FILTRATION OF A MUCILAGINOUS PLANT SAP

How optimization saves time and reduces operating costs

NOTE
Product names and filter sheet grades may have changed since the application note was created.

1 Introduction

Depth filtration is one of the most efficient and most economical types of filtration. The solid particles are mainly retained in the interior of the matrix of the filter media. Depth filter sheets (e.g. FIBRAFIX® and PURAFIX® series from FILTROX) are the most common of depth filter media. They are between 3 and 4 mm thick and consist of a blend of refined cellulose fibers, powdery filter aids, e.g. kieselguhr (diatomaceous earth) and/or perlite. An inert resin is added to provide wet strength; and – depending on the type of resin – also to create a higher charge or "zeta potential". For this reason, FILTROX offers the higher charged series PURAFIX® CH ZP. Depth filter sheets are utilized either as flat sheets in sheet filters (e.g. NOVOX® systems) or as pre-assembled modules (FILTRODISC™) in closed filter housings (e.g. DISCSTAR™).

For even higher requested capacities, e.g. products with very high particle loads, compressible particles or slimy impurities, alluvial filtration is used. Alluvial filtration is another type of depth filtration and a well-established, economical method in pharmaceutical applications (e.g. purification of human plasma derived proteins or cell removal in biologicals manufacturing). Instead of only using immobilized depth filter media, filter aid is used for precoat and/or bodyfeed to build a filter cake during filtration.

2 The Challenges

A large variety of plant extracts are manufactured for use in the cosmetics industry. This paper describes the filtration process for a gelatinous pressed leaf juice containing suspended particles and colloids, both floating and sedimenting. The high content of mucilage (natural polysaccharides) leads to premature blocking of the filter surface due to conglutination and, therefore, makes filtration difficult. The product needs to be filtered over an absolute membrane with a pore size of 0.2 µm in order to achieve stability regarding microbiology as well as turbidity.

In order to get to the 0.2 µm membrane, the former process consisted of 3 prefiltration steps, all with filtration products from notable manufacturers. Including the membrane filtration, a total of 4 filtration steps were needed which are shown in the figure below (fig. 1). The filtration of a small batch (220 kg) took 11 hours with several changes of bags, filter sheets (70 and more filter sheets size 40×40 cm were needed) and cartridges. The costs for material and labor made this process not economic.

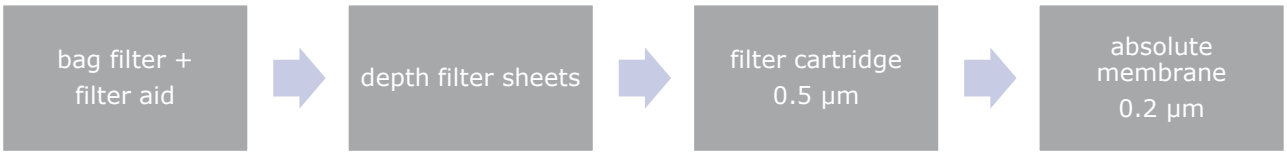

Figure 1: Former process with a total of 4 filtration steps

The objective was to optimize the filtration process, reduce operating costs and keep an eye on easy handling for the operators.

3 The Solution

Initially, several tests at lab-scale took place where the steps as shown in figure 2 showed the best results. These results were verified during production-scale tests with a batch of 220 kg of the gelatinous leaf juice.

Figure 2: New process with FILTROX products

The first filtration step was an alluvial filtration with a relatively fine cellulose (Vitacel L-10; JRS) as filter aid onto a lenticular module (FILTRODISC™ CH 03P; FILTROX) containing a coarse depth filter sheet as support for the filter cake. Due to simplicity reasons, precoat and bodyfeed took both place directly from the feed tank. Turbidities of the raw material as well as after every filtration step are shown in table 1. For the second filtration step, it was important to remove any colloids and fines that were left behind, for a good protection of the subsequent membrane. Therefore, a fine depth filter sheet with a higher charge was chosen (PURAFIX® CH ST 145ZP; FILTROX). Following straight after this depth filtration, the membrane filtration felt like a breeze, leading to perfect product quality, and the whole filtration process took place without any filter changes, lasting a maximum of two hours.

After successful testing and validation, the new process was implemented in the production.

Table 1: Turbidity values throughout new process

	Turbidity [NTU]
Raw material	398
After 1st filtration step (alluvial filtration)	12
After 2nd filtration step (depth filter sheets)	1
After 3rd filtration step (absolute membrane)	0.04

4 The Benefits

The customer's filtration process was optimized regarding simplicity, labor and use of materials, leading to general cost reduction:

- Reduction of filtration steps from 4 to 3 steps
- Reduction of filtration time from 11 hours to only 2 hours
- No change of filters throughout filtration
- Only 14 filter sheets needed instead of 70+
- Maximum differential pressure was not yet reached at the end of filtration

5 Contact Information

For further information on this or other applications contact your local FILTROX representative or the FILTROX Academy (applications@filtrox.com).