

## Turbidity and Particle Control in Water for Soft Drink Production

### Introduction

Water is the key ingredient of most soft drinks today. Not only does it represent the largest ingredient by volume, its quality can greatly impact the beverage itself. Many soft drink manufacturers spend considerable effort locating their plants with access to a consistent supply of high quality water.

Incoming plant water however, usually requires some additional treatment before it is suitable for ingredient use in soft drinks. This treatment can involve carbon filters, sand filters, neutralizers, and particle control filter cartridges.

Particle control filter cartridges have long played a role in helping to provide turbidity-free, good tasting water at a reasonable cost per gallon to soft drink bottlers. Conventional filter formats have included polypropylene or cotton string-wound filter cartridges, “melt-blown” polypropylene filter cartridges and “bag” or “sock” filters.

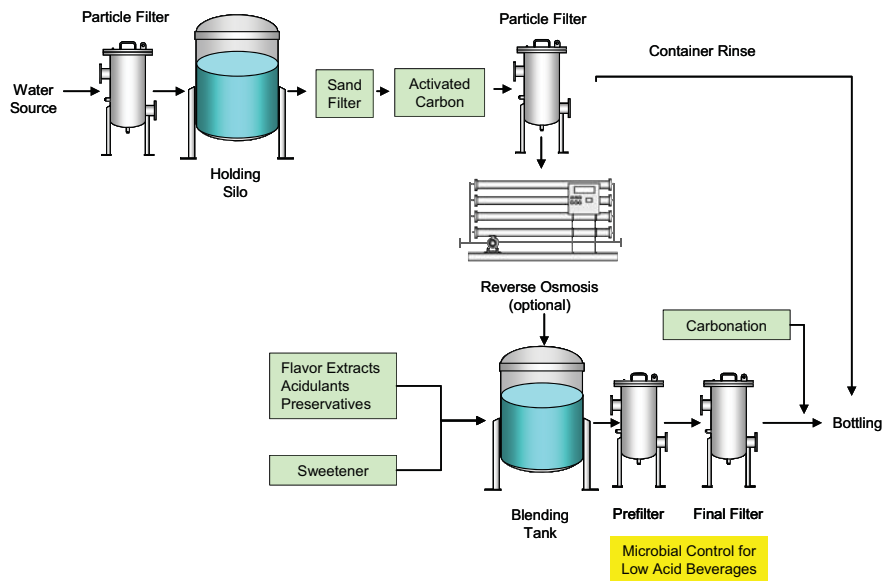
However, as bottlers continue to strive to increase product quality and process control, while driving down operating costs, they are turning to newer, more reliable versions of the filter cartridge, as well as a new design which has the potential to replace dozens of conventional small diameter filter cartridges with a single, high flow rate capacity filter element. This Customer Application Brief describes advances made in particle control filter cartridge design and performance and the benefits they present.

3M Purification Inc. particle control filters offer:

- A fixed barrier against turbidity-causing particulate resulting in reliable particle control.
- High particle capacity for fewer filter change-outs and longer service life than conventional filters.
- Flow rates from as low as 10 gpm to greater than 500 gpm.
- NSF Standard 61 and 53 certified options.
- Designs to greatly minimize filter housing footprint.



## The Process



**Figure 1 - Typical Soft Drink Process\***

\* Schematic is intended as a guide only. Water treatment options and filter positions can vary by company and the nature of the water.

## The Problem

Water for soft drink production is typically supplied either from a local well or via the municipal water system. Turbidity and particulate in these supplies can either be from the source itself, from the distribution system employed to transport and store the water in the facility, or from processing steps within the facility.

Common source particulates include silt, sand, suspended clays, algae and other biological material. The water distribution system (conduits, pipes, valves, tankers, holding silos) can also contribute particulate in the form of scale, rust, biofilm or other materials generated by older or poorly maintained distribution elements. Additionally, some processing steps included in the initial water treatment process, such as carbon treatment and sand filtration, can themselves generate turbidity causing particulate.

The obvious impact of high turbidity and particulate are poor customer perception, especially in clear beverages, and potential off flavors or odors. High levels of turbidity and particulate can also be associated with increased fouling of downstream equipment, particularly Reverse Osmosis (RO) membranes, but also including tank bottoms, filling valves and the like. Poor particle control upstream can lead to higher maintenance costs and an increase in system downtime. There is also an increasing concern regarding the control of biological material in the water, generally benign HPC bacteria and algae. If not addressed early in water processing, these organisms can find areas in the system to form biofilms. Biofilms consist of complex associations of microorganisms held together in an extra-cellular matrix of excreted materials and attach to surfaces like stainless steel piping via an adhesive-like material.

## The Solution

Depending on the particular needs, quality concerns and flow rate requirements of the bottling plant, 3M Purification has a variety of cost effective filter alternatives. The table below provides an overview of the 3M Purification's filters for particle control grouped by retention rating method and by the typical system flow rate. Systems with Lower Flow Rates

**Betapure™ NT-T Series Filter:** Betapure NT-T series filter cartridges are 3M Purification's latest advance in depth filtration technology. The all polypropylene filter is constructed using a design that utilizes flow enhancing filter media and an innovative flow

**Table 1. Particle Control Filter Options**

|                           | System Flow Rates <100 gpm | System Flow Rates >100 gpm         |
|---------------------------|----------------------------|------------------------------------|
| Absolute Retention Rating | Betapure™ NT-T Series      | 3M™ Series Filter Housing Elements |
| Nominal Retention Rating  | Micro Klean™ RT Series     | 3M™ Series NB Filter Bag           |

pattern. The result is an absolute-rated filter with vastly superior on-stream life that provides more cost effective filtration than conventional melt-blown filter technologies.

**Micro Klean™ RT Series Filters:** Micro Klean RT Series filter cartridges are nominally rated, all polypropylene, depth filters manufactured using 3M Purification’s rigid extrusion bonded technology. This process provides a high degree of fiber-to-fiber thermal bonding, without the use of binders, to produce a rigid, core-less, filter structure. The result is a high capacity, high flowing filter with a media rigid enough to permit the cutting of surface grooving that further increases filter particulate holding capacity.

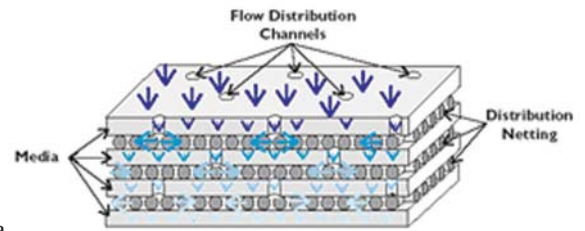


Figure 2 - Betapure™ NT-T Series Filter Diagram

**3M Purification’s Systems with Higher Flow Rates**

**3M™ High Flow Series Filter Systems:** The construction of 3M High Flow series filter systems permits flow rates of up to 500 gpm in a single cartridge. The result? Fewer filter elements to accommodate your flow requirements. In fact, the 3M High Flow series filter system requires as few as one-tenth the number of elements as competitive 2.5” pleated cartridges (see Figure 4).

For systems with exceptionally high particle loads, the 740 Series filter should be selected. The 740 series features the same innovative compound radial pleat design as the High Flow, but with additional filtration media to retain even greater levels of particulate – as much as 24 lbs for some grades.

**3M™ Series NB Filter Bags:** 3M series NB filter bags are highly reliable, nominally rated filters with predictable and repeatable performance. The 3M series NB filter bags are designed for applications where 1 to 200 μm filtration at flow rates up to 180 gpm per each #2 size bag is required. The 3M series NB filter bag features thermal treatment of the external media surface to provide excellent fiber control, and a specially designed sealing collar to ensure proper sealing.

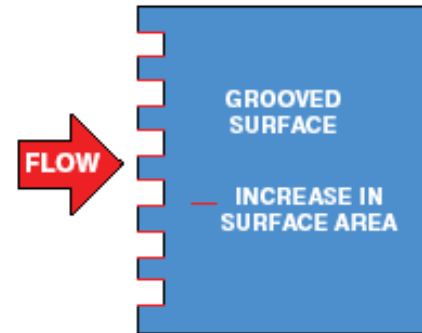


Figure 3 - Micro-Klean™ RT Series Grooved Surface

**NSF International Certification:** NSF International is a not-for-profit, non-governmental organization, focused on standards development, product certification, education, and risk-management for public health and safety.

**NSF** Betapure™ NT-T, 3M™ High Flow series filter system and Micro-Klean RT series filters have been tested and certified against NSF/ANSI Standard 61 for material requirements. 3M Purification’s LifeASSURE™ BLA100 series microporous membrane filters have been tested and certified against NSF/ANSI Standard 53 for cyst reduction and material requirements.

**Microbial Control in Non-pasteurized or Low Acid Beverages**

In many soft drinks, a combination of product formulation and processing steps are sufficient to keep microorganism growth in check. A low beverage pH and the addition of preservatives, combined with either hot-fill or full pasteurization, are common strategies in the beverage industry.

However, some beverage processors seek to eliminate adding preservatives to the beverage or using thermal processing to kill off any microorganisms in an effort to maintain a better flavor profile. These beverages,

particularly if they are “low acid” beverages, benefit from the added security of employing a bacteria-retentive final membrane filter prior to bottling. These final membrane filters are composed of microporous filter media with pores smaller than the organisms found in the beverage, so they essentially “sieve out” organisms as the beverage flows through the filter.

**350 GPM System (1325 LPM)**

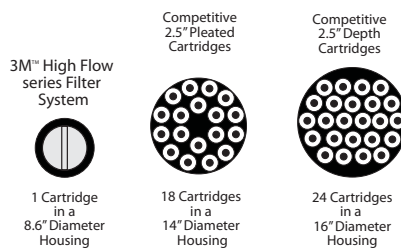


Figure 4 - 3M™ High Flow Series Filter System vs. conventional 2.5” cartridge systems

Final filter service life can be optimized by placing a prefilter just upstream of the final filter. The prefilter helps protect and extends the life of the final filter resulting in lower running costs and less frequent filter change-outs.

**Table 2. Filter Recommendations**

| Application  | Filter Recommendation                          | Micron Rating |
|--|--|---------------|
| Plant inlet particle filter                                | 3M™ High Flow, Micro-Klean™ RT                 | 1 - 10 µm     |
| Post-carbon particle filter/Pre-RO filter                  | 3M™ High Flow, Micro-Klean™ RT, Betapure™ NT-T | 1 - 5 µm      |
| Microbial Control in non-pasteurized or low acid beverages |  |               |
| Pre-filter   | Betafine™ XL Series, Betapure™ NT-T            | 0.5 - 2 µm    |
| Final Filter   | LifeASSURE™ BLA, LifeASSURE™ BA                | 0.45 - 0.2 µm |

**Conclusion**

Particle control filter cartridges have longed played a role in helping to provide turbidity-free, good tasting water at a reasonable cost per gallon to soft drink bottlers. As bottlers continue to strive to increase product quality and process control, while driving down operating costs, they are turning to newer, more reliable versions of the filter cartridge, as well as a new design which has the potential to replace dozens of conventional small diameter filter cartridges with a single, high flow rate capacity filter element. This Customer Application Brief describes advances made in particle control filter cartridge design and performance and the benefits they present. 3M Purification Inc. particle control filters offer:

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**Table 3. Additional Information**

| 3M Purification Inc. Product               | Data Sheet Order Number |
|--|-------------------------|
| Betapure™ NT-T Series Filter               | 70-0201-8720-2          |
| Micro Klean™ Filter                        | 70-0201-8723-6          |
| 3M™ High Flow Series Filter System Element | 70-0201-8710-3          |
| 3M™ Series NB Filter Bag                   | 70-0202-1135-8          |
| Betafine™ XL Series Filter                 | 70-0201-8686-5          |
| LifeASSURE™ BLA100 Filter                  | 70-0201-8712-9          |
| LifeASSURE™ BA Series Filter               | 70-0201-8877-0          |

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**3M Purification Inc.**  
 400 Research Parkway  
 Meriden, CT 06450, U.S.A.  
 Tel (800) 243-6894  
 (203) 237-5541  
 Fax (203) 238-8977  
 www.3Mpurification.com

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