Nihonkaisui

Environmental Business Comprehensive Explanatory Materials

Nihonkaisui Co.,Ltd.
Environmental Business Division

Ver. 220701

Hazardous Substance Removal Technology

- Hazardous substance treatment technologies related to water treatment at our company

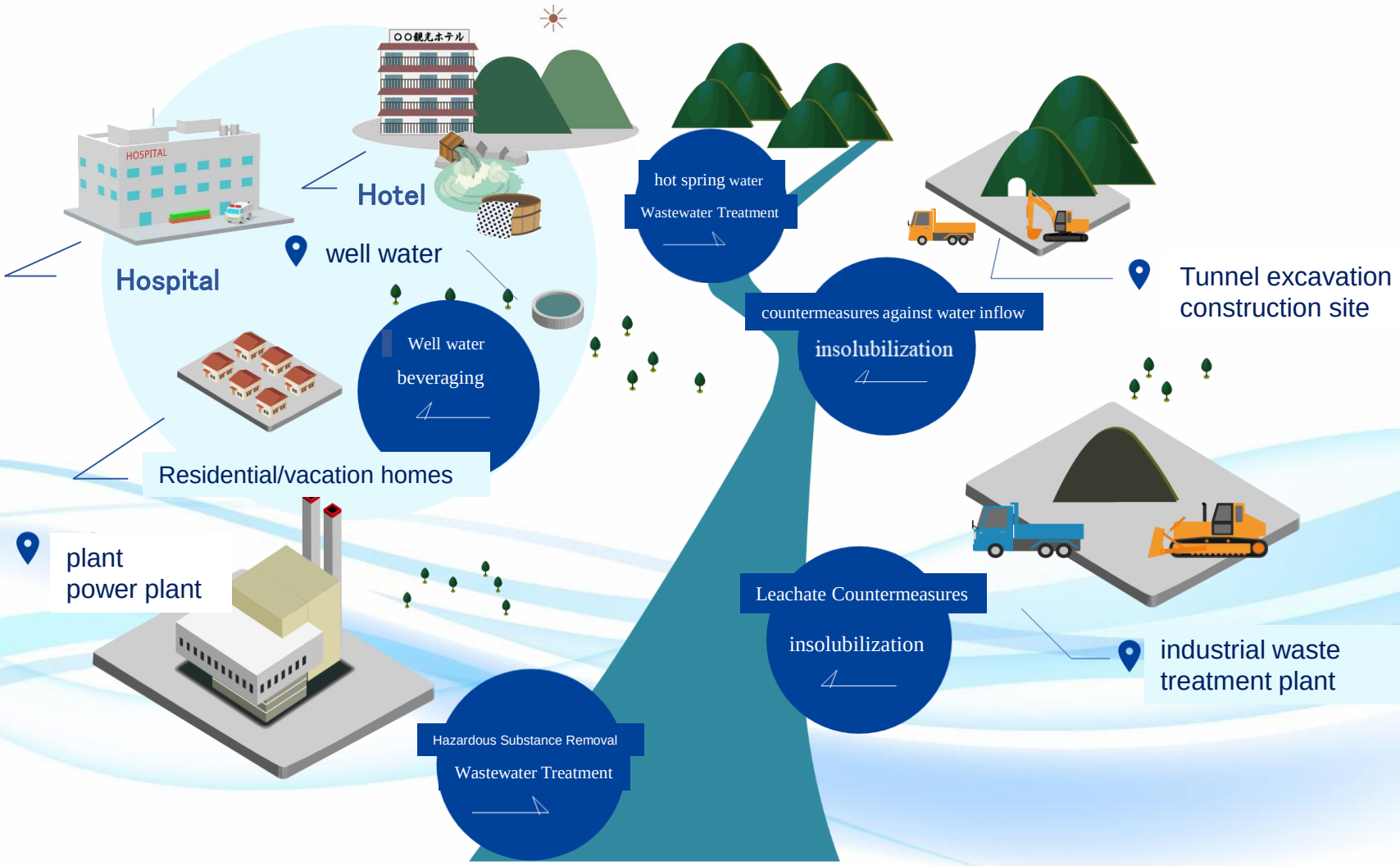
①Adsorbent for heavy metal removal ＜READ series＞

- Selective adsorption of difficult-to-treat elements such as fluorine, arsenic, and boron
- Adsorbent lineup for general heavy metal treatment also available

②Coagulant for heavy metal removal ＜READ-CX＞

- Coagulant developed by applying the above adsorbent
- High performance and small amount of additives reduce sludge generation

Main Installation Locations



Adsorbent for water treatment READ Series

- READ is derived from rare earth adsorbent
- High selectivity for specific elements

《 READ Series Lineup 》

Product name	Processed elements	Product Features
READ-F(HG)	fluorine ion	Ion-exchange adsorbent for fluorine High adsorption capacity and long regeneration cycle Has a long track record of use, mainly in wastewater treatment applications
READ-As	arsenic ion	Ion-exchange adsorbent for arsenic High adsorption performance allows treatment of both trivalent and pentavalent forms without pretreatment Can also be used for drinking water applications such as well water purification (certified as water supply materials)）
READ-B	boron ion	Ion-exchange adsorbent for boron Highly concentration-dependent, effective in treating high concentrations
READ-B(MC)		Chelate adsorbent for boron Sufficient performance even at medium to low concentrations
READ-P	phosphate ion	Ion-exchange adsorbent for phosphoric acid Highly selective, proven in removal of phosphorus in plating wastewater, etc.
READ-HM	Heavy metals in general	Chelate adsorbent for heavy metals Proven track record in the treatment of heavy metals such as copper, lead, and cadmium

Features of the READ Series

➢ High selectivity

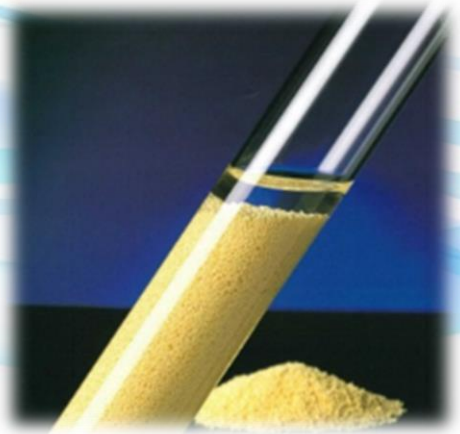
Demonstrates high selectivity for specific elements and selectively adsorbs and removes toxic substances in target water

➢ Recycling and reusing

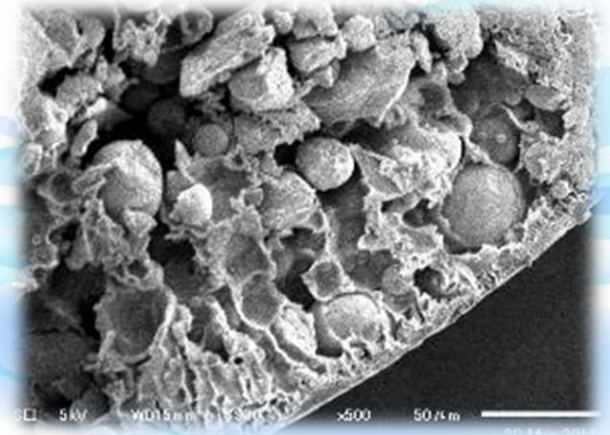
Adsorbent enables desorption of target elements by acid or alkali for reuse

➢ High performance

High adsorption performance and extended regeneration cycle reduce running costs



Adsorbent appearance



Adsorbent cross section

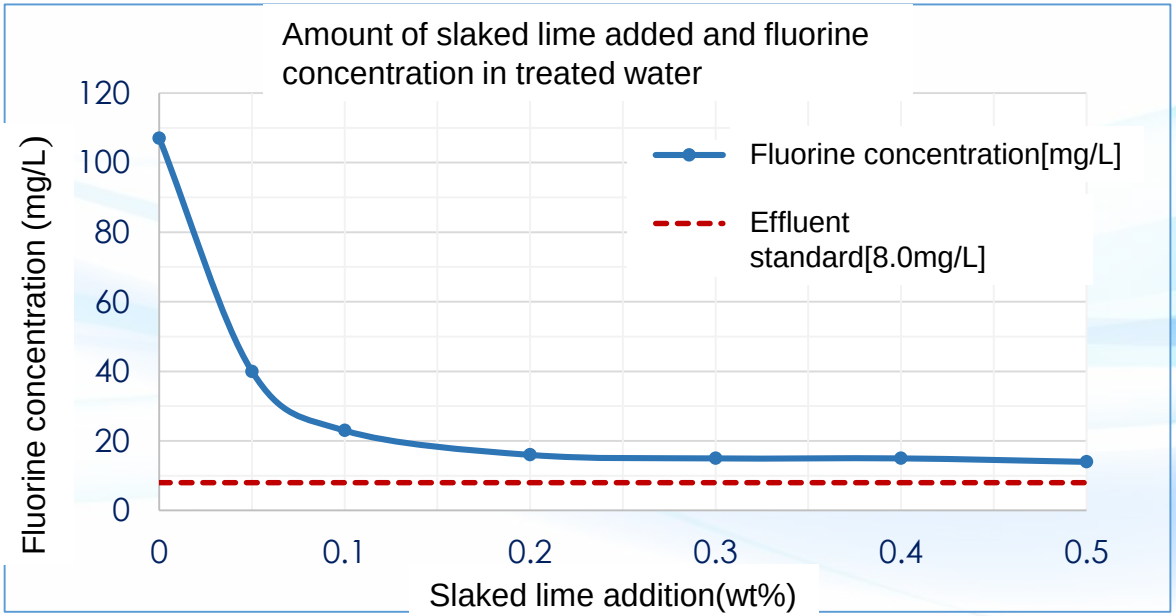
Fluorine treatment

➢ What is Fluorine?

- Effective in small doses, e.g., for cavity treatment
- Excessive intake can cause osteosclerosis and death

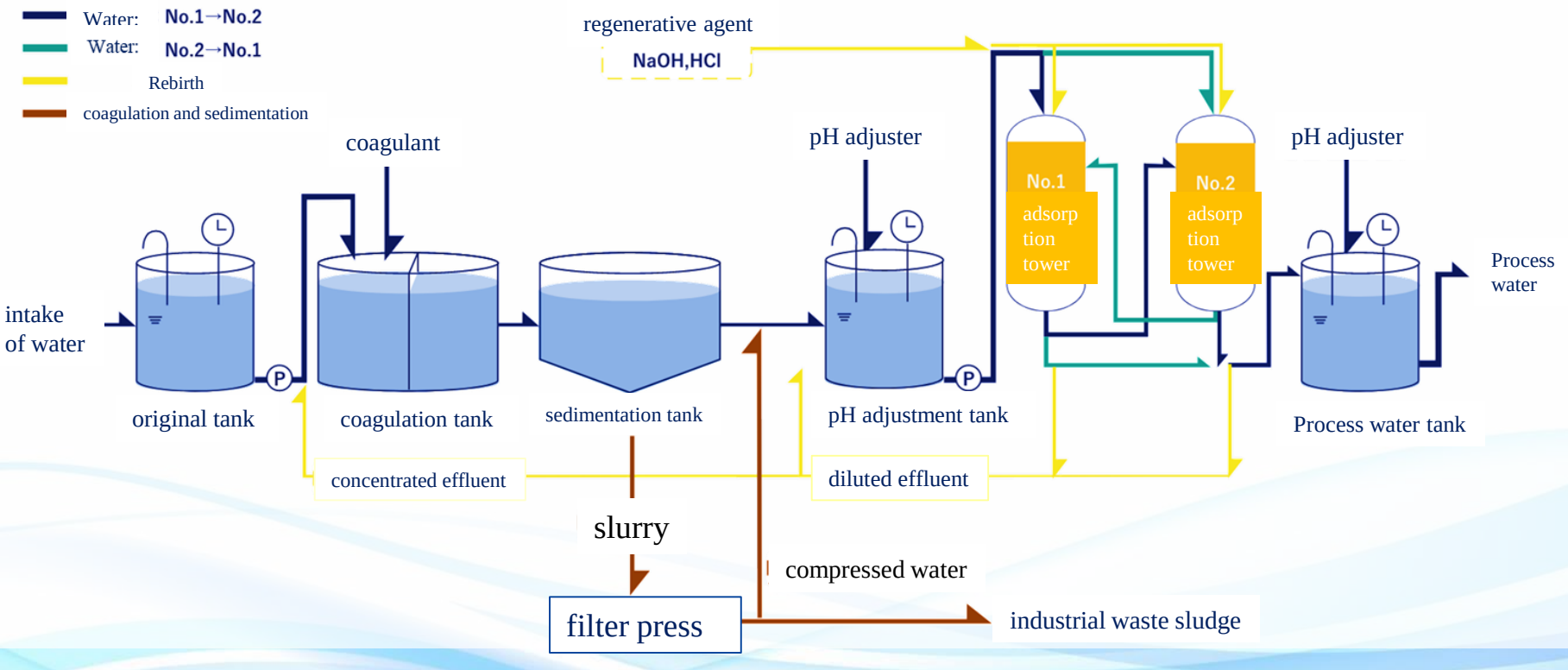
➢ Fluorine treatment

- Generally, coagulation sedimentation treatment with calcium
- Since it is difficult to treat up to the effluent standard with the above, treatment is combined with other treatment methods.



Treatment of fluorine with adsorbent

➢ Fluorine treatment flow



- Assuming our adsorbent is used in combination with general coagulation sedimentation process
- Use of adsorbent in low concentrations to stabilize treatment and reduce running costs
- Initial capital investment required, consult separately

Fluorination Case Study

➢ Wastewater treatment at auto parts plant

Fluorine concentration：15→5mg/L

Volume of water treated：15m^3/h

- Coagulation sedimentation treatment with calcium in the first stage
- Treatment below the effluent standard in the adsorption tower in the latter stage
- Regeneration is performed when operation is stopped, and the regenerated effluent is returned to the front stage for treatment.

➢ Semiconductor plant wastewater treatment

Fluorine concentration：15→2mg/L

Volume of water treated：25m^3/h

- Advanced treatment after coagulation sedimentation treatment with calcium
- Continuous treatment is possible even during regeneration due to treatment in multiple columns.
- Reduced operating costs by using the system as a safety device.

Arsenic treatment

➢ What is Arsenic?

- Highly toxic and may cause life-threatening health problems if ingested even in trace amounts
- Arsenic is released into the environment due to volcanic activity.
- In Japan, a volcanic country, arsenic exceeding environmental standards has been detected in groundwater and hot spring water.

➢ Arsenic treatment

- Iron coprecipitation method is commonly used.
- Adsorption method is essential for treatment of lower concentrations.

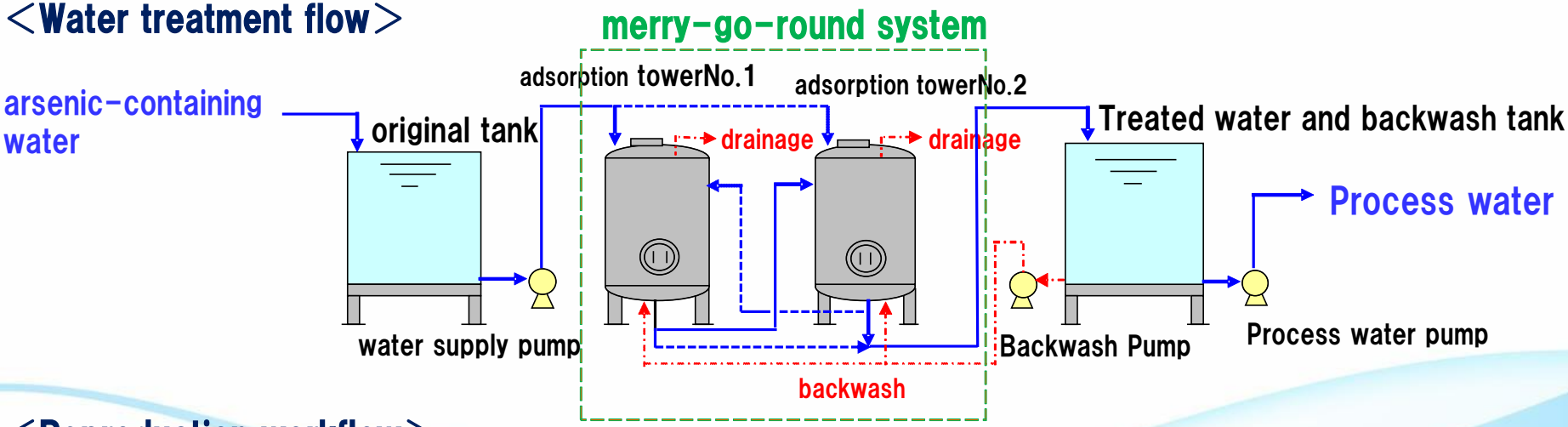
➢ Overseas Achievements

- The right figure shows a simple device used in India to remove arsenic from well water.
- Groundwater in the lower Himalayas is widely contaminated with arsenic, with tens of millions of people suffering from arsenic poisoning.

Operation of adsorbent READ-As for arsenic

- As the arsenic adsorbent is regenerated infrequently due to low arsenic concentration in raw water, recycled products are delivered after regeneration treatment at our plant in Japan.

＜Water treatment flow＞



＜Reproduction workflow＞

Example of arsenic treatment <Tunnel spring water >

- **Tunnel spring water treatment at a certain location in Nara Prefecture (continued 2 tunnels installed at various locations)**

①Arsenic concentration: 0.11 to less than 0.01 mg/L Treated water volume: 1,512 m3/day
Adsorbent volume: 5,000 L/tower x 2 towers
②Arsenic concentration: 0.10 to less than 0.01 mg/L Treated water volume: 360 m3/day
Adsorbent volume: 1,500 L/tower x 2 towers

- Treatment of arsenic-contaminated spring water from tunnel excavation
- The adsorbent is regenerated at our plant at regular intervals and re-filled into the adsorption column.
- Automatic operation to reduce arsenic concentration to less than 0.01 mg/L in response to fluctuations in flow rate.



Example of arsenic treatment <Tunnel spring water >

➢ **Tunnel spring water treatment at a certain location in Ehime Prefecture**

Arsenic concentration: 0.02 to less than 0.01 mg/L

Antimony concentration: 0.1 mg/L to less than 0.08 mg/L

Treated water volume: 50 m3/day　Adsorbent volume: 200 L/tower x 2 towers

• Arsenic is treated to less than the environmental standard value by automatic operation and discharged.

• The adsorbent is regenerated at our plant at regular intervals and re-filled into the adsorption column.

• Antimony is a voluntary controlled substance in the controlled area and is treated with the same adsorbent at the same time.

Example of arsenic treatment <Food factory well water >

➢ Well water purification at a certain location in Kanto (2 facilities installed)

①Arsenic concentration: 0.009 to less than 0.001 mg/L

Treated water volume: 200 m3/day Adsorbent volume: 1,000 L/tower x 2 towers

②Arsenic concentration: 0.010 to less than 0.001 mg/L

Treated water volume: 300 m3/day Adsorbent volume: 1,500 L/tower x 2 towers

- The company introduced a treatment system utilizing adsorbents to reduce the concentration below the detection limit to less than 0.001 mg/L.
- Later that year, a new well was constructed in conjunction with the expansion of the plant, and the same equipment as described above was installed.
- The adsorbent is regenerated at our plant every few months and re-filled after treatment.

Example of arsenic treatment <Well water for restaurants>

➢ Simple well water purification system for restaurants

Arsenic concentration: 0.019→less than 0.01mg/L

Treated water volume: 5m3/day

Amount of adsorbent: 100 L/cylinder x 2, activated carbon cylinder x 1

- Arsenic in well water is treated to less than the environmental standard using a cylinder system filled with an adsorbent.
- The regeneration cycle is about 300 days, and the adsorbent is removed from each cylinder and sent to our factory.
- The regenerated adsorbent is simply attached to the cylinder system for easy operation.
- Operation control is limited to checking differential pressure, and the system is basically left unattended.

Example of arsenic treatment <Spring water at construction site>

➢ Spring water treatment at a construction site in Hyogo Prefecture

Arsenic concentration: 0.30 → 0.05 mg/L or less

Treated water volume: 5,760 m3/day

Adsorbent volume: 6,000L/tower x 2 towers, 2 biological treatment towers

- Iron co-sedimentation method generates a large amount of sludge and is difficult to operate and manage, so biological treatment and an adsorption tower were introduced.
- The system can easily cope with changes in water volume, which is typical of construction sites, and arsenic is treated in a stable manner.
- The adsorbent is regenerated at the plant every three months and continues to be used during the construction period.

Biological Contact Filtration Tower　Arsenic adsorption tower

contaminant	Concentration (mg/L)			Removal rate (%) After biological treatment
	raw water	After biological contact filtration tower	AfterREA D-As adsorption tower	
iron	12.30	2.15	Less than0.01	82.6
manganese (Mn)	0.23	0.05	Less than0.01	78.2
arsenic (As)	0.30	0.09	Less than0.01	69.1
phosphorus	2.55	0.43	Less than0.2	83.1
ammonia nitrogen	2.30	0.1	Less than0.1	95.7

Boron treatment

➢ What is Boron?

- Non-toxic to mammals, comparable to salt
- Has a significant impact on the natural environment, acting as a toxin to insects and causing leaf necrosis and other damage to plants.

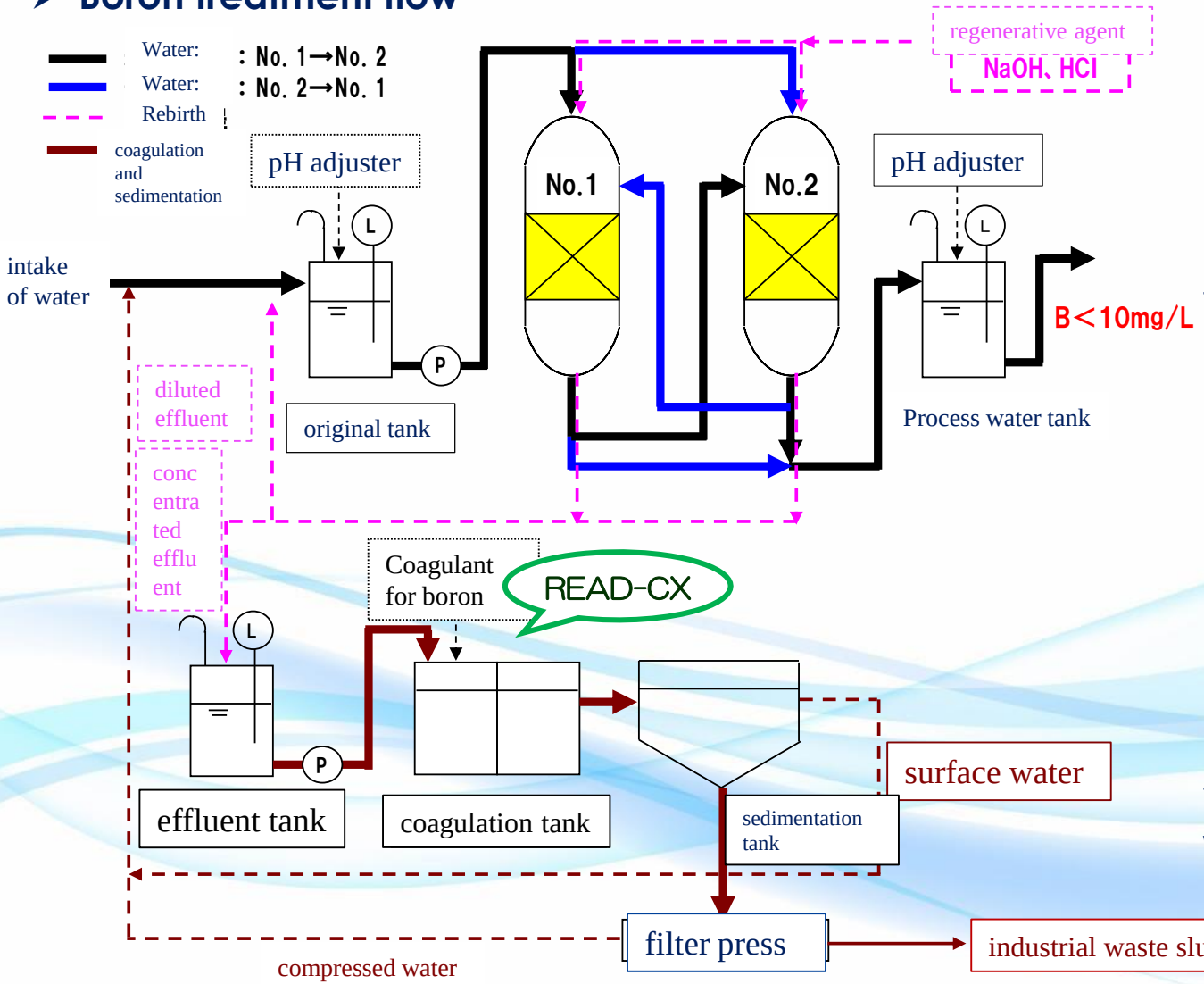
➢ Regulation of boron

- Boron is a controlled substance under the Water Pollution Control Law
- On the other hand, there are few effective treatment methods, and regulations have been loosened for some industries as provisional standards.
- The environment is changing year by year, and we never know when regulations will be tightened.

Boron effluent standards and provisional standards	
Type of industry	Standard (mg/L)
General effluent standards	Less than10
the hotel business	Less than500
Houro-ironware manufacturing industry	Less than50
metal mining industry	Less than100
Electroplating	Less than30
drainage system	Less than50

Proposed complex treatment of boron

➢ Boron treatment flow



- Treatment of boron is difficult, and the cost of low-concentration treatment is prohibitive for the common treatment method of coagulation using sulfuric acid bands and slaked lime.

- Treatment with adsorbent enables stable treatment, and treatment costs can be reduced by using coagulation treatment or direct industrial waste treatment for the liquid waste generated during regeneration.

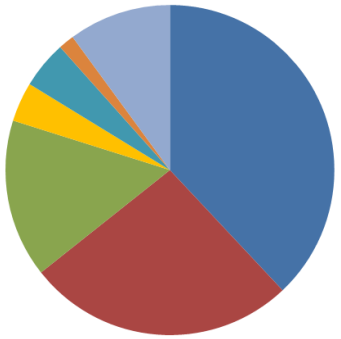
Example of boron treatment <Adsorbent: READ-B(MC)>

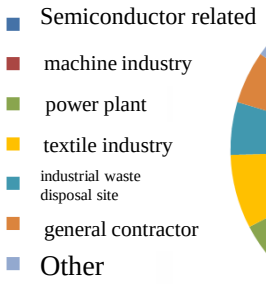
➢ **Plant wastewater treatment ＜Adsorbent: READ-B(MC)＞**

Boron concentration: 10 → 5 mg/L or less Treated water volume: 3 m3/day

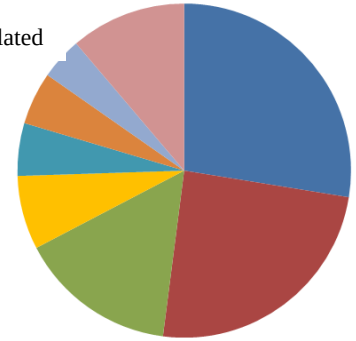
- Processing is carried out to achieve the in-house standard of 5 mg/L or less
- Resin is returned to our plant with cylinders on a regular basis, and recycled resin continues to be used.

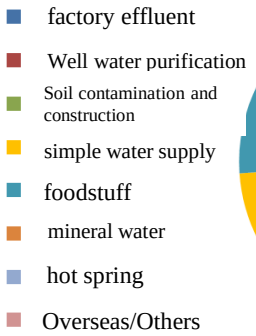
Adsorbent introduction results



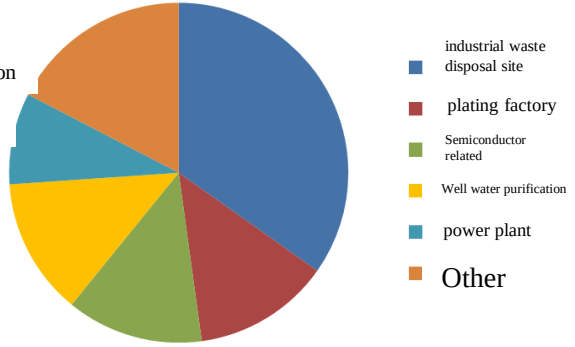


Fluorine adsorbent delivery status





Arsenic adsorbent delivery status



Boron adsorbent delivery status

- The largest number of fluorine adsorbents are used in semiconductor-related plants, followed by the machinery industry, power plants, and industrial wastewater treatment.
- Arsenic adsorbent is used in a wide range of applications including factory wastewater, well water purification, soil contamination work, and both wastewater and water purification.
- Boron adsorbent is most commonly used at industrial waste disposal sites, and is also widely used in industrial wastewater treatment at plating factories, semiconductor plants, etc.

Coagulant READ-CX

- Coagulation sedimentation treatment is a common treatment method in which chemicals are added to the target water and the pH is adjusted to settle the harmful components as sludge.
- READ-CX is a liquid version of the READ series of adsorbents, and therefore contains rare earths as its main component.

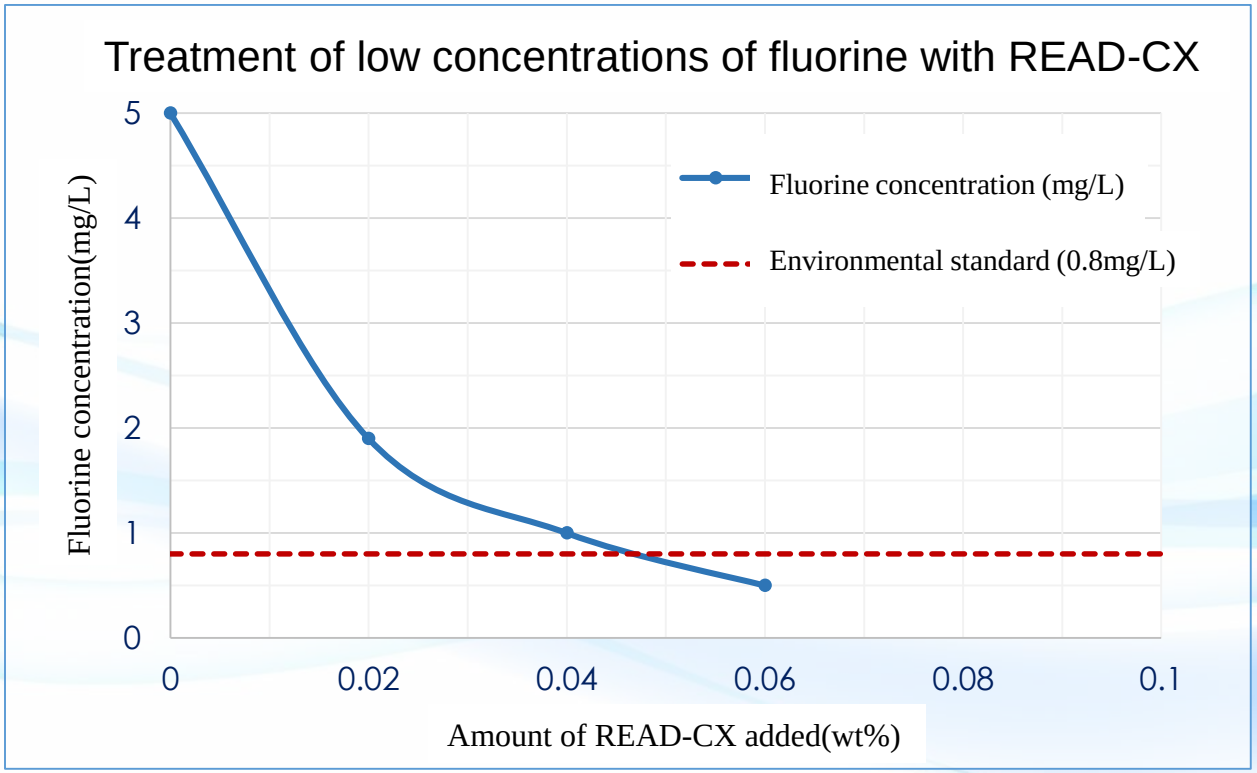
Appearance of READ-CX

Features of READ-CX

- High treatment performance enables treatment with less chemicals, reducing the amount of sludge generated.
- Easy replacement of existing installations due to its liquid form with good handling properties
- Optimal treatment pH range is neutral to slightly alkaline, so pH adjustment after treatment is easy or unnecessary
- In addition to boron, elements such as fluorine, arsenic, selenium, phosphorus, hexavalent chromium, and lead can be treated

Fluorine treatment by READ-CX

- READ-CX demonstrates high performance in fluorine treatment as a coagulant
- There is no concentration barrier, and low-concentration treatment is possible according to the amount of chemical injection.
- High effectiveness can be obtained with a small amount of additive, thus reducing the amount of sludge generated.



Example of boron treatment <coagulant: READ-CX>

➢ Power plant wastewater treatment ＜Coagulant: READ-CX＞

Boron concentration: 500 → 50 mg/L or less　Treated water volume: 500 m3/day

- Removal of boron from desulfurized wastewater at an overseas thermal power plant
- The coagulation treatment using READ-CX is being implemented to achieve the target value of 50 mg/L or less.
- Compared to conventional methods, READ-CX uses less water and generates less sludge, which contributes to cost improvement.

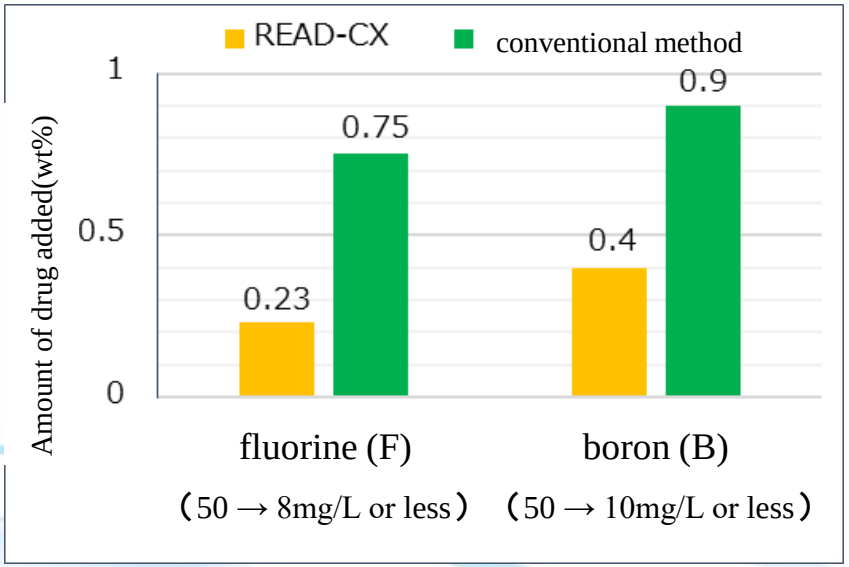
Multi-element processing with READ-CX

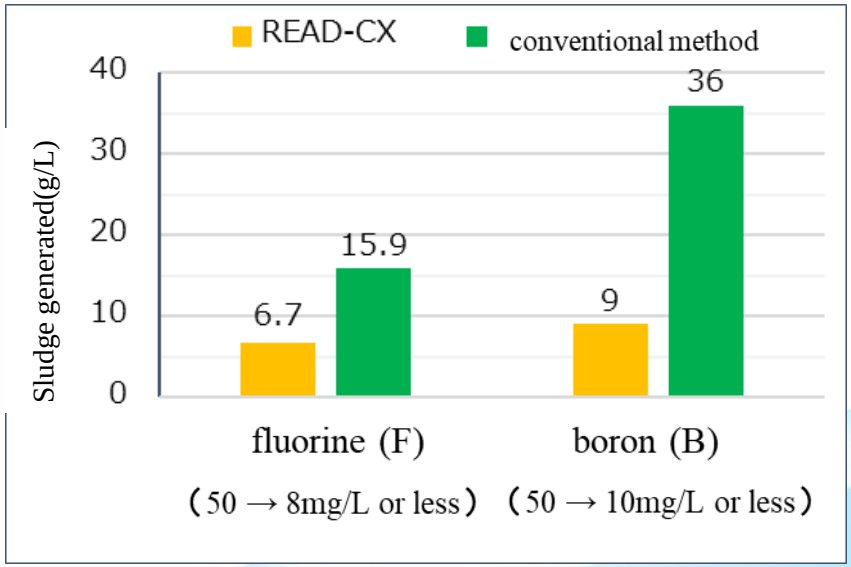
- READ-CX can simultaneously treat various heavy metals other than fluorine and boron
- The table below shows the analysis values of filtrate when pH was adjusted to 9.0 after adding the prescribed amount of three types of flocculants to a mixed simulated solution of various heavy metals.
- READ-CX shows higher treatment performance for selenium and chromium than other flocculants.

Processed elements	unit	imitative fluids	READ-CX		Sulfuric acid band slaked lime		ferric chloride	
Amount of drug added	wt%	0.0	0.5	1.5	0.5	1.5	0.5	1.5
Se(VI)	mg/L	1.3	0.801	**0.026**	1.336	1.330	1.341	1.339
As(V)	mg/L	1.3	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**<0.005**
Cr(VI)	mg/L	3.9	0.16	**<0.01**	3.21	2.71	0.62	0.08
F	mg/L	49.5	4.2	**0.8**	12	6.6	39	32
B	mg/L	207.3	85	**13**	172	78	179	138
P	mg/L	43.3	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**
Pb	mg/L	2.9	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**<0.005**	**<0.005**
Sediment generation	g/L	-	5.6	12.4	9.5	28.0	3.9	10.5

Advantages of READ-CX

- Comparison of READ-CX with sulfuric acid bands commonly used in boron fluoride treatment





Example: When treating boron from 50 mg/L to 10 mg/L

- Conventional method ⇒About 0.9wt% chemical injection is required, and the amount of sludge generated is 36g/L.
- READ-CX ⇒Only 0.4wt% chemical injection is required, and the amount of sludge generated is reduced by 75% to 9g/L.

Test support

- The target wastewater exhibits various properties, so the performance may not be as designed.
- Laboratory tests and evaluations are conducted using actual wastewater, and the design is verified based on the results.

Column water flow test

Beaker batch processing test

Sales model

- **Various adsorbents**
  - Sold in 15L gallon cans or 500L flexible containers
  - Filled with tap water inside the inner bag to keep the bag moist

- **READ-CX**
  - Sold in 20 kg cubiteners or 1 m3 chemical tanks
  - No extra packaging cost for basic chemical tanks

Contact us

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