading, the ethylene glycol picks up contamination such as dirt and pipe scale. Pall recommends that a Profile II or Ultipor GF Plus 5-10 µm absolute rated cartridge be employed at the rail car unloading position.

2. As it is pumped, the ethylene glycol picks up contaminant from storage tanks and piping. Pall recommends filtering the ethylene glycol feed to the polymerization reactor using a 2 µm absolute rated Ultipor GF Plus or Profile II filter element.

3. Recycled ethylene glycol should be filtered using a Profile II or Ultipor GF Plus 5-10 µm absolute rated filter. The recycle stream contains typical contaminants associated with dirt and pipe scale as well as large polymeric particles from the process.

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

**Table 1.**

| Filter Position | Application | Recommended Removal Level (Absolute µm) | Recommended Filter Element | Typical Contaminant | Typical Filter Used |
|---|---|---|---|---|---|
| 1 | Virgin ethylene glycol from rail car | 5-10 µm | Profile II<br>Ultipor GF Plus | Fe, Si (<25 µm)<br>Al, Cu | As coarse as 5 µm cotton wound (~20-30 µm absolute) |
| 2 | Virgin ethylene glycol point of use | 2 µm | Profile II<br>Ultipor GF Plus | Fe, Si, (<25 µm)<br>Al, Cu | 1-5 µm cotton wound (~10-30 µm absolute) |
| 3 | Ethylene glycol recycle | 5-10 µm | Profile II<br>Ultipor GF Plus | Polymeric (>50 µm)<br>Fe, Si (25 µm)<br>Al, Cu | 1-5 µm cotton wound (~10-30 µm absolute) |

## Benefits

Since installing Pall filters, polyester film and 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 ethylene glycol gives the added benefit of increased life to the final melt filter. Refer to Polymer Processing Application Guides #1 and #2 for further production information.

The three photomicrographs, shown at 100X magnification, represent samples of ethylene glycol obtained from systems utilizing no filtration (see Figure 1), effluent samples of a conventional 2 µm nominal rated string wound filter (see Figure 2), and Pall's 2 µm absolute rated filter (see Figure 3). Equal aliquots of samples were drawn down on 0.8 µm absolute rated analysis membranes (14.6 µm/division).

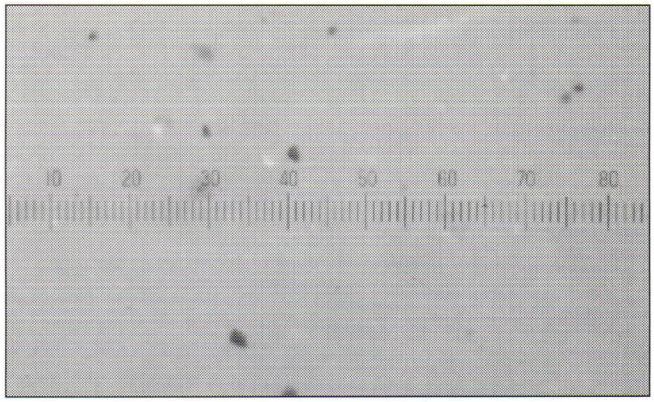



***Figure 2.*** *Effluent Samples of Ethylene Glycol Filtered Using A Conventional 2 µm Nominal Rated String Wound Filter.*

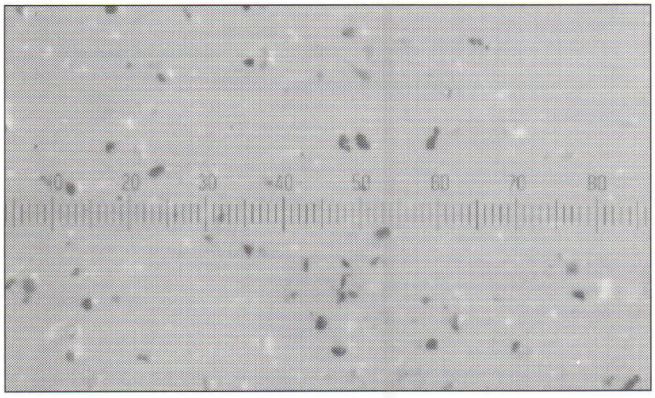



***Figure 1.*** *Samples of Ethylene Glycol Unfiltered.*

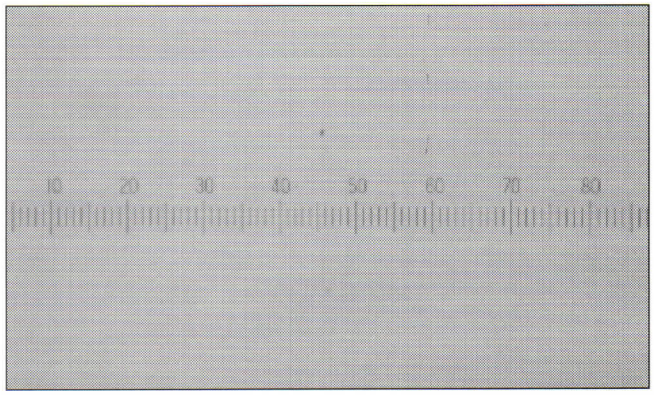



***Figure 3.*** *Effluent Samples of Ethylene Glycol Filtered Using Pall's 2 µm Absolute Rated Filter.*

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