TUBULAR BACKPULSE PRESSURE FILTERS: IDENTIFICATION OF ACID-INSOLUBLE FILTER PLUGGING COMPOUNDS AND OPTIMIZATION OF ACID WASHING PROCEDURES

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ABSTRACT

Tubular backpulse pressure filters are commonly used in Kraft mills for clarification of white liquor and weak wash. Filter replacement due to plugging can cost approximately $40,000 per filter unit and may result in mill downtime. Acid washing of filters is commonly used but is not always effective. In this study, acid-insoluble filter-plugging materials are identified by SEM/EDS and XRD in both polypropylene and Gore-Tex™ membrane filter socks. Calcium sulphate (gypsum), calcium phosphate (hydroxylapatite), aluminosilicate clays, metal sulphides and carbon were identified as major filter-plugging components. Detailed sampling of both the standard acid washing procedure and a modified procedure were carried out, with detailed sample analysis.

Calcium sulphate (gypsum) formation on the filter was shown to result from significant hydrolysis of sulphamic acid solutions used to clean the filters. Modification of the acid washing procedure greatly reduced the amount of gypsum present as a filter-plugging component. Addition of a surfactant to the acid reduced wash time and was able to mobilize some of the carbon from the filter. With surfactant, acid wash was 95% complete after 40 minutes. In this work, modified acid-washing procedures improved filter washing. Potential methods to remove acid-insoluble filter-plugging materials are discussed.

INTRODUCTION

Tubular backpulse pressure filters consist of a large filter housing containing several hundred perforated stainless steel tubes with filter socks placed on each tube. Each filter sock is roughly 7 cm in diameter by 120 to 180 cm 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. It is also used for filtration of weak wash.

The filter socks themselves are available in two types: polypropylene and Gore-Tex™. Both filters consist of a woven polypropylene fiber filter fabric. In the polypropylene filter, the surface has been calendered to cause some flattening of the surface fibers. Fiber diameter is about 25 microns. Pore size of these filters is typically 10 to 150 microns and sizes are irregular. An SEM image of a used polypropylene white liquor pressure filter (WLPF) is shown in **Figure 1.** In the figure, the filter surface is on the left and the flattened polypropylene fibers can be seen. The body of the filter consists of polypropylene fibers and thicker reinforcing fibers.

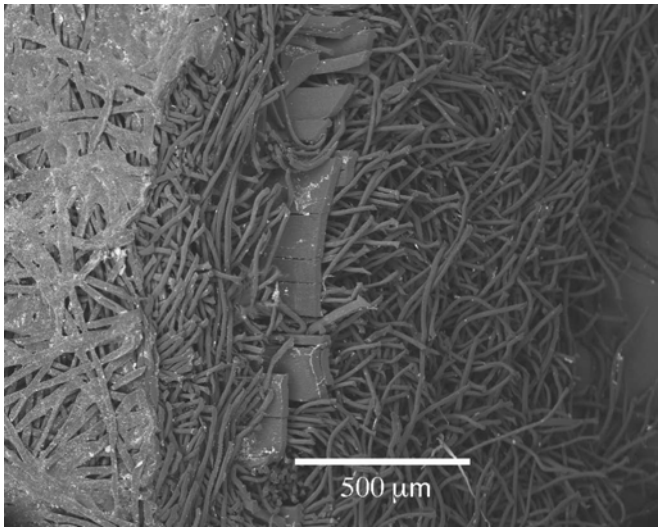

Figure 1. SEM Image of Cross-Section of Used WLPF Polypropylene Filter (KT1). (Filter surface at left).

The 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 the SEM image of a used Gore-Tex™ WLPF. The filter surface is on the left, and the pore size is too small to observe at this magnification.

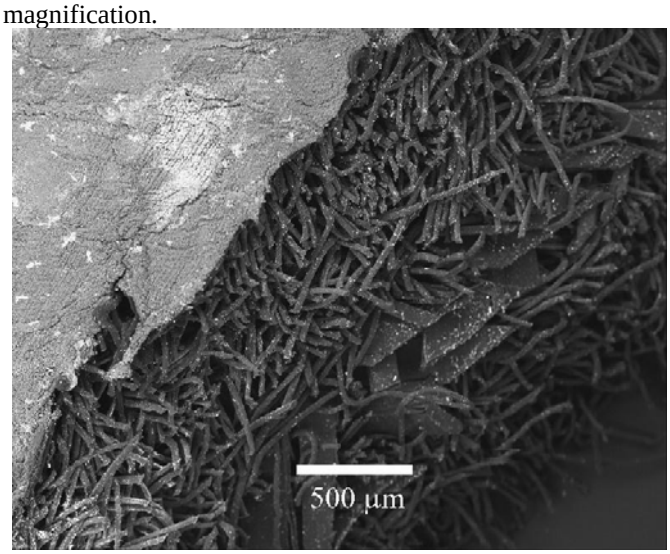

Figure 2. SEM Image of Cross-Section of Used WLPF Gore-Tex™ Filter (KT3). (Filter surface at left).

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 (Gore, 1980). The size of these voids, or pores, will vary depending on the manufacturing conditions and intended end use. Pore sizes of Gore-Tex™ filter membranes are much smaller than polypropylene filters. **Figure 3** shows a typical Gore-Tex™ filter membrane at much higher magnification than **Figure 2**. Pore size is 0.5 to 3 microns and sizes are much more uniform than observed with the polypropylene filter material shown in **Figure 1**.