

## Powell Bleach Filter System



# Powell Filter-Aided Bleach Filter System

Filtering of the bleach to remove heavy metals and suspended solids is required in almost every application. Typically, bleach used in drinking water treatment and laundry bleach packaged in small bottles must be filtered. Other typical applications that require filtered bleach include wastewater treatment applications and any bleach stored at the customer's site in large tanks where accumulated suspended solids will precipitate with the heavy metals and settle to the bottom of the tanks.

The only filtering method that will produce the required results for these circumstances is a system that uses a filter aid in conjunction with additives to the bleach to help complex the metals and suspended solids. The typical filter aid is either perlite or diatomaceous earth. With a proper choice of filter aids and additives, it is possible to achieve maximum particle size of approximately 0.2 micron, and metal contents of <0.5 ppm of iron, <0.05 ppm of nickel and <0.05 ppm of copper.

The Powell Bleach Filter System is the only packaged system available that offers an engineered system with guaranteed performance with the correct materials of construction such as titanium for metal components and PVC and Teflon® as nonmetallic components. The Powell Bleach Filter System provides the highest level of bleach quality available in the market and can be used with any quality caustic to yield bleach that can be packaged for the household market using sealed bottles, in the drinking water industry or any other application required.

Standard sizes of filters are 100, 200, or 300 square feet. Any of the filters can be purchased with a reduced number of plates, which reduces the initial cost. For example, a 300 square feet filter supplied with 200 square feet of plate (17 instead of 23). Additional plates can be added as flow rate and capacity require.

The filter shell and pump are constructed of titanium with fiberglass precoat tank and PVC piping providing an expected service of 30 to 35 years minimum for major components of the system. All parts of the system are easily repaired and maintained. Typically the filter is inspected every 6 to 9 months depending on the type of operation and the filter cloth is replaced every 12-18 months with minimal expense.

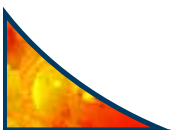
Powell can assist in the design of the complete system and provide all the required components except the site, building and installation labor.

## Consider the Growing Trend for High Purity Sodium Hypochlorite

High purity sodium hypochlorite — a product low in heavy metal content and suspended solids — is fast becoming the industry standard and is no longer considered a specialty product. As a result, product quality will be of even greater concern to sodium hypochlorite producers. The Powell Bleach Filter can help take advantage of this growing market trend. The benefits of producing a product with only trace amounts of nickel, copper, and suspended solids are give below.

### 7 Reasons to Consider Producing High Purity Sodium Hypochlorite with the Powell Bleach Filter

1. You can produce sodium hypochlorite using any quality of sodium hydroxide, including diaphragm cell caustic. This gives you a wider choice of suppliers, which usually results in lower material cost and subsequent reductions in production costs.
2. You can sell your high quality product at a higher price, a basic principle of supply and demand that's been proven many times in more than 15 years we've sold Powell Bleach Filters.
3. High purity sodium hypochlorite does not decompose as rapidly as standard grade, so you can reduce the strength of the product you produce.
4. Oxygen formation is significantly lower. As a result, product safety is improved, allowing customers to package product without bottles swelling due to oxygen formation.
5. Costly customer quality complaints relating to oxygen and solids formation in storage tanks, pumps and piping are eliminated.
6. After filtration, sniff gas bleach can be sold as high quality bleach.
7. Virtually all contaminants are removed during final filtration, so most plant wastewater, including filter backwash water, containment area drains, and other wastewater, can be reused to make bleach. Many plants using the Powell system have no wastewater connects to sanitary sewer systems.



## Typical Results of Filtration

The table below shows typical results when a number of commercially available bleach samples were tested in an effort to define a typical transition metal (Cu, Fe and Ni) ion concentration range in bleach. Data presented compares Chloroform Extraction Colorimetric (CEC) and Ion Chromatography (IC) methods.

The table illustrates similar results for each transition metal ion in the bleach samples. The difference between the two methods ranges from 5.2 to 13.1% for Cu and from 3.7 to 13.2% for Ni. Analysis of the data showed high transition metal ion concentrations were found in unfiltered bleach samples. Transition metal ion concentrations in unfiltered bleach were found for Cu (40 to 70µg/L), Fe (230 to 1200µg/L) and Ni (50 to 390µg/L). For filtered bleach samples, Cu and Ni concentrations were greatly reduced by filtration and were generally below the limits of detection and iron was reduced to levels from 0.2 to 0.3 ppm.

IC Method				
Supplier	Condition	Cu(µg/L)	Fe(µg/L)	Ni(µg/L)
1	Unfiltered	55	948	387
	Filtered	<9.8	186	<9.8
2	Unfiltered	40	1217	416
	Filtered	<9.8	237	<8.3
3	Unfiltered	69	323	110
	Filtered	<9.8	92	<8.3
4	Unfiltered	<9.8	234	47
	Filtered	<9.8	37	<8.3
CEC Method				
Supplier	Condition	Cu(µg/L)	Ni(µg/L)	
1	Unfiltered	47.8	326	
	Filtered	15.5	<4.1	
2	Unfiltered	42.5	432.0	
	Filtered	15.8	<4.1	
3	Unfiltered	65.4	98.2	
	Filtered	<4.4	<4.1	
4	Unfiltered	<4.4	56.7	
	Filtered	<4.4	<4.1	

## Operation of the Powell Filter-Aided Bleach Filter System

The Powell self-cleaning filter system is a horizontal vessel of titanium construction manufactured to ASME specifications. The unit consists of a gear-driven manifold, which is mounted horizontally and held in a packed gland in the rear dish. The gear drive is mounted on the rear platform and transmits power by chain and sprocket to the manifold. The manifold holds the circular-shaped leaves, covered by 2 layers of filter cloth. A spray manifold carrying special two-way jets is mounted above the leaves. The unit is typically equipped with a bolted cover.

## Filter Plates

The filter contains polypropylene filter plates covered with white polypropylene filter cloth.

## Clarity and Brilliance

A wide selection of filter-aids, such as diatomaceous earth and Perlite, is available to be used alone or in combination. Not too much stress, however, can be put on the many advantages of a well-blended precoat. All too often this valuable fiber is premixed with other filter-aids, destroying its prime function - that of protecting the life of the costly leaves. Practically all liquids can be filtered with a uniformly high degree of clarity and brilliance by the proper choice of filter-aids. However, the best that any filter can do is provide a mechanically sound, leak-proof device to hold back the precoat and body feed powders with as little pressure drop and complication-free parts as possible.

## Auxiliary Tanks

The precoat tank functions as a container for the mixing of the filter-aid and re-circulation while the precoat layers are being formed on the leaves. Sometimes it can serve as they body feed vessel also, but it is less complicated from the operator's point of view to keep the precoat fibers away from the feed pump for fear of clogging and also to be able to maintain a constant control and mix of the feed solution. A smaller vessel equipped with its own agitator and feed pump serves this purpose.

## Pressure Drop

High flow rates at remarkably low pressures are obtained on a pressure leaf filter. A starting operational pressure drop from 2 to 5 psi is normal, climbing to 30 psi at the end.



Powell Bleach Filter Unit

## Volume of Bleach Filtered

The total volume of bleach filtered varies with the amount of contaminant and grade of filter aid used. A finer grade of DE or Perlite is typically used for household bleach or commercial bleach that will be diluted for household bleach. The table below indicates typical amounts of bleach filtered per cycle for each size of filter. After the filter completes a full cycle and backwash is required, total time to prepare the filter for the next cycle is 45 minutes to 1 hour. Typical flow rate of the bleach is approximately 60 gallons per minute per 100 square feet of filter area.

Typical Amounts of Bleach Filtered Per Cycle		
Filter Area (Square Feet)	Household Gallons	Commercial Gallons
100	12,000 - 18,000	10,000 - 15,000
200	24,000 - 36,000	20,000 - 30,000
300	36,000 - 54,000	30,000 - 40,000

## Backwash

When the filter has completed the filter cycle and contains that total amount of filter aid the unit is designed to hold, the filter must be backwashed. The first part of the backwash cycle consists of blowing the bleach out of the filter with air back to the unfiltered bleach storage tanks. After the bleach is emptied out of the system, water is sprayed onto the rotating plates, driven by a small gear drive motor. Backwash water at the rate of 300 - 400 gpm of water, along with air, washes the plates and pushes the solution into a holding tank, commonly called a mud tank. The water backwash will require approximately 1500 - 2000 gallons of water to clean the filter aid from the plates.

## Waste Disposal Cycle Liquid Waste

The backwash is typically put into a holding tank, neutralized, and legally discharged to city sanitary systems. Some chemicals used for neutralization are hydrogen peroxide, sodium bisulfite, and sodium sulfite. Often, after the bleach is neutralized the pH of the solution may have to be lowered to meet the discharge requirements. Some owners of Powell Bleach Filters hold permits for this type of operation.

## Solid Waste

In some cases, the DE or Perlite cannot be discharged, although the backwash water can be discharged to the sanitary sewer after neutralization. In this circumstance, an automatic filter might be installed to remove the filter aid from the solution and produce a dry cake for solid waste disposal. This cake is typically a 45 - 50% solid by weight. In each application this cake will have to be subjected to a leachate test in order to prove the material is non-hazardous and can be landfilled. The dry cake, when subjected to the leachate test to facilities of existing Powell Bleach Filter owners, has

been found to be non-hazardous. In some cases, although the cake is non-hazardous, it will have to be treated as a waste needing a secured waste handling facility. One site required to use a secured waste site has a current cost per day for disposal of approximately \$65. This customer produces approximately 40,000 gallons per day, so the cost per gallon for disposal in the case is \$0.00163 per gallon or 0.163 cents per gallon. In summary, the disposal of the filter aid can be relatively easy and inexpensive or, depending on local requirements, could be an additional expense. However, the total cost savings of the operation will justify the added process requirements.

## Liquid Disposal

Some locations do not have a sanitary discharge and the neutralized backwash water must be recycled. Once the liquid is removed from the filter aid, it can be used for additional bleach production or backwash cycles. Therefore, no sanitary connections will be required for the liquid portion of the backwash cycle.

## Cost of Operation

The cost of operation of the filter is based on the cost of the filter aid, wood fiber precoat, and miscellaneous chemical addition for improved settling. A bleach producer manufacturing 10,000,000 gallons of bleach per year will have a \$10,400 cost of raw materials for the filter. If it is assumed the solid waste must go to a secured waste site, which is the worst case known to date with this type of operation, the cost of disposal for a 10,000,000 gallon plant at 0.163 cents per gallon will be \$16,300 per year.

## Cost Savings

Although many producers currently use a rayon grade caustic to produce bleach, experience has shown that a higher grade caustic does not guarantee a high grade of bleach. Currently most chlorine and caustic producers charge an additional \$30 - \$40 per ton for rayon grade caustic. Since diaphragm cell caustic can be used, bleach producer can save large amounts of money with the use of the filter. Total savings per year are based on the amount and strength of bleach produced per year. Assuming a 16% trade bleach producer make 10,000,000 gallons of bleach, using approximately 6600 tons of caustic per year. With a savings of \$35 per ton (the average difference between rayon grade caustic and diaphragm cell caustic), the average total savings will be \$231,000. If the cost of filter aid and the disposal cost is deducted, the approximate savings per year at this volume would be \$204,300. Depending on the type of operation, cost of caustic, and bleach production, it is typical to have a return on investment in 18-36 months.

### Summary Cost of Filtering (Based on Truckload of Perlite, including Freight)

Perlite at \$0.20/# & 3.6#/1000 gal of bleach	\$0.00072
Wood Fiber (precoat) at \$1.00/# & 3#/30,000 gal	\$0.0001
Chemical A at \$0.13/1000	\$0.00013
Chemical B at \$0.09/1000 gal.	\$0.00009
<b>Total</b>	<b>\$0.00104 or 0.104 cents per gallon</b>

### Additional Information

The standard sizes of filters are 100, 200, or 300 square feet. Any of the filters can be purchased with a reduced number of plates, which reduces the initial cost. For example, a 300 square feet filter can be supplied with 200 square feet of plate (17 instead of 23). Additional plates can be added when the flow rate and capacity requires them. Since the filter shell and pump are constructed of titanium with fiberglass precoat tank and PVC piping, the expected service of the system is 30 to 35 years minimum for major components. All parts of the system are easily repaired and maintained. Typically the filter is inspected every 6 to 9 months depending on type of operation and the filter cloth is replaced every 12-18 months with minimal expense.

### Dry Cake Pressure Filter

The Dry Cake Pressure Filter is an optional component of the Powell Filter-Aided Bleach Filter System package. The unit offers high performance liquid filtration with solids removal down to 0.5 micron particles. Operation is completely automatic, no operator is required. Pressurized air or inert gas will reduce moisture to a minimum, so dry cake discharge is also a plus.

### Absolute Series Filter Cartridges

The Absolute Series Sodium Hypochlorite Filter Cartridges incorporate a patented radial pleat for an exceptional amount of surface area in a single cartridge. Meltblown FDA-compliant polypropylene microfiber filter media provides high particle removal efficiency below 15 microns for high quality filtration with broad chemical compatibility. Benefits include high loading capacity for long life and lower cost filtration, fewer seals, reduced risk of bypass, and extremely low disposal costs.

### For More Information

If you would like to discuss a Powell Bleach Filter for your location, contact us at 989.681.2158 or email [info@powellfab.com](mailto:info@powellfab.com). You can also find information and interactive tools on our website at [www.powellfab.com](http://www.powellfab.com).



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