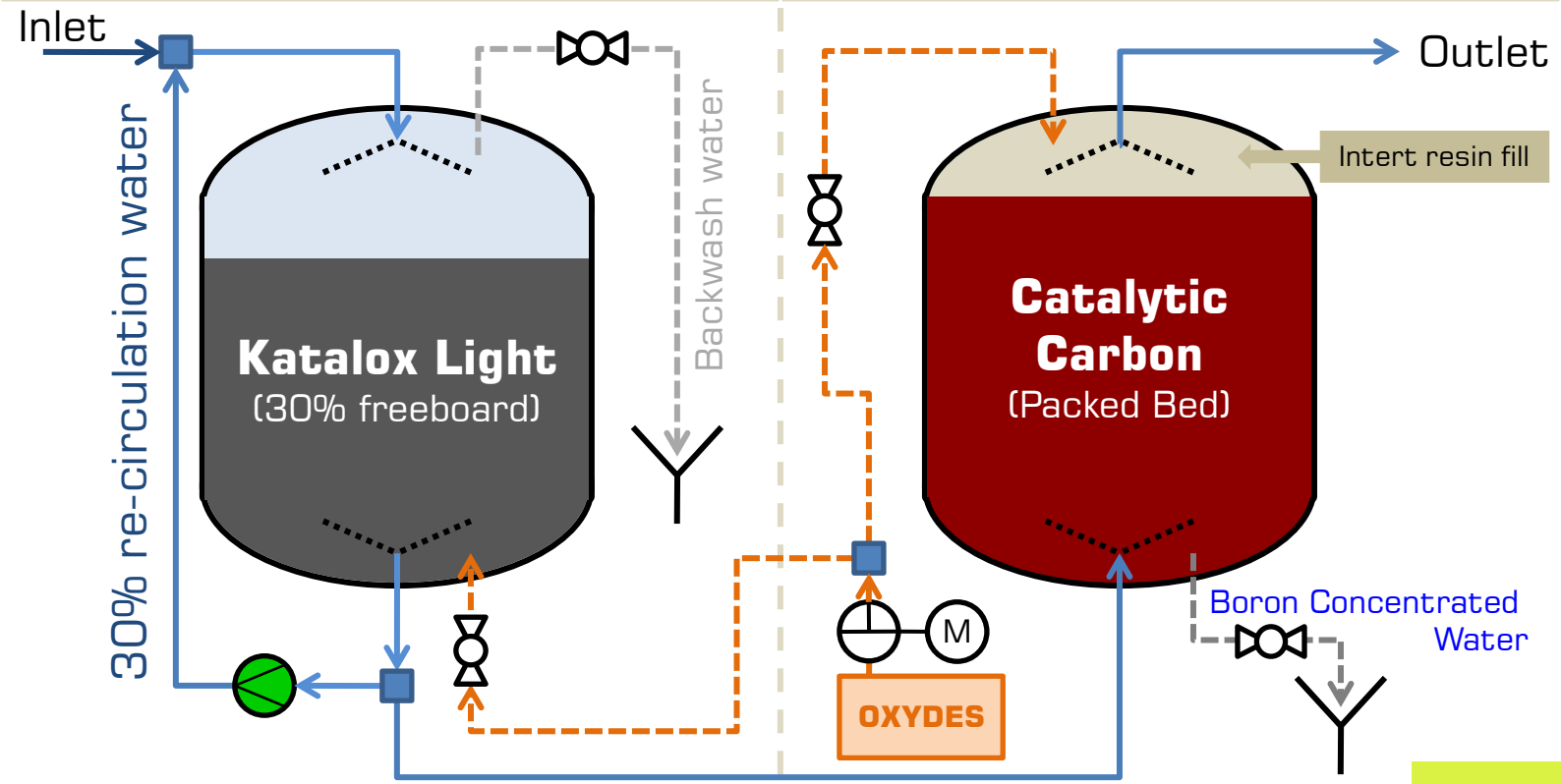
BORON - REMOVAL

Katalox Light + Catalytic Carbon

First Process: Concentrating Boron & pH raise/adjustment

Second Process: Adsorption of concentrated Boron on Catalytic Carbon



Boron Concentrating System

Watch-Water® Germany has made an easy method to remove Boron from water which was technically very difficult with Ion-Exchange resins or Membrane Technology. Coagulation sedimentation method needs large amount of calcium hydroxide, aluminium compound which generates huge amount of sludge. Therefore cost of chemicals goes high and at the same time it becomes very difficult to perform sludge treatment.

Adsorption & Desorption

In the Ion-Exchange process, in order to treat water or wastewater containing high concentration of Boron, a very large amount of Boron-adsorbing Ion-exchange resin is required.

To solve these problems in an optimal way, Watch-Water® has introduced Boron-Treatment-Method of efficient Boron removal from water and wastewater.

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The efficient Boron Treatment Method reduces the cost of resins, reverse osmosis process and generation of large amount of sludge and cost of chemicals.

In the first process with a 30% re-circulation is performed to obtain Boron-Concentrated-Liquid and in the next step Catalytic Carbon is used to rush the adsorption process with a coated inorganic ferroxydate hydroxide to adsorb Boron in the Boron-Concentrated-Water to remove Boron. The treatment process and this unique process is the main contention of this literature preparation.

Process Description

In the Katalox-Light treatment the Boron containing water and the circulation of 30% from the first pass is to obtain Boron-Concentrated-Water. The higher is the concentration of Boron, the more it exists in the form of a polymer ion such as $B_3O_3(OH)_4$ → $B_5O_6(OH)_4$ and in the third circulation $B_3O_3(OH)_5^{2-}$. Now it becomes possible to adsorb easily and effectively on a principle of Adsorption and removal of the Hydroxides.

Please note: There is a small possibility that the Catalytic Carbon gets a little scale trouble even with the use of water in which Boron exists as a polymer. Further it should be noted that the pH of the water is 8 or more. If the ph of Boron-Concentrated-Water is 8 or more the ionization of Boron in the Boron-Concentrated-Liquid based on a reaction formula

H_3BO_3 + Katalox-Light + H_2O → $B(OH)_4^-$ + H^+

-and this increases the adsorptive activity of Boron by the packed bed of Iron Hydroxide coated Catalytic Carbon.

The second process is very important to keep the pH or maintain the pH of the Boron-Water not to fall within a range of ≤ 6.0 to obtain corrosion on ferric hydroxide media. Only having a negative charge, exchange of anion can be performed, so that the ferric hydroxide has a better function of adsorption than any other process.

In second stage of filtration Catalytic Carbon has the highest removal capacity of Boron. The amount of chemical required to clean the adsorbent is quite small compared to Ion-exchange resins and Reverse Osmosis and other conventional techniques. This unique method is most effective when treating a relatively large amount of water, irrigation as well as wastewater applications.

The removal method using Katalox-Light and Catalytic Carbon nullify the worries that a water purification facility would be large in size. There are huge benefits of not regenerating a large amount of waste water including acids and alkalis.

Further Benefits

For the first time it is possible to recover Boron Ions namely, by regenerating Catalytic Carbon by diluting OXYDES powder, the granulated Hydrogen peroxide powder with a pH of 10 to bring into contact with the Boron-Saturated Adsorbent media in the pressure vessel column. The wastewater produced is limited.

Desorption Process

100 liters of diluted OXYDES liquid can treat 1000 liters of Katalox-Light and Catalytic Carbon. This process is called ***Desorption Process***. In this process the Boron-Concentrated-Liquid is being removed from iron hydroxide coated Catalytic Carbon. The adsorbed polymer ions of form $B_3O_3(OH)_5^{2-}$ is oxdized to $B(OH)_4^-$ and can be used as fertilizer mix or discharged to waste water.

Another noted benefit is that the Catalytic Carbon media can be regenerated repeatedly when saturated, without hardly any notable degradation of Boron adsorption efficiency. Desorbed Boron-Concentrated-Liquid (extracted from Catalytic Carbon) can be concentrated by the means of evaporation. Crystals deposited from the concentrated liquid by evaporation can be separated and can be mixed with fertilizers for agricultural use. Boron is one of the seven essential micronutrients vital for fertilization, fruit and seed production. But it is a micro-nutrient with a macro effects!

Boron Toxicity in Agriculture

Boron, unlike sodium is an essential for plant growth. Boron is needed in relatively small amounts, however if it is present in amounts appreciably greater than needed, it becomes toxic.
If 0.2 mg/L Boron in water is essensial, 1 – 2 mg/L is very toxic (WHO MCL is 0.5 mg/L). Well water occasinally contains toxic amounts, especially near geo-thermal areas and earth quake faults. ***Boron Toxicity*** can effect nearly all corps. The extent of Boron-Adsorption depends only on the pH of the water. The greatest adsorption generally occurs in pH range of 7.5 – 9.5. Watch-Water® Adsorbents are used for Sea-Water de-salination, pre-treatment to remove Boron. All sea water contains average Boron concentration of 4.5 – 7 mg/L. Concentration of Boron in ground water throughout the world range widely, from < 0.5 to 150 mg/L. Boron (B) is a naturally occurring element found in rock and soil.

Sources

Some Boron found in groundwater is naturally occurring. The presence of Boron in well water depends on the rock and soil type in the area.
Boron may also be present in groundwater due to

- coal combustion products
- municipal sewage
- leaching of landfill materials
- the production of fertilizers and pesticides

Some animal manure may also contain small amounts of Boron.

Maximum Acceptable Concentration for Drinking Water = 0.5 mg/L (WHO)

In water, Boron has no taste, smell, or color. It can only be detected through a chemical test.
The WHO (World Health Organization) drinking water quality guideline for Boron is 0.5 milligrams per liter (mg/L). The guideline limit for Boron is based on the level that can be achieved by treatment units. Make every effort to keep Boron levels as low as possible in drinking water.

Health Risks

Some studies have shown that very high concentrations of Boron in drinking water can cause reproductive malfunctions in men and developmental abnormalities. However, these occurred at much higher levels of Boron than are commonly found in drinking water. The risk to human health is through ingestion only – drinking, cooking, teeth brushing. Well water with Boron levels greater than 0.5 mg/L may safely be used for bathing, hand-washing, and dishwashing.

Testing

Regularly test your well water for a standard suite of chemical parameters, including Boron. Use an accredited water testing laboratory.

Solutions

If Boron is present above 0.5 mg/L in the first test, get a second test to confirm the original results. Treat your current source of water to reduce Boron levels.

Treatment

We recommend purchasing a treatment system that has been certified to meet the current NSF standards. NSF International is a not-for-profit, non-governmental organization that sets health and safety standards for manufacturers in 80 countries.

Although there are currently no treatment units certified specifically for Boron reduction, effective treatment methods for reducing Boron levels in drinking water can be achieved using Catalytic Carbon's adsorption – desorption method.

QUICK FACTS

- Boron is present in rock and soil.
- Boron in drinking water has no taste, smell, or color.
- Boron can only be detected through chemical testing.
- The Canadian drinking water quality guideline for boron is 0.5 mg/L.
- Exposure to very high concentrations of boron in drinking water can cause reproductive and developmental abnormalities.
- Well water with boron greater than 0.5 mg/L should not be used for drinking, cooking, or teeth brushing. It may be used for bathing, hand washing, and dishwashing.
- If boron is present above 0.5 mg/L in drinking water, consider water treatment options or alternative sources of water.

Presented by:

Watch Water®, Germany
A Water Company

Fahrlachstraße 14, Mannheim, D-68165, Germany
Tel: +49 621 87951-0
Fax: +49 621 87951-99
Email: info@watchwater.de