ACHIEVING CLEANER SOLUTIONS

(*Filtration employing 'step-down' particle retention)*

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ABSTRACT

Filtration is the process of solid/liquid or solid/gas separation. Many such applications exist, like the processing of beer or maintaining clarity in a swimming pool; others are selected to reduce waste, improve a product by preventing rejects, but in each application, there is a downside - the recovery of a solid, what to do with the liquid or what to do with a solid when it ends up as part of the filter media, as is the case with precoat filter aids, cartridges or surface media.

This paper introduces the possibility of using the experience gained by the employment of re-circulatory filtration when applied to an in-line application. In an effort to reduce the amount of filter media, solution loss, down time and waste, another approach should be considered . . . . . employ 'step-down' filtration.

KEYWORDS

Filtration, Recirculation, Backwashing, Cartridge Filter, Particle Size.

We are all familiar with the ability of a filter to provide excellent clarity when allowed to recirculate on a reservoir of liquid. For instance, sand type media, strainers or even depth type filter cartridges will exceed their efficiency particle removal ratings when the solids which they pick up create a denser mass through which the liquid is to pass. Thus, finer and finer particles are retained on the media until the retention exceeds the pump pressure capabilities. Such re-circulatory systems are essentially applied to engine lube oil or fluids used for hydraulics. Filters used to re-circulate on a swimming pool, when left unattended; their flow will fall to nothing or very little, because of lack of attention.
The purpose of this paper is to expand on the experience which can be gained by these other industries so that it could be applied to numerous liquids used for cooling, following final clarity required by waste treatment, and even machine tool coolants where the liquids without particulates will extend the life of a cutting tool or grinding wheel and insure more uniform exacting results.

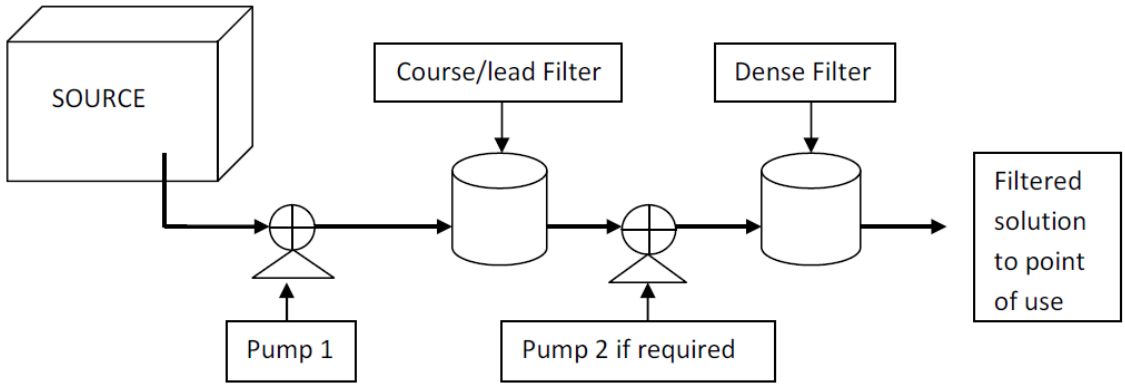
To better identify the applications where this process could be employed, it should revolve around those which require extremely fine particle retention,

such as now being provided by 1 to 10 micron filter cartridges, surface type media whether pleated or disc or bags, or pre-coat filters using diatomaceous earth where the frequency of servicing through backwashing or changing of the media itself would be prohibitive because of the low solids holding capacity of the media.

Applications which could benefit from re-circulatory filtration would be in food pro-cessing such as syrups, oils, detergents, brine and even on beer, where the pump being used to transfer from the process tank which is being used to blend the product and even assist in dissolving dry ingredients. The agitation of the liquid from the discharge of the pump, works to the benefit of the blending process. Here again, the pump rate to achieve the re-circulation would be dependent upon the amount of time devoted to the processing vs. the time required to transfer the liquid to a bulk storage tank, transport tank, and/or an actual packaging line.

There is, of course, perhaps a simpler way in which the above can be accomplished by what is referred to as 'step-down' filtration, in which case the primary (or lead) filter handles a large quantity of particulates or solids before they are allowed to reach the denser media. Whether or not an additional booster pump might be required by the first and second stage will depend upon the loss of pressure across the media and the need to meet a required amount of through-put of the filtered solution.

The following chart indicates typical piping which would be required -

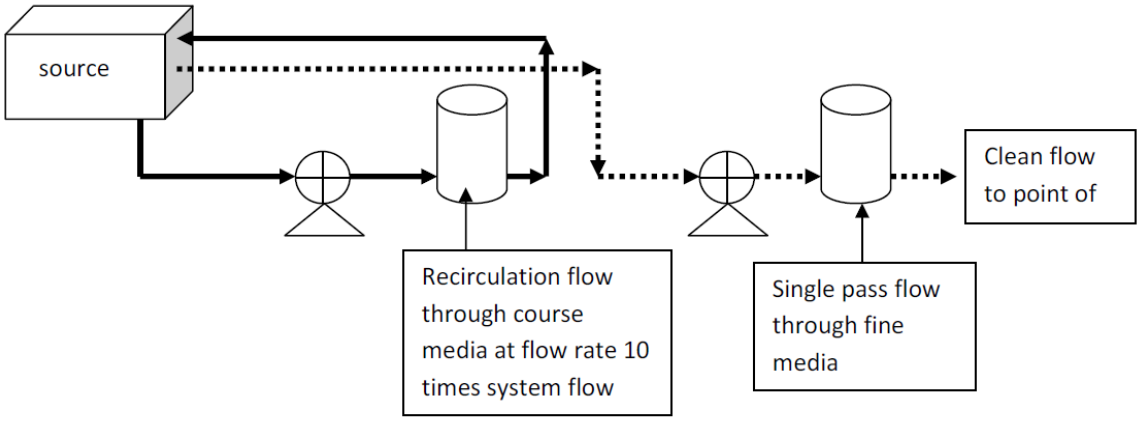


Single pass/Inline Step-down Filtration

However, a recirculatory system offers the greatest potential of reducing the amount of filter media consumption

For instance, in an in-line application where water is being provided from an outside source before passing through a filter, reverse osmosis, carbon or softening, an additional tank is required along with a pump and auxiliary filter designed to operate at a flow rate which exceeds that of the required flow to the system. Thus, a system requiring 10 gallons per minute could be re-circulated at 10 times system required flow so that at 100 GPM the liquid would pass across the filter at least 10 times before being allowed to pass on to the denser filter media required for the process. Obviously, to quantify the reduction in filter media in such a system would depend upon the type of solids to be retained and their size, also the velocity across the auxiliary media so as to retain as high a percentage as possible. Of course, as the size of the reservoir or the recirculation rate are modified, the amount of denser media required will be reduced, saving

considerable money due to less labor for servicing, disposal cost and reduction in the volume of waste going to a landfill.



Step-down filtration utilizing re-circulation and polish filter

An extreme example would suggest that the recirculation on the process tank would require operation during a complete 24-hour day, whereas the transfer to the subsequent step in the process might only require 2 to 8 hours. Of course, here again the goal is to reduce the amount of time for labor, solution loss, landfill, etc., of the denser media.

The use of recirculation is even more valuable when the product to be retained is considered a hazardous waste and requires additional processing for safe disposal.

The type of filter along with its media will further complement the success of this modification of your process. Manual type filters which require cleaning or replacement when servicing, would generally be employed where flow rates, solids, and type of fluid to be clarified are under consideration.

On the other hand, continuous process lines where hazardous waste is picked up by the media, such as in a nuclear plant, would lend itself to an automatic type of filter which could employ sand or straining where the interruption caused by the backwashing cycle of a sand filter would have to be minimized, and the liquid when backwashed might have to be retained in storage for further clarification. Therefore, the use of 'step-down' filtration or recirculatory filtration or batch clarification prior to application, should all be evaluated according to your filtration/separation process.

Keep in mind, however, that even a 50 micron filter cartridge ahead of a 5 or 10 micron in-home dialysis machine, could reduce the amount of filter media employed by as much as 50%.

Finally, several types of automatic Filter systems are available; one "multi-media" type system applies a backwash to clean the media and isolate the dirt that has been trapped either for further treatment or safe disposal. Gravity type systems employ roll media which is disposable. Both types are generally used for re-circulation but can also be used as final trap filters.

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