Powell
Fabrication & Manufacturing, Inc.

The Powell Sodium Hypochlorite Filtration Process

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Introduction

This year, US bleach producers will ship about 500 million gallons of household bleach (characteristically 5.25% NaOCl) and about 275 million gallons of industrial bleach (usually 12.5% NaOCl), a combined total of nearly 800 million gallons of sodium hypochlorite.

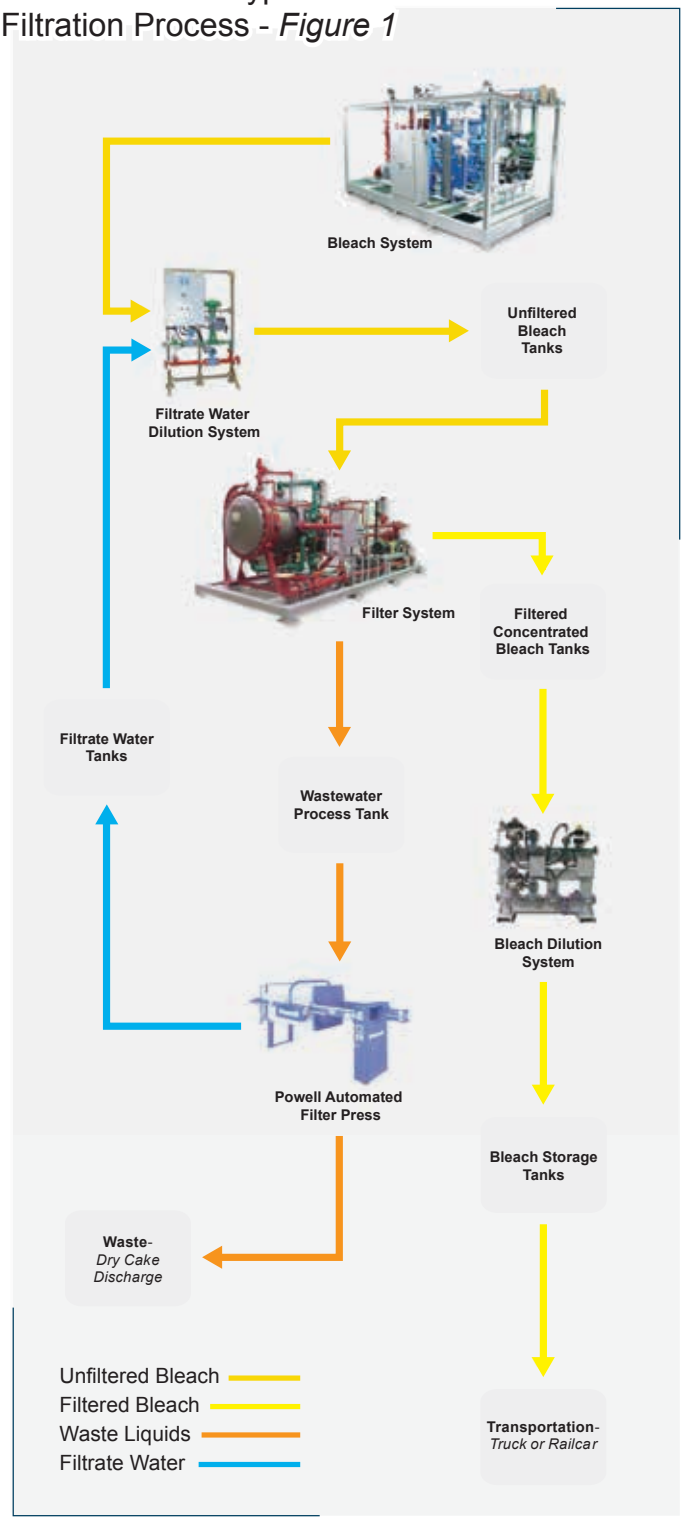
Sodium hypochlorite - commonly called bleach in the US - is made by reacting chlorine in a solution of sodium hydroxide (caustic soda). The resultant product, due to the nature of the process, as well as other factors, usually has a significant amount of contamination from metal ions and/or substantial amounts of suspended solids. These conditions adversely affect the quality of the bleach, and significantly shorten its shelf life.

In order to meet the tough specifications drinking water treatment facilities and other industries mandate for a high purity sodium hypochlorite, the metal ions and suspended solids must be removed from the bleach in additional process steps. This critical step is achieved with a complete filtration process that removes heavy metals, suspended solids, and other contaminants.

Powell has developed the technology and equipment for a complete filtration process for high quality sodium hypochlorite. When properly deployed, the Powell Sodium Hypochlorite Filtration Process not only removes suspended solids and metal ions such as iron, nickel and copper from the bleach - it also ultimately reclaims liquid waste streams created in the production and storage processes for reuse in subsequent sodium hypochlorite manufacture.

The equipment components of the process are each designed to specific parameters and made from appropriate materials of construction. The system can be expected to provide remarkable results and years of reliable service. The block flow diagram in *Figure 1* illustrates the process.

Powell Sodium Hypochlorite Filtration Process - *Figure 1*



Powell Sodium Hypochlorite Filtration Process

Raw Material and Process Efficiencies with the Powell Sodium Hypochlorite Filtration Process

The Powell Sodium Hypochlorite Filtration Process is designed to take advantage of raw material and process cost efficiencies to produce high quality sodium hypochlorite. Some of the advantages of the process are discussed below:

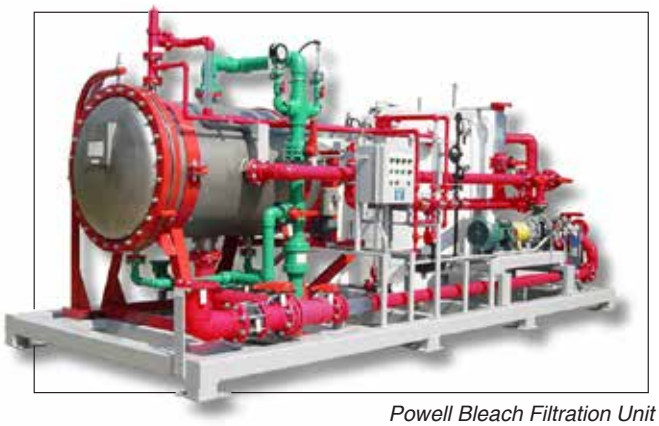
- Since virtually all contaminants are removed during final filtration, most of the plant's liquid wastes can be reclaimed and re-used in the production of sodium hypochlorite, eliminating or minimizing costly disposal.
- High quality sodium hypochlorite can be produced using any quality of sodium hydroxide, including less expensive diaphragm cell caustic. This results in lower raw material costs and provides a wider choice of suppliers.
- Contaminant-free sodium hypochlorite does not decompose as rapidly as standard grade, so strength of bleach can be reduced. Also, since metal ions and suspended solids that contribute to oxygen formation are filtered from the bleach, swelling due to oxygen formation in the bottled product is eliminated or greatly reduced. Similarly, costly customer complaints relating to oxygen and solids formation in storage tanks, pumps, and piping are eliminated or minimized significantly.
- Higher quality bleach provides a competitive market advantage and often commands a higher price.

Powell Bleach Filter for Sodium Hypochlorite Filtration

The Powell Bleach Filter is the first step in the filtration process. Prior to filtration, sodium hypochlorite produced in any production facility can typically have metal contamination in the range of 1 ppm iron, 400 ppb nickel, and 60 ppb copper. Also, significant amounts of suspended solids will be in the solution. This sodium hypochlorite is referred to as "unfiltered bleach" or "unfiltered sodium hypochlorite."

After the unfiltered bleach is processed through the Powell Bleach Filtration Process - with chemical treatment and the proper selection of filter aid and sizing, body feed amounts, pre-coat, and related process control - metal contamination will typically be less than 0.300 ppm iron, 10 ppb nickel, and 10 ppb copper. Similarly, the suspended solids will be very low.

These results can be verified with the use of a test called "Suspended Solids Quality Test for Bleach Using Vacuum Filtration," a method to very quickly determine if the suspended solids of a sodium hypochlorite solution are within acceptable levels. Although this test, developed by Novachem, a sodium hypochlorite research and testing laboratory in Oxford Ohio, is not an indication the metals content of the solution is within acceptable limits, low levels of suspended solids directly correlates to low levels of metals. Specific procedures to perform the "Suspended Solids Quality Test for Bleach Using Vacuum Filtration," along with research documentation and additional information on the test procedure, can be found on the Powell website at www.powellfab.com. There is also a listing of the laboratory equipment utilized for repetitive test results.



Powell Bleach Filtration Unit

The Powell Filtration Process to Reclaim Liquid Waste Streams

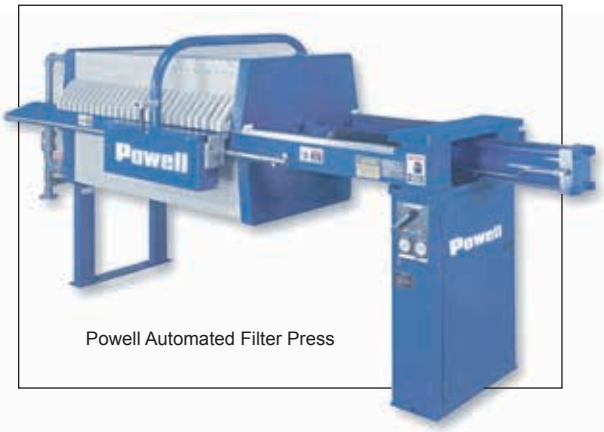
All sodium hypochlorite production processes generate liquid wastes that require disposal. Many times these liquid wastes are difficult and costly to chemically treat and neutralize for safe and legal disposal. It is not unusual for the production facility to be required to haul all liquid wastes to outside treatment systems, since in many locations even treated wastewater can not be discharged into local sanitary sewage systems.

These waste liquids typically include the following:

- Backwash liquids from filtration
- Sodium hypochlorite spilled in process production and tank truck loading
- Containment water collected in outside tank containment systems
- Sodium hydroxide liquids spilled and contained within process areas, loading areas or storage tank containment areas
- Backwash liquids from water softeners, water deionizers, brine deionizers and other processes
- Brine purge from chlorine plant brine systems
- Other liquid wastes that can be pH adjusted above 9 such as HCl wastewater
- Waste stream contaminants

These waste liquids have many commonalities, including low levels of contaminants such as heavy metals, iron, calcium, magnesium, and other chemicals commonly found in the wastewater streams of a sodium hypochlorite production facility. Rather than costly disposal, in subsequent process steps, all wastewater, including the backwash water with spent filter aid from the Powell Bleach Filter Unit, can be reclaimed for use in sodium hypochlorite production. The liquid is pumped to a wastewater process tank along with other plant liquid wastes such as spillage, wash water, softener purge and other liquid solutions. The wastewater is further processed through the Powell Filter Press System, resulting in a solution of water referred to as “filtrate water.” Typically, filtrate water - which could be as much as 10% to 20% of the total volume of the sodium hypochlorite produced - has very low levels of iron, nickel, and copper, along with low levels of sodium chloride, calcium, magnesium and other related chemicals. This filtrate water is reused in sodium hypochlorite production.

The waste of the Powell Automated Filter Press is discharged as a dry cake. The dry cake is comprised of Perlite®, which contains very low levels of contaminates removed from the sodium hypochlorite and any contaminates removed from any other waste streams. Powell can supply material handling systems for discharged cake including dumpsters equipped with self-dumping forklift mounts. The dry cake has to be analyzed for hazardous wastes. With normal testing, using the typical TCLP testing, this dry cake is currently being treated as non-hazardous waste. Powell can provide additional information about dry cake testing upon request.



Powell Automated Filter Press

Equipment to Complete the Powell Sodium Hypochlorite Filtration Process

The complete Powell Sodium Hypochlorite Filtration Process includes several additional components.

These include:

Filtrate Dilution System

- The filtrate water from the Powell Bleach Filter may be pumped to a holding tank, neutralized and disposed of a safe point of discharge. However, if desired, this water/trace bleach solution can be used in the bleach production. This allows the plant, in many applications, to become a zero discharge plant with regard to the bleach process liquids. The major components of the Filtrate Dilution System and a filtrate water supply pump.


Powell Filtrate Water Dilution System

Dust Collection and Removal System

- The filter aid used in the Powell Bleach Filter is a dust that can become airborne when handled during the filtering process. Powell can supply major components of a ventilation system designed for appropriate dust removal or collection and disposal.

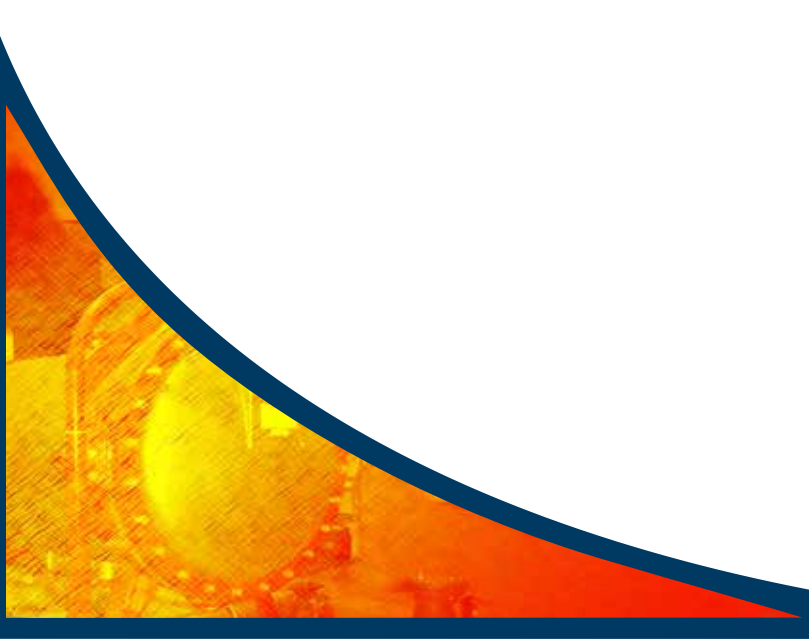
Tank Level Automation and Control

- Complete automated systems that offer both continuous level monitoring as well as high-point level detection are available from Powell.

For More Information

Powell would like the opportunity to put our extensive knowledge and more than 40 years experience in the production of sodium hypochlorite at the disposal of those who must produce high quality sodium hypochlorite, and must also process the waste streams of the plant safely and economically. Over the years, Powell has been able to show that when all process equipment is considered and the savings due to wastewater reuse and diaphragm cell caustic are factored into the cost equation, the Powell Sodium Hypochlorite Filtration Process is very cost competitive.

For more information on the advantages and cost efficiencies the Powell Sodium Hypochlorite Filtration Process can provide for your operation, please contact Powell at 989.681.2158 or email info@powellfab.com.



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