Save 98 % Water from Filter Backwash Recovery

Overview
Today, the demand for water is fast outstripping supply. This water scarcity underscores the need for better water management. The Food and Beverage industry started measuring its water footprint – water volume used in the process to produce 1 L or 1 kg of finished product - as part of its sustainable strategy.

Water management programs are in place in main Food and Beverage manufacturers in order to optimize water usage, reduce the water footprint and achieve overall cost improvements.

Traditional water treatment in place in most food and beverage industries uses sand and carbon filters. Typically in a water treatment plant 2 to 5 % of the total water production is used for backwashing those filters \[1\]. This filter backwash water contains a high amount of solids and the general practice of disposal is to use sedimentation storage tanks where the sludge is settled with the optional help of chemical treatment. The clarified water is then recycled back to the water treatment plant (Figure 1).

The Challenge
Without adequate control, there is a risk of re-introducing increased concentrations of pathogenic contaminants such as Cryptosporidium and Giardia to the filters and recovery water. By treating the recovered backwash water before re-introducing it to the filter, this risk can be controlled.

Furthermore, depending on the level of water flow per day, more than a hundred of cubic meters of backwash water per day may require treatment. Recovery of water is key to reduction of water fees within the plant and the reduction of water footprint. Chemical treatment can improve sedimentation time of waste water streams but they increase the cost of the recovery treatment.

Finally, the waste streams coming from the water treatment plant may contain different type of contaminants such as clarifier sludge with high levels of colloids that may be difficult for some installations to treat.

Ultimately, each water treatment plant manager wants:
• to reduce the waste streams and conserve as much as water as possible
• to produce clean water of consistent and safe quality
• a robust installation that can withstand feed variability
• to improve the operating costs of the water treatment plant

The Solution
Beside the conventional water treatment using clarification and sand filtration, single step membrane microfiltration has proven to be an efficient and cost effective way to obtain consistent water quality from backwash waste \[2\].

The Pall Aria™ FB membrane system (Figure 2) has been specifically developed to satisfy the water treatment plant manager requirements in a single step.

The system utilizes a robust PVDF hollow fiber microfiltration membranes to retain suspended solids and pathogenic microbes, thus reducing the risk of recontamination of the water treatment plant. The hygienic stainless steel design combined with an automated disinfection cycle when the system is not in operation for more than 24 hours ensures a high microbiological safety level to the water recovery process. The retained solids are concentrated in a low volume waste stream that is discharged from the system.

A proprietary mechanical backwash with air scrubbing allows uninterrupted performance and high yield, achieving over 98 % backwash water recovery.

Downstream, the water quality is maintained to the required standards regardless of the variability of the feed water stream. The system provides water quality far superior to conventional treatment with typical water turbidity lower than 0.1 NTU. Thanks to its compact footprint, the system is easy to integrate into existing water treatment plants.

The fully automated system is simple and easy to operate. Mechanical backwash and low energy consumption (typically 0.09 kWh per m³ filtered water) allows operating costs improvement by over 50 % compared to conventional treatment (Table 1).
Benefits

Table 2 shows an economical approach using data from a published case study [3].

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conventional treatment</th>
<th>Pall Aria FB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Turbidity</td>
<td>&gt; 1 NTU Variable</td>
<td>&lt; 0.1 NTU Consistent</td>
</tr>
<tr>
<td>Pore Size Stability</td>
<td>Variable</td>
<td>Stable</td>
</tr>
<tr>
<td>Operating Flexibility</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Chemical Consumption</td>
<td>High (coagulants)</td>
<td>Low (chlorine for disinfection)</td>
</tr>
<tr>
<td>Water Recovery</td>
<td>90 – 92 %</td>
<td>98 %</td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>High</td>
<td>0.09 kW/m³</td>
</tr>
<tr>
<td>Footprint (e.g. for 1 m³ building)</td>
<td>Large</td>
<td>Small (50 m³/h system)</td>
</tr>
<tr>
<td>Microbial Contamination</td>
<td>Can occur</td>
<td>High retention of Cryptosporidium and Giardia</td>
</tr>
<tr>
<td>Typical Operating Costs</td>
<td>&gt; 0.25 $/m³</td>
<td>&lt; 0.12 $/m³</td>
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Table 1 - Filter backwash recovery treatment comparison

Table 2 - Case study

Per year | No recovery treatment | Pall Aria FB |
---------|-----------------------|--------------|
Water reclaim | 0 | 98% |
Water savings (m³) | 0 | 4018 |
Water costs ($) | 4100 | 82 |
Operating costs ($) | - | 287 – 574 |
Water costs improvement (%) | - | 84 – 91 |

The Pall Aria FB membrane filtration system provides:

- Up to 98 % water recovery
- Consistent water quality production regardless to raw water quality within specified limits covering the most typical water treatment applications
- High microbiological removal
  - Stainless steel hygienic design and automatic disinfection when the system stays out of operation for more than 24 hours.
  - Typically 6 log removal for Cryptosporidium oocysts and Giardia cysts
- Overall costs improvement
  - Low chemical consumption, low energy consumption (typically 0.09 kWh per m³ filtered water) and minimal water losses (up to 98 % water recovery).
- Simple single step filter backwash water recovery
- Long production cycles

There are no globally harmonized water or food regulations. Please contact Pall to verify that the product conforms to your national and/or regional regulatory requirement.

References:


About Pall Corporation

Pall Corporation is the largest and most diverse filtration, separation, and purification company in the world. Pall serves the food and beverage industries with advanced membrane filtration technology and systems engineered for reliability and cost-effectiveness. Easy to install and simple to use, our systems satisfy a wide range of filtration requirements. Our Total Fluid Management approach offers customers solutions to address the needs of an entire process, encompassing filtration products, services, systems and training.

Visit us on the Web at www.pall.com

Pall Corporation has offices and plants throughout the world. For Pall representatives in your area, please go to www.pall.com/contact

Please contact Pall Corporation to verify that the product conforms to your national legislation and/or regional regulatory requirements for water and food contact use.

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