Identification of acid-insoluble filter-plugging compounds and optimal acid-washing procedures for tubular backpulse pressure filters

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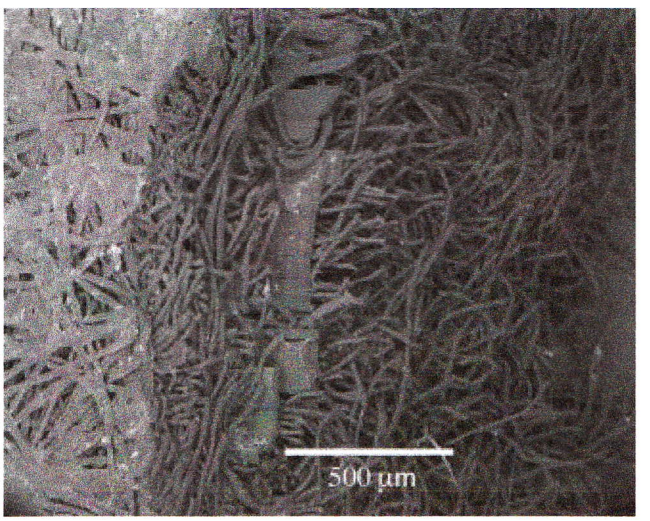
ABSTRACT: Over time, performance of tubular backpulse pressure filters in kraft mills deteriorates, even with regular acid washing. Unscheduled filter replacement due to filter plugging results in significant costs and may result in mill downtime. We identified acid-insoluble filter-plugging materials by scanning electron microscope/energy-dispersion X-ray spectroscopy (SEM/EDS) and X-ray diffraction (XRD) analysis in both polypropylene and Gore-Tex™ membrane filter socks. The major filter-plugging components were calcium sulfate (gypsum), calcium phosphate (hydroxylapatite), aluminosilicate clays, metal sulfides, and carbon. We carried out detailed sample analysis of both the standard acid-washing procedure and a modified procedure. Filter plugging by gypsum and metal sulfides appeared to occur because of the acid-washing procedure. Gypsum formation on the filter resulted from significant hydrolysis of sulfamic acid solution at temperatures greater than 130°F. Modification of the acid-washing procedure greatly reduced the amount of gypsum and addition of a surfactant to the acid reduced wash time and mobilized some of the carbon from the filter. With surfactant, acid washing was 95% complete after 40 min.

Application: By modifying acid-washing procedures, process engineers can reduce costs of pressure filter operation by increasing the time between acid washes and reducing unscheduled filter replacement due to plugging.

Tubular backpulse pressure filters consist of a large filter housing containing several hundred perforated stainless steel tubes with filter socks on each tube. Each filter sock is roughly 7 cm (2.75 in.) in diameter by 120–180 cm (48–70 in.) in length. This system provides excellent filtration efficiency at high flow rates with high solids content. This filtration system is commonly used with lime mud slurry to produce clarified white liquor and for filtration of weak wash.

The filter socks are available in two types—polypropylene and Gore-Tex™—consisting of a woven polypropylene-fiber filter fabric. In the polypropylene filter, the woven surface is calendered to flatten the surface fibers. Fiber diameter is about 25 μm, pore size is typically 10–150 μm, and sizes are irregular. **Figure 1** shows a scanning electron microscope (SEM) image of a used polypropylene white liquor pressure filter (WLPF); the filter surface is on the left and shows the flattened polypropylene fibers. The filter body consists of polypropylene fibers and thicker reinforcing fibers.



1. Scanning electron microscope (SEM) image of used white liquor pressure filter (WLPF) polypropylene filter cross section (sample T1). Filter surface is at left.

A typical Gore-Tex filter consists of a woven polypropylene-fabric base filter with a very thin membrane of Gore-Tex fabric bonded to the filter surface. **Figure 2** shows an SEM image of a used Gore-Tex WLPF; the surface is on the left, and the pore size is too small to see at the magnification used.

Trademarked Gore-Tex filter membranes are expanded film polytetrafluoroethylene (PTFE) polymers. A highly oriented film is stretched at right angles to the original orientation of the polymer crystallites to produce voids in the membrane surface [1]. The size of these voids, or pores, will vary depending on the manufacturing conditions and intended use. Pore sizes of Gore-Tex filter membranes are much smaller (0.5–3 μm) and more uniform than those of the polypropylene filter material shown in Fig. 1. **Figure 3** shows a

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