CRITICAL PROCESS FILTRATION, INC.

Application Summary

Final Filtration in Chemical Processing

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Final filtration in chemical processing is the most critical filtration process. While removing particles and clarifying the product are important, the quality and value of the final product depends on the efficiency and cost effectiveness of the final filters.

The filtration objective is what will govern the choice of filter technology. The objective is always to remove all the particles and other contaminants that might adversely affect product quality. However, the amount of particle reduction and what needs to be removed can vary widely.

Bulk chemicals may only need to have visible particles removed from the packaged product. Specialty chemical products may require the removal of all particles above a certain size. High purity chemicals, such as those destined for use in fabricating semiconductors or electronic products, will require the removal of almost every particle larger than a few nanometers in size. If a chemical will be used to manufacture drug products, then it will certainly have to be free of bacteria. Of course, all final filtration has to be performed using filters compatible with the chemistry.

Housing "3" in the figure below is where "final" filtration is performed. This is just before packaging and is shown as a single filter. For products that only need to have larger particles removed, this process could be completed in a single filtration step. However, processors need to be aware if the type and number of particles in their products along with the size distribution of those particles. A very highly loaded stream may require multiple filtration steps, even if the filtration goal is only removal of large particles.

If the goal is removal of either bacteria or very small, sub-micron or even nanometer sized particles, operators will often use 2 or more stages of filtration. Using multiple filter steps improves filtration process efficiency and cost-effectiveness, even if the initial cost of the filters is higher than for a single step.

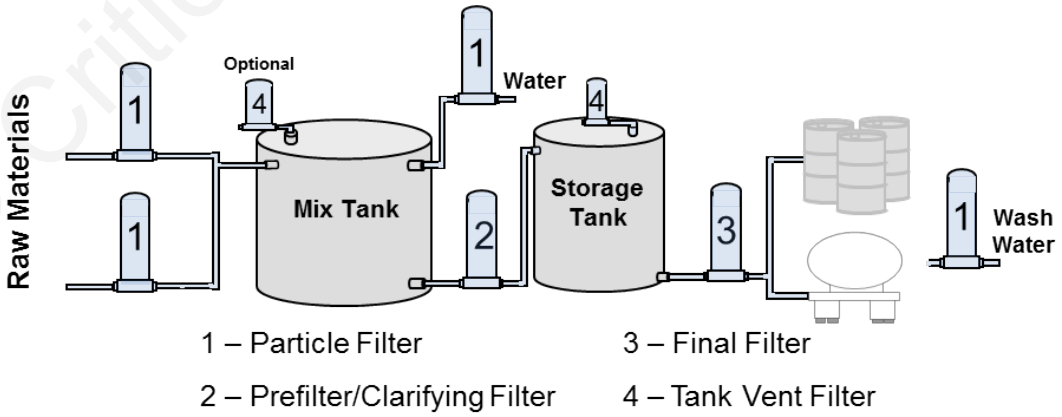

Figure 1: Common Filtration Steps in Chemical Processing

The schematic in the figure shows a simplified chemical processing system. This simplified version shows a single step final filtration process just before packaging.

The particles and other contaminants to be removed may be introduced to the process with ingredients from outside sources and too small to be removed during particle filtration, or they could be created as part of the process. Powder ingredients, for example, may introduce undissolved particles and impurities that can be carried downstream and through the process. The chemical reactions used in production can result in particles. Even normal wear and tear on system components such as pumps and valves can create particles. The housing marked "3" may have a lot of particles to remove.

Choosing the Right Filter

The decision on which filters to use for final filtration applications is based chemical compatibility and the types and sizes of particles or other contaminants to be removed.

For particles larger than 1 or 2 microns, depth filtration media is almost always used. Cartridge filters are available with two forms of depth media. The standard depth filter is a self-supporting, thick media tube made using a polymer. The polymer is often polypropylene but standard depth filters are also available in nylon, which may have better compatibility with some chemicals. The other form of cartridge depth filter uses pleated flat sheet media, available in polypropylene or fiberglass. Polypropylene is the most widely used material for water and chemical filtration, but fiberglass has better filter efficiency and generally allows higher flows and throughput than polypropylene in many applications and may be chosen if fiberglass is compatible with the chemistry.

Standard depth filters will capture a range of particle sizes through the thickness of the media. Pleated media filters have the advantage of a large surface area that can hold a higher quantity of particles on that surface than standard depth filters.

For particles smaller than 1 micron, membrane filters are used. In almost all cases, the membrane filters will be used as part of a 2-step process. If there is a concern about bacteria, then a 0.22 micron rated filter is often used as the last step. That filter will be protected by a filter with a larger pore size rating, which could be another membrane-based filter or a depth filter with pore size rating only slightly above the final filter rating. The most cost-effective choices are usually determined by testing media combinations on a small scale.

Filter Options

Depth filtration products such as Critical Process Filtration Melt-Blown Polypropylene, Melt Blown Nylon or Nano-Spun Polypropylene cartridges are commonly used to remove larger particles. These products will hold a large quantity of particulates before requiring replacement.

If finer particles need to be removed from the fluid stream, an economical alternative to standard depth filters is pleated media filters. Pleated filtration products, such as pleated polypropylene depth filters, have several times more surface area than melt-blown or nano-spun depth filters and will hold a much higher quantity of particles. While pleated filters do generally cost more, the increased life in high-particle-load applications and savings from the reduced number of cartridges required for batch processes may make pleated filters economically advantageous.

Sub-micron sized particles and even microorganisms are removed most efficiently by membrane filters. The membrane filters are often used in two-step filtration configurations with a prefilter protecting the filter from excess particle loading.

Filter Media Options for Final Filtration in Chemical Processing

Process Area	Filter Application	Filtration Function	Media **
Final Filtration	Small Particle Reduction or Removal, Bacteria Removal	Remove all particles, including sub-micron size particles and even bacteria that might adversely affect product quality	MB, NMMB, NS, PD, GD, MC, NM, PS, CWPS, PVWB, PVWL, TM

**Media Codes

MB = Melt-Blown Polypropylene Depth Media
NMMB = Melt-Blown Nylon Depth Media
NS = Nano-Spun Polypropylene Depth Media
PD = Pleated Polypropylene Depth Media
GD = Pleated Fiberglass Depth Media
NC = Positively charged Nylon 6,6 Membrane
NM = Nylon 6,6 Membrane
PS = Polyethersulfone Membrane
PVWL = High Capacity Hydrophilic PVDF Membrane
PVWB = High Capacity Hydrophobic PVDF Membrane
TM = PTFE Membrane

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